On the Paradoxical Nature of Innovation

Evidence from Social Networks in Fryslân

Celik, Sine

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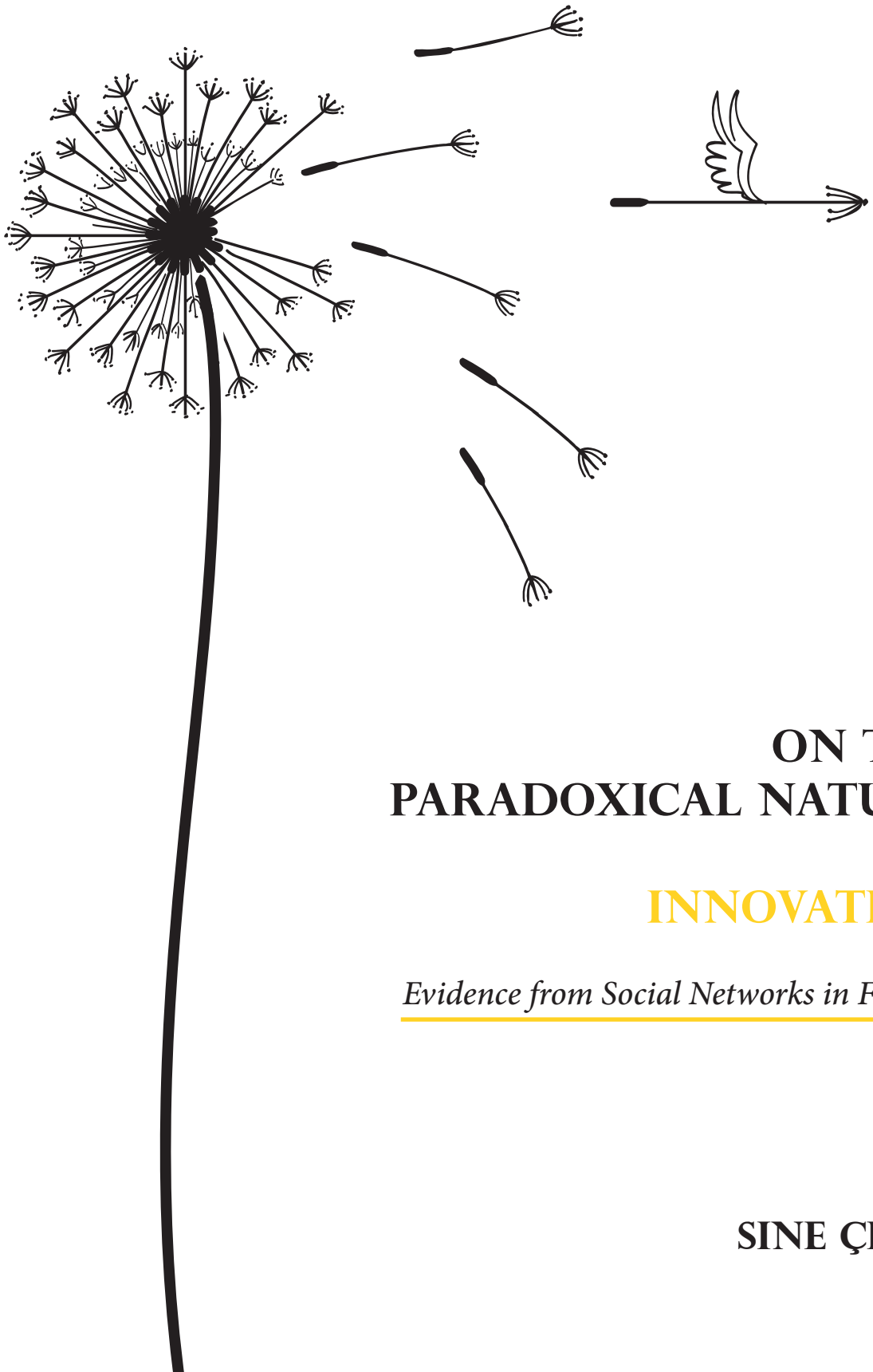

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SINE ÇELIK

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Ph.D. Thesis

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Evidence from social networks in Fryslân

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by

Gül Sine ÇELIK
Master of Science in Architecture, Urbanism and Building Sciences,
Delft University of Technology, The Netherlands
born in Ankara, Turkey

This dissertation has been approved by the promotors.

Composition of the doctoral committee:

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Dr. ir. L.S.G.L. Wauben, Delft University of Technology, has contributed significantly to the preparation of this dissertation as a supervisor.

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To all minorities on this planet...

CONTENTS

Executive Summary

With the ever-growing development of technology, global communication modalities are evolving towards a new dimension. This connectedness provides easy access to knowledge, but also brings along necessities, prompting humanity to come up with novel ideas to fulfill these necessities, or in other words: innovation. Today, being able to innovate is the ultimate goal to create an advantage for organizations, regions and countries. Innovation enables the prosperous growth of communities all over the world, but not all regions are able to keep up. This thesis focuses on regions that have not benefitted fully from this innovative development.

Fryslân, a northern province of the Netherlands, is an example of such a region, but at the same time, it is also an example of how the progress-oriented mindset of local entities and citizens has the potential to change the destiny of a region despite hampering societal factors. The first one of two interrelated reasons of this societal transition struggle in Fryslân is the internally oriented social system that is a result of the historical origination and the geographical condition of the province. The second reason is the closed-off nature of the industrial activities that are the primary economic resource of the region, such as agriculture, that does not correspond to the open character of innovative communities. This research aims to explore the social constructs that block progress and help regions to enhance their innovative output by answering the following question: *How can closed innovation systems be opened up through the effective use of social constructs to achieve sustainable development?*

Enhancing the innovative output of a region is a complex societal problem due to the interrelatedness of contradicting interests of various levels of organisations and individuals involved in the process simultaneously. Studying complex systems aims to understand indirect effects that occur when there is no cause-effect relationship. This cuts through all traditional fields of science by exploring parts, wholes and relationships. There are three interrelated approaches to studying complex systems: (1) understanding the link between interactions and behaviour, (2) understanding the ways of describing complex systems, and (3) understanding the process of formation through patterns. This thesis adopts a combination of these three approaches to provide a holistic understanding of regional innovation systems and determines two consecutive paradoxes to explain their complexity.

Paradox 1 relates to the interdependency of social and technical processes within innovation systems. The ultimate aim of all innovations, regardless of their origins, is to achieve systemic impact that changes the 'old ways' of doing in the social context they are introduced to. The literature on the definition of innovation is broad and multidisciplinary. Scholars have tried to come up with a definition that is applicable for all fields, but have not yet succeeded, which is understandable considering the complex nature of innovation, where a variety of perspectives and expectations can play a role. However, despite the lack of consensus, scholars increasingly use the words social, sustainability, ecology, system, and change while defining innovation, demonstrating how the field of innovation is expanding in parallel to societal concerns. A comprehensive approach to innovation must consider social processes as a part of innovation that develops hand-in-hand with the technical processes, and therefore, understanding social constructs is crucial.

Social relationships form a significant part of social constructs, which are the enablers of the knowledge exchange that will lead towards an innovation ecosystem. Innovation relies on creativity, unleashing the mind's potential to conceive new ideas that are shaped through physical and social encounters. Therefore, social relationships between the community members must be facilitated in order to maximize the innovation potential.

Paradox 2 focuses on the contradictory set of relationships between actors that involves a mixture of attraction, repulsion, conflict and cooperation that naturally influence innovative output. The relationships must not hinder the creativity to develop new ideas. Studying the relationships between actors can reveal specific network dynamics that create a negative or positive effect on performances of both individuals and the system as a whole.

At its simplest, innovation is defined as the operationalization of a creative idea, which immediately underlines two different natures of social relationships between the actors: managerial and creative relationships. These two lines of work have very different structures from each other by nature: creative relationships are cyclic and discursive, whereas managerial relationships are linear and chronologic.

Social relationships among a group of individuals are commonly identified as networks and the relationships that form the network are also the cause of unplanned occurrences of newness. Therefore, social network analysis (SNA) is an appropriate tool to study the social constructs that are relevant for innovation systems. For assessing the situation of the

innovation systems in Fryslân, in addition to the creative and managerial networks, two other networks were found to be relevant and were included in the study: the political network, due to the significant leadership position of the local government, and the friendship network, due to the close-knit character of the community.

The networks are analyzed through the NetRep method, which was specifically developed as a part of this research for studying the social networks where the size and predictability of the system makes regular SNA procedures inapplicable. The NetRep method enables efficient and structured data collection, validation and analysis by performing intensive sessions with representative actors. The analysis of Frisian networks was conducted through a sample set of 232 actors divided into five professional groups: academics (66), government workers (48), NGO-based actors (33), creative individuals (38), and corporate-based actors (47).

The analysis showed that the networks in Fryslân are compact and not open enough for external knowledge. In addition, the actors that are involved are weakly connected to each other, possibly because of the repetition of the same relationships over time. The analysis of the formation and operation of, and the benefitting from the innovation networks in Fryslân showed that the current state of the creative, managerial, and political networks, which experience problems regarding the number and connectedness of actors, make it difficult to establish healthy collaborations. The friendship network was identified as a well-formed network. In the operation phase, based on connectedness and reachability, the creative and managerial networks were noted to be in critical condition, while the political and friendship networks were in a less critical state. In the benefitting phase, the creative and managerial networks were again in critical condition based on the openness of the networks and the density and the ability of sustaining knowledge, while the political network was in less critical condition and the friendship network was again close to ideal.

Although the strong friendship bonds play a role in the hampering closed-like social structure of the province, the least problematic network in Fryslân is the friendship network and, therefore, it must be utilized for the purpose of innovation. Friendship does not have a direct link to innovation, but the power of existing networks and the local dynamics makes the friendship network the best path towards innovative progress.

This study contributes theoretically to the fields of innovation, networks, and societal transitions by developing a complementary approach that considers social and technical

processes as a whole. The theoretical findings emphasize the importance of social constructs in facilitating the development of creative ideas for the innovative progress of societies.

While tracing the diverging meaning of innovation in parallel to societal dynamics, the research also presents a new way of clustering socially oriented innovation initiatives. The argumentative line of thought that links innovation to network studies from a societal perspective provides an easily applicable methodology for collecting data on large-scale networks. The analysis of these networks determined relevant relationships between actors and the multiplex dynamics within that have an influence on their performance.

To conclude, communities provide means for interaction for their members and enable information exchange. Social interactions expose individuals to new ideas and contribute to their creative thinking. Creative thinking, when combined with a prompt, can be operationalized into an innovation. A successful innovation will be accepted by the community and have an impact on the old habits of the members. This cycle has the potential to sustain itself and create a constant prosperous development. However, the communities themselves must be open to the world to absorb external ideas. In the growing connectedness of society, modern communities should never be limited to physical or emotional boundaries that are created through local or global values because the opportunities for interaction are unlimited.

Samenvatting

Met de altijd groeiende ontwikkeling van technologie, bewegen globale communicatie-modaliteiten zich naar een nieuwe dimensie. Deze verbondenheid zorgt voor een gemakkelijke toegang tot kennis, maar brengt ook behoeftes met zich mee, dat zorgt dat de mensheid met nieuwe ideeën moet komen om in deze behoeftes te voorzien, of in andere woorden: innovatie. In deze tijd, kunnen innoveren is het ultieme doel om een voordeel te creëren voor organisaties, regio's en landen. Innovatie maakt een welvarende groei mogelijk voor samenlevingen over de hele wereld, maar niet alle regio's zijn in staat om bij te blijven. Dit proefschrift richt zich op regio's die niet volledig hebben kunnen profiteren van deze innovatieve ontwikkeling.

Fryslân, een noordelijke provincie van Nederland, is een voorbeeld van zo'n regio, maar tegelijkertijd is het ook een voorbeeld van hoe een op vooruitgang gerichte instelling van lokale entiteiten en burgers het potentieel heeft om de toekomst van een regio te veranderen, ondanks belemmerende maatschappelijke factoren. De eerste van de twee met elkaar samenhangende redenen van deze maatschappelijke overgangsstrijd in Fryslân is het intern georiënteerde sociale systeem dat het resultaat is van de historische oorsprong en de geografische toestand van de provincie. De tweede reden is het gesloten karakter van de industriële activiteiten die de primaire economische bron van de regio zijn, zoals de landbouw, dat niet overeenkomt met het open karakter van innovatieve gemeenschappen. Dit onderzoek heeft tot doel de sociale constructies te verkennen die de vooruitgang blokkeren en regio's te helpen hun innovatieve output te verbeteren door de volgende vraag te beantwoorden: *Hoe kunnen gesloten innovatiesystemen worden ontsloten door effectief gebruik van sociale constructies om duurzame ontwikkeling te bereiken?*

Het verbeteren van de innovatieve output van een regio is een complex maatschappelijk probleem vanwege de onderlinge samenhang van tegenstrijdige belangen van verschillende niveaus van organisaties en individuen die tegelijkertijd bij het proces betrokken zijn. Het bestuderen van complexe systemen is bedoeld om indirecte effecten te begrijpen die optreden als er geen oorzaak-gevolg relatie is. Dit snijdt door alle traditionele wetenschapsgebieden door delen, gehelen en relaties te verkennen. Er zijn drie met elkaar samenhangende manieren van aanpak om complexe systemen te bestuderen: (1) het verband tussen interacties en gedrag begrijpen, (2) de manieren begrijpen om complexe systemen te beschrijven, en (3) het proces van vorming door patronen begrijpen. Dit proefschrift

neemt een combinatie van deze drie manieren van aanpak aan om een holistisch begrip van regionale innovatiesystemen te bieden en bepaalt twee opeenvolgende paradoxen om deze complexiteit te verklaren.

Paradox 1 heeft betrekking op de onderlinge afhankelijkheid van sociale en technische processen binnen innovatiesystemen. Het uiteindelijke doel van alle innovaties, ongeacht hun oorsprong, is het bereiken van een systematische impact die de 'oude manieren' van doen veranderen in de sociale context waarin ze worden geïntroduceerd. De literatuur over de definitie van innovatie is breed en multidisciplinair. Geleerden hebben geprobeerd een definitie te bedenken die op alle terreinen van toepassing is, maar zijn daar nog niet in geslaagd, wat begrijpelijk is gezien de complexe aard van innovatie, waar verschillende perspectieven en verwachtingen een rol kunnen spelen. Ondanks het gebrek aan consensus, gebruiken wetenschappers echter steeds meer de woorden sociaal, duurzaamheid, ecologie, systeem en verandering, terwijl ze innovatie definiëren, en laten zien hoe het gebied van innovatie zich parallel aan maatschappelijke zorgen uitbreidt. Een alomvattende benadering van innovatie moet sociale processen beschouwen als een onderdeel van innovatie dat hand in hand gaat met de technische processen, en daarom is het begrijpen van sociale constructies cruciaal.

Sociale relaties vormen een belangrijk onderdeel van sociale constructies, die de kennisuitwisseling in gang zullen zetten die leidt tot een innovatie-ecosysteem. Innovatie is afhankelijk van creativiteit, en ontketent het vermogen van de geest om nieuwe ideeën te bedenken die gevormd zijn door fysieke en sociale ontmoetingen. Daarom moeten sociale relaties tussen de leden van de gemeenschap worden vergemakkelijkt om het innovatiepotentieel te maximaliseren.

Paradox 2 richt zich op de tegenstrijdige set van relaties tussen actoren die een mengeling van aantrekkingskracht, afstoting, conflicten en samenwerking met zich meebrengt, die uiteraard invloed heeft op innovatieve output. De relaties mogen de creativiteit niet hinderen om nieuwe ideeën te ontwikkelen. Bestudering van de relaties tussen actoren kan specifieke netwerkdynamiek onthullen die een negatief of positief effect heeft op de prestaties van zowel individuen als het systeem als geheel.

Op zijn eenvoudigst gezegd, wordt innovatie gedefinieerd als de operationalisering van een creatief idee, dat onmiddellijk twee verschillende aarden van sociale relaties tussen

de actoren onderstreept: bestuurlijke en creatieve relaties. Deze twee takken hebben van nature een heel andere structuur: creatieve relaties zijn cyclisch en discursief, terwijl managementrelaties lineair en chronologisch zijn.

Sociale relaties tussen een groep individuen worden vaak geïdentificeerd als netwerken, en de relaties die het netwerk vormen zijn ook de oorzaak van ongeplande gebeurtenissen van nieuwheid. Daarom is sociale netwerkanalyse (SNA) een geschikt hulpmiddel om de sociale constructies te bestuderen die relevant zijn voor innovatiesystemen. Voor het beoordelen van de situatie van de innovatiesystemen in Fryslân, naast de creatieve en managementnetwerken, bleken twee andere netwerken relevant te zijn en werden deze meegenomen in de studie: het politieke netwerk, vanwege de belangrijke leidende positie van de lokale overheid, en het vriendschapsnetwerk, vanwege het hechte karakter van de gemeenschap.

De netwerken worden geanalyseerd via de NetRep-methode, die specifiek is ontwikkeld als onderdeel van dit onderzoek voor het bestuderen van de sociale netwerken waar de grootte en voorspelbaarheid van het systeem normale SNA-procedures niet toepasbaar maken. De NetRep-methode maakt efficiënte en gestructureerde gegevensverzameling, validatie en analyse mogelijk door intensieve sessies met representatieve actoren uit te voeren. De analyse van Friese netwerken werd uitgevoerd via een steekproef van 232 actoren verdeeld in vijf professionele groepen: academici (66), overheidswerknemers (48), op NGO-gebaseerde actoren (33), creatieve personen (38) en op bedrijven-gebaseerde actoren (47).

Uit de analyse bleek dat de netwerken in Fryslân compact zijn en niet open genoeg voor externe kennis. Bovendien zijn de betrokken actoren zwak met elkaar verbonden, mogelijk vanwege de herhaling van dezelfde relaties in de loop van de tijd. De analyse van de vorming, werking, en het profijt van de innovatienetwerken in Fryslân heeft aangetoond dat de huidige stand van de creatieve, bestuurlijke en politieke netwerken, die problemen ervaren met betrekking tot het aantal en de verbondenheid van actoren, een gezonde samenwerking moeilijk maakt. Het vriendschapsnetwerk werd geïdentificeerd als een goed gevormd netwerk. In de exploitatiefase, gebaseerd op verbondenheid en bereikbaarheid, bevonden de creatieve en managementnetwerken zich in kritieke toestand, terwijl de politieke en vriendschapsnetwerken zich in een minder kritieke toestand bevonden. In de profiteerfase bevonden de creatieve en bestuurlijke netwerken zich opnieuw in kritieke toestand op basis van de openheid van de netwerken en de dichtheid en het vermogen

om kennis te onderhouden, terwijl het politieke netwerk zich in minder kritieke toestand bevond en het vriendschapsnetwerk opnieuw dicht bij ideaal was.

Hoewel de sterke vriendschapsbanden een rol spelen in de belemmerende gesloten sociale structuur van de provincie, is het vriendschapsnetwerk het minst problematische netwerk in Fryslân en daarom moet het worden gebruikt voor innovatie. Vriendschap heeft geen directe link met innovatie, maar de kracht van bestaande netwerken en de lokale dynamiek maken het vriendschapsnetwerk het beste pad naar innovatieve vooruitgang.

Deze studie draagt theoretisch bij tot de gebieden van innovatie, netwerken en maatschappelijke transities door een aanvullende benadering te ontwikkelen die rekening houdt met sociale en technische processen als geheel. De theoretische bevindingen benadrukken het belang van sociale constructies bij het faciliteren van de ontwikkeling van creatieve ideeën voor de innovatieve vooruitgang van samenlevingen.
Terwijl de divergerende betekenis van innovatie wordt gevolgd in parallel met de maatschappelijke dynamiek, presenteert het onderzoek ook een nieuwe manier om sociaal gerichte innovatie-initiatieven te bundelen. De argumentatieve gedachtegang die innovatie verbindt met netwerkstudies vanuit een maatschappelijk perspectief biedt een gemakkelijk toepasbare methodologie voor het verzamelen van gegevens voor grootschalige netwerken. De analyse van deze netwerken bepaalde relevante relaties tussen actoren en de meervoudige dynamiek die van invloed zijn op hun prestaties.

Ter conclusie, gemeenschappen bieden middelen voor interactie voor hun leden en maken informatie-uitwisseling mogelijk. Sociale interacties stellen mensen bloot aan nieuwe ideeën en dragen bij aan hun creatief denken. Creatief denken kan in combinatie met een trigger worden geoperationaliseerd in een innovatie. Een succesvolle innovatie wordt door de gemeenschap geaccepteerd en heeft een impact op de oude gewoontes van de leden. Deze cyclus heeft het potentieel om zichzelf in stand te houden en een voortdurende ontwikkeling te creëren. De gemeenschappen zelf moeten echter wel openstaan voor de wereld om externe ideeën op te nemen. In de groeiende verbondenheid van de samenleving mogen moderne gemeenschappen nooit worden beperkt tot fysieke of emotionele grenzen die worden gecreëerd door lokale of globale waarden, omdat de mogelijkheden voor interactie onbeperkt zijn.

Translation to Dutch: Daniel Mulder

Gearfetting

Mei de altyd groeiende ûntjouwing fan technology, bewege globale kommunikaasje-modaliteiten harren nei in nije diminsje. Dy ferbûnens soarget foar in maklike tagong ta kennis, mar jout ek behoeften, dy't soargje dat it minskdom mei nije ideeën komme moat om yn dy behoeften te foarsjen, of yn oare wurden: ynnovaasje. Yn dizze tiid is ynnovearje kinne it ultime doel om in foardiel foar organisaasjes, regio's en lannen kreëarje te kinnen. Ynnovaasje makket in woltierige groei mooglik foar mienskippen oer de hiele wrâld, mar net alle regio's binne by steat om by te bliuwen. Dit proefskrift rjochtet him op regio's dy't net alhiel fan dy ynnovative ûntjouwing profitearje kinnen hawwe.

Fryslân, in noardlike provinsje fan Nederlân, is in foarbyld fan sa'n regio, mar tagelyk is it ek in foarbyld fan hoe't in op foarútgong rjochte ynstelling fan lokale entiteiten en boargers it potinsjeel hat om de takomst fan in regio te feroarjen, nettsjinsteande beheinende maatskiplike faktoaren. De earste fan de twa mei-inoar gearhingjende redenen fan dy maatskiplike oergongsstriid yn Fryslân is it yntern oriïntearre sosjale systeem dat it resultaat is fan de histoaryske oarsprong en de geografyske tastân fan de provinsje. De twadde reden is it sletten karakter fan de yndustriële aktiviteiten dy't de primêre ekonomyske boarne fan de regio binne, lykas de lânbou, dat net strykt mei it iepen karakter fan ynnovative mienskippen. Dit ûndersyk hat as doel de sosjale konstruksjes te ferkennen dy't de foarútgong blokkearje en regio's te helpen harren ynnovative output te ferbetterjen troch de neikommende fraach te beantwurdzjen: *Hoe kinne sletten ynnovaasjesystemen troch effektyf gebrûk fan sosjale konstruksjes ûntsletten wurde om duorsume ûntwikkeling te berikken?*

It ferbetterjen fan de ynnovative output fan in regio is in kompleks maatskiplik probleem fanwegen de ûnderlinge gearhing fan tsjinstridige belangen fan ferskate nivo's fan organisaasjes en yndividuën dy't tagelyk by it proses behelle binne. It bestudearjen fan komplekse systemen is bedoeld om yndirekte effekten te begripen, dy't har foardogge as der gjin oarsaak-gefolch relaasje is. Dat rint troch alle tradisjonele wittenskipsgebieten, troch parten, gehielen en relaasjes te ferkennen. Der binne trije mei-inoar gearhingjende manieren fan oanpak om komplekse systemen te bestudearjen: (1) it ferbân tusken ynteraksjes en gedrach begripe, (2) de manieren begripe om komplekse systemen te beskriuwen, en (3) it proses fan foarming troch patroanen begripe. Dit proefskrift nimt in kombinaasje fan dy trije manieren fan oanpak oan om in holistysk begryp fan regionale ynnovaasjesystemen te bieden en stelt twa opinoar folgjende paradoksen fêst om dy kompleksiteit te ferklearjen.

Paradoks 1 slacht op de ûnderlinge ôfhinklikens fan sosjale en technyske prosessen binnen ynnovaasjesystemen. It úteinlike doel fan alle ynnovaasjes, wat harren oarsprong mar wêze mei, is it berikken fan in systematyske ympakt, dy't de 'âlde manieren' fan dwaan feroarje yn de sosjale kontekst dêr't se yn yntrodusearre wurde. De literatuer oer de definysje fan ynnovaasje is breed en multydissiplinêr. Gelearden hawwe besocht in definysje te betinken dy't op alle mêden fan tapassing is, mar binne dêr noch net yn slagge, dat begryplik is mei it each op de komplekse aard fan ynnovaasje, wêr't ferskate perspektiven en ferwachting in rol spylje kinne. Nettsjinsteande it brekme oan konsensus, brûke wittenskippers lykwols hieltyd mear de wurden sosjaal, duorsumens, ekology, systeem en feroaring, wylst se ynnovaasje definiearje, en sjen litte hoe't it mêd fan ynnovaasje him parallel oan maatskiplike soargen útwreidet. In alles omfiemjende oanpak fan ynnovaasje moat sosjale prosessen beskôgje as in ûnderdiel fan ynnovaasje dat hân yn hân giet mei de technyske prosessen, en dêrom is it begripen fan sosjale konstruksjes krúsjaal.

Sosjale relaasjes foarmje in wichtich ûnderdiel fan sosjale konstruksjes, dy't it útwikseljen fan kennis yn gong sette sille, dy't liedt ta in ynnovaasje-ekosysteem. Ynnovaasje is ôfhinklik fan kreativiteit, en bringt it fermogen fan de geast op gong om nije ideeën te betinken dy't foarme binne troch fysike en sosjale moetings. Dêrom moatte sosjale relaasjes tusken de leden fan de mienskip makliker makke wurde om it ynnovaasjepotinsjeel te maksimalisearjen.

Paradoks 2 rjochtet him op de tsjinstridige set fan relaasjes tusken aktoaren dy't in gearmjuksel fan oanlûkingskrêft, ôfstjitten, konflikten en gearwurking mei him meibringt, dy't fansels ynfloed hat op ynnovative output. De relaasjes meie de kreativiteit net beheine om nije ideeën te ûntwikkeljen. It bestudearjen fan de relaasjes tusken aktoaren kin spesifike netwurkdynamyk ûntbleatsje, dy't in negatyf of posityf effekt hat op de prestaasjes fan yndividuën likegoed as it systeem as gehiel.

Sa ienfâldich mooglik sein, wurdt ynnovaasje definiearre as de operasjonalisearring fan in kreatyf idee, dat daliks twa ferskate aarden fan sosjale relaasjes tusken de aktoaren ûnderstreket: bestjoerlike en kreative relaasjes. Dy twa takken hawwe fan nature in hiel oare struktuer: kreative relaasjes binne syklysk en diskursyf, wylst managementrelaasjes lineêr en gronologysk binne.

Sosjale relaasjes tusken in groep yndividuën wurde faak identifisearre as netwurken, en de relaasjes dy't it netwurk foarmje binne ek de oarsaak fan net plande barrens fan nijens.

Dêrom is sosjale netwurkanalyze (SNA) in geskikt helpmiddel om de sosjale konstruksjes, dy't relevant foar ynnovaasjesystemen binne, te bestudearjen. Foar it beoardieljen fan de situaasje fan de ynnovaasjesystemen yn Fryslân, neist de kreative en managementnetwurken, blieken twa oare netwurken relevant te wêzen en waarden dy yn 'e stúdzje meinommen: it politike netwurk, fanwegen de wichtige liedende posysje fan de lokale oerheid, en it freonskipsnetwurk, fanwegen it hechte karakter fan de mienskip.

De netwurken wurde analysearre fia de NetRep-metoade, dy't spesifyk ûntwikkele is as ûnderdiel fan dit ûndersyk foar it bestudearjen fan de sosjale netwurken, dêr't de grutte en foarsisberens fan it systeem gewoane SNA-prosedueres net tapasber meitsje. De NetRep-metoade makket it effisjint en strukturearre sammeljen fan gegevens, falidaasje en analyze mooglik, troch yntinsive sesjes mei represintative aktoaren út te fieren. De analyze fan Fryske netwurken waard útfierd fia in stekproef fan 232 aktoaren, ferdield yn fiif profesjonele groepen: akademisy (66), oerheidswurknimmers (48), op NGO basearre aktoaren (33), kreative persoanen (38) en op bedriuwen basearre aktoaren (47).

Út 'e analyze bliek dat de netwurken yn Fryslân kompakt binne en net iepen genôch foar eksterne kennis. Boppedat binne de oanbelangjende aktoaren net sterk mei-inoar ferbûn, mooglik fanwegen de werhelling fan deselde relaasjes yn 'e rin fan 'e tiid. De analyze fan de foarming, wurking, en it profyt fan de ynnovaasjenetwurken yn Fryslân hat sjen litten dat de hjoeddeistige stân fan de kreative, bestjoerlike en politike netwurken, dy't problemen ûnderfine oangeande it tal en de ferbûnens fan aktoaren, in sûne gearwurking dreech makket. It freonskipsnetwurk waard identifisearre as in goed foarme netwurk. Yn 'e eksploitaasjefaze, basearre op ferbûnens en berikberens, wiene de kreative en managementnetwurken yn kritike tastân, wylst de politike en freonskipsnetwurken yn in minder kritike tastân wiene. Yn de faze fan profitearjen wiene de kreative en bestjoerlike netwurken op 'en nij yn kritike tastân op grûn fan de iepenheid fan de netwurken en de tichtens en it fermogen om kennis te ûnderhâlden, wylst it politike netwurk yn in minder kritike tastân wie en it freonskipsnetwurk op 'en nij tichteby ideaal wie.

Hoewol't de sterke freonskipsbannen in rol spylje yn de behinderjende sletten sosjale struktuer fan de provinsje, is it freonskipsnetwurk it minst problematyske netwurk yn Fryslân en dêrom moat it foar ynnovaasje brûkt wurde. Freonskip hat gjin direkte link mei ynnovaasje, mar de krêft fan besteande netwurken en de lokale dynamyk meitsje it freonskipsnetwurk it bêste paad nei ynnovative foarútgong.

Dizze stúdzje draacht teoretysk by ta de gebieten fan ynnovaasje, netwurken en maatskiplike transysjes troch in oanfoljende oanpak te ûntwikkeljen dy't rekken hâldt mei sosjale en technyske prosessen as gehiel. De teoretyske befinings beklamje it belang fan sosjale konstruksjes by it fasilitearjen fan de ûntwikkeling fan kreative ideeën foar de ynnovative foarútgong fan mienskippen.
Wylst de divergearjende betsjutting fan ynnovaasje folge wurdt yn parallel mei de maatskiplike dynamyk, presintearret it ûndersyk ek in nije manier om sosjaal rjochte ynnovaasje-inisjativen te bondeljen. De argumintative tinkwize, dy't ynnovaasje ferbynt mei netwurkstúdzjes út in maatskiplik perspektyf wei, biedt in maklik tapasbere metodology foar it sammeljen fan gegevens foar grutskalige netwurken. De analyze fan dy netwurken stelde de relevante relaasjes tusken aktoaren fêst en de mearfâldige dynamyk dy't fan ynfloed is op harren prestaasjes.

Konklúzje: mienskippen biede middels foar ynteraksje foar harren leden en meitsje ynformaasjeútwikseling mooglik. Sosjale ynteraksjes stelle minsken bleat oan nije ideeën en drage by oan harren kreatyf tinken. Kreatyf tinken kin yn kombinaasje mei in 'trigger' yn in ynnovaasje operasjonalisearre wurde. In suksesfolle ynnovaasje wurdt troch de mienskip akseptearre en hat in ympakt op de âlde gewoanten fan de leden. Dy syklus hat it potinsjeel om himsels yn stân te hâlden en in trochgeande ûntwikkeling te kreëarjen. De mienskippen sels moatte lykwols iepenstean foar de wrâld om eksterne ideeën op te nimmen. Yn de groeiende ferbûnens fan de mienskip meie moderne mienskippen nea beheind wurde ta fysike of emosjonele grinzen dy't troch lokale of globale wearden kreëarre wurde, omdat de mooglikheden foar ynteraksje ûnbeheind binne.

Translation to Frisian: Marijke de Roo

Özet

Her gün gelişen teknoloji ile birlikte, global iletişim yöntemleri de yeni bir boyuta evrilmektedir. Bu iletişim gücü, bilgiye kolay ulaşımı sağlarken, yanında bazı gereklilikleri getirmekte ve insanlığı bu gereklilikleri karşılayacak yeni fikirler bulmaya itmektedir, başka bir deyişle: İnovasyona**.** Günümüzde inovasyon, şirketler, bölgeler ve ülkelerin avantajlı bir konum elde etmek için kullandıkları en önemli araçtır. İnovasyon, dünyanın bir çok yerinde toplumlara hızlı bir gelişim imkanı vermektedir, fakat her bölge bu gelişim hızıyla baş edememekte, gelişimden yararlanamamaktadır. Bu tez, dünyanın inovatif gelişiminden tam olarak yararlanamayan bölgelere odaklanmaktadır.

Hollanda'nın kuzeyinde yer alan Friesland, Türkçe adıyla Frizya, hem bu tip bölgelerden biri olarak örnek gösterilebilir, hem de toplumsal engellere rağmen, gelişme odaklı bir zihniyete sahip yerel yönetimlerin ve vatandaşların nasıl bir bölgenin kaderini değiştirebileceğine dair örnek olabilir. Frizya'nın yaşadığı toplumsal değişimi engelleyen nedenlerden birincisi, bölgenin tarihinden ve coğrafi konumundan kaynaklanan içe-kapalı toplumsal yapısıdır. İkinci neden ise, bölge ekonomisinin ana kaynaklarını oluşturan endüstriyel aktivitelerin dışarıya kapalı sürdürülme biçimidir. Mesela tarım endüstrisinin çalışma biçimi , inovasyonun dışarıya açık olması gereken karakteristiğiyle uyuşmamaktadır. Bu araştırmanın amacı, bu gelişimi engelleyen sosyal yapıları keşfetmek ve şu soruyu cevaplayarak bölgelerin inovatif verimini arttırmaya yardım etmektir: *Efektif sosyal yapılar kullanılarak kapalı inovasyon sistemleri nasıl dışarıya açılabilir ve sürdürülebilir gelişme sağlanabilir?*

Bir bölgenin inovatif veriminin arttırılması, konunun içinde yer alan farklı kişilerin ve organizasyonların çelişen çıkarları nedeniyle karmaşık bir toplumsal problemdir. Karmaşık sistemleri incelemek, sebep-sonuç ilişkisinin bulunmadığı, dolaylı etkileri anlamaya çalışmaktır. Bu çalışma alanı, parçalar, bütünler ve bunlar arasındaki ilişkileri inceleyerek, bilimin tüm geleneksel alanlarını kapsamaktadır. Karmaşık sistemleri araştırmada birbiriyle ilişkili üç yaklaşım bulunmaktadır: (1) davranış ve ilişkiler arasındaki bağlantıyı anlamak, (2) karmaşık sistemleri tanımlamanın farklı yollarını anlamak ve de (3) oluşum sürecini ortaya çıkan modeller üzerinden anlamak. Bu tez, bölgesel inovasyon sistemlerini bütüncül bir şekilde anlayabilmek için bu üç farklı yaklaşımın bir birleşimini benimsemekte ve karmaşıklığı açıklayan iki ardışık paradoks saptamaktadır.

Birinci paradoks, inovatif sistemlerin kapsadığı sosyal ve teknik süreçler ile ilgilidir. Bütün inovasyonların ana amacı, ortaya konuldukları sosyal bağlamdaki eski yöntemleri değiştiren bir etki bırakmaktır. İnovasyonun anlamı hakkındaki literatür geniş ve multi-disiplinerdir. Bazı araştırmacılar farklı alanlarda kullanılabilecek tek bir tanım bulmaya çalışmışlarsa da henüz başaramamışlardır ki, inovasyonun üzerinde farklı perspektiflerin ve farklı beklentilerin rol oynayabileceği karmaşık yapısı düşünülürse, bu anlaşılabilir bir durumdur. Bir fikir birliğinin eksikliğine rağmen, araştırmacılar inovasyonu tanımlarken toplum, sürdürebilirlik, ekoloji, sistem ve değişim gibi kelimeleri her gecen gün daha fazla kullanmaktadırlar. Bu durum, inovasyonun toplumsal ve evrensel kaygılar ile nasıl paralel bir şekilde ilerlediğini gösterir. Kapsamlı bir yaklaşım, sosyal süreçleri, inovasyonun teknik süreçler ile beraber gelişen bir parçası olarak düşünmelidir ve bunun için sosyal yapıyı anlamak çok önemlidir.

Sosyal ilişkiler, sosyal yapıların önemli bir kısmını oluşturur ve bu ilişkiler bir inovasyon ekosistemini oluşturacak bilgi alışverişinin sağlayıcılarıdır. İnovasyon, fiziksel ve sosyal deneyimlerle şekillenerek zihnin yeni bir fikir tasarlama potansiyelini serbest bırakmak anlamına gelen yaratıcılığa dayanır. Bu yüzden, inovasyon potansiyelini arttırmak için toplumu oluşturan bireylerin sosyal ilişkiler kurmaları ve bunları korumaları kolaylaştırılmalıdır.

İkinci paradoks kendi içerisinde çelişkiler taşıyan, ve hatta fikir ayrılıkları, dayanışma ve çekimin bir birleşiminden oluşarak inovatif verimi doğal olarak etkileyen ilişkilere odaklanır. Bu ilişkiler yeni fikirler için gereken yaratıcılığı aksatmamalıdır. İlişkiler üzerinde etkisi olan aktörleri incelemek, hem kişisel performanslar hem de sistemin genel performansı üzerinde pozitif ve negatif etkisi olan farklı dinamikleri ortaya çıkarabilir.

En basit haliyle inovasyon, yaratıcı bir fikrin işlevselleştirilmesi olarak tanımlanmıştır, bu da aktörler arasında var olan farklı mizaçtaki sosyal ilişkilerin iki tipini öne çıkarır: yaratıcı ve yönetimsel ilişkiler. Bu iki ilişki biçiminin doğal olarak birbirlerinden çok farklı yapıları vardır: yaratıcı ilişkiler döngüsel ve düzensizken, yönetimsel ilişkiler doğrusal ve kronolojiktir.

Bir grup birey arasındaki sosyal ilişkiler bir sosyal ağ olarak tanımlanır ve bu ağları oluşturan ilişkiler de planlanmamış yeniliklerin ortaya çıkmasının ana nedenidir. Bu sebepten dolayı, sosyal ağ analizi, inovasyon sistemlerini amaca uygun incelemek için

doğru bir araçtır. Frizya'daki inovasyon sistemlerinin durumunu belirlemek için, yaratıcı ve yönetimsel ilişkilerden oluşan sosyal ağlara ek olarak, iki farklı ilişki daha saptanmış ve araştırmaya eklenmiştir. Yerel yönetimin içinde bulunduğu önemli liderlik pozisyonu sebebiyle, politik sosyal ağ ve bölgedeki toplumun birbirine bağlı karakteristiği sebebiyle, dostluk sosyal ağı da çalışmaya eklenmiştir.

Bu sosyal ağlar, boyutu ve tahmin edilebilirliği dolayısıyla geleneksel sosyal ağ analiz metotlarını geçersiz kılan sosyal ağları incelemek için bu araştırmaya özel olarak geliştirilmiş NetRep metodu ile analiz edilmiştir. NetRep metodu, temsilci aktörler ile yoğun oturumlar icra ederek, verimli ve düzenli bir veri toplama, onaylama ve analiz etme imkanı sunmaktadır. Frizya sosyal ağlarının analizi beş farklı profesyonel gruba bölünmüş 232 aktörden oluşmaktadır: akademisyenler (66), devlet çalışanları (48), sivil toplum örgütü çalışanları (33), kreatif bireyler ve küçük şirketler (38) ve tüzel kişiler (47).

Yapılan analize göre Frizya sosyal ağları, küçük ölçeklidir ve dışarıdan gelen bilgilere yeterince açık değildir. Ayrıca, ağlara dahil olan aktörler, muhtemelen aynı aktörler arasındaki ilişkilerin sürekli olarak tekrarlanması yüzünden, zayıf kreatif bağlantılara sahiptir. Frizya'daki sosyal ağların oluşum, işleyiş ve fayda sağlama safhaları incelenmiştir. Oluşum aşamasının analizi göstermiştir ki; ilgili aktörlerin sayısı ve bağlılığı ile ilgili sorunlar yaşayan kreatif, yönetimsel ve politik ağların şu anki durumu sağlıklı işbirlikleri oluşturmayı zorlaştırmaktadır. Dostluk sosyal ağı ise iyi yapılanmış bir ağ olarak tanımlanmıştır. İşleyiş safhasında, bağlanabilme ve erişebilme kriterleri baz alındığında, yaratıcı ve yönetimsel ağların kritik, politik ve dostluk ağların daha az kritik bir durumda oldukları belirlenmiştir. Faydalanma safhasında ise, sosyal ağların dışarıya açıklığı ve bilgiyi devam ettirme yeteneği baz alınarak, yaratıcı ve yönetimsel ağların yine kritik bir durumda olduğu, politik ağların daha az kritik bir durumda olduğu ve dostluk ağlarının ideale yakın olduğu belirlenmiştir.

Sağlam arkadaşlık ilişkileri bölgenin engelleyici ve kapalı sosyal yapısı üzerinde bir rol oynasa da, Frizya'daki en problemsiz sosyal ağ, dostluk sosyal ağıdır, bu yüzden bu ağlar inovasyon amaçlı değerlendirilmelidir. Arkadaşlık ilişkileri ve inovasyon arasında direk bir ilişki olmasa da, mevcut sosyal ağların gücü ve yerel dinamikler, dostluk sosyal ağlarının inovatif ilerleme için en doğru yol olduğunu göstermektedir.

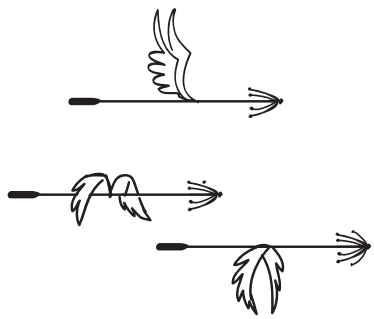
Bu araştırma sosyal ve teknik süreçleri bir bütün olarak algılayan bir yaklaşım geliştirerek, inovasyon, sosyal ağ ve toplumsal değişim çalışma alanlarına teorik yönden katkıda bulunmaktadır. Bu teorik bulgular, toplumların inovasyonla ilerlemesi için gereken yaratıcı fikirlerin gelişmesinde sosyal yapıların önemini vurgulamaktadır. Bu araştırma, inovasyonun sosyal dinamiklerle paralel olarak genişleyen anlamının izini sürerken, aynı zamanda sosyal amaçlı inovasyon girişimlerini kategorize etmenin yeni bir yöntemini sunmaktadır. İnovasyonu bu toplumsal perspektif üzerinden sosyal bağlar ile birleştiren bu düşünme biçimi, beraberinde büyük ölçekli sosyal ağların analizi için kolayca bilgi toplanabilecek bir metodoloji sunmaktadır. Çalışma dahilinde yapılan analiz, aktörler arasındaki inovasyonla ilişkili bağlantıları belirlerken, içerisinde çok katli dinamikler bulunduran bu bağlantıların performansa olan etkisini de belirlemiştir.

Sonuç olarak, toplumlar içinde bulundurdukları bireylere iletişim ve bilgi alışverişi imkanı sağlarlar. Sosyal iletişimler kişileri yeni fikirlere maruz bırakır ve böylece kişilerin yaratıcı düşüncelerine katkı sağlar. Yaratıcı düşünce, modern hayatin ortaya çıkardığı gerekliliklerle tetiklenirse bir inovasyona dönüştürülebilir. Başarılı bir inovasyon, toplum tarafından kabul edilecek ve bireylerin eski alışkanlıkları üzerinde bir etki bırakacaktır. Bu döngünün, sürdürülebilir bir gelişim yaratma ve kendini ayakta tutma potansiyeli mevcuttur. Ama toplumlar kendilerini dışarıya ve dışarıdan gelen fikirlere açık tutmak durumundadırlar. Her gün artan iletişim olanakları ile, modern toplumlar yerel ve global değerler üzerinden yaratılmış hiç bir fiziksel veya duygusal sınıra takılmamalıdırlar çünkü, karşılıklı etkileşim fırsatları artık sınırsızdır.

Translation to Turkish: Doga Çelik & Nermin Atilkan

Chapter 1

THE GREAT ESCAPE



"This one beach holds the story of a world always changing, always on the move..."

Michael Pye, The Edge of the World

The world we live in is immensely unequal. On one side of the world, well-fed and educated children are raised to be wealthy adults, while on the other side parents still have to watch their newborns die. Yet, a significant part of humanity live healthier and wealthier lives than their great-grandparents did. In his 2013 book, *The Great Escape: Health, wealth and the origins of inequality,* Nobel Prize winning economist Angus Deaton tells the story of mankind's escape from deprivation and how humans managed to make their lives better.

Inequality is commonly understood as a poverty issue, as if richer people, communities, or nations can 'escape' more easily. But Deaton (2013) sees money as a result rather than a tool, and according to Deaton, it is not even the most important result. He sees 'the chance to prosper' as the most important outcome of a great escape. In communities that were able to 'escape', individuals are free in the sense that they are able to have a good life and to do things that make life worth living.

Deaton (2013) explains the term *escape* as a continuous action of progress. But he underlines the fact that when there are escapees, there are always those who are left behind. This is the primary source of inequality. The Industrial Revolution was one of these escapes.

During the Industrial Revolution, the progress of one country was often at the expense of another. Although they were parts of the same trade roads, laborers in London, for instance, had higher incomes than those in Southern Europe and Asia, which led to the sustained growth of North-western Europe, also known as the Great Divergence (Pommeranz, 2000).

The Netherlands is one of the escapees of the Industrial Revolution. By the end of the 18th century, the Dutch lived remarkably better lives than they did 100 years before. But just because the average standard of living rose, this does not mean that the entire population flourished in prosperity simultaneously. Similar to the rest of Europe, and even the rest of the world, there are still rural areas of the Netherlands that have only minimally benefitted from this increased welfare. The province of Fryslân is an example of such regions in the Netherlands. This thesis is about how to make the great escape available for rural areas departing from the situation in Fryslân.

Deaton (2013) also discussed what happens to those who were left behind. Why have they not learned from the escapees and created their own escape? Is it because the escape plan was not shared with them? Or was there a lack of resources? Was there a growing

desperation resulting from staying behind? Although all of these are viable options that may have played a role, Deaton emphasises the collective nature of great escapes and sees 'the will to progress' as something that comes from inside.

The word *progress*, which Deaton uses interchangeably with *escape*, strongly relates to innovation in the book. Those who escaped were able to develop novel solutions that made life better in a structured manner. Deaton emphasises the role of innovation for sustained socio-economic growth and describes the Industrial Revolution as a series of innovations that led towards an escape. But even for the European countries that have benefitted from the Industrial Revolution the most, the great escape is far from complete because the reach of innovation capability is limited.

In the case of Fryslân, there are two interdependent reasons for not being able to escape together with the rest of the country: (1) the internally oriented social system that has dominated the region for centuries (Buijtenen, 1953), and (2) the closed-off nature of the industrial activities that are the primary economic resources of the region (Omta, 2017). Chapter 1 of this thesis will focus on these two reasons respectively.

But before starting the explanation of these two reasons, it is essential to understand the origins of the provi+nce and the historical developments in the area that played a lead role in the existence of these reasons.

1.1 It Heitelân:[1] The Past and the Future

The history of the Frisians dates back to the Germanic tribes identified as Proto-Frisians that lived in southern Scandinavia between 1750 and 700 BC. With the break up of Celtic Europe in 400 BC, together with other smaller groups such as the Juts, the Proto-Frisians migrated and settled down around the coast of North Sea and colonised the area that lies between Fryslân and Groningen (Haywood, 1999).

[1] 'Fatherland' in Frisian. This is also how Frisians that do not live in Fryslân refer to the province.

Figure 1. Place of origin of the Frisian folk (Adapted from Wikimedia Commons, 2018)

While colonising the existing settlements in the area, the Proto-Frisians also looked for ways to fight against the rising sea levels. They started building artificial hills similar to mounds (*terp* in Dutch) to stop the water. However, their struggle with water levels continued for centuries.

After Caesar conquered Galicia, the borders of the Roman Empire reached the Rhine delta. From 50 BC and on, Frisians had to resist the Roman attacks and the rising seawater at the same time. Despite many attempted rebellions by the Frisians in collaboration with Batavians, their southern neighbours at the time, the area below the Rhine river remained under the control of Roman Empire until it's collapse in 410 (Tacitus, 117; Vries, 1986).

The conditions became very harsh between AD 250 and 400; the coast of North Sea was not habitable for 150 years. During this period, the Frisian folk moved to the south, but a large part of the group returned to the north when the sea levels dropped down around 400 AD (Haagsma, 2015).

When the Roman Empire lost its power, many groups in the area that is currently called Western Europe started re-settling and declaring independence (Buijtenen, 1953). Around 400 AD Fryslân also declared independence and established the Frisian Kingdom (De Vries, 1986). During the sixth and seventh centuries, Frisians became very powerful through trade.

The reputation of the kingdom reached a level where the North Sea was called 'Mare Frisicum' (Haagsma, 2015). However, the documentation on this era is scarce, and there are scholars that find the stories regarding the glory of Fryslân controversial (Boers & Nicolaay, 2014).

During the early middle ages, the coast of the North Sea went through major developments. Not only did the folks living in the area master ship building and become the greatest traders of the world using the inland and open water ways, but the area also showed early examples of modernity. In his 2015 book *The Edge of the World: A Cultural History of the North Sea and the Transformation of Europe*, British historian Pye refers to the area as the cradle of modernity. He points out that the Frisians were pioneers of trade with Britain to the extent that the word 'Fries' was used as a synonym for 'merchant' in English. Pye defines the coast of North Sea, including Frisia, as the birthplace of the modern monetary systems we use, law, science, and women's rights. In fact, he argues that the revolutionary developments around this area made Renaissance possible much before the movement in Rome or Athens. However, Pye claims that there is very little known about this due to the distraction the Renaissance in the south created. There has been little written in popular history about what happened in the North between the 7th and 16th centuries, and this timeframe is often introduced as the Dark Era (Pye, 2015).

The powerful early medieval era, when the Frisian Kingdom was at its largest state between 6th and 8th centuries is commonly named Magna Frisia in modern history (Halbertsma, 2000). The kingdom (possibly) lost its glory during the Frisian-Frankish wars in 7th and 8th century, but the Frisians remained settled in the area (Haagsma, 2015). According to Pye (2015), despite the war, Frisian success in trade continued until Vikings arrived at the end of the 8th century. Many things were destroyed by their attacks, and the cities on the North Sea coast suffered the most.

Around 1000 AD, the Frisians started building dikes along the coast because the mounds were not effective enough to fight against the rising seawater anymore. This struggle against the water continued for centuries and had an immense impact on the Frisian culture (Haagsma, 2015).

Between 795 and 1500 AD, Frankish, Danish, Vikings, Germans and the Dutch Earls attacked Frisians. These attacks, some of which were successful, caused the inhabitants of the settlements in Fryslân to take different sides and turn against each other. These disagreements

continued for centuries and resulted in the absence of feudal structures. This era without any administration or law is known as the Frisian freedom period (Buijtenen, 1953).

Figure 2. The area Magna Frisia covered (Reprinted from Wikimedia Commons, 2018)

According to historians, the leaderless community that drove itself during the Frisian freedom period had a character-defining impact on Frisians. The struggle with both attacking enemies and rising seawater levels created a strong culture of solidarity among the members of separate communities that had previously functioned as isolated tribes. With no common set of rules, these communities started to find individual ways to protect themselves, and the area became a community of communities that operated independently (Haagsma, 2015).

When Albrecht of Saxony established a central authority in Fryslân in 1498, order in Fryslân was restored for a while, but this caused a large portion of Frisian culture to diminish, especially their mother tongue, and the original Frisian language became vulnerable. The language had already been influenced by the chaos of the long freedom era. Many dialects

emerged from the villages under siege during this period. With the arrival of the Saxons, the church and the traders were using German as the language of operation and Frisians had to adapt to this. Especially in the Mid-Fryslân area, this caused a loss of linguistic identity (Haagsma, 2015). After the series of Friso-Hollandic wars, in 1579 Fryslân gained autonomy and declared independence. Frisians restored authority of their land, established a local government, and had their own army (Janse, 1993).

During the French invasion between 1787 and 1815, Fryslân had a unitary state status. In the following hundreds of years, the province operated in isolation as a peripheral state during which, the inhabitants searched for a new identity and new resources. The agricultural sector developed in this era was as close as Frisians got to having a 'great escape' like Deaton (2013) mentioned.

In the second half of the 18th century, the prices of agricultural products rose. In Fryslân there was plenty of affordable space for agricultural activities whereas in the rest of the country the land prices were rising. The Frisians took their chance to have a prominent place in the agricultural market. They were also quite inventive; for instance, they developed a famous method for making cheese and butter. In addition, they were harvesting potatoes and oats, which were important products in the market for having high nutritional values (Faber, 1972).

The economy started to get better. The opening of the dairy factory in 1879 marked a turning point for Fryslân in becoming an agricultural hotspot. In the 20th century, Frisians developed themselves further in agriculture as a modernised province (Faber, 1972). However, the agricultural sector is very internally oriented by nature, which, in combination with the already internally oriented structure of the community originating from the tribal development of the society during the freedom era, became a disadvantage for Frisians.

In fact, these tribal characteristics are not unique to Fryslân. Former Belgian Prime Minister Guy Verhofstadt (2016) describes 'dealing with the tribal characteristics' as the greatest challenge Europe has faced for centuries. He states that Europe's pursuit of unity will always be fighting against the ancient tribal structures that were not able to open themselves up. But, there are areas and communities that freed themselves from this. Those are the innovative ones as a result of being open to exchange of knowledge. Unfortunately, the food industry that agricultural areas exist on is not yet capable of adopting open innovation strategies to a large extent (Omta, 2017).

With the beginning of the autonomous era, Frisian culture and language re-flourished. Especially because of the efforts of scholars like Gysbert Japicx, Frisian literature gained popularity, and many old publications were translated to Frisian (Breuker, 1989). Yet, the arrival of new habitants during the war with the Dutch, newly established commercial relationships with the neighbours, and the necessity of using Dutch for legal matters caused the decline of the use of the Frisian language (Haagsma, 2015). From 1500 on, many Frisians adopted Dutch as the common tongue, especially for writing. Thus, Frisian remained mainly a spoken language. It is said that the written language was forgotten to a level that, after the Renaissance period, scholars had to re-invent the written form of the Frisian language to be able to use it (Oppewal, 1994).

Despite these changes, Frisians always kept their mother tongue as their official language. Currently, there are about 400,000 native speakers of Frisian language, and the language is protected as a minority language facing extinction (Fase, Jaspaert, & Kroon, 1992). Non-Frisian habitants in Fryslân and the young generations outside of Fryslân who have Frisian roots have also shown a great interest towards learning the language (Galan, 2016).

Language is another important aspect that separates the internally oriented Frisian culture from expressive Dutch culture. Centuries of bilingual operation of the area and the threat against their mother tongue facing extinction required Frisians to isolate themselves. This isolation, together with the individual culture, contributed in the creation of a community that is self-sufficient, modest but stubbornly connected to their roots and ideals (Haagsma, 2015).

Today Fryslân (or Friesland in Dutch) is a province of the Netherlands that is situated on the northwest corner of the country. With around 650,000 inhabitants, it is the eighth most populated province of the twelve provinces of the Netherlands. However, it is the largest province in size when water and land areas are combined. As a result, Fryslân is the least densely populated province of the Netherlands (Urlings & Braams, 2011). This imbalance between the size and population is merely due to agricultural activities that form the base of the economic resources of Fryslân, which require space (Provinsje Fryslân, 2017).

The story of this research starts here as well. The agricultural roots of the province and the opportunities that depart from these do not match the diverse expectations of youth that grow in parallel to the connectedness of the world (LWD18, 2013). Or in other words, the

existing situation in Fryslân regarding the self-development, education, and employment does not appeal to the needs and values of young generations, therefore they choose to leave. This population shrinkage, or *krimp* in Dutch, has not yet reached an irreversible point, but the predictions for the future are not bright unless action is taken, as the infographic from the Dutch Plan Bureau (Figure 3) shows (De Jong & Van Duin, 2010; Kooiman et al. 2016).

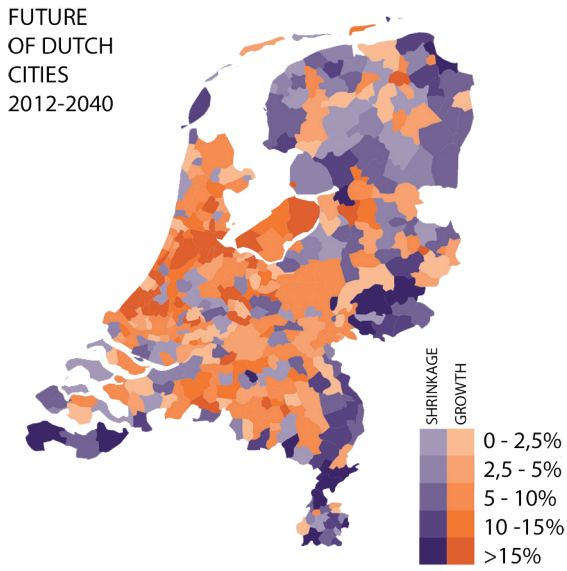


Figure 3. Future of Dutch cities in terms of growth and shrinkage (Adapted from PBL, 2014)

The (local) government acknowledges the situation and takes various actions to re-create a resilient community, which in short time became an example to other shrinkage areas with rural origins worldwide (Provinsje Fryslân, 2010). In addition to curating and facilitating various activities as a step towards finding solutions to local issues, supporting academic research regarding this issue, like this thesis, can be seen as one of these actions as well.

It is important to understand the basic history of the area to realise that Fryslân is much more than minority group that live in the rural periphery of the Netherlands. Although it is not the initial subject of this thesis, the research departs from a series of impressions that are strongly related to the historical and geological isolation of Fryslân.

1.2 **First Impressions of Today's Fryslân: Krimp Biedt Kansen**[2]

According to the Global Innovation Index of 2017, the Netherlands ranks third in the list of most innovative countries, following Switzerland and Sweden. The government investments, academic institutions, and the corporate dynamism demonstrate a world-class innovation culture that resulted in 419 million patents (WIPO, 2017). However, this innovative culture is limited to certain provinces that function as the innovative hubs of the country (EC, 2015).

While these innovative provinces grow economically and demographically, other regions that mainly consist of rural areas are facing risks of population shrinkage and poverty. This imbalance is not a problem that is unique to the Netherlands. The centralisation of agricultural activities all over the world is causing population shrinkage in rural areas. Many European countries have worked on this issue since the early 90s. Jutland is an example of such regions in Europe that managed to successfully form an innovation structure by actively engaging universities in local development strategies (Tietjen & Jorgensen, 2016).

Despite the rather slow growth of rural areas compared to innovative hubs, the situation in the Netherlands is not drastic. Rural areas remain relatively vibrant compared to rest of the European rural scenery. A 2011 report produced by the Social Economic Council's Northern Netherlands branch stated that the problems in the agricultural job market had been compensated for by other sectors. Moreover, due to the small size of the country, it was easier for inhabitants of rural areas to commute to nearby cities for job opportunities (SER, 2011).

The potential decrease in population and the insufficient job opportunities is only the directly visible side of a much larger problem: lack of knowledge infrastructure (RUG, 2017). Knowledge generation is essential for resilience, and education is its first pillar. The difference between Jutland and Fryslân is the existence of a university, and therefore the Jutland model cannot be directly applied to Fryslân since it recognises different dynamics.

Numbers show that Frisian youth have lower levels of education compared to the country average (EC, 2015). This makes sense because there is no university in Fryslân since 1811, which is the year that the University of Franeker was shut down (Huizinga, 2002). There

[2] 'Population shrinkage offers opportunities' in Dutch

are vocational institutions and polytechnic schools throughout the province. Also, the University of Groningen has a small campus in Leeuwarden. In addition, the Wetsus and Dairy Campuses, the top institutes on water technologies and dairy production that work in collaboration with various Dutch universities, are located in Fryslân (De Jong, 2016; Van der Molen, 2010).

Figure 4. University of Franeker by Pieter Feddes van Harlingen (Reprinted from Wikimedia Commons, 2018)

A series of interviews with Frisian youngsters conducted by the local newspaper of Leeuwarden (the capital of Fryslân) in 2017 shows that not only the education level is low, but also the major ambition of students is to get a job in the Randstad area and leave the province. Some students point out that there is very little to do in Fryslân in their field of education whereas others simply state that Fryslân is not appealing and 'nothing happens in the province' (Vloeimans, 2017).

This 'appeal' issue does not only concern the youth. A strong knowledge of infrastructure enables the necessary resources for business networks to grow further as well. According to a 2014 ING Economisch Bureau report, Fryslân, together with Groningen, are the provinces with the fewest innovative jobs. The fact that large corporate establishments or multinationals are not to be found in Fryslân points to the lack of opportunities for such structures. Business initiatives in Fryslân struggle to become resilient establishments. In their report, de Jong and

Eikelenboom (2017) point out that Frisian entrepreneurship is doing well financially but not socially.

Fryslân is dominated by small-medium enterprises (SMEs), but among many smaller initiatives, Royal Philips of the Netherlands is an example of the local struggles. Philips had one of its largest factories in the Frisian city of Drachten for many years but, in 2003, the production line moved to China (Volkskrant, 2003). The factory in Drachten stayed open and later became the production centre for luxury domestic appliances (Pil, 2014). Moving the production line east, where labour is cheaper is not an uncommon strategy. However, despite the fact that Philips products were made in Fryslân, the company always represented the innovative face of the city of Eindhoven. Philips is still very important within the innovation cluster of Drachten, but that does not mean that the province was able to sustain the advantageous position of being the production centre of such a company. In fact, the innovation cluster of Drachten was working on building partnerships with the clusters in Leeuwarden at the time of this research.

The neighbouring province Groningen, on the other hand, where the domestic appliances department of Philips was formally located, managed to sustain the advantageous position and grew further. Today Campus Groningen is one of the largest universities in the Netherlands with more than 30,000 students (RUG, 2017).

Looking at the variety and success of the companies that reside at the high-tech campus in Eindhoven, it is understandable that this context, even if it was not the birthplace of the company, is much more inspiring and fruitful for Philips. Such an establishment of innovation requires a network that enables knowledge generation and flow, which can only be gained from a surrounding innovative culture (Brown, 2017).

The socio-economical resilience of the province is strongly associated with the reach, scale, and diversity of innovation by the provincial government and local municipalities (Halmainen, 2007). This means taking primary action such as attracting expertise to the area to expand the sectoral borders of innovation through structural interventions that will eventually lead towards a stronger economy. But it also means secondary activities such as facilitating creative thinking by establishing hubs for start-ups and playing the bridge role to bring different initiatives together.

The provincial government shows high levels of awareness towards developing an innovation culture and is aiming to expand the provincial potential in various scales (De Jong & Eikelenboom, 2017). Although innovation on its own is generally seen as a technical matter, looking at it from a resilience perspective makes it a cultural issue. The situation in Fryslân provides a great opportunity for studying the development of necessary structures to create this innovation picture on a regional scale. In addition to the researcher's access to local dynamics, the political awareness towards falling behind in innovativeness and the proactive enthusiasm of the local government to solve it enables studying this case.

1.3 Problem Definition: Innovating in Closed-like Systems

For centuries, Frisians were surrounded by enemies and lived as an isolated society that showed characteristics of *solidarité mécanique*, a term meaning a group of people who stay together based on the correspondence of individual values, which Durkheim (1893) used to describe pre-modern societies. In this set-up, individuals have their own roles that enable them to be self-sufficient to a certain extent. However, in pre-modern Fryslân, not just the resistance against neighbouring populations was causing a struggle but also the harsh geographical location of the kingdom required a constant fight against natural forces, especially the sea. Due to a combination of these two major obstacles, Frisians learned to solve their own problems (Haagsma, 2015).

During one of the interviews conducted with locals at the beginning of the research, the interviewee related this self-sufficiency to today's innovation culture anecdotally. The isolated society developed a creative do-it-yourself culture for satisfying its own needs without asking for help from outside. Also, being modest was common because 'showing off' was discouraged due to moral values in difficult times. This way, through the course of the time, being innovative became a habit, as it was a regular activity to bring novel solutions to quotidian problems and to not mention it to anyone. These ancient societal characteristics have evolved into a state of having the creative basis for being innovative, yet not sharing the developments with each other or with the rest of the world in the most effective way.

If this is a recognisable claim, then it is possible to characterise Fryslân as a case that lacks intensity on communication patterns while switching to *solidarité organique*, an organic structure where each unit has their own role but they need each other to complete the whole (Durkheim, 1893).

In 2015, together with 193 other countries of the United Nations (UN), the Netherlands reached an agreement on a sustainable development agenda for 2030 consisting of seventeen global goals, commonly known as the Sustainable Development Goals (SDG). The seventeen goals reflect on various aspects of ecological life on the planet from climate actions to gender equality. Agreeing on the UN's goals rapidly influenced the vision statements of institutions and organisations in the Netherlands. Naturally, Dutch provinces updated their agendas based on these seventeen goals (Rijksoverheid, 2017).

Figure 5. The UN's sustainable development goals for 2030 (Reprinted from Wikimedia Commons, 2018)

The province of Fryslân also adjusted their local strategic vision based on these common goals and encouraged universities, businesses, and other organisations to work towards realisation of the goals (Provinsje Fryslân, 2018). The (local) government of Fryslân therefore continuously works on creating awareness and bringing expertise together to accelerate the journey of Fryslân towards the goals, which also corresponds to the state of solidarite organique as Durkheim (1893) described. Only with the engagement of the youth can the actions taken lead to an innovative culture. However, despite these efforts, the acquired results still were not considered satisfactory by locals for creating and sustaining a system that would fulfill the needs of new generations in the area.

The provincial planning for 2018 focuses on the importance of an innovative climate to achieve an inclusive socio-economical system, as declared in the following excerpt from the planning report:

In the Europe of 2020, Fryslân wants to develop into, and profile itself as, a resilient province that is known for the innovative way in which social and economic benefits are derived from sustainable innovations in an attractive environment. ...We strive for a resilient economy with which we can respond more easily to change. Creating an innovative climate is the precondition for this. The emphasis in the coming period will be on (1) supporting SMEs in the broad sense, (2) promoting joint ventures between governments, education and entrepreneurs and (3) boosting, faciliting and coordinating Frisian projects to relevant northern, national and/or European schemes. (Provinsje Fryslân, 2018)

Fryslân is currently one of the least innovative provinces in the Netherlands according to the annual reports of European Commission (EC, 2015). In 2014, ING bank also published a highly criticised report titled '*Innovatiepotentieel niet in alle provincies benut*',[3] which simply states that Fryslân is among the five least innovative provinces of the Netherlands. Figure 6 demonstrates the innovation potential of Dutch regions according to this report. The report bases this outcome on the number of highly educated individuals, employees in the knowledge sector, innovative jobs, growth and number of freelancers.

Dairy production and water are the first two fields of innovation in Fryslân and are dominated by large-scale corporate and academic institutions that do not fully correspond to the defined criteria of the ING report, which includes parameters such as starter growth and number of freelancers. Also, considering the unconventional areas of innovation that are among the strengths of the province, such as tourism, the perspective from which, innovation is measured becomes a critical point. However, emerging sectors, such as gaming and media, that succeed above country average are easily relatable to such parameters (Libbenga, 2014). Apart from the critique of the report, it is not possible to argue against the statement that the existing innovation potential is not fully realised in Fryslân.

[3] 'Innovation potential not utilised in all provinces' in Dutch.

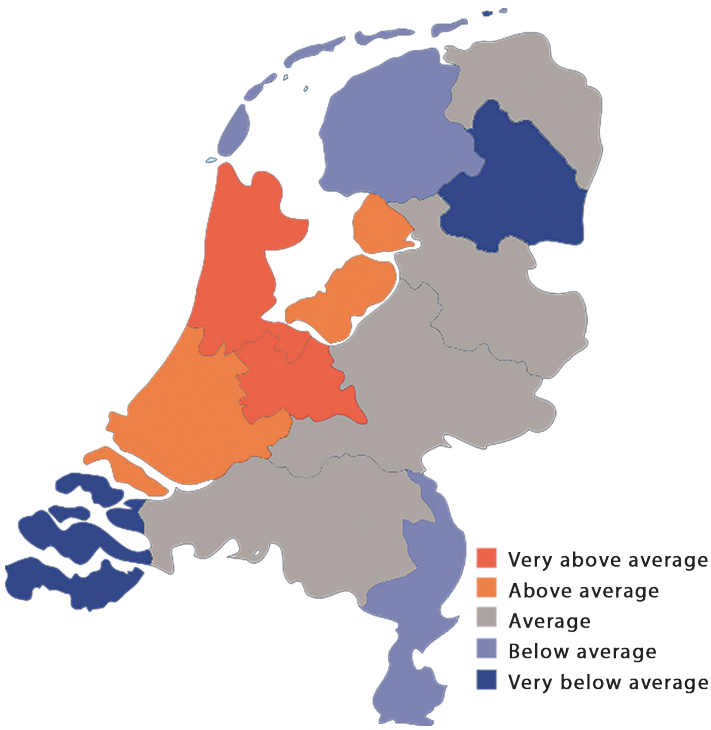


Figure 6. Innovative potential of Dutch regions (Adapted from ING, 2014)

The Economical Council of the Netherlands presents a positive attitude towards the shrinkage issue in the North and describes it as an opportunity. The reason for this is that the northern region still has space for further growth, unlike the other areas that have experienced shrinkage as a result of congestion. If the correct infrastructural investments are made, Fryslân will have many opportunities in the area of education, care, and energy (SER, 2011).

The strengths-weaknesses-opportunities-threats (SWOT) analysis in Table 1 is taken from the Bureau voor Beleidsonderzoek report (2010) that focused mainly on creative industries in the province. This analysis has been used as a point of departure for other initiatives in the area such as the Creative Cooperation, a local initiative that tackles regional issues. Their analysis on the creative industries supports the positive attitude of SER towards the opportunities the shrinkage brings and lays out the issues to be considered in a structured manner (Boneschansker, 2009). However, the highly successful sectors of water and agriculture were left out of the analysis due to its limited focus.

Table 1. SWOT analysis on the creative industries of Fryslân (Adapted from BBO, 2010)

Strengths	Weaknesses
• strong sectors such as architecture, advertisement, communication and graphic design • interesting sectors with potential, such as gaming, pop-culture and media • good education facilities that pay attention on business development • creative sector plays an important on Frisian rural area • affordable facilitations for creative individuals • affordable housing in a city centre with a lot of cultural activities	• non-existing relationship between local companies, creative individuals, and the government • lack of attention towards gaining the interest of youth by educational institutions and companies • no academic institution • minimal work for predicting the future of potentially successful sectors • underdeveloped spatial quality and sustainability of rural area • below average quality of workspaces for creative individuals • young generation missing self-development opportunities around the area
Opportunities	**Threats**
• growing sectors are fashion, interior design, consultancy and research • international orientation is limited also in strong sectors that are expected to go international • entrepreneurs of interesting sectors are very domestic with very limited growth possibilities • limited demand of networks and lack of connection between potential activities/ crossovers • entrepreneurship is very weak within older generations • poor connection between creative sectors and appointed action areas (water, tourism, energy, services) • living environment unattractive compared to other cities • Frisian cities are not considered as rich or active in term of creativity • housing opportunities for students in the centrum • cultural activities are not directed towards stimulating an underground culture	• weak connection to international business platforms • cultural climate not embracing innovation and technology • domestic society without international bonds • city centre has an image of cheap temporary residence • cultural climate stays behind other cities • young generation and entrepreneurs are not interested in local issues • brain-drain due to lack of underground culture

Apart from laying out the current situation in the province, the SWOT analysis reveals an very interesting contrast. The analysis focuses on technical matters mainly concerning business sectors while describing strengths and opportunities. But while describing weaknesses and threats, which function as the point of 'fixation', the focus is on social matters that target the community in general. This distinction acknowledges social processes as pioneers of innovative output through establishing an infrastructure.

Creating an infrastructure that enables knowledge sharing is indeed an important step towards an open system that stimulates innovative output. A closed system is by definition closed to growth and since the society is also a system, only open societies can grow (Venuvinod, 2011).

The concept of 'being open' in the field of innovation has been on the agenda of various multinational corporations since Chesbrough wrote his famous book *Open Innovation: The New Imperative for Creating and Benefiting from Technology* in 2003. Although innovation has a broad range of meanings that have become increasingly positive for economic development, essentially innovation identifies change (Omta, 2017; Godin, 2017). More than 90% of top executives that participated in an American Management Association survey believe that innovation is crucial for their firm's survival, of which 95% believe that this will be a consistent situation for the next decade (Jamrog, 2016).

In 1997, Stevens and Burley described the mortality curve of new ventures by introducing the *innovation funnel*. According to the funnel, less than 0.1% of creative ideas are likely to become successful ventures. However, many scholars discussed the increasing likeliness of success by studying team dynamics in the 2000s. Still, these scholars described a rather 'closed' understanding of innovation. Chesbrough (2003) argued that it was not enough to look just at the internal dynamics of a company, but that the external cooperation occurring outside the boundaries of an organisation must be the main focus. With empirical evidence in favour of this statement, the idea of novelty and technologies also originating outside the company became a key concept. Open innovation suggests the beneficial inclusion of all collective actions through which co-creation of innovation processes are boosted (Von Hippel, 1987).

Today, open innovation is on the political agenda of governments (Ebersberger & Herstad, 2011). But switching to an open innovation mind-set means being open to collaboration,

and collaborations bring along risks (Omta & Van Rossum, 1999). Some sectors are prepared to take these risks before others, and these are also more open by nature. An example of the open side of the 'open-close' scale would be the IT sector, where agile solutions structures and collaborative developments are hyped. On the other extreme of the scale, military developments are known to (and have to be) operate in closed systems.

Although the Netherlands is the second biggest exporter of agricultural goods after the USA, the agro-food industry is structured as a closed system as well. Food is one of the largest industries in the world, but it is relatively slow in developing. A reason for this could be the fact that the food industry does not benefit from globalisation as much as other industries, such as IT, by being stuck in a closed innovation system that does not embrace new opportunities for growth (Omta, 2017).

For centuries, agriculture has been the main source of income for Fryslân. The dairy sector, in particular, grew stronger in time and became a trademark for the area. Yet, in regards to technological developments, it remains as a closed system and struggles with the transition to an open system (Omta, 2017). The transition towards an open system means not only globalisation, but also creating a global meaning for local developments.

The two pillars of the innovation struggle in Fryslân are (1) the agro-food industry operating in a closed system and forming the core of the economic structure and (2) the closed social system of the isolated community as a result of the historical development of the area. The province has to embrace an open culture to have a resilient socio-economic balance.

The fact that developing a culture of innovation requires an open system is not something unknown to Fryslân. The province has developed various projects to tackle this issue. One of the most remarkable recent initiatives was becoming the cultural capital of Europe in 2018 with a bid book that promotes the 'connectedness of inhabitants' in order to support the societal openness (LWD2018, 2013).

The province has also invested in smaller projects on a local scale. These projects are focused in four primary fields: sustainability, water, elderly care, and tourism. There are various organisations that support initiatives from all four fields and some additional sub-areas from proposal to delivery phases. For example, *Fryslân Fernijt* operates as an umbrella organisation where innovative projects in these four fields are facilitated. *Innovatie Pact Fryslân*, on the

other hand, supports continuous collaboration between local initiatives. In addition, recent transformation of the old prison Blokhuispoort and the Kanselarij building in Leeuwarden into hubs for creative industry and entrepreneurship are examples of physical facilitation of these activities, as such locations carry an increasingly important role for knowledge sharing (Bilandzic & Foth, 2016).

But why hasn't the situation in Fryslân improved despite all these efforts? Acknowledgment of the problem is there, stakeholders are there, and action is there but, there is not enough output in terms of creativity and innovation to make the transition happen (Boneschansker, 2009). Change has yet to arrive in the province. The scientific problem that this research departs from is the lack of such an analysis to assess the reasons behind the situation and help Fryslân, or any other province with similar issues, to develop a resilient future.

The existing literature on innovation originates from the business management context. A large portion of this discipline is dedicated to how to enhance the innovative performance of a company or a team within a corporate setting. Innovation is commonly discussed by targeting a group of individuals that operate on the basis of similar goals, which describes a rather closed system and therefore lacks the complexity of a regional system. The complexity of a regional innovation system that is derived from the involvement of multiple actors with completely different expectations cannot be explained by theories and methods from business management literature. However, acknowledging the complexity and learning from existing theories can be a starting point.

1.4 Research Questions, Aims and Objectives

Fryslân, and the north of the Netherlands, has been experiencing (relative) socio-economic difficulties for decades. Being an example of rural Europe, these difficulties make the Frisian society vulnerable for serious issues such as population shrinkage (Provinsje Fryslân, 2010). In a highly innovative country like the Netherlands, Fryslân is running behind in providing output that will lead towards a strong region with a diverse job market that can accommodate upcoming generations, who have (and will continue having) strong creative aspirations (Del Conte & Celik, 2015).

The history and identity of the province as the agricultural hotspot of the country is now falling behind due to closed innovation approaches of such industries coupled with the

rise of technological innovation of other sectors in the country (Omta, 2017). Innovative industries are known to be Netherlands' strong suit, but, in Fryslân, the small number of innovative attempts is struggling to move forward as successful businesses (Welink, 2015). This research attempts to understand the systemic reasons of the province falling behind in innovative output.

The assignment given by funding parties TU Delft, Noordelijke Hogeschool Leeuwarden, and the province of Fryslân that triggered this research is briefly described as 'to develop a methodology to explore the dynamics of regional innovation and to enhance the output for strengthening the socio-cultural and economic situation of the northern region'. Although regional dynamics differ through the historical and geographical background, the problems Fryslân is experiencing are valid for many different systems in the world that come in various sizes, forms, and contexts.

McLeod (2008) defines research as the "systematic, rigorous investigation of a situation or problem in order to generate new knowledge or validate existing knowledge" (as cited in Carey, Harris, & Lee, 2017, p. 208). Formulating the initial assignment for a PhD research project that is supposed to generate new knowledge can result in vaguely explained questions with many assumptions behind them. It is the researcher's task to create a series of research relevant questions while considering the validity of the assumptions. The researcher is expected to close a knowledge gap by answering the research questions and possibly give a direction to further research as a result.

In addition to the conventional theoretical expectations out of a PhD trajectory, having received the assignment from the local government of Fryslân, providing practical output for the issues experienced by Fryslân was an additional requirement of this thesis. Naturally, region-specific output of the research that derives from local dynamics should be applicable to global settings as well.

The given assignment, which came with various research assumptions, was reformulated as a preliminary societal question to be investigated thoroughly:
'*How can we enhance the innovative output of Fryslân so that the province becomes more attractive socio-economically and culturally?*'

Deriving from this assignment, the historical and demographic analysis conducted on the province of Fryslân, the case of this thesis, has brought this researcher to the conclusion that the societal construct of the region is not open enough to facilitate the development of innovation. The internally oriented society and industries are the major hinderance here. That being said, the study acknowledges the correlation between innovation and social dynamics that have the power to influence societal processes and orientates the research direction through this correlation.

After developing first impressions through observing local dynamics, asking expert opinions, and studying the regional history, this societal question led to a research question that forms the theoretical basis of this thesis:
"How can closed innovation systems be opened up through the effective use of social constructs to achieve sustainable development?"

Societal questions are complex due to multitude of interests and interdependencies of these. Therefore, similar to all complex situations, the innovation struggle in Fryslân may have multiple solutions (Monge & Contractor, 2003). Apart from answering the above mentioned initial research questions, the research aims to develop a series practical pieces of advice for Fryslân and other parts of the world that experience similar issues. The theoretical output of the thesis regarding innovation processes will move hand-in-hand with the practical output that will be provided to help the situation in areas that have not 'escaped' yet.

1.5 Research Strategy and Methods

The study takes the situation in the province of Fryslân as a case and explores several interdisciplinary fields around it. The first and foremost direction of exploration is to unfold the reasons behind the innovation struggle in Fryslân to understand the essence of the research subject. The research is derived from the societal question that has developed as a result of a problem caused by the historical, demographical, and geographical character of the province of Fryslân. This problem in Fryslân can be summarised as the lack of innovative output despite acknowledging that Fryslân lags behind and the recurring attempts to boost the economy for over ten years.

This highly complex and subjective topic is explored through studying the historical background of the area and studying the contemporary literature regarding the local dynamics in

combination with interviews with locals. Based on this societal problem definition, a general research question was formulated to give the research a direction:
'How can we enhance the innovative output of Fryslân so that the province becomes more attractive socio-economically and culturally?'

Departing from this first research question, the first fieldwork conducted consisted of talking to locals on the defined question. The local insights gave a general shape to the research and led to the first literature review. Indeed, the first literature review on this area and other similar areas that experience such problems showed that the low innovative output is related to the highly closed up social constructs of these regions since innovation needs an open atmosphere. With this question, it is presumed that Fryslân could not take the good measures to be an open community.

This preliminary conclusion is based on desk research and first fieldtrips, and led the research towards a new research question: *'How can closed innovation systems be opened up through the effective use of social constructs to achieve sustainable development?'*

To be able to answer this question, a secondary literature review was performed, but it was not possible to find in-depth answers that explained a similar situation in the same scale and historical context. This is because innovation studies are heavily influenced by business management literature, which deals with the technical side of the story. The scarcity of literature that investigates the link between social constructs and low innovative output on the scale we are looking at required the question to be derived through the situation at hand in Fryslân. Therefore, based on the available literature, we have compiled a series of propositions that make preliminary assumptions regarding the answer of the research question. The research methodology followed in this thesis is therefore based on validating these priory-formulated propositions regarding the situation in Fryslân.

Studies that focus on a specific social context often adopt an empirical approach that collects data through observation. De Groot (1999) defines five steps of the empirical cycle: observation, induction, deduction, testing, and evaluation. The induction step here refers to the creation of hypotheses in relation to the observations on the research phenomenon. And the following step of deduction formulates testing experiments to decide on the applicability of the created hypotheses. Since the scarcity of data on regional innovative output in relation to social constructs disables the observation and data collection phases, it

was not possible to apply the empirical research methods directly, or to generate statistically checked hypotheses. Because in such a situation the collected data came from a related, but not similar situation, it was not possible to create hypotheses that could be statistically tested and proven true or false. Therefore, this research adopted an interpretation of empirical studies by formulating propositions of different natures to be explored for finding supporting empirical evidence. The propositions do not aim to become conclusive hypotheses, but instead, explore the situation at hand by combining desk research and fieldwork.

Propositions are the researcher's interpretations of the theoretical research, identified in different ways. The reason for identifying propositions is to summarise the main conclusions of the literature study and to provide a basis for the studies that will be conducted later in the research. However, the propositions differ in nature, and three major types of propositions can be found at the end of Chapters 3 and 4:

- Literature-based propositions: These are scientific conclusions that are directly derived out of the literature. They are created by relating findings to each other but are (or can be) relevant for Fryslân.
- Reflective propositions: These are the conclusions from explorative field research, not necessarily the results of scientific research but more in the form of practical insights that seem reasonable for Fryslân.
- Empirical-based propositions: These are conclusions that are reached as a result of the analysis presented in this research and their abbreviation through designed methodologies.

The fundamental problems and the propositions derived from the literature research are at the end and are combined with the fieldwork. The fieldwork conducted in this research also does not correspond to the phases of the classic empirical cycle where the researcher remains an objective outsider and observes the situation without being involved. Donald Schön (1983) defines this as the reflective practice, where the practitioner reflects on the taken actions and engages in the process of continuous learning. In addition, due to the steadily evolving perspective of the study along with creating and finding evidence to support the applicability of propositions, new areas of exploration will be included in the scope of the research. Therefore, while discussing the applicability of the propositions, the theoretical perspective will be broadened if necessary to lead to additional insights useful for explaining the situation in Fryslân.

The interviews with the locals at the beginning of the research showed a clear relationship between the historical development of the province and the current social constructs. Therefore, the first part of the literature review presented in this thesis investigates historical facts, the local struggles, and demographical developments that are also relevant for many similar regions. This way, a societal perspective towards understanding the regional dynamics was developed which has opened up new fields of exploration.

Upon gaining insights on the development of social constructs in Fryslân and how the society showed characteristics of a closed-like system, literature-based questions that were derived from these subjects were used to formulate a theoretical perspective through new literature studies. The results of the conducted literature reviews to explore the societal and theoretical perspectives, which also form the flow of arguments in this thesis, are summarised in Chapter 2.

Exploring the theoretical and societal perspectives through literature reviews helped to identify the first paradox of this thesis regarding innovation processes, which can be simply described as the contradictory nature of the social and technical sides of innovation: they are dependent on each other but are commonly understood as separate matters. This paradox (Paradox 1) has led to studying the process of innovation in detail, through literature and empirical studies. This approach required the implementation of both qualitative and quantitative methods, which were used interdependently for conducting the empirical and theoretical parts of the study. However, the research initially evolved through intertwined and discursive iterations that did not follow one another as chronologically as described in the thesis. It is not possible to expect such linearity from a study that aims at creating new knowledge.

In relation to Paradox 1, the first study in Chapter 3 focuses on the phenomenon of innovation by approaching the multidisciplinary character of innovation from a functional perspective. While doing this, a combination of qualitative methods was used in an explorative nature to understand the origins, state-of-the-art applications and relationship of the innovation phenomenon to society.

While looking at innovation from a process perspective, the research strategy consisted of providing new insights based on the opinions of fellow scholars, looking at best examples and drawing explorative conclusions. On the other hand, while looking at the process

from an actor's perspective, the research aimed at collecting new data through interviews, advising on strategies based on findings and developing these further with expert opinions.

Studying the first paradox of the innovation process concluded with a series of propositions that summarised the gathered knowledge, from which some aimed at enhancing academic knowledge, whereas the others were observations regarding the societal situation at hand as described earlier. Together, the propositions directed the research and became crucial points of the argumentation. While defining the main research focus, the paradoxes and the accompanying sub-research questions also helped to answer the general research question by breaking it into manageable pieces. Through the literature search, the relationship between the community and innovation was identified as a paradox (Paradox 2).

The historical background of Fryslân and the relative closedness of the society were concluded to be the root of today's problems based on the preliminary literature research. Frisians want to innovate now to fix these issues, but we know that there are societal factors that hamper innovation. Since Paradox 1 concludes that societal context is the critical success factor for innovation and especially in Frisian situation, it is worthwhile to study how the society operates. Paradox 2 of this research therefore focused on these social constructs. For this purpose, social network analysis (SNA) was a wonderful tool. Before engaging in social network analysis, the two paradoxes broadened the initial research question with sub-questions. Later on, the paradoxical approach and the flow between the two paradoxes appeared to be highly useful to build up the empirical research.

After unfolding the theoretical and practical definitions of innovation in Chapter 3, based on Paradox 1, new paradoxical concepts that emerged from the complexity of innovation were explored through interrelated qualitative methods to provide explanatory insights. In chapter 4, the complexity of innovation, as concluded in Chapter 3, is explained from a relationships perspective. Chapter 4, therefore, guides the reader through the pattern of thoughts that links the research question and the two paradoxes to the network analysis that forms the main topic of the remaining chapters of the thesis.

The data collection in the first half of the thesis involved investigating existing literature and gathering expert opinions. In the second part of the thesis, data was collected through interviews with the members of the innovation community in Fryslân in a structured way.

Therefore, the province of Fryslân is the exploratory case study of this research, where the data was collected and the results were tested.

SNA is a preferred method to study the social constructs and the series of relationships that form them. In addition to fitness of the classical empirical cycles to the study, the fitness of classical SNA tools is also questionable. This is because, although very helpful, SNA conventionally looks at networks with a given sample size, where the data regarding the relationships between actors are directly accessible. In a regional study, where the system boundaries are not clearly defined, the relationships between individuals are multifold and the data are not directly accessible. Also, considering the lack references to similar studies in the literature, the application of SNA needs to be re-designed. Chapter 5 of this thesis is purely dedicated to explaining the applied methodology of the social network analysis developed to study the social constructs within large-scale networks. The Network Representative Method (NetRep method) that enables efficient data collection and analysis of actors and their relationships in large scale networks is explained step by step in the second half of the thesis. In Chapter 6, the analysis of the collected data through the NetRep method is explained and the results of the analysis are reported.

In Chapter 7, the results of the SNA are explained in relation to the propositions developed from the literature reviews. Chapter 7 brings the SNA and the paradoxes together and form a complete picture. However, in addition to the propositions that we went through one by one to see the applicability to the Fryslân case, a series of expert interviews were held. The Network Representative method relies on the information given by knowledgeable individuals that are a part of the network and also includes validation phases. One of the most important steps in the methodology (which is described in detail in Chapter 5) is the interviews, which have a two-fold function, with the experts. The first function of the expert interviews is to validate the reliability of the data given by the representatives. The second function is to perform as a plausibility check on the line of argumentation that we have knitted together with literature reviews, propositions, and SNA. After gathering the data and creating the network maps, it is especially necessary to collect additional literature to explain the underlying dynamics in the graphs. This step has the potential to cause an unplanned divergence of the theoretical perspective in order to get more out of the collected data and explain the network graphs.

This research focused on the intersection of various study fields that were not explored in a comparable scale or level of complexity. Therefore, the study borrows its tools and methods from relevant disciplines such as management and sociology to provide potentially helpful results. However, the lack of a single method to follow makes it necessary to bring in a variety of references from the literature that are operationalised through the course of the research in coherence with the conducted fieldwork. Which means that this study evolved through designing the approach based on the plausibility criterion. Plausibility refers to an explanation or a statement that seems likely to be true or valid (Thesaurus, 2017). Therefore, at the end of the thesis, before concluding the research, an expert round will be presented to confirm the recognisability of the final statements and the coherence of the entire set of findings.

1.6 Generalisability of Findings

This research has evolved through broadening the initial assignment to develop a wider view based on the problem definition that originates from the province of Fryslân. The elements that constructed this view were investigated to create societal and theoretical perspectives, leading to a research focus.

The reliability of the conducted studies relates to the consistent and well-documented data collection and analysis methods applied throughout the research. During the research, multiple sources of data were utilised to ensure the coherence between empirical studies and literature reviews. For instance, in Chapter 3, the definition of innovation in the literature and in the corporate world are analysed separately in order to have a holistic view on this topic.

For the literature research, which also forms a significant portion of the theoretical output of this thesis, search queries were formulated to be as inclusive as possible and were used in interdisciplinary platforms to access a variety of data. These queries and the search platforms are openly shared to enable methodological consistency, especially regarding the literature review on the terminology of innovation in Chapter 3.

The first part of Chapter 3 attempts to bring an understanding to what is meant by 'socially oriented innovation in Fryslân and related surroundings' and presents explorative research based on randomly collected cases to open up the horizons of the research before engaging

any literature. Just like the rest of this thesis, this study did not aim to provide descriptive statistics on organisations and their innovative output. It only tried to identify similarities and differences between commonly known organisations that work on similar goals. The categorisation that was the result of this study has been validated through questionnaires with experts in the field.

The main qualitative research in this study, which is the social network analysis that forms the core of this thesis, was performed through multiple series of interviews with individuals that were pointed out by the experts as representatives of local networks related to innovation. These interviews were conducted as identically as possible and the interviewees had equal amount of knowledge regarding the topic, process, and methodology.

Social network analysis that is based on third party knowledge, as it was performed in this thesis, is by definition inter-subjective. However, as explained in Chapter 5, the study did not aim for descriptive data. It only aimed to explore the existing situation through a small sample that represented the situation. Moreover, multiple methods were implemented to validate the collected data. First of all, the data were validated quantitatively through 'an outlier analysis'. This way, it was possible to measure the reliability of the answers gathered from interviewees by comparing the answers to each other. Additionally, the analysis results were shared with experts as a second validation to simulate the triangulation method used to combine data sources for validation (Saunders et al., 2009).

Research validity is defined as the ensemble of theoretical findings and the generalisability of these in different settings (Bryman & Bell, 2003; Saunders et al., 2009). The generalisability aspect refers to the external validity of findings and is concerned merely with the findings of empirical studies. These are discussed in detail in the concluding parts of the corresponding chapters. However, the results gathered in this thesis are meant to be useful for other rural areas than Fryslân or areas that experience several other forms isolation throughout the world.

1.7 Thesis Outline and Reader's Guide

The thesis is divided into seven chapters that explore the complexity of innovation processes from different perspectives. The first two chapters form the introductory chapters that explain the research background, focus and methodology. Specifically, the first chapter describes the

problem and the interpretation of the given assignment. Chapter 1 also gives an overview of the initial research questions. Chapter 2, on the other hand, details these research questions through societal and theoretical perspectives. These perspectives in relation to the problem statement unfold through two paradoxes, which are explored in Chapters 3 and 4 of the thesis. These two paradoxes form the core of the research.

Chapter 3 looks at the complexity derived from the interdependency of social and technical processes within innovation. This chapter consists of two parts. Thefirst part presents an overview of innovative initiatives with social aims and explains a method for how such initiatives can be categorised. The second part provides an extensive literature review that looks at the divergence of the terminology within innovation studies in relation to societal development by analysing over 250 definitions of innovation published in the last ten years. Chapter 3 concludes with a complementary model proposal that describes innovation as a combination of societal and technical processes.

Chapter 4 of the thesis explores the complexity of innovation further by looking at the ever-growing connectedness between actors of innovation by focusing on the paradoxical relationship between creative and managerial lines of work. The chapter, therefore, explores the *network emergence* concept and explains why social networks are relevant to innovation. Chapter 5 gives a structured explanation of the social network analysis performed in the province of Fryslân as a case study in terms of data collection, validation and analysis. Chapter 6 reports the theoretical results of this SNA and gives practical recommendations to various actor groups in Fryslân based on these results. Chapter 7 gives the conclusions of the SNA and revisits the propositions of this thesis.

The thesis concludes with a final chapter (8) that summaries the general research contributions in theory and practice relating to both paradoxes. This chapter also gives direction to future research by emphasising the limitations and underlines the remaining knowledge gaps.

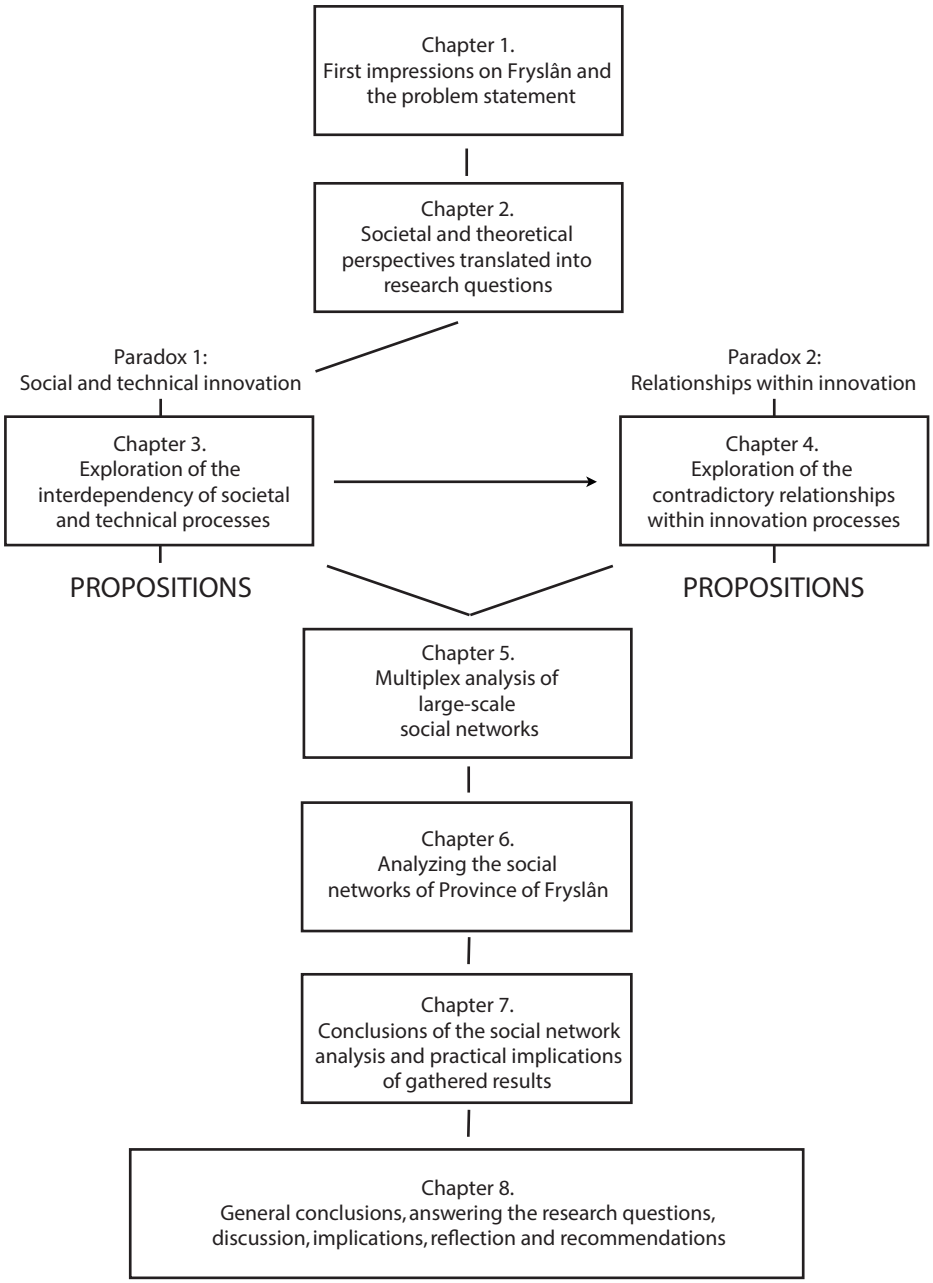


Figure 7. Thesis outline and the overview of chapters

Chapter 2

INTERDEPENDENCIES OF INNOVATION

"I'm a scientist and I know what constitutes proof. But the reason I call myself by my childhood name is to remind myself that a scientist must also be absolutely like a child. If he sees a thing, he must say that he sees it, whether it was what he thought he was going to see or not. See first, think later, then test. But always see first. Otherwise you will only see what you were expecting. Most scientists forget that."

Douglas Adams, The Ultimate Hitchhiker's Guide to the Galaxy

In this chapter, the research focus deriving from the initial assignment as described in Chapter 1, will be reformulated as societal and theoretical perspectives. The problem statement is divided into several thematic parts of exploration that focus on two core aspects: regional resilience and complexity of innovation. In addition, the chapter explains research assumptions and summarises the theoretical perspective before starting the explanation of empirical studies.

2.1 Societal Perspective: Resilient Communities Through Innovation

2.1.1 Necessity of innovation for resilience

By 2011, 1% of the population in the Netherlands had a job that is directly related to creativity (Urlings & Braams, 2011). This large group of employees is mainly located in metropolitan areas that function as innovative hubs (Celik et al., 2014). Thanks to the international success of these hubs, the term 'Dutch innovation' is now known worldwide (Egusa & Cohen, 2015). Although innovation and entrepreneurial activities can be seen as a large part of the daily life in the Netherlands, it is not yet possible to say that this is homogeneously distributed over the country (ING, 2014).

As explained in the first chapter of this thesis, not every region in the country is benefiting from this innovative growth to the maximum. Recently, a question of resilience has developed together with the socio-economic issues arising in Fryslân and became the top point of local agenda (Taskforce RIS3 Noord-Nederland, 2014). Resilience is defined as the capacity to recover quickly in science (McCarthy, Collard & Johnson, 2016). As an urban term however, it refers to the strength of systems and their capability of facing externally or internally caused damage. Therefore, resilience in this thesis is understood similarly to the 'great escape' of Deaton, referring to an improved state of sustainability where each and every citizen gets the chance to prosper within a system that acknowledges the nonlinearity of social dynamics (Chandler, 2014).

As the definition of resilience suggests, being prepared to the impact created by external and internal matters is only possible through renewing existing conditions and creating alternatives for survival. The novelty of these actions is directly related to innovation and its purpose. However, innovation does not always go towards sustainability, as many outputs of technological innovation work against the UN Sustainability Goals, by creating more waste

for instance. What we are looking at in this thesis is broader than the outputs of technological innovation and relates to social sustainability that aims to give better futures to regions and their inhabitants. Therefore, it is possible to say that from a holistic perspective, innovative capacity in this era has a direct impact on resilience of regions, since it refers to the ability of finding alternative solutions and leading towards a sustainable future (Bristow & Healy, 2013).

Knowledge and innovation have become crucial for developing systems, which is a consequence of simultaneously operating matters. Globalisation means, opening up and therefore enables new communication channels, through which opportunities grew and challenges the humanity faces have increased. This sudden growth has also enhanced the ambiguity in the developed economies. Through this development, has given innovation gained a significant role in economic and social growth. Innovation came as a natural follow-up of the open structures. In fact, openness to external ideas and paths became a necessity for successful innovation (Chesbrough, 2003).

Regionally becoming innovative has multiple parameters as well; it can never be undermined to simple governmental procedures that have to be realised. A productive environment that facilitates innovation holistically through inspiration, education, realisation and all it's other phases is necessary for this (Davenport & Bibby, 1999; Dooley, 1999; Borras & Edquist, 2013). But why did being innovative become very important suddenly? There are two sides to this story in Fryslân. First of all, as briefly described in previous chapter, the lack of opportunities available for personal development of younger generations such as academic or employment opportunities, oblige the young generations who carry most of the innovative potential to leave the province (Altena, 2013). The youngsters, who can be specified as Generation Y and Z (born between 1980-2020), are known to be the most creative generations ever lived with strong entrepreneurial vision. With the expansion of tech-savvy upcoming generations in the business world, industries are expected to experience positive changes (Gursoy, Maier, & Chi, 2008). Fryslân needs to bring the youngsters back to be able the reach the critical mass of changing the course of things. Creativity that leads to innovation is dependent on more levels of society then only youngsters, but without future generations being present, the effect will remain limited. Secondly, since humanity is experiencing the technology era, not being able to contribute in technology that life is becoming dependent on, will be making regions (such as Fryslân) dependent on those who can produce it (OECD, 2007).

The two parameters described above are dependent on each other. Society rapidly goes through radical changes. Whether it is a product or a service, satisfaction levels get very high. Innovation is not one men's job; it is a process that evolves through multiple phases that are fed by the creative, entrepreneurial environment around it (Drucker, 1985). With the lack of a triggering ecosystem around it, the environment will remain underdeveloped.

The innovative environment is highly dependent on regional (or national) development strategies that facilitate potential changes. Although regional development is an age-old field of study, relating it to innovation and considering the complexities that rise from both of these fields is rather new. Therefore, it is helpful to have a look at different approaches to this matter and go through its applications to shape the societal perspective of this thesis further.

2.1.2 Regional innovation systems

Studies on 'innovative output' are abundant in theory and in practice. There are various tools and methods that are developed for enhancing resources and results of innovation. However, these existing studies are mainly oriented towards helping the innovative output in corporate settings.

In the last decades innovation has become a multidisciplinary phenomenon and therefore gained multiple meanings. The simplest definition is that innovation is: operationalisation of a creative idea. Just like all creative processes, innovation in corporate settings also recognises a certain level of complexity (Engler, 2009; Harkema & Browaeys, 2002; Dias et al. 2014). Since complexity refers to the multi-dimensional interactions between system components, the level of complexity in rather closed corporate settings does not correspond to the level of complexity that has to be considered while talking about the innovative output of an entire region. Therefore, the methods and models developed for enhancing innovative output of businesses cannot be expected to directly help regional problems.

Regional innovation is documented and studied scarcely compared to technological innovation. A large portion of the limited amount of documentation regarding regional innovation focuses on the sum of corporate activities that occur in a given region (Reynolds et al. 2001). Additionally, various researchers studied how regional innovation systems contribute to the innovative output of local firms in multiple contexts, which again helps the firms rather than the region itself (Lau & Lo, 2015; Belussi et al., 2010). For instance Porter

(1990, p.12) relates regional innovation to the success of firms in the region and state that "this success is influenced by four elements: conditions of the local factors; conditions of demands; strategies of relating and supporting industries, and firm strategy; structure and rivalry." However, these claims target a profit through innovation rather than creating a regional innovation culture.

In late 80s scholars defined innovation systems as operational networks of entities nation-wide (Freeman, 1987). "The national innovation systems were used to describe the complex flow of technology and information among people, enterprises and institutions that are key to the innovative process" (OECD, 1997, p.8). Regional innovation systems, that form a part of this flow, relate to a smaller part of the system that is greater than the scale of a city but smaller than the entire innovation system of the nation as a whole (Hemert, Nijkamp, & Masurel, 2013). The idea behind is that the skills of companies and research institutions, and the interactions between them and with the public institutions together define the innovative economy of regions.

This vision is often criticised for operating from top to down and not taking context-related dynamics of regions in consideration. According to Autio (1997), regional innovation systems are not just a designated part of national innovation systems. They carry distinctly different contextual characteristics and therefore regional innovation culture cannot be studied with the same tools as national or global innovation.

In 2008 the British government described the ideal regional innovation system with the diagram Figure 8. This diagram suggests a quadruple helix-like structure that combines universities, local government, industries and local clusters that tackle regional challenges while taking local values into consideration (Carayannis, Barth, & Campbell, 2012). "Regional Innovation System (RIS) is a set of networks between public and private agents that interact and give mutual feedback in a specific territory by taking advantage of their own infrastructure to adapt, generate and extend knowledge and innovation" (Lau & Lo, 2015, p.100).

A majority of studies on regional innovation originate from the field of macro-economics and transition studies. Doloreux (2002) state that "these discussions deal mainly with technological innovation but remain as limited as many aspects of the complex nature of innovation" (p. 2). Macroeconomic development is determined by the gross capital and labour power. Scholars have confirmed the idea that investing in knowledge can positively affect development in

the long-term (Lucas 1988; Rebelo, 1991). From here, the interrelated concepts of localisation of technological development, cumulative knowledge generation and network learning have developed. This inclusion of intangible resources to macroeconomic growth models gained such an importance that the concept of 'industry society' discussed since 50s evolved to 'knowledge society', which refers to the production of commodities of high knowledge values (Naumanen, 2004).

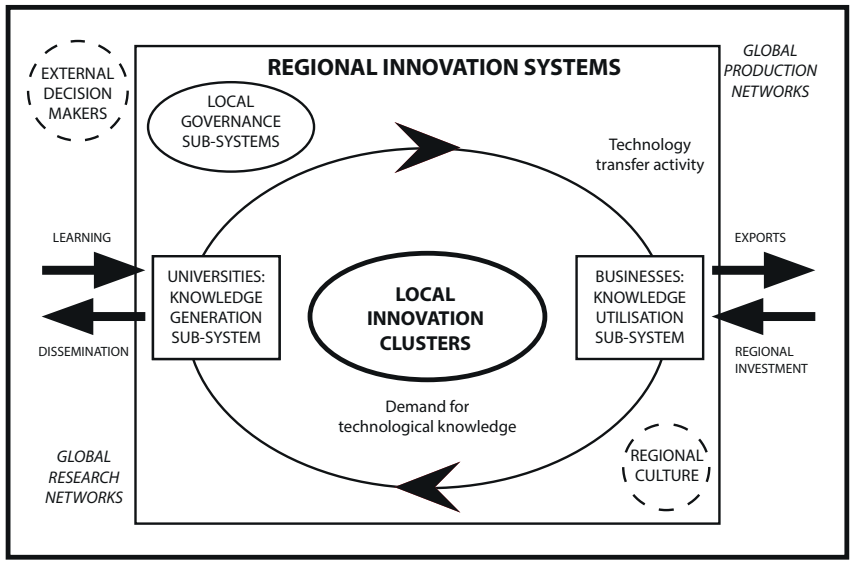


Figure 8. Regional innovation systems model (Adapted from OECD, 2008)

The literature of macro-economy commonly uses 'the overall competitiveness index' to measure growth capacity, which also functions as a model for regional growth. Schienstock and Hamalainen (2001, p. 34) "state that this index has seven components that are dependent on each other for successful operation.

1. new productive resources (venture capital, human capital, scientific knowledge, ICT infrastructure;
2. new technologies (R&D inputs, innovations, adoption of ICTs);
3. new organisational arrangements (allocative, technical, coordination and dynamic efficiencies);
4. new product market characteristics (sophistication of demand, product market institutions, user-producer cooperation);

5. degree of economic internationalisation (foreign direct investment, international trade, cross-border alliances);
6. institutional incentives (taxation, regulation, returns to education);
7. role of government (expenditures on efficiency and competitiveness vs. equity related tasks)."

These seven components do not only refer to the broad operation field of innovation systems, but also to the facilitation of innovation by various bodies. However, according to these components, the competitiveness of a region is mainly measured via its output rather than the prosperous development of society as Deaton suggest (2013) and leaves the society out of the process.

Recently, numerous regions formulated ways to enhance innovative output on top of measuring it, especially in Europe. Finland is one of these countries that work on regional growth strategies. In 2007, Harmaakorpi published a study regarding the development of Lahti region where he used -regional development platform- as a tool for assessing the development opportunities that can contribute to competitive advantage. In this study, "the Regional Development Platform Method is presented as a tool for designing and managing a regional innovation system, in which the underlying potential in the region is explored and the exploitation of the potential is organised" (Harmaakorpi, 2007, p. 1).

Similarly, in his article from 2004, Naumanen presents a barometer for measuring the 'knowledge society development' of a given country, which he tested in eight countries. "The Knowledge Society Development Barometer is a tool for evolving from an information society via a knowledge society towards a knowledge-value society" (Naumanen, 2004, p. 1). Naumanen describes "the knowledge-value society as where innovation, technological development, economic regeneration, openness to new ideas and their active exploitation are all inherent elements of a society's basic values and culture" (2004, p. 5). This vision fully corresponds with the open innovation ideals that emphasise on the necessity of knowledge exchange within and around the direct context of innovation. However, the open innovation literature that Chesbrough (2003) leads remained limited to organisational settings for decades. Despite various developments regarding measuring and enhancing company 'openness' to enhance innovative output, the application of such studies on regional contexts is scarce. Therefore, from all the literature referred to, Naumanen's vision towards how to create an innovation culture by embedding the mind-set into the cultural values

is the closest match to the scope of this research. However, the barometer is meant for the measurement of given activities rather than serving as a tool for enhancing the output.

In their publication Regional Innovation Systems, Cooke et al. (2002) investigate eleven EU regions to define elements for supporting regional innovation. They eventually divide the regional innovation systems in three categories as strong, medium and low capacity for developing regional innovation systems based on their infrastructure, institutional capacities, development policies and active organisations. The strong category defines regions possessing a strong structure and demonstrates strong autonomy such as Baden-Wurttemberg region. Medium category defines regions with some issues in the organisational support such as Wallonia, Brabant and Tampere. Low category regions have weak organisational structure that supports innovation due to various hindrances like not missing triple-helix relationships such as Centro, Fejer and Lower Silesia. According to this description, Fryslân falls in the last category.

In the remote areas of Denmark and Portugal, similar economic development strategies to the one in Fryslân are being followed, but these are not evolving in parallel to each other. One of the greatest examples of such transition studies took place in the Nordic part of Denmark, Jutland, which was considered a deserted region until the end of 1980s (Francke, 2007). However, through a joint effort of local, regional and national governments, emerging entrepreneurship and strong innovation aimed support of local polytechnics and universities. This collaboration made northern Jutland one of the flourishing areas of Denmark today (European Commission, 2018). Some of the initiatives taken in this area became world-famous demonstrators of this success, from which companies like Vestas, Siemens Wind Power, as well as the newly established University of Aalborg that operates in the league of top European universities with high research and education ratings. Jutland today continuously contributes to sustainable development of local and regional economy.

Likewise, in Portugal since a few years, the government is developing a stimulation program for its remote regions, with polytechnics as the nuclei for practice based research and project-based learning. The remote regions in Portugal are expected to lead to innovation and new economic activities by enabling regional and local opportunity creation in the future (Hasanefendic, 2016).

Most of the studies conducted on regional innovation provide a solution to overcome the structural inefficiencies created by the investment-driven growth strategy that is only applicable to industrialised regions. Fryslân on the other hand, is dominated by small-medium enterprises (Provinsje Fryslân, 2010). The province has a couple of strong sectors that can be considered as innovative and there are many different companies that function in several fields. According to the experts that are interviewed throughout the research, innovation system in Fryslân can be globally divided in four groups: creatives, academics, bureaucrats and managers, which correspond to the quadruple helix-like structure of the British Council. However, that does not mean immediate growth. A successful regional innovation system is so much more than enabling stakeholders. This paragraph from the report of Finnish national research agency (2001) titled as Transformation of the Finnish Innovation System concludes the necessary vision for regional innovation systems quite thoroughly by emphasising on the most important take-away:

"The adjustment challenge of the Finnish society is systemic in nature; the different parts of the society must find a sustainable development path together. Being the most competitive country technologically is not enough. Even having the most competitive innovation system in the world is not sufficient. What is needed is the balanced and rapid development of the whole Finnish society. Only then can we reap the full economic and social benefits of mutually reinforcing elements in the socio-economic system. This calls for a broader concept of innovation; one that includes organisational, institutional and policy-related innovations besides the usual technological ones" (Schienstock & Halmainen, 2001, p. 8).

Regional transition plans that focus solely on technological development display minimal chances to create resilient futures. It is necessary to develop a vision that incorporates local and global dynamics as a part of the process. The community is the main stakeholder of a regional transition and the majority of local dynamics derives from the community. Therefore, the community dynamics need to be taken into consideration while working towards enhancing resilience through innovation.

The following part elaborates further on the role of community dynamics as a continuation of the societal perspective established for this research.

2.1.3 Community dynamics in relation to innovative output

Innovation is a collective action in its results and means (Slawsby & Rivera, 2007). In his theory of diffusion Rogers (1963) identifies the success of innovations through the adoption patterns of the social unit that the innovation is introduced to. One of the major conclusions of this theory is that adoption only occurs through the interaction of the members of the community and therefore this is neither an individual nor an automatic process (Wisdom et al., 2014).

Rogers (1963) describes the diffusion of innovation in the community through different groups of adopters in a time-based linear structure. The impact of the community during the adoption as a linear occurrence as Rogers describes can be expanded to a cyclic process by realising that the source of innovation is also the community because regardless of its character, innovation is triggered through a prompt that serves as a source. This prompt is often identified through the needs of the community that are ever evolving based on the social dynamics.

While Rogers' points out the role of community on the diffusion of innovations, Florida's (2002) theory on learning regions focus on the communities that are open to new and unconventional ideas, and provide the necessary environment or ecosystem that facilitates the flow of information and exchange of ideas ideas that lead towards innovation. Lundvall and Johnson (2002) also point out that knowledge as a most fundamental resource.

Doloreux (2002, p. 13) raises four concerns with respect to these claims:

"1. that the sustainable advantage of the learning region is knowledge creation, which is its principal source of value
2. that innovation is created and reproduced through firms, networks, and suppliers systems
3. that the human infrastructure requires a learning region, which is educated and highly specialised;
4. that the communication networks and organisations used must be globally oriented and operate through electronic data exchange."

Another necessity for innovation that is triggered through community is creativity. Regardless of the sector or character innovation requires novelty that is dependent on creativity. Despite

many objections, human is possibly shaped through the combinations of external and internal factors (Zhu, 2014).

In his comprehensive study on the creative peaks of 41 artists from 19th and 20th centuries, Accominotti (2009) discovered that creativity occurred regardless of age, background or education level of the painters but their involvement in various art movements, which required them to come into interaction with other artists. The art movements that functioned as communities where ideas were discussed and challenged facilitated the interaction that triggered the creativity of the artists. Therefore, it is possible to say that a significant part of creativity is shaped through ones encounters with physical and emotional world. In modern society, a large part of these encounters happen to be social interactions. This means that providing possibilities for interaction is an important part of triggering creativity that forms the core of innovation processes. Naturally, such interaction can only emerge from communities that facilitate these dynamics.

2.1.4 Conclusions on the societal perspective

Regional resilience is strongly linked to innovation. Because next to 'being prone to damage', from societal perspective resilience also means having opportunities to grow. In todays interconnected society, growing requires being open to new ideas and knowledge or in other words, being open to global developments. Regional innovation systems must make a local meaning of the global dynamics to be open to growth.

'Opening' local communities starts with enhancing communication. Communication is the only way to enable knowledge exchange between individuals and organisations that will lead towards an infrastructure. In addition, human creativity is shaped through interactions and creative ideas forms the core of innovation.

Openness of innovation systems in corporate settings is ever-growingly popular, however, it is relatively new term for regional settings. The little amount of studies on regional openness mostly focuses on measuring it rather than enhancing it. The reason behind this scarcity is the incomparable difference of complexity between regional systems and corporate settings. The number of actors, different visions and variety of goals in a regional innovation setting makes it very difficult to apply the findings of open innovation literature that is mainly targeted towards corporate settings.

This complexity is main reason behind conducting a systemic study that embraces the regional dynamics. Especially the practically unlimited group of actors in regions, whose multiform relationships form a complex structure, in combination with the complex structure of innovation process that derives from the creative nature of the process and the diversity expectations of stakeholders, are required to be studied together. Therefore, this complexity forms the core of the theoretical perspective adopted in this thesis as described in the following parts of this chapter.

2.2 Theoretical Perspective: Complexity of Innovation Systems

The word complex literally means woven (plex) together (comp) in Latin, which refers to the connections between the parts of a system (McInerney, 2013). Complexity is commonly defined as the unpredictable behaviour of a system, where the parts interact in multiple ways with each other (Johnson, 2006). Johnson uses the term emergence to describe the outcome of these interactions. Therefore, studying complex systems tell us how the interaction of parts triggers collective non-linear behaviour, and how the system interacts with its environment.

Studying complex systems aims to understand indirect effects, which means that there is no cause-effect relationship to be studied between occurrences. Therefore, studying complex systems relates to all traditional fields of science since it explores parts, wholes and relationships. (Holovatch, Kenna, & Thurner, 2017).

Enhancing the innovative output is a complex societal problem (Torfing & Triantafillou, 2016). Societal questions are complex due to the interrelatedness of contradicting interests of various levels of organisations and individuals involved in the process simultaneously. Not only that there are contradicting interests presents, especially when talking on a regional scale, these actors may have different perspectives (Ricciardi, 2014).

In societal systems, complexity partially derives from the fact that involved actors have different expectations from the same process. There are extrinsic and intrinsic motivations behind these expectations (Pelletier, Tuson, & Haddad, 1997). For instance, extrinsic motivation of policy makers can be related to making the region socially and economically stronger. Behind this aim, there might be various intrinsic (and personal) motivations such as getting more votes as a politician. The designers on the other hand, are intrinsically looking

for profit, maybe patents or even reputation. This example does not point out the necessity of manipulation of motivation, only explains one of the potential origins of complexity in a concrete way.

According to Bar-Yam (2009, p.3), there are three interrelated approaches to studying complex systems: (1) how interactions give rise to patterns of behaviour, (2) understanding the ways of describing complex systems, and (3) the process of formation of complex systems through pattern formation and evolution". In this thesis, all three approaches are applied in a structured manner to understand the innovation systems. Because, only adopting these three perspectives together can provide the necessary holistic understanding of complexity for studying innovation systems on a regional scale. But before proceeding to the empirical studies, it is essential to go through how complexity matters to regional innovation processes.

2.2.1 Societal dimension of innovation

When reflecting on pre-modern and modern societies through the thoughts on mechanical and organic solidarity, Durkheim (1893) emphasised the differences on the reasons behind the 'solidarity' and staying together. While in pre-modern societies individuals stayed together with a collective consciousness that derives from personal similarities, in the modern and more complex society, the solidarity derives from interdependency of individuals that need each other's skills and abilities to exist. Durkheim does not suggest that 'solidarite organique' blocks collective consciousness. There are general shared values that leave open room for personal development to enhance our differences, which relates to individualism in modern society. According to Durkheim the switch from mechanical to organic solidarity relates to 'dynamic density', which is explained as the amount of people and the interactions in between increasing to a certain level that cannot accommodate more member individuals with similar roles within the society. Therefore personal development takes place. This concept is similar to the necessary 'tipping point' for major changes to occur as described by Gladwell (2002). Durkheim ironically pointed out that individualism is something that is collectively valued in modern society. However, individualism does not bind society together but bounds individuals to each other, or in other words creates interdependency. Each individual has a specified role and these roles come together to create something that no individual could have achieved alone. This 'the sum being greater than its parts' is a widely known description of complexity as well. What Durkheim (1893) called 'Division of Labor' and defined as the DNA of modern society is in fact the source of innovation as well.

Organic relations that enable knowledge transfer among members of the community as Durkheim describes is not the only societal dimension of innovation. By now, the cyclicality of innovation is widely accepted. The relationship between the society and innovation is also cyclic. Society does not only trigger innovation but also uses it. In fact, innovation is measured through its diffusion in the social unit it is introduced to (Rogers, 1963).

Looking at recent market examples, it is possible to say that enabling systemic change through innovation can only happen through societal acceptance (Stewart, 2010; Blind, 2012). Societal acceptance as it is referred in this thesis has multiple names in the literature such as adoption or diffusion. All these terms refer to the impact the innovation has on the existing ways of doing, making or thinking. Whether the novelty is a product or a service, for a technological innovation to achieve success and sustain this status for a remarkable period, positive response of the target group, therefore the society is necessary.

Aiming for societal acceptance brings a whole new layer of complexity to the innovation process, since requires constant communication between decision makers, creatives and the acceptors. Narrating, communicating and receiving the positive response, which are the key elements of acceptance, can be achieved through only by including these in the natural cycle of innovation processes. The suitable means for acceptance are contextually dependent and strongly effected by cultural values and milestones; therefore it requires a deep understanding of local dynamics (Nijs, 2014).

2.2.2 Creativity as the first step towards innovation

Creativity and innovation are used interchangeably on many platforms. Creativity is defined as unleashing the mind's potential to conceive new ideas although it remains as a subjective and immeasurable phenomenon (Marshall, 2013). Innovation on the other hand can be described as the technical and social operationalisation of a creative idea, which means that without creativity, it is not possible to speak of innovation. But it is also not possible for a single bright idea to become an innovation on its own. Through this unique combination, the discipline of innovation brings two worlds with opposite ways of working together under one goal: achieving systemic change through a novelty (Weber & Weber, 2007).

Post-modern societies are facing important challenges such as shrinkage, ageing populations, environmental and economical pressure (Van de Kaa, 2001; Lutz, O'Neill & Scherbov, 2003).

At the same time, developing trends offer opportunities for companies that are willing to benefit from technological changes. Numerous companies in a variety of sectors are increasingly co-creating novel products or services by engaging stakeholders in the process in order to create competitive advantage (Verganti, 2009). Sleuwaegen and Boiardi (2014) state "the combination of these developments has given rise to a new paradigm in the development of business models. This new paradigm holds creativity to be central to the development of sustainable production and consumption patterns for the future. Creativity is what makes people, firms and regions unique. It is the ability to find innovative solutions to problems, to create new products and processes, to set up new firms, and to expand into new areas that create economic value. Thus, creativity should be linked to innovation and entrepreneurship in order to guarantee its translation into market opportunities" (p. 1).

Innovation processes are evolutions of iterative and discursive cycles (Garcia & Calantone, 2002; Kline, & Rosenberg, 1869]). This process is not only complex because it requires the involvement of various actors with different expectations as described in the previous sections, but it also brings the world of creativity and management together to perform interdependent tasks. On one side, the creative line of work deals with iterations and processes that require inspiration, while trying to match assignment requirements. On the other side, management processes commonly follow a linear path, simplified through deadlines, inputs and outputs. This methodological gap between these two ways of understanding the same process affects the efficiency of the system (Kratzer et al. 2007).

Creativity is an unplanned, impulsive occurrence and it cannot be fruitful when the iterative character is not supported. Incomplete, unsupported or disrupted processes without implementation will lead to starvation of the creativity on a larger scale (Graziano, 1969). Therefore, although there is interdependency between creativity and management trajectories, the delicacy of creativity makes it the first step that needs to be established and supported in a consistent manner (Kratzer, 2006). This process requires optimum interaction between actors of both sides, which is the subject of this thesis.

Supporting the iterative nature of the creative processes with minimal interruptions for the sake of innovations means establishing an open system (Lynch, 2013). This puts great responsibility on decision makers who must seek for ways to track the information flow and enable the openness of the system for new information. Only with the constant flow of information within, from and towards the system, it is possible to speak of 'openness'

(Chesbrough, 2003). Yet, the openness cannot be forced on the system, it can only be directly supported externally by investing in the existing creative emergence of the system itself, which brings us to the final aspect of the theoretical perspective.

2.2.3 Network emergence

In his book Division of Labor, sociologist Emile Durkheim (1893) describes social systems as the explanation of human behaviour. That means, what he calls social facts, which can be numerous phenomena such as norms, values, politics, technology, economy are all affecting each other and consequently the people. However, it is not possible to look at this impact on individual level to understand it. The 'social explanation' lays in the networks the individuals form by interacting with each other and what comes out of these interactions as a new property of the whole system.

Yaneer Bar-Yam explains the perspective of emergence in contrast to the reductionism that views systems through their isolated parts and names this the "anti-complex systems" based view. He states that "the concept of a system is itself based upon a limited form of reductionism that distinguishes the system from its environment, the difference is that the complex systems approach considers the relationships among the parts as a part of the systems as well" (NECSI, 2011, p.10).

The criticism against studying complex systems mostly relate to the confusion of exploring the system attributes as parts of a whole versus exploring the relationship between the system and the environment the system belongs to. Since environment is visualised as a static matter, the changes within the system are used to explain its relationship with the environment (Pieterse, 1988). This is done for simplicity, because when the environment is a constant, only the system needs to be described in order to understand the link in between.

Emergence is a third option, as it explores the collectively defined pattern of behaviour in a system, which makes it sees the parts and the environment as a whole that form the system together. Regardless of the perspective, emergence has to do with these links, either between the parts or between the surroundings of the system (Bar-Yam, 2004). Parts of a system, which are also portions of the environment, are often referred to as networks, through which the emergence is studied within the scope of this thesis.

Network emergence relates to the formation of collective behaviours by taking Aristotle's 'the whole is greater than the sum of its parts' principle, which means that the systemic patterns would not have occurred if the parts operated alone. Emergence explains the behavioural properties of a network rising from the properties of its actors and how patterns arise at a larger scale from the interrelatedness of relationships between parts (Cardillo et al. 2013).

Studying network emergence can be described as seeing the patterns that are formed by the relationships between actors as relevant as the network itself. The 'trees in a forest' metaphor is often used to explain emergence. In conventional views the observer considers either the trees or the forest as: "Those who consider the trees consider the details to be essential and do not see the patterns that arise when considering trees in the context of the forest. Those who consider the forest do not see the details. When one can shift back and forth between seeing the trees and the forest one also sees which aspects of the trees are relevant to the description of the forest" (NECSI, 2011, p.4) Understanding the relationship between the parts and the whole, and the interaction in between in general is the study of emergence, which is also how this thesis views the different networks emerging within one region.

2.2.4 Conclusions on the theoretical perspective

The growing technological capacity of the world causes (and requires) the multidimensional growth of social interactions. The perspective towards the role of these interactions in this thesis are two-folds.

Firstly, the interactions have a strong role in determining the use of the technological capacity, therefore innovation. Regardless of the purpose or novelty of an innovation, we cannot call it success without the positive response from the social unit it is introduced to. Since the social unit communicates and share opinions through interactions, their role in the 'acceptance' of innovations is crucial.

Secondly, interactions are also crucial to development of innovations. Innovation is highly dependent on creativity and creative thinking is triggered through ones encounters with the outside world. As a large portion of human encounter occurs in the form of social interactions, it is possible to say that interactions are the primary cause of innovation.

Social interactions among a group of individuals are commonly identified as networks. The process of 'causing' something (in this case innovation) refers to the unplanned occurrence of newness as a result of the interactions that form the network. Therefore, studying networks has the potential to give plenty of information on the emergence or acceptance of innovation, which will be the main subject of the remaining chapters of this thesis.

2.3 Research Focus

The initial assignment regarding the enhancement of innovative output of regions was unfolded through analysing the problem and translated into the following research question: *"How can closed innovation systems be opened up through the effective use of social constructs to achieve sustainable development?"*

Through relating the research context to the assignment, a series of relevant societal and theoretical perspectives were selected for investigation. The societal perspective focuses on the concept of community resilience in relation to innovation and investigates it by breaking the concept down in three pieces as resilience, innovation and community. The theoretical perspective focuses on the complex nature of innovation in relation to societal change and investigates the topic by looking at main reasons of this complexity one by one.

Before opening up the developed research focus by introducing two paradoxes, it is essential to explain that this research takes a certain stand towards critical discussion points that are controversial among scholars. The affinity to certain terminology and school of thoughts that developed throughout the study on societal and theoretical perspectives is summarised with the following steps.

Innovation aims at change:
Innovation is defined in numerous ways but there is a general consensus regarding the ultimate aim of innovation and that is to change existing ways of doing things (Lancaster, 1966; Meijkamp, 1998).

Change requires a set of complex interdependencies:
Innovation consists of a series of contradictory, yet interdependent relationships.

Interactions feed creativity; creativity feeds innovation:
Creative ideas are seen as the main source of any innovation. Creativity is shaped by our encounters with the world around us, from which a major part consist of interactions.

Creativity is the structural opposite of management:
Creativity and management form the two main pillars of innovation process. Creativity does not follow a linear pattern; it is discursive, cyclic and iterative. Any attempt to describe it as a linear process will not be reflective enough and eventually fail. However, management processes are linear and output oriented.

Networks are relationships:
In network theory, which forms the fundamental theoretical perspective of this thesis, a network is defined through the relationships between the actors (Monge & Contractor, 2003). This means that it is possible that the same group of actors form multiple networks based on the nature of the relationships in between.

With the broadening of theoretical and societal perspectives, also considering the research assumptions, the first paradoxical concept was identified, which will be opened up further with sub-research questions in this part.

Paradox 1: social and technical processes of innovation
In the first parts of this chapter, we have concluded that innovation is essential for the resilience of societies simply because it gives a chance to citizens to solve their own problems and create a resistant environment where citizens have the chance to prosper. Although stipulation of this empowering process resembles a social transition, innovation is highly associated with technical development. The perspectives we described in the beginning of this chapter however suggest the complementary nature of social and technical process that develop together and become meaningful as a whole.

The first paradox that derives from this vision statement relates therefore to the inter-dependency of social and technical processes within innovation. Although social innovation is commonly described as a 'type' of innovation in the literature, many scholars acknowledge the societal dimension of innovation as an inseparable part. The confusion occurs mainly because of social innovation being traditionally schieved via initiatives whose immediate purposes are not centreed on profit maximisation (Mulgan, 2006). However, innovation

processes are complex and it is not possible to speak of sole technological novelties anymore. Ultimate aim of all innovations regardless of origin is to change how society behaves in order to achieve systemic change. The society is the main target of each and every innovation either directly or indirectly (Neumeier, 2016; Bock, 2016).

In addition, the literature studies which point out the role of the society in feeding creativity and triggering innovation. This means that innovation is not only diffused through society but it is also triggered through it. The society is also the source of innovation. The paradox refers to this continuous role of the society that creates a chicken-egg problem. The research approaches this problem by seeing social and technical sides of innovations as interdependent parts of the same process, which will be explained in depth in Chapter 3 by answering the following question.

RQ1. How can the relationship between social and technical innovation be operationalised? (Chapter 3)
To be able to answer this question, sub-questions were developed that are explored respectively in the first, second and third parts of chapter 3.

s-RQ1- How does technical innovation relate to social change?
s-RQ2- What are the state-of-the-art examples of relating innovation to social development?
s-RQ3- How did the definition of innovation become more socially oriented in the last decades?

In the following chapters of this thesis, there will be extensive elaborations on the identified paradox. The first paradox deriving from the societal and theoretical perspectives were identified as the social and technical lines of work within innovation that evolve together. Through this acknowledgement and the societal findings on the case area Fryslân, the influence of social context on innovation is concluded. Therefore, the following chapter kicks off the first empirical investigation of this thesis by exploring this influential relationship. The chapter aims at forming a multidisciplinary understanding of how social processes are included in innovation that will provide a theoretical base for the other studies conducted for this thesis. Also, the chapter will be unfolding the state-of-the-art discussions around the ever-evolving phenomenon of innovation with two separate studies.

Chapter 3

PARADOX 1: SOCIAL AND TECHNICAL INNOVATION

"If at first the idea is not absurd, then there is no hope for it."
Albert Einstein

In 2012, innovation was described as the 'most abused word' in the fields of technology, business and education by the Wired magazine. In his article 'The most important and overused word in America', O'Bryan (2012) states that from politicians to professors, everybody consistently associates potential success with innovation like beauty pageant contestants wanting world peace.

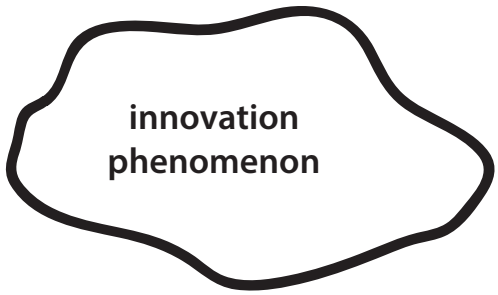


Figure 9. The innovation phenomenon

The overuse of the word itself may have created a negative vibe and caused a loss of understanding as O'Bryan suggests, but this does not change the fact that innovation has been, is and will be the synonym of modernisation (Thesaurus, 2017).

Fairly any organisation strives to be more innovative for reasons varying from profiting more, being more successful, gaining reputation or engaging into any other possible way to create more impact. These different reasons could be summarised under the umbrella of trying to change the usual course of things. 'Change' here suggests a more alert, active and engaged state of causing an impact. This means when visualising the process of innovation as a path, 'change' can be the final point of arrival.

Figure 10. The innovation process from prompt to change

While change is the point of arrival, it is also the ultimate point of departure of innovation as innovation is triggered by the development of society that results in new dynamics. These new dynamics require the progression of conventional approaches and consequently create a trigger for innovation. In other words, innovation that leads to change is also a prompt of future innovations to serve this change. Therefore, while visualising the path of innovation, it is possible to place 'prompt' across change (Figure 10).

Many know the saying 'the road to success being always under construction'. This highly relatable metaphor refers to the unexpected and discursive nature of being successful. Since progression and therefore innovation is considered as success, the path that start with a prompt and ends with change cannot be linear either. In addition, innovation is strongly linked to creativity and coming up with a creative idea is an inspirational process, which does not recognise linearity (Cates, 1979). Innovation can then be described as a cyclic process that is triggered by a prompt and aiming at change (Figure 11).

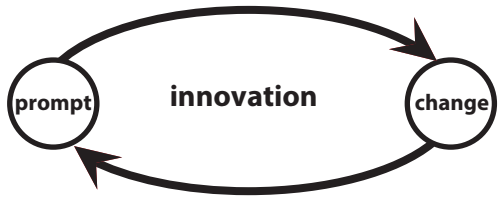


Figure 11. The innovation cycle

This chapter aims to8b answer the first research question 'How can the relationship between social and technical innovation be defined?' together with its sub-questions by unfolding the phenomenon of innovation. The cycle shown in Figure 11 is taken as a starting point here. Throughout the parts, the chapter will look at innovation from two different, yet complementary perspectives that focus on the definition of this phenomenon in theory and in practice to develop a holistic understanding. By studying the state-of the-art definitions and practices, this chapter aims to explore the ever-evolving meaning of innovation.

The need to unfold the phenomenon of innovation emerged from the initial assignment received from the province of Fryslân that kick-started this research. Being the buzz-word of our century, innovation now has different meanings in different fields. What

first was defined simply as 'something new' has now multiple dimensions that refer to properties, results, methods and targets related to various parts of the innovation process (Doloreux, 2002). Despite the depth innovation is gaining, the common understanding still suggests some kind of a novelty that is operationalised and targeted to benefit a social unit by changing their existing ways of doing things.

3.1 Relevance of Defining Innovation

This chapter explores the relationship between social development and innovation. Fryslân and many other regions (even organisations) heavily rely on innovation for sustainable futures. However, looking at the examples in the world, innovation is understood as technical progress, which does not directly relate to social development. Yet, the field research conducted in Chapter 1 of this thesis confirms the clear relationship between social context and innovation is identified. By investigating this relationship in the literature and in practice, the studies conducted in this chapter resulted in a conceptual understanding to operationalise the technical and social aspects of innovation.

For a long while, scholars and professionals discussed the essence of innovation on the level of the 'novelty' that is being produced, which forms the technical part of the process. Later on, in combination with this novelty, the operational part of the novelty has been the major issue within the management world and literature (Fagerberg, Martin, & Andersen, 2013). With the rising complexity of our society in relation to technology and developing communication channels, the target of innovation is expanding beyond the technical processes. The possibility to make a bigger impact than it was ever possible is bringing 'social change' on the table. Therefore, in addition to exploring the definition of innovation, this chapter is also looking at the growing connection between innovation processes and social change.

For understanding the societal dynamics of innovation processes, it is essential to look at the contextual meaning of innovation first. The first section looks at 500+ initiatives that define themselves as innovation with social aims and presents a categorisation for such initiatives. The second part on the other hand presents a literature review that explored the emerging terminology within innovation studies in the last decennia.

3.2 What is Innovation?: An Overview of Innovative Initiatives with Social Goals[4]

The first study of this chapter takes a first glance through the meaning of 'innovation' and its relationship with social change by collecting interdisciplinary evidence from Frisian, Dutch and international initiatives that mention social goals as their core value. The research was conducted on a database of 500+ cases of various innovation initiatives that were selected through snowball sampling method (Goodman, 1961). A list of the collected cases are to be found under Appendix E. This database has been used to identify organisational, methodological and functional properties of different initiatives, and to cluster them in seven functional categories: create, facilitate, stimulate, efficiate, educate, associate and corporate.

The study was originally initiated by plans to implement Creative Cooperative Blokhuispoort (CC), in the city of Leeuwarden that has recently endorsed plans to become the Cultural Capital of Europe in 2018. The initial aim of the research was to support this initiative, and similar ones, by determining which types of social innovation initiatives exist. For this purpose, the formation and analysis of a case database will be described, which has helped to come up with an explanation of what is understood from 'socially oriented innovation' through seven categories. Each of these categories is explained by a short description and practical examples.

3.2.1 Social change and innovation

The emergence of creative initiatives is increasingly important for innovation and the development of an innovative culture within society (Arranz & Fdez de Arroyabe, 2012). This growing importance relates to innovation being taken more and more out of the business and technology contexts and becoming a part of daily life that contributes in social progress. This makes innovation itself a social process (McDaniel, 2002; Maxwell, 2003). This shift is requiring innovators and industries to find new forms and methods of collaboration to enhance knowledge creation. Facilitation of creative thinking and inspiring citizens to come up with novel solutions to ever-evolving needs of modern society is seen as an important part of the process as well. Although these non-technical parts are commonly seen as a part of the innovation process, they are mostly referred to social innovation or innovation

[4] This section is adapted from the paper titled as 'Towards a functional categorisation of social innovation networks' (Celik, Joore, Brezet, 2014) published within the proceedings of What's On: Cumulus Conference.

with social goals. Such initiatives are the important tools of creating and implementing new ideas into local development strategies as they represent strong social aspirations, but also because their affectivity grows proportionally with the ability to discover, facilitate and sustain innovations within the society (Rutten & Boekema, 2007). However, the organisations and groups that identify themselves, as 'social innovators' is so diverse, it is not always clear what exactly is meant when the terms social and innovation are used together (Battisti, 2010; Edwards-Schacther & Wallace, 2017; Hassan, 2013). This overview looks at the range of operation of initiatives that describe themselves as 'social innovation or innovation with social goals' from Fryslân, Netherlands, Europe and the rest of the world.

Creative Cooperative (CC), which is a non-profit organisation in the city of Leeuwarden, triggered the initiation of this research. This collaborative initiative in the northern part of Netherlands aims to stimulate the productivity of local creative entrepreneurs by linking them to each other and to various stakeholders from the industry, government and societal organisations. The start of CC group may be interpreted as a response to a socially threatened life-style, and an effort to define more communicative patterns of creation (LWD2018, 2013).

Bringing locals together with the aims to enhance socially oriented innovation, as the CC aimed, requires having an understanding of how such groups operate worldwide. This question formed the starting point of creating an overview of different examples of socially oriented innovation initiatives worldwide. During this process, the functional variety of collected cases showed that there is a need for a clear classification of social innovation initiatives. This classification may in time help to support the effectiveness of future initiatives – like the Leeuwarden CC – in this field.

3.2.2 Literature review on other methods of categorising innovation

In the literature, innovation initiatives or innovations themselves are categorised in various ways. Although the aim of the study was not to come up with a categorisation, once the categories were realised, it was essential to look at other methods of categorisations in the literature to see if such a categorisation or something similar was published earlier. Therefore, the review on categorisation literature can be considered a discursive process rather than a linear approach. This discursive study has shown the knowledge gap regarding a functional categorisation of innovation, since the existing categorisations either relate to the impact of the innovation or the nature of the innovated product (Miller & Miller, 2012).

There are various emerging typologies that can be identified as innovation initiatives. These typologies have different properties and this diversity brings along a need for a strategy that enables comparison between different initiative types and links them based on their functional similarities. Miller and Miller (2010) explain the existing categorisations in the literature in a compact way as shown in table 2.

Table 2. Categorisations of innovation in the literature (Based on Miller & Miller, 2012)

Eight categories:
Johnson & Jones (1957): reformulated / new parts / remerchandising / new improvements/ new products / new user / new markets / new customers
Five categories:
Freeman (1994): systematic / major / minor / incremental / unrecorded
Tetra categorisation:
Henderson & Clark (1990): incremental / modular / architectural / radical
Abernathy & Clark (1985): niche creation / architectural / regular / revolutionary
Moriarty & Kosnik (1990): incremental/evolutionary/market/evolutionary technical/radical
Chandy & Tellis (2000): incremental / market breakthrough / technological breakthrough / radical
Tidd (1988): incremental / architectural / fusion / breakthrough
Triadic categorisation:
Kleinschmidt & Cooper (1991): low innovativeness / moderate innovativeness / high innovativeness
Wheelwright & Clark (1992): incremental / new generation / radically new
Dichotomous categorisation:
Anderson & Tushman (1990) / Robertson (1967): discontinuous / continuous
Grossman (1970): instrumental / ultimate
Normann (1971): variations / reorientations
Madique & Zirger (1984): true / adoption
Yoon & Lilien (1985): original / reformulated
Rothwell & Gardiner (1988): innovations / reinnovations
Meyers & Tucker (1989): radical / routine
Utterback (1996): evolutionary / revolutionary
Christensen (1997): sustaining / disruptive
Schmidt & Calantone (1998) / Song & Montoya-Weiss (1998): really new / incremental
Rice et al. (1998): breakthrough / incremental
Balachandra & Friar (1997) / Freeman (1994) / Atuahene-Gima (1995) / Kessler & Chakrabarti (1999) / Lee & Na (1994) /
Schumpeter (1934) / Stoubaugh (1988): radical / incremental

These categorisation methods are very valuable but they are not sufficient for the purpose of this study, which is mainly focused on understanding various approaches towards innovation with social aims and through a clustering that is based on their functional properties. Therefore, an effort was made to collect a large number of innovation initiatives in an overview to study their functional properties.

3.2.3 An overview of innovative initiatives with social goals: Evidence from Fryslân and the rest of the world[5]

During this research, 500+ socially oriented innovation initiatives are collected to understand functional properties of remarkable cases worldwide. A series of selected projects are investigated from multiple directions in order to detect a pattern that could be used for creating guidelines or typologies for future initiatives. The analysis on this dataset, which includes 500+ cases, resulted with a new categorisation method of social innovation initiatives. The overview was formed through looking at of currently active initiatives and a series of interviews with experts in the field of socially oriented innovation.

The case collection began by identifying relevant cases between regional examples in the north of the Netherlands, which was the closest source of information for CC group. In the next phase, the scale of the examples expanded by covering first the whole country, then Europe and the whole world respectively. In this way, the overview accommodated as many different organisation types as possible, while having a manageable size at the same time.

After selecting the 500 cases to study on, detailed information is collected for each case that can be summarised in five fundamental groups practical, organisational, structural properties, used methods and tools. However, some of this information was only meaningful when there is a comparison between all cases. In order to carry out a systematic study on the cases, an effort was made to group the cases based on their functional similarities. This grouping started by identifying common points of different initiatives and evolved into its current state of seven categories of social innovation initiatives. These empirically defined categories appeared to cover the complete database; there were no exceptions that stay out of any category. On an additional note, it was possible to identify one organisation through multiple categories depending on the scale of the organisation and the amount of activities conducted within.

[5] For more information on the cases please visit www.sinecelik.com/innovationwithsocialgoals

The purpose of the study was explained in a structural way to the interviewees. In the guidance of carefully picked examples that were collected from governmental reports and contemporary literature, they were asked to name relevant practices they are familiar with. All participants appeared to have a clear idea about which local cases would be relevant for the purpose of this study. Later on the list was expanded to national and international initiatives by using online resources. This database will be published online later on.

Although the formulation of the overview followed a snowball structure, the idea behind was to create an overview of as many different kinds of initiatives as possible. The 'Svalbard' metaphor was used to explain this idea. Svalbard Global Seed Vault is a basically a seed storage facility that accommodates an example of each plant specie in the world. The aim was to form a large overview of unique cases that naturally carry similarities to each other, but remain different just like to seeds in Svalbard are.

The next phase of the research concentrated on finding ways to use the database in a beneficial way and testing the various categories on a local scale by running pilot projects with Blokhuispoort Creative Cooperative.

3.2.4 Analysis of the collected initiatives

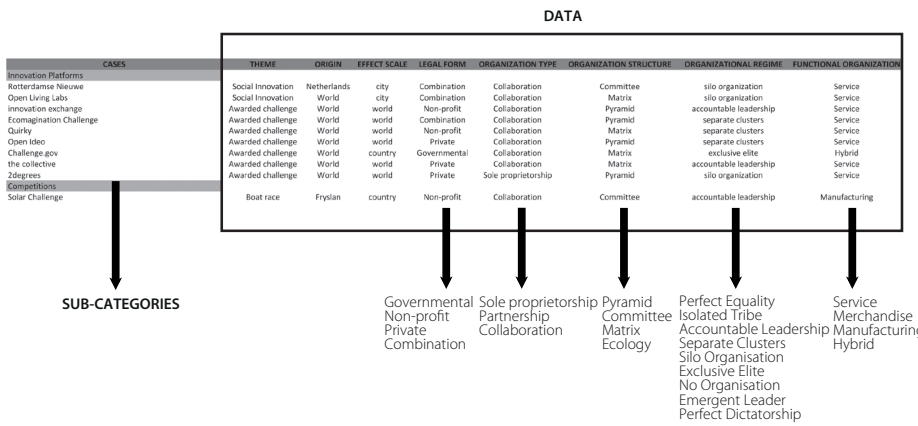


Figure 12. A partial screen-shot of the database displaying the data groups

While working with a complex dataset with 500 cases, it is important to prioritise the information. In this case nearly half of the data represents practical information such

as budget, year of foundation or contact person, which was not expected to have influence on future projects of CC, thus not considered as a priority. On the other hand, the research also covers information over organisational structure and used tools, which were relevant for CC.

While looking for relevant parameters, a functional description of each case taken from the websites of organisations that clarified the purpose of the initiative in a few words was used. Based on these statements and practical data on organisations datasets were defined. Figure 12 shows a screenshot of the database and the relevant data groups for CC that are theme, origin, scale, legal form, organisation type, organisation structure, organisational regime and functional organisation.

In this database 'design involvement' was also considered as a parameter. British Design Council's design cycle with four stages (discover, define, develop, deliver) was used as a reference at this point. This is more or less similar to the cycle described by Joore (2010), in which the four stages are named (reflection, analysis, synthesis, experience). By placing the cases in this cycle, it was possible to understand to which design stage a certain category would fit. This placement, in combination with the functional organisation data, enabled function-based groups of cases that later turned into the categories. Therefore the design involvement can be considered as a parameter.

Next, the clustering was worked out to seven categories and their sub-categories, although this was not the initial aim. The aim was to understand the variety of this field and help CC group determine its place within other initiatives. However, the database and the analysis of the data unravelled a functional connection between these initiatives and have led to seven categories.

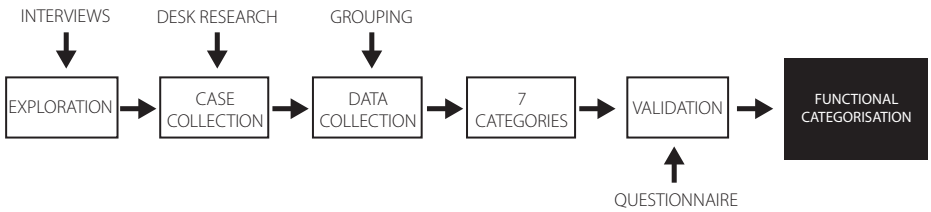


Figure 13. Steps taken in the research that has lead to the seven categories

3.2.5 Categories of socially oriented innovation

1. **Create:** Organisations that gather innovative ideas directly through co-creation or crowdsourcing.
2. **Facilitate:** Spaces or organisations that provide a platform for creative activities.
3. **Stimulate:** Inspiring organisations or activities that lead individuals towards innovation.
4. **Efficiate:** Initiatives that help innovators to reach correct tools they need and work more effectively.
5. **Educate:** Organisations that prepare a research based ground for innovation and its integration.
6. **Associate:** Connecting platforms that bring people together and enable communication between disciplines.
7. **Corporate:** Entrepreneurial initiatives that innovate socially beneficial products or services.

Figure 14. Seven categories of socially oriented innovation

Category 1: Create

The concept of using the power of society to generate solutions for societal problems is hip. Crowdsourcing was no stranger to the world of innovation. It is especially used in forms of idea generations, (design) competitions or tenders in disciplines like architecture, product design, fashion design and graphical design. However, gathering ideas from a large group of intenders became a part of other fields that are not directly connected to innovation. Especially firms, who are in constant need of new solutions, started using this method effectively. A large part of this competitive idea generation happens through online

platforms that accommodate 'challenges' but there are also offline groups who are aiming at the same target. Some of these offline versions are also non-competitive. Therefore the first category of this overview covers organisations that are directly aimed at finding solutions through technology, design or planning and have an impact on society by using creativity as a tool.

Online or offline, competitive or not, all forms receive a question from external parties and create a solution. Although the result is achieved through following similar paths in all cases, there are two linked differences between these groups that helped two preliminary sub-categories to emerge; first, the level of interaction between members and second, competitiveness in the group. Each sub-category is explained here with a selected case from the database that was active at the time of the research.

online platforms that engage into innovative processes with social aims or means
Challenge.gov: This online platform aims to enable partnership between government and public to find solutions to societal challenges with a technical touch. Regardless of the topic and technical detail level, government related organisations regularly post awarded challenges on this website. Some of the challenges are open to everyone while the others specify the group of competitors, for instance by inviting undergrad students only. The registered users are expected to submit their solutions for challenges they pick. A jury that is defined by the organisation itself selects the best entry and this awarded solution is expected to be applied afterwards. *www.challenge.gov*

collectives that engage into innovative processes with social aims or means
R'damse Nieuwe: This Rotterdam based group aims to bring active citizens together to make their city more attractive. The group meets regularly to work on pre-defined projects but there is an online platform as well. In this hybrid system, the group has a list of pre-defined themes and they receive projects to work on from external parties. As a result, the community delivers concrete solutions or advisory reports that are socially, physically and environmentally beneficial for the city of Rotterdam. *www.rdamsenieuwe.nl*

(design) competitions that engage into innovative processes with social aims or means
Solar Challenge: Solar Challenge is a race for solar-powered boats that takes place in Fryslân. The race stimulates technically oriented students to work with the theme of solar energy and at the same time contribute in the naval culture of the area. Participating groups are

expected to design, build and sail the boat along a traditional route that passes through eleven cities. Innovative solutions that came out of this annual competition have given the organisation an international reputation. Similar competitions for environmentally conscious technical innovations are organised in other design disciplines as well, such as the Solar Decathlon of architecture students. *www.dongenergysolarchallenge.nl*

Category 2: Facilitate

Since innovation has overflown from large companies, there is a rising need for physical spaces that bring initiators together and facilitate the idea generation process. In Europe, especially in the Netherlands old industrial buildings are being transformed into collaborative spaces that serve to start-ups or individual creatives. Some of these spaces only provide an affordable shelter function with adequate technical facilities while there are also others providing professional help for problems that might come up on the way to success. In this case, the facility functions as an incubator for new ideas and business start-ups as well. The category 'facilitate' identifies these generic spaces or their initiators that contribute in innovation through the service they offer. It is possible to define two sub-categories here:

physical meeting spaces that engage into innovative processes with social aims or means

Seats2Meet: Functioning in six different countries, Seats2Meet facilitates a dynamic environment for creative individuals to work together, meet each other and to share knowledge. It is an environment where people can use their expertise and enthusiasm to add value to a greater good. The concept focuses on connecting the users virtually and physically at the same time. There are meeting spaces for groups of different sizes, as well as individual working stations. With a small membership fee, it is possible to access these hubs and use every offered service for free. *www.seats2meet.com*

incubators/accelerators that engage into innovative processes with social aims or means

Yes! Delft: This Delft based organisation helps young entrepreneurs with concrete ideas to realise their innovative ideas in many ways. Apart from offering physical space to work in, the organisation also provides initiative taking opportunities, trainings and inspiration. Yes! Delft works together with Delft University of Technology but there are various organisations worldwide that are not connected to academia, such as Technolab of Istanbul, a private foundation that helps innovators of the future to grow their own firms from scratch. *www.yesdelft.nl*

Category 3: Stimulate

Triggering creative thinking is an important aspect of innovation and it is not possible to achieve consistent impact unless the society is sourced with inspiration. Art and culture are two important elements that enable this inspiration and indirectly trigger the innovation process. This stimulation can happen in form of fairs or events that is specially designed for this purpose or serve as a hidden effect of a music festival. Regardless of the difference in directness, 'stimulate' category focuses on organisations that lead people towards innovation by inspiring them one way or another. It is possible to say that a region without a strong cultural background is not expected to develop a sustainable innovation environment that is beneficial for the society.

The database does not cover every museum or music festival on earth, but only focuses on entities that contribute in the cultural development of their target group by implementing new ideas or processing old ideas in an innovative way. The stimulate category can be seen as a combination of three sub-categories:

museums and cultural institutions that engage into innovative processes with social aims or means

Chicago Museum of Science and Industry: Unlike a regular technical museum that only exhibits the development of local science, Chicago's science museum lets the visitor be a part of the innovation experience. The museum owns a fab lab where especially kids can play with new materials and fabrication technologies under guidance of experts. *www.msichicago.org*

festivals and artistic events that engage into innovative processes with social aims or means

In to the great wide open: ITGWO is a small-scale festival that takes place on a Dutch island and combines stage performances with art and design. The festival aims at being environmentally harmless to the island; therefore every year the organisation implements new energy solutions such as smart grids between stages or re-using grey water. For this reason, the organisation works together with universities and laboratories. *www.intothegreatwideopen.nl*

Festivals are not only stimulators of creative thinking but can they also function in Create, Facilitate and Efficiate categories (Larson, 2011). In fact, INNOFEST platform aims to bring festivals of Northern Netherlands together to pilot innovative projects. *www.innofest.nl*

creative collaborations that engage into innovative processes with social aims or means
TILLT: Swedish initiative that brings creative minds of artists together with various field of business. The aim of such collaboration is to cross-fertilise the competences of the two worlds: the world of the arts and the world of the organisation. On one side TILLT focuses on processes of human growth and artistic competence as a tool to stimulate creativity, innovation, human development, and more. On the other side, TILLT works for increasing the field of work for artists where new art can be born and new artistic methods can be developed. *www.tillt.se*

Category 4: Efficiate
The cycle of innovation mostly struggles on the second half of the process, which covers the delivery of project results (Snyder & Duarte, 2008). Efficiate category concentrates on initiatives that are offering services for this issue. A trending business type that is similar to incubation facilities is matchmaking organisations that help innovators, artists or designers to reach potential customers. The organisation is not directly involved in the process but makes the process more effective through establishing correct connections. Most of the time this happens through an online platform. Another type that is subject to this category is organisations that help the innovators financially. This category has two main sub-categories for now:

funding programs that engage into innovative processes with social aims or means
Stimuleringsfonds voor Creatieve Industrie: This Dutch funding program serves designers and artists who need financial support to realise their project. Each year the organisation announces a total budget and priority topics. Participants are expected to submit their ideas together with a budget plan to be able to receive grants. The aim of the organisation is to expand the reputation of Dutch design internationally and support young creative on their independent projects. *www.stimuleringsfonds.nl*

connecting platforms that engage into innovative processes with social aims or means
House of Design: This is a Groningen based platform that helps designers and artists to find customers for their products or pieces. This matchmaking platform aims to connect correct customer with correct designer, therefore it is possible to say that it functions as an agency of artists and designers. *www.houseofdesign.nl*

Category 5: Educate

Innovation requires research and a continuously updated vision. Educational institutes are important sources of this knowledge. A respected amount of innovation comes directly out of universities and this creates an unbreakable bond between academia and innovation worldwide. This category covers every research-based initiatives of innovation that has various forms including universities, academies, research institutes, and laboratories. Next to these academic organisations, there are also independent units such as labs or research centres, which are not directly connected to an educational institute. The difference between origins divides this category into two main sub-categories:

university-based organisations that engage into innovative processes with social aims or means

VEIL Melbourne: Victorian Eco Innovation Lab at University of Melbourne aims to identify and promote social, technical and organisational innovations that could be a part of a sustainable future. Next to performing academic research on innovation, the group also develops concepts in collaboration with others and organises events that promotes the results of their studies to the whole world. *http://www.ecoinnovationlab.com*

independent organisations that engage into innovative processes with social aims or means

UNESCO Institute for Water Education: is a research centre that has multiple locations worldwide. Although the main purpose of the institute is education, next to academic programs that are offered, initiating opportunities for the water sector, advisory services for ministries and other governmental organisations are also included in the spectrum.
www.unesco-ihe.org

Category 6: Associate

There are also groups that are not actively coming together to design or develop, but they form a group of expertise together. Labour groups, international communities, federations can be major examples of this category. These organisations prepare a ground for communication by regularly organizing events where members share experiences or new ideas with each other. Innovation cannot make a difference unless it communicates correctly with relevant disciplines and public. Associate category also enables the flow of knowledge between necessary people and fields. Although most of these types of organisation bring individuals with similar professional titles together, there are also examples who are concerned with diverse fields of interest, which makes it possible to see this category in two sub-categories:

(labour) unions that engage into innovative processes with social aims or means

EFAP: European Forum for Architectural Policies organises events to share knowledge and experiences with professionals who work on creating a sustainable future for cities by adapting architectural policies. The forum functions as a platform that leads to new collaborations, inspirations and innovation in its field. *http://www.efap2013.lt*

communication initiatives that engage into innovative processes with social aims or means

DESIS: Design for Social Innovation towards Sustainability is a initiative of design labs, schools, universities who are actively involved in promoting a sustainable change. Initiated by United Nations, DESIS also brings its partners together with various non-academic stakeholders for providing a ground for co-creation. *http://www.desis-initiative.org*

Category 7: Corporate

Corporate category involves all kinds of businesses that form a respectful part of innovation environment worldwide. The only selection criterion to this category is the purpose of innovation that is defined in a social manner by the firm. Pure product innovation or technological innovation that is targeted towards financial profit is not taken into account unless it has a certain societal impact or has achieved through socially beneficial ideas. In this category, next to fresh entrepreneurs and large companies that have turned their faces towards innovation, spin-offs that originate from traditionally structured companies are taken into account as well. This category looks at businesses in three different scales:

large companies that engage into innovative processes with social aims or means

Lays / Smaakmakers (NL): Lays potato chips organised a crowdsourcing campaign where customers were asked to develop new tastes for Lays crisps. The finalists were made available for the market and at the end the most popular product won the first prize. This campaign was applied in several countries. *http://www.lays.nl/smaakmakers/*

SMEs that engage into innovative processes with social aims or means

Plakkies: Originating from the graduation project of TU Delft student, Plakkies are basic plastic flip-flops made of car tires coming from South Africa where car tires are dumped massively and illegally. The project is socially and environmentally responsible at the same time. Colourful patterns on the soles are created by orphans of South African villagers and all profit that is earned from these products go to these orphans as well.
http://www.tudelft.nl/en/current/dossiers/archive/plakkies/

spin-offs that engage into innovative processes with social aims or means
Shapeways: This 3D printing company is originally a Phillips spin-off, initiated by a group of engineers and designers who were willing to explore this new technology further. The company applies the latest technologies in 3D printing but at the same they have developed an interesting online shop where designers can put up their own designers for sale. This interesting business model is beneficial for young designers and their connection with this new technology. *http://www.shapeways.com*

3.2.6 Validation of the overview

Despite the unconventional data collection, analysis and reporting methods, there has been a study to validate the results of this study as well. During the International Design Factory Week of 2014, responsible professors or designers of ten factories throughout the world have been interviewed in a strategic way to validate the categories. Although these factories are clustered under an international umbrella, their origins and purposes vary. Some groups are directly connected to a university and have educational purposes, whereas others operate as independent labs. Prior to the validation, the participating factories were placed into the seven categories. There appeared to be three different kinds of Design Factories: Create, Facilitate and Educate, although each carried elements from other categories.

During the validation, the interviewees were asked to determine where in these seven categories the factory they are responsible from fits through a series of questions that were identified with the help of Educational Tools chair of Technology, Policy and Management Faculty of TU Delft. As a result, all ten participants were able to locate their Design Factory organisation in the designated category (1 Create, 1 Facilitate, 8 Educate). This validation questionnaire can be found in the Appendix C.

3.2.7 Conclusions of the overview

In recent years, industries but especially the creative industry became less individualistic with the emergence of collaborative initiatives that are aiming at innovation to tackle societal questions. Strong socio-economical structures are now strongly dependent on the functioning of these initiatives within the system. However, there appears to be a large variety of initiatives that associate themselves with socially oriented innovation. Therefore, it is not possible to define a single structure for these collaborative initiatives. This study is a first

attempt for displaying the similarities and differences in the application and understanding of innovation with societal goals.

In this chapter, next to presenting various practices of socially oriented innovation, a first effort, that aims to cluster these innovation initiatives in a systematic manner, is presented as well. The proposed grouping of 7 categories – and their various sub-categories - appears to be a useful first attempt to support the discussion in this field. Future research will have to determine if and how this typology may be used to advance existing initiatives.

3.3 What is Innovation?: A Literature Study on Emerging Terminology

Innovation is the buzzword of this century. Every discipline, every organisation strives to be 'more innovative' and constantly seeks for new models and methods to gain a better position in the market. Innovation is being seen as the only way towards a profit, bankruptcies are being blamed on lack of innovation (Priestly, 2015). This reliance means that innovation defines more than a new product and indeed as to be seen from quick glance at recent literature, it is mostly used in form of a noun, but it is used as a verb too and even as an adjective. Since the ultimate aim of this study is to enhance the innovative output of Fryslân region, it is essential to understand what innovation means in different fields.

Second part of this chapter builds on the empirical study described in the first part, which is conducted on the functional definition of innovation with social goals as practiced by various initiatives worldwide. In the second part, the study explores the ever-growing complexity of innovation through the definitions used in publications within the last decade.

Rapid development of technology that came along with the integration of new communication channels has increased the complexity of society. The new dynamics that emerged from this complexity has naturally reflected on the innovation pathways of businesses and organisation. Despite being the key success factor of fairly any organisation since the last two decades, innovation became a buzzword with no common understanding behind (O'Bryan, 2012). This shift in perspective triggered innovators and researchers to look for a single, uniting definition that is applicable in various fields. However, the multifaceted nature of innovation that develops in parallel with societal processes does not allow a single definition that specifies what innovation might mean in diverse fields.

Consequently, since the beginning of the millennia innovation received field-specific definitions with additional discipline or target specific terms (Sullivan, 2009). This way, instead of converging into a common definition, the term innovation diverged throughout all relevant disciplines, target groups, aims and societal levels. These emerging definitions and specifications have added new terminology to the field, which are evidently related to current technological and social dynamics that the world is going through (Govindarajan & Desai, 2013). But what does this divergence mean for innovation studies? Departing from this main question, this study analyses 273 definitions of innovation from last ten years (2006-2016) to pinpoint the relationship between technical and societal process that simultaneously evolve within innovation process and to identify the emerging trends, terminology shifts and additions within the fields of business, management, economics, technology, science and engineering.

3.3.1 The reasoning behind this study

Before becoming a buzz-word, worlds of technology and business practically owned the term *innovation*. The reason behind this is that the true era of innovation studies followed industrialisation, which was a result of the industrial revolution. In this period of fast transition, an immense acceleration of technological inventions changed almost every aspect of manufacturing in almost every field. Once the inventors needed to operationalise their inventions the two worlds of technology and business needed to come together (Chesbrough, 2007). This explains why during the early years of innovation studies there is a dominance of these two fields. The operationalisation of these inventions did not only affect factories and production lines but also how people lived their lives, therefore the innovation had a social impact as well, but this was only studied years and years later. Fast forwarding to the digital era, the developments in IT enabled the society to become more connected, which caused the term innovation to merge into other fields (Castells, 1999). Developments in IT brought up new channels of communication and interaction. Relationships between individuals were not local anymore. This globalisation added a new layer of complexity to daily life, which reflected on the marketplaces as well. Marketplaces becoming available for a larger crowd of producers and consumers meant addition of new stakeholders. These stakeholders had a varying line of interests and sometimes contradicting ones. In addition to rapid growth in scale, this contradiction between the expectations of involved parties made the marketplaces more complex. Innovation came as a necessary response to this complexity (Freeman, 1979). However, the complexity of the innovation process itself is rarely acknowledged.

While countless scholars are working on a new, common, multidisciplinary definition for this term, converging the complexity behind innovation in to a single definition seems to be impossible. Instead, in the last ten years various disciplines and fields are steadily coming up with their own definitions by adding descriptive words to this term regarding the discipline it originates from, the product it ends with or even the methods used to achieve it. Examples can be service innovation, eco-innovation or open innovation. The chapter looks at the extent of these additional terms by scanning 273 definitions from last ten years.

During the last ten years, especially with the Internet becoming a daily part of life, the connectedness of people enhanced, new relationships emerged out of this connectedness and social media entered the picture, which together resulted in a more complex society. The new relationships that arouse from societal complexity, had to be facilitated by new or adapted marketplaces. This way, innovation found a wider field and it followed the evolution of marketplaces. New dynamism in marketplaces required a broader definition of innovation. The converging definitions scholars came up with since Schumpeter (1934), who is known as the father of innovation, could not satisfy the needs of this diverging culture. With each discipline creating their own definition, the definition diverged and got embedded into several fields from marketing to engineering.

Historian Benoit Godin (2010) traced the term "innovation" to its roots and found out that the word 'novation' was first used in 13th century texts as a term for renewal of contracts, which did not refer to creation but only to newness. In the religious 16th and 17th centuries innovation, or being innovative could get you imprisoned. The cursed nature of innovation was even made official by the proclamation of Edward IV of Engeland titles as 'A Proclamation against Those that Doeth Innovate':

"Considereing nothing so muche, to tende to the disquieting of his realme, as diversitie of opinions, and varietie of Rites and Ceremonies, concerning Religion and worshippyng of almightie God (…); [considering] certain private Curates, Preachers, and other laye men, contrary to their bounden duties of obedience, both rashely attempte of their owne and singulet witte and mynde, in some Parishe Churches not onely to persuage the people, from the olde and customed Rites and Ceremonies, but also bryngeth in newe and strange orders (…) according to their fantasies (…) is an evident token of pride and arrogance, so it tendeth bothe to confusion and disorder (…): Wherefore his Majestie straightly chargeth and commandeth, than no maner persone, of what estate, order, or degree soever he be, of his private mynde, will or phantasie, do omitte, leave doune, change, alter or innovate any order, Rite or Ceremonie, commonly used and frequented in the Church of Englande (…).

Whosoever shall offende, contrary to this Proclamation, shall incure his highness indignation, and suffer imprisonment, and other grievous punishementes." (Godin, 2010, p.5)

In his article 'Innovation as Evil' Godin (2010) also mentions a particular case from 1636 where newness was related to Puritanism and people who are accused of being innovators were sentenced to life imprisonments.

Only towards the mid 19th century, following the Industrial Revolution, innovation became related to science. Still, the term mostly referred to technical inventions. According to Godin (2010) until Schumpeter defined innovation simply as 'bringing new technology to market' in 1939, the terms innovation and invention were used interchangeably. Schumpeter (1939) clarified the difference between these two terms by stating that innovation occurs when companies find out how to operationalise novelties into constructive changes. However, recent development shows that innovation does not belong to companies anymore. It is a cultural matter, a way of thinking that goes beyond business profit and even evolves together with the civilized world, by following the present trends and challenges, in contrast to what Schumpeter suggests (Govindarajan & Desai, 2013).

The necessity of studying how innovation studies respond to societal processes is also acknowledged by other scholars. This knowledge gap is explained as follows by Engerman and Rosenberg (2014) who took an historical look at the innovation studies:
"The implication is that it is necessary to study the historical record concerning the socio-economic nature of technological change, the constraints it confronts, and the complementarities with other sectors of the economy to fully understand the nature of innovation. Consideration must be given to the market environment, the available production facilities, the existing body of knowledge, and to the social and organisational contexts of the innovation, in addition to the series of required changes within other sectors, not just to the limited aspects of a narrowly-defined specific innovation." (p.1)

While studying the shift of innovation and trending terminology, it was necessary to look at existing studies. The most recent, comprehensive and structured study is from Baregheh et al. (2009). The article presents a structured literature review for exploring all the definitions of innovations until 2008. The article does not only present an analysis based on attribute occurrences in existing definitions, it also results in a new and inclusive definition as follows:

Innovation is the multi-stage process whereby organisations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace. (Baregheh et al., 2009, p.11)

Unlike Baregheh et al. (2009) it is not the aim of this chapter to bring yet another definition to this ever-evolving field. This chapter acknowledges the complexity of innovation and tries to pinpoint the correlation to social processes through looking at how it was defined by scholars through the last decade.

3.3.2 Methodological approach

The study follows a similar methodology to the work of Baregheh et al. (2009) in their paper titled as "Towards a multidisciplinary definition of innovation'. Although this paper was published in 2009, the collection of definitions practically stops in 2005 except for a single definition from 2006 and one from 2008. This research takes over the study from where Bargeheh et al. stopped. Since there were various definitions found from 2006 and on that were not included in the study of Baregheh et al., the decision to look at the definition in the last decade was made, which covers years 2006 to 2016.

From the developments in the IT sector, knowledge suddenly became available for everybody regardless of location. Before this, knowledge was dependent on time and context since it only travelled through people. This connectedness of society also meant growing complexity. Society being more complex brought new needs that cannot be satisfied through existing systems. In a very short period of time, people's reach expanded immensely which brought new relationships that require new means and tools. These developments brought a whole new field that needs innovation.

In parallel to these developments, the definition of innovation diverged directly in proportion to societal complexity. In the last two decades we see a divergence in the definition of innovation rather than converging to a single definition as the leading scholars suggested.

There is a paradoxical relationship between innovation and societal movement. This parallel movement of societal dynamics and innovation together could mean that innovation feeds on what is going on in the world and the direction of innovation follows the societal discourse. But also it is possible to say that innovation gives a direction to society and

determines how the dynamics will respond. However, which one came first and what triggers what, innovation or societal dynamics is an ages old chicken egg problem that has not received a clear answer yet. However, complex processes do not recognise an order of events. Innovation and social dynamics are complementary parts of each other that move in parallel to one another and trigger the development of each other simultaneously.

Table 3. Comparison of the source categories in two studies

The definitions were found by setting up a search query that is as general as possible. Baregheh et al. (2009) found the definitions from following fields in their study:
• Business & management
• Economics
• Organisation studies
• Innovation & Entrepreneurship
• Technology & Science & Engineering
• Knowledge management
• Marketing
However in this study, source categories were slightly different:
• Business & management
• Economics
• Organisation studies
• Innovation & Entrepreneurship
• Technology & Science & Engineering
• Medicine

The categories were rearranged and renamed to fit the research categories of Scopus database, which is one of the two databases where the literature review was carried out. Therefore, the categories were altered into a group of four as follows:

1. Business & Management (includes marketing, innovation & entrepreneurship as well)
2. Economics
3. Engineering (includes technology)
4. Sciences (includes social sciences and organisational sciences)

These categories exclude the medical field, which was present in prior findings. There were 44 remaining articles from this field that had additional definitions of innovation. However, the medical field has been excluded from this study for two reasons. First of all, Baregheh et

al. left this field out and to be able to compare results this was a logical step to take for this study. Secondly, medical definition of innovation has an incomparable character that did not fit in the word-clustering method that was applied in this study.

3.3.3 Data collection and the formulation of search queries[6]

For the data collection Scopus and Web of Science databases were used. The search query was purposely selected as inclusive as possible in order not to miss a single definition. 'Innovat* W/3 defin*' query was used, which orders the database to search for sentences that include any form of the words 'definition' and 'innovation' within the three consequent words. This makes it possible reach each the broadest range of definitions. The search was limited to years 2006-2016, which resulted in over 1000 publications.

The years were selected based on the paper of Baregheh et al. who investigated all papers in same fields until the year 2008. However, the latest found definition in the paper dates back to 2004 in most of the fields. This could be because there were no additional definitions found, but it could be because the research has stopped at that time. Since the publication gives no information on this matter, the decision to start from 2004 seemed more reliable.

After excluding the medical field, which sticks to a single, rather technical definition of innovation, the number of papers was dropped down to a total of 836. The abstracts of these papers were scanned for the possibility of new definitions presented in the paper. In total 323 papers were selected for further exploration that were distributed into the four fields in Scopus as follows:

1. Business & Management: 83
2. Economics: 71
3. Engineering:84
4. Science: 85

All 323 papers were scanned for possibility of new definitions and a total of 273 definitions were found. A list of these definitions can be found under Appendix D. There were additional 35 definitions found dating before 2004 that were referred to by the authors of scanned papers, which were not included in Baregheh study, are left out from the numbers above.

[6] For more information on the definitions please visit www.sinecelik.com/whatisinnovation

3.3.4 Analysis of the collected data

Table 4. Comparison of the steps taken in two studies

Baregheh et al. (2009) followed a 7-step flow chart for the analysis of the collected data that they describe as 'content analysis on new definitions'. This method is an adaptation of the method developed by Bryman (2001). Bryman (2001) describes the approach and its purpose as: "an approach to the analysis of documents and texts . . . that seeks to quantify content in terms of predetermined categories and in a systematic and replicable manner" (p. 177). Baregheh et al. (2009) applied an interpretation of this method by following nine steps:
1. "Classification of definitions of innovation by their disciplinary orientation.
2. Cleaning the text in order to simplify the word frequency count process.
3. Counting of word frequencies
4. Grouping of words with the same stem
5. Elimination of the words, which appeared only once or twice
6. Identification of the innovation attributes from the word frequency counts.
7. Clustering of the descriptors used in connection with each attribute
8. Cross disciplinary analysis of the descriptors used for each attribute.
9. The proposal of a diagrammatic and text definition of innovation" (p. 5-7).
Seven of these nine steps that were relevant for this study are re-listed and followed as the steps of this study without changing the order of the application. The two steps that were eliminated are step 4 and 9. Step four was eliminated because this small operation was conducted as a part of step 2 in our list. Step 9 was eliminated because coming up with a new definition was not the purpose of this study from the beginning.
1. classification of found definitions by discipline
2. cleaning the text:
3. counting word frequencies
4. identification of attributes
5. clustering descriptors
6. cross disciplinary check for similarities
7. diagrammatic presentation of attributes and translation to text in form of an updated definition

Definitions have been directly taken from the original texts before the analysis began. Six columns of information has been collected on each definition: the defining sentence, year it has been created, the author of the definition, the author of the source, the type of innovation and finally a link to trace the source back.

	A	B	C	D	E	F
1	Definition	Year	Author(s)	Source	Field	Doc.no
2	Where fossiled elemenets of conventional financial market products have been substituted by new and fi	20167	Anderloni et al	Micula	financial innovation	E14
3	Simpler, cheaper, and lower performing. Promise lower margins, not higher profits. Often initially shunned by leading customers who can't use and don't want them. First commercialized in emerging or insignificant markets.	20167	Christensen	Berlin	open innovation	ENG7
4	Concepts, ideas and organizations that meet social needs of all kinds from working conditions and education to community development and health; and extend and strengthen the civil society	2016	Saji & Ellingstad	Saji & Ellingstad	Social Innovation	B13
5	Process of explicitly applying innovation to social and environmental improvements through business actions.	2016	Saji & Ellingstad	Saji & Ellingstad	Social Innovation	B13
6	An innovation that changes the performance metrics, or consumer expectations, of a market by providing radically new functionality, discontinuous technical standards, or new forms of ownership.	2016	nagy et al	nagy et al	Distruptive innovation	B19
7	Having features of discovery", "having features of invention", and "providing added value."	2016	Aslan et al.	Aslan et al.	innovation	S3
8	Innovative products or services motivated by the goal of meeting a social need, with the opportunity to create new social relationships or collaborations.	2016	Altuna et al.	Altuna et al.	social innovation	B26
9	The foundation that helps to ensure a competitive edge, both economical and in the military.	2015	Smit & Pretorius	Smit & Pretorius	military innovation	B30
10	An idea turned into reality	2015	manuylenko	manuylenko		E16
11	Innovation is an object, introduced into production upon the completed scientific research or discovery made, differing from the previous analogue by qualitative parameters	2015	manuylenko	manuylenko	innovation	E16
12	An integral, complex, contradictory dynamic system oriented to an ultimate practical result, where a certain effect is achieved through interaction of its elements and complex processes.	2015	Manuylenko	manuylenko	innovation	E16
13	As a novel, inventive and usable solution, in either material or immaterial space: an end-product, process or method related to people's practical needs and purposes	2015	Lindfors & Hilmola	Lindfors & Hilmola	innovation	ENG1
14	The process of strategically managing the sharing of ideas and resources among entities to co-create value".	2015	Johansson et al.	Johansson et al.	open innovation	ENG6
15	quality upgrading	2015	Imbriani	Imbriani	innovation	E12
16	new products	2015	Imbriani	Imbriani	innovation	E12
17	optimal value of the knowledge inherent	2015	Gray & Grimaud	Gray & Grimaud	innovation	E2
18	new knowledge /intermediate good".	2015	Gray & Grimaud	Gray & Grimaud	innovation	E2
19	An innovation at date t in any sector ω, ω ∈ Ω, consists in i) an increase of Δqωt units of new knowledge in this sector, and ii) the embodiment of this new knowledge in the intermediate good ω.	2015	Gray & Grimaud	Gray & Grimaud	innovation	E2
20	Implemented products or services are novel and useful from the standpoint of external audiences.	2015	Godart et al.	Godart et al.	innovation	B25
21	The only way that enterprises can maintain long-term competitive advantage is the continuous and effective management of technological innovation, which can strengthen their own core technology capabilities	2015	Chen et al.	Chen et al.	technology innovation	ENG10
22	That has the explicit objective of addressing a complex social problem that is defying resolution through established means.	2015	McMahlan	Bitzer	social innovation	E18
23	Generating social and economic value and re-ordering sectoral relationships to achieve this shared social purpose	2015	Moore	Bitzer	social innovation	E18

Figure 15. Partial presentation of the collected definitions

For example:

innovation: An **integral, complex, contradictory, dynamic system** oriented to an **ultimate practical result**, where a certain **effect** is **achieved** through **interaction of its elements and complex processes**. (Manuylenko, 2015)

social innovation: A **complex process** of **introducing new products, processes or programmes** that profoundly **change the basic routines, resource and authority flows, or beliefs** of the **social system** in which the innovation occurs. (Westley & Antadze, 2010)

In these two examples, the common factors referring to similar attributes that compose the definitions have been matched to each other by using different colours. In this study, a similar analysis will be performed on all definitions by grouping the words used to describe certain attributes of innovation. Later on, collected definitions are analysed based on very simple attributes that were present in almost all definitions, which are:

How?: Relating to the action (making, having, implementing)

Which?: relating to the form (new, improve)

What?: relating to the output (ideas, products)

Where?: relating to where innovation happens (social system,economy)

Why?: relating to the purpose/result (change, value creation)

Who?: relating to the audience (industry, company, society)

Methods: relating to tools & methods used (knowledge)

*The methods part was eliminated later due to the insignificant amount of findings.

The attributes are simplified versions of Baregheh's six attributes, which are described briefly in the paper. An extra attribute category 'means of innovation' is also being discussed in the paper of Baregheh, which refers to the necessary resources that need to be in place for innovation. This category has been excluded from this analysis due to such information being rarely available within the definitions.

3.3.5 Findings of the study

The literature on definition of innovation is broad and multidisciplinary. Scholars have tried to come up with an inclusive, general definition that is applicable for all kinds of innovations in all fields. However, based on the hundreds of papers that were investigated in this study, it is possible to say that even the most detailed definitions does not seem to fulfill the needs of scholars who are working on specific areas of innovation.

These unsatisfactory attempts to define innovation for once and for all can be explained by the complex nature of innovation. Innovation today is not a single property deriving from a single entity but a multi-layered multi-stakeholder series of activities and results with systemic impacts. Within this system, each party has their own inputs, methods or expectations and therefore their own understanding of innovation. This complexity cannot be described through a single definition. The aim of is this paper is not to come up with yet another definition of innovation but to acknowledge the complexity and to identify current trends in innovation studies by looking at how scholars defined innovation in the last decade.

In this study, the divergence of innovation studies is clearly visible when we look at "what" the definition is actually defining. Instead of defining what innovation in general is and applying it a specific field, we can see that definitions diverge as 'social, service, eco innovations etc.' But when we look at the concepts that are involved in each definition, it is possible to see that similar words have been used although the definition addresses a completely different field.

HOW		WHICH		WHAT		WHERE		WHY		(for) WHO	
create		23 new		101 product		41 organisation		14 meeting needs		20 society	51
develop		14 improved		27 service		39 society		8 change		18 customer	16
implement		14 existing		13 process		36 business		5 benefit		14 market	11
offer		11 novel		10 idea		27 management		5 performance		9 life	10
generate		9 significant		10 innovation		22 system		5 goal		7 people	9
apply		8 innovative		4 practice		11 technology		5 compete		6 environment	6
produce		7 better		3 way		11 culture		4 environment		6 individual	6
integrate		6 important		3 way		11 economy		4 enhance		5 organization	6
introduce		6 modification		3 way		11 environment		4 quality		5 community	5
deliver		5 succesful		3 way		11 company		2 sustainability		5 economy	4
design		5 competing		2 knowledge		10 finance		2 well-being		5 group	4
improve		5 considerable		2 system		9 humanity		2 impact		4 client	2
organise		5 effective		2 value		9 individual		2 advantage		3 competing company	2
provide		5 intangible		2 model		7 operation		2 good		3 employee	2
adopt		4 not previously available		2 concept		6 social practice		2 achieve		2 management	2
change		4 renewal		2 method		6 sustainability		2 collaboration		2 planet	2
diffuse		4 simoulteanous		2 relationship		6 actors		1 differentaiate		2 public	2
involve		4 state-of-the-art		2 problem		5 brand		1 efficiency		2 stakeholders	2
make		4 useful		2 solution		5 characteristic		1 extend		2 technology	2
adapt		3 useful		2 activity		4 city		1 influence		2 alliance	1
contribute		3 affective		1 opportunity		4 commerce		1 minimim use		2 audience	1
resolve		3 alternative		1 challenge		3 delivery		1 need		2 authotiry	1
solve		3 best		1 collaboration		3 department		1 position		2 broad context	1
work		3 brilliant		1 combination		3 development		1 profit		2 business owner	1
addition		2 collaborative		1 departure		3 economic structure		1 reduction		2 consumer	1
assimilate		2 collective		1 element		3 ecosystem		1 satisfy		2 culture	1
combine		2 commercial		1 mechanism		3 employee		1 stregthen		2 ecology	1
do		2 common		1 organization		3 ends		1 success		2 finance	1
identify		2 contant		1 procedure		3 entreprise		1 acceptability		1 firm	1
increase		2 continous		1 startegy		3 facility		1 access		1 humanity	1
launch		2 current		1 structure		3 government		1 added value		1 industry	1
learn		2 direct		1 technique		3 group		1 advance		1 institution	1
optimise		2 diverse		1 technology		3 innovator		1 behaviour		1 labour market	1
promote		2 efficient		1 component		2 institution		1 coherence		1 military	1
respond		2 embracing		1 experience		2 manufacturer		1 collective		1 partner	1
accomplish		1 exceptional		1 information		2 means		1 convenience		1 patient	1

Figure 16. Partial presentation of the sorted out definitions

Figure 16 shows the distribution of key-words used in 273 definitions among the 6 attribute categories. The remarkable changes compared to Baregheh's findings are listed as follows:

- Inclusion of words such as 'social, socio-, societal' increased remarkably.
- The value of 'progress' increased rather than 'output'.
- The definitions started mentioning alternative ways of innovating process-wise.
- The definitions growingly embrace the development of planetary concerns relating to innovation: sustainability, ecology, environment
- Some words started occupying higher ranks on multiple lists and these are system, society, organisation, change, sustainability, environment to be specific.

Baregheh	B	This Thesis	TT				
New	76	New*	173	Customer	15	Technical	
Produc*	40	Soci*	140	Resources	19	Commercial*	
Organiz*	29	Produc*	107	Firm	18	Success	
Service	25	Process*	76	Meet*	18	Group	
Process	23	Service*	72	Effect*	18	Collaborat*	
Idea	22	Organiz*	53	Benefit	18	Interact*	
Develop	13	Idea*	48	Work	15	Financ*	
Invent*	12	Creat*	48	Structur*	14	How	
Technology	12	Chang*	46	Invent*	13	Element*	
Firm	11	Improv*	45	Sustain*	13	Inclu*	
Market	11	Systems	35	Involve	13	Role*	
Technical	10	Need	34	Concept	13	Experienc*	
Creat*	10	Develop*	32	Individu*	13	End*	
Chang*	10	Environment*	31	Form	13	Continu*	
Commercial*	7	Technolog*	30	Achiev*	13	Advantag*	
Improv*	6	Market	30	Appl*	13	Time*	
Implement	6	Value	29	Generat*	13	Renew*	
Econom*	6	Solve*	29	Life	13	Public	
Success	6	Business	23	mean*	13	Research	
Superior	5	Novel*	22	Model*	13	Think	
Group	3	Way*	22	Qualit*	13	Important	
Value	2	Implement	21	Adopt*	12	Procedure	
		Econom*	21	Enhance*	12	First	
		Performance	20	Combin*	11	Basic	
		Practic*	20	Result	10	Actor*	
		Knowledge	19	Method*	10	Superior	
		Existing	19	Design*	10		
		Management	17	Good	10		
		Problem	17	Human	10		
		Relation*	17	Deliver*	9		
		Signific*	17	Impact*	9		
		Goal	16	Complex*	9		
		Compet*	16	Challeng*	9		
		People	16	Better	9		

Figure 17. Presentation of the word-count comparing the findings in the study of Baregheh to our study

Figure 17 compares the lists of most used words in Baregheh's study and the study presented in this paper. Although many of the most used words were still used, it is possible to see a clear divergence of subjects. In addition to the divergence, the most drastic change is visible on the number of words that describe the 'social' side of innovation. In fact, the word social itself was the second most used word within all the definitions, 140 times in 273 definitions to be specific.

Table 5. Distribution of definitions per field and type

	TYPE	BUS&MAN	ECON	ENG	SCIENCE	Total
1	building innovation			1		**1**
2	channel innovation	1				**1**
3	cognitive innovation			1		**1**
4	design innovation	2				**2**
5	distruptive innovation	1	1			**2**
6	eco innovation	13	1	1	2	**17**
7	educational inno.		1			**1**
8	environmental inno.		1			**1**
9	financial innovation		6			**6**
10	food innovation				3	**3**
11	healthcare inno.				1	**1**
12	institutional inno.	1				**1**
13	innovation	36	22	21	20	**99**
14	management inno.	6				**6**
15	marketing inno.	2				**2**
16	military innovation	1				**1**
17	network innovation	1				**1**
18	open innovation	1		2		**3**
19	organisational inno.	2		4	2	**8**
20	process innovation	2	1			**3**
21	product innovation	2	1			**3**
22	service innovation	20	1			**21**
23	social innovation	63	9		5	**77**
24	spececraft inno.			1		**1**
25	sustainable inno.		1	1		**2**
26	structural inno.	1				**1**
27	technological inno.	1		1	2	**4**
28	transformational in.		1			**1**
29	value innovation	1				**1**
30	workplace inno.		1			**1**

- The divergence in definitions exceeded the four major fields of research, resulted in 30 sub categories that specify the 'type' of innovation such as eco-innovation, service innovation etc. distributed as shown in the Table 5.
- Top 5 discussed types were highlighted in Table 5.

The study of Baregheh also identifies 'types' but instead of dividing the found definitions into these types, they identify four prominent types that are: product, service, process and technical, saying 40 definition out of 60 mentions product innovation, 25 service, 23 process and 10 technical. As to be seen in Table 5, the discussion has shifted immensely in the last ten years, technical and product innovation are not buzz-words anymore.

- Since 2006, new terms & fields came into play and definitions became more specified, even evolved in different directions. (highlighted)

Table 6 presents list of sources per discipline and per type. When compared to previous table, many authors have provided multiple definitions, however the prominent five fields of discussion (highlighted) have remained consistent.

Table 6. Authors of definitions per field and per type

	TYPE	BUS&MAN	ECON	ENG	SCIENCE	Total
1	building inno.			Sexton & Barrett		1
2	channel inno.	Smit & Pretorius				1
3	cognitive inno.			Barnes		1
4	design inno.	Moon et al.				1
5	distruptive inno.	Nagy et al.	Koen			1
6	eco innovation	Xavier et al.	Kemp	Harju-Oksanen	OECD Moralez et al.	5
7	educational inno.		Presto			1
8	environmental in.		Bitzer			1
9	financial inno.		Rossignoli & Arneboldi Micuila			2
10	food innovation				Beckeman	1
11	healthcare inno.				Omachanu & Einspruch	1
12	institutional in.	Mei & Arcadia & Ruhanen				1
13	innovation	Diaz Godart et al. Hristov & Reynolds Jalonen Jamali et al. Massa & Testa Quintane et al. Scholten & Blok Smit & Pretorius Strazdas et al Witell et al. Zizlavsky	Ubius&Alas Sethibe & Steyn Morena-Mas et al. Mars Manuylenko Imbriani Herzog Gray & Grimaud Franz et al. Cook Bowman & Taengoi Baporikar Ayyagari	Badinelli Apilo Johansson et al. Matt Souza Szajnfarber et al. Lindfors & Hilmola Montagna Tsach Harju-Oksanen Schindel et al. Jensen et al. Tekic et al. Buntz	Manrique Willis & Matrofski Fagerberg Neumeier Grunert Edison et al. Tytler et al. Ye & Ye Abernethy et al. Panfilis & Missikof Jablonksi & Jablonski Hansen et al. Gupta Aslan et al.	56

	TYPE	BUS&MAN	ECON	ENG	SCIENCE	Total
14	management in.	Birkenshaw et al. Mei & Arcadia & Ruhanen Volberda				3
15	marketing inno.	Edler & Yeow Mei & Arcadia & Ruhanen				2
16	military inno.	Smit & Pretorius				1
17	network inno.	Smit & Pretorius				1
18	open innovation	Sisodiya		Johansson Berlin		3
19	organisational in.	Totterdil & Exton Zizlavsky		Sexton & Barrett Liu & Qian	Kang & Jaskite	5
20	process inno.	Mei & Arcadia & Ruhanen Smit & Pretorius	Lee & Kang			3
21	product inno.	Smit & Pretorius	Sethibe & Steyn			2
22	service inno.	Smit & Pretorius Snyder et al. Witell et al.	Narayanan			4
23	social innovation	Altuna et al. Ettore et al. Hochgerner Jacobsen & Josmeier Saji & Ellingstad Scott	Scott Dawson & Daniel Franz et al Bitzer		Neumeier Laria et al. Lubelcova	13
24	spececraft inno.			Szajnfarber		1
25	sus. inno.		Koen	Hou & He		2
26	structural inno.	Smit & Pretorius				1
27	technological in.	Zizlavsky		Chen et al.	Godin Betz	4
28	transformational i.		Koen			1
29	value innovation	Balsano et al.				1
30	workplace inno.		Franz et al.			1

Also, the discourse on the definition of innovation is growing as well. Table 7 shows the distribution of the definitions found in this study per year. Although there is a general growth, it is possible to say that there has been a proportional development between the four fields. Business & Management has been leading the path towards defining innovation. With the recent relation of innovation to economical development, the field of economy has shown a significant contribution to the field as well.

Table 7. Distribution of definitions per field and per year

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
	7	5	16	22	14	21	9	8	12	15	2	5	B&M
1	1	1	3	3	1	7	7	2	4	1	11		ECON
1	5	3	1	3	1	2	4	3		1	3		ENG
		1	1	3	4	2	3	7	5	4		1	SCI
2	13	10	21	31	20	32	23	20	21	21	16	6	TOT.

3.3.6 Conclusions of the study

When we compare the amount of definitions Baregheh (2009) looked at to the amount presented in this study, it is possible to see a clear growth of discussion on this topic. Of course the similarity of search queries and sources are open to discussion since Baregheh et al. has given little information on how the data was collected. Yet the difference is remarkable. While Baregheh found 60 definitions from all the publications until the year 2008, this study that only focuses on the last decade (2006-2016) found 273 different definitions.

Regardless of origin, each and every innovation derives from a prompt and seeks to create change. The prompt is a derivative of technical and social conditions of the time and place with aim of creating change of impact to the social unit it serves to. This relationship innovation has with society results in new social dynamics that requests new innovations. This chain-reaction of social processes and innovative processes suggests a chicken-egg problem in which it is not clear what triggers what or what comes first. Looking at the definitions of innovation within the last decade and the correlation they have with the worldwide challenges, it is possible to say that social processes and innovation moves hand-in-hand and evolve together.

Innovation, and therefore the definition of it within multidisciplinary innovation studies, diverges by following social trends regarding the 3 P's (people-planet-profit) and their technical implications on daily life. Therefore, a comprehensive innovation model must consider social processes as a part of the innovation process that develops hand-in-hand with the technical processes that form the conventional, tangible result of innovations.

In the remaining sections of this chapter, a brief look at existing innovation models and their inclusion of social processes will be presented.

3.4 A Holistic Description of the Innovation Process

Insights from the two studies discussed in this chapter suggest that technological innovations can only be meaningful for the society if the process is organised for solution-oriented purposes, preferably approached in a non-linear and complex manner that is scaled through an ecosystem of interactions (Dosi et al. 1998; Kline & Rosenberg, 1986; Lundvall & Borras, 1997). Accordingly, Doloreux states "technological change and innovation are not context-specific. Rather, they are created and disseminated as an outcome of interaction between a multitude of actors, distributed over many different institutions and locations" (2002, p. 3).

In addition to functional and theoretical definitions of innovation, there are also various models to describe the innovation process (Buijs, 2003). Majority of these models were developed to define the iterative innovation process in simplified ways to be used for managerial purposes. Such models commonly aim to divide the process in consequent pieces to make smaller, manageable parts (Cooper, 2008). This section takes a brief look at the most commonly used innovation models and how the steps they present relate to the social processes the previous section has concluded.

Although they come in all shapes and sizes, innovation models can be very simply categorised in two. First one is the stage-gate-inspired model, which was developed by Cooper and Edgett in 2010. Stage-gate model is one of the most popular tools for innovation that simplifies the innovation process for management purposes. Examples to similar, but less simplified phase-gate based models can innovation process model by Hobday et al. (2005) and phases of product innovation product by Roozenburg and Eekels. (1995).

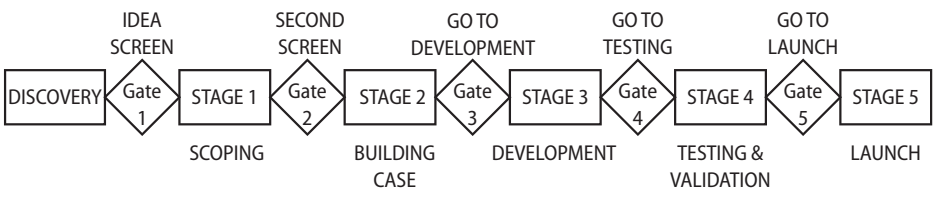


Figure 18. The stage-gate model (Adapted from Cooper, 2008)

Despite the fact that it was initially developed for product innovation, stage-gate suggests a path of activities and managerial decision points to control these activities. By giving a very clear description of timing and content of actions to take, the stage-gate model functions as a simple tool for managers to control a complex process. Although among others, the creator of this approach himself strongly criticised the model's rigid and linear structure, and created an edited version, it is still a widely used approach due to simplicity and it formed a basis for many linear management oriented innovation models (Cooper, 2008). While providing a great opportunity to pinpoint the 'gap' between managerial and creative ways of working, the simplicity of this model can be seen as a start for developing an alternative holistic approach that considers both output oriented needs of managers and discursive nature of creative work.

Phase-gate approaches are often criticised with their structured character that works against innovation because the linearity makes the model too product-centric. It is widely discussed that new perspectives are necessary to bring in new approaches, processes, and alternative tools for efficiently innovating (Mootee, 2008).

Still today, a variety of firms make use of stage-gate-based processes in their innovation management mechanisms. This means that novel ideas must be worked through a series of stages and gates, where they are polished before being transferred to the next stage. This linear development of quality might theoretically lead towards better-developed ideas. But in practice, the teams end of with a result that is a compilation of the most risk-free ideas that made out through the stages and the gates.

The second group is the milestone (-inspired) models. Milestone models acknowledge the non-linearity of innovation process by dividing the task in iterative cycles. Such models commonly operate in an agile manner that triggers interaction between performers as well. Examples of such models are the chain-linked model introduced by Kline and Rosenberg (1986) and the cyclic innovation model by Berkhout and Duin (2007).

Milestone methods are commonly criticised for not giving enough freedom to innovate due to the strictly woven planned processes. In addition, in the world of IT, where such methods are commonly used, agile is criticised for enabling the people to talk too much about innovating rather than working on innovation itself (Meijer, 2015).

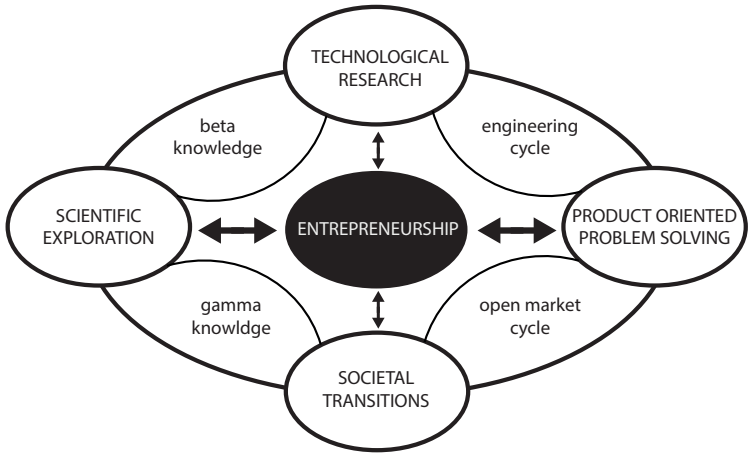


Figure 19. The cyclic model (Adapted from Berkhout & Duin, 2007)

The fact that milestone models require strict planning based on goals, even if the plans are continuously revisited through iterations, operates against the uncertain nature of innovation. Innovation may not always start from a clearly defined goal and it recognises a discursive character (Schon, 1967).

But the disadvantage brought by such models is greater than limiting innovative output by over controlling it. None of the models that fall into the category of stage-gate or milestone – based models acknowledges the societal dimension of innovation processes. In a part of the given model examples, terms as market introduction, scaling and adoption are used. But they remain as steps of the technical process rather than a parallel development where technical processes depend on. However, the definition of innovation in theory and in practice as described in the previous parts of the chapter show that innovation evolves together with the social dynamics. Not only that gets influenced through emerging trends, it also aims to create an impact on existing ones. In other words, social processes are continuously influencing technical processes. These two parts cannot be separated from each other when the innovation process is holistically described.

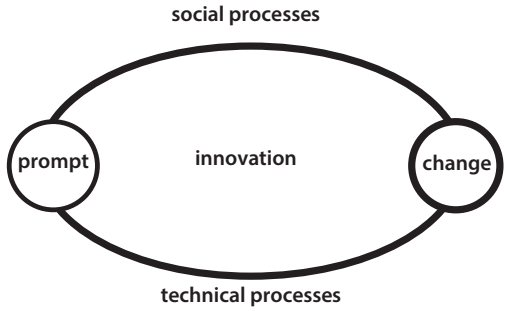


Figure 20. A complementary approach towards innovation cycle

3.5 Conclusions and Propositions Deriving from Paradox 1

Literature shows a strong relationship between the societal context and the realisability of innovation. This is because innovation reflects the complexity of society. This complexity creates many views on the definition, target and result of innovation second because complex problems do not recognise straightforward solutions.

Especially in the business and management fields where a majority of definitions come from, there is a tendency to manage this complexity. Stage-gate and milestone models are the two main approaches towards the management of innovation but both of them are simplifications of the complexity of the process. These models help very little with controlling the outcome of innovation and they are never enough as managing innovation is a helpless case. The only way to achieve results through innovation is to approach it from holistic and systemic way. Therefore the conclusions of Paradox 1 can be summarised as: since there is interdependent complexity of societal context and innovation, understanding the societal context is crucial for making innovation happen.

Innovation is not a singular event but a process often resulting from most successful traditions and it does not entirely depend on the sparkling novel ideas. Innovation derives from "social interactions as forms of relations between a variety of actors and social practices involving perceptions, meanings, experience and bodily competences, purposes and values, materiality and acts" (Shove et al. 2012, p. 24-25).

Social processes of exchanging knowledge among a diverse group of actors are increasingly referred to while defining innovation (Garud et al. 2012). Innovation process is defined through a series of purposeful acts that involve knowledge exchange and contributing to permanent change (Hellström, 2004). Knowledge, which is one of the most essential elements of innovating, is known to be the outcome of social processes (Borrás & Edler, 2015). The relationships between the stakeholders, or in other words actors of innovation trigger and facilitate a learning society. (Edwards-Schachter & Wallace, 2017).

In literature there is a 'transformative' approach that characterises (social) innovation in relation to systemic change and an 'instrumental' approach that addresses societal needs. (Edwards-Schachter & Wallace, 2017). However, innovating societies or firms are required to tackle both of these approaches to be able to develop a holistic perspective, because innovation is not limited to an economic development. Once scaled, innovation serves to a broad spectrum that includes technological, social and cultural contexts simultaneously (Hochgerner, 2009). Edwards-Schachter and Wallace (2017) explain the involvement of social processes in the field of innovation by explaining that "social innovation is used to name the development of products, processes and services mediated by technologies or closely linked to technological innovations with social purposes. After decades of marginalisation, social innovation is starting to be recognised as part of the black box of innovation to inquire which is the place of social practices in innovation processes and how they take part of different activities and the building of social, technological even cultural innovation systems and their contribution to socio-technical change" (p. 11).

Despite social change being on everyone's agenda, most corporate organisations strive for technological innovation by using a form of the stage-gate process to be able to innovate more effectively. Which means, that new ideas get developed and evaluated through a series of stage gates, before moving on towards launching. Stage-gate approach is widely criticised for working against innovation because it is encouraging risk-free development of ideas.

The innovation literature recognises two main notions that surprisingly belong to separate schools of thoughts. Schumpeterian (1934) notion approaches innovation and the impact it creates from an economical perspective, while Kallen (1930) identifies innovation as a series of socio-cultural improvements. However, the ever-growingly complex development of social, cultural and economical developments, these two perspectives can only be complementary to each other. And therefore, also considering the knowledge aggregation presented in the

previous sections of this chapter, the field of innovation must take a holistic direction that includes both notions of economical and socio-cultural development to achieve the wished for 'change'.

Three pillars change through innovation are defined as the opportunity structures and capable agents in a system, the instrumentation of governance of change, and the legitimacy and acceptance of change (Borras & Edler, 2015). This is a rather restrictive and rather top-down view that is directed towards conventional outputs of innovative processes and dismisses the role of social processes that develops in parallel to technical development. Technical developments need time to be transferred from an invention to innovation, but this process is largely to dependent on social constructs, behavioural patterns and dynamics in the society. (Hochgerner, 2009).
As a result of the above summarised literature studies, a series of preliminary propositions are identified. Propositions are the researcher's interpretations of the theoretical research, identified in different ways, from which some were aiming at enhancing academic knowledge, whereas the others were observations regarding the societal situation at hand. Together, the propositions directed the research and became crucial points of the argumentation in this research.

The reason for identifying propositions is to underline the main conclusions of the literature study and to provide a ground for finding evidence to support empirical studies that will be conducted later in the research. The outcome of the knowledge aggregation that explains the paradoxical relationship of social and technical innovations are explained through following propositions:

1. Innovation is complex because it is a reflection of complex social processes.
2. Innovation cannot have a single definition because society constantly creates new needs, prompts and mediums.
3. Innovation can only be considered complete if the social unit it is introduced to accepts it.
4. There are two common ways to manage innovation: stage-gate (-inspired) models and milestone (-inspired methods) but neither responds to the social complexity that is a part of innovation processes.
5. Social and technical processes within innovation develop together and therefore a holistic understanding is necessary.

From the studies in Chapter 1 of this thesis, it has been concluded that the context in Fryslân is historically rather complicated. The society shows the characteristics of a closed-like system that has been operating in isolation for centuries. This may have been the usual course of events for centuries but now, in the growing connectedness of the world, Fryslân is experiencing problems. Creating an innovation ecosystem is on the local agenda to fix these problems, but the hampering societal factors are not letting this happen despite the efforts.

This brings us to Paradox 2 of this thesis. Since the overall proposition that societal context is the critical success factor for innovation is accepted, and especially considering the historical background of the Frisian situation, it appears to be worthwhile to study the social constructs. The Paradox 2 focuses on the potentially contradictory set of relationships that define these social constructs. Social Network Analysis is defined as the study of social contracts, therefore provides a wonderful constructs the tackle Paradox 2 of this thesis.

Paradox 2: contradictory relationships within innovation

A paradox is "a seemingly self-contradictory statement or proposition that when investigated or explained may prove to be well founded" (retrieved from Oxford dictionary, 2017). In the series of societal and theoretical perspectives that are described through brief literature reviews until now, two self-contradictory concepts are underlined multiple times regarding the phenomena of innovation and how to enhance it on a regional level. These are referred as paradoxes of this thesis and they form the core of the remaining chapters.

The Paradox 2 refers to the contradictory relationships within innovation that has been identified as one the main reasons of complexity. Even in the most traditional context, innovation is described as a process that typically follows two intertwined lines of creativity and management (Adams, 2005; Holzmann, & Golan, 2016). These two lines of work have very different structures than each other by nature, one being cyclic and discursive, while the other one is linear and chronologic.

The paradox here derives from the fact that two natures of relationships with absolutely opposite values have to exist together and work towards the same goal. Moreover, in a regional context that recognises a much higher level of complexity, there are additional relationships to be considered as well (Cardillo et al. 2013). Chapter 4 looks at how a network perspective can help explain inefficiencies that are created from these contradictory relationships and answers the following research question with its sub-questions:

The globally defined research question that was formulated at the beginning was re-formulated after broadening the societal and theoretical perspectives into paradoxes. This question is: *"How can closed innovation systems be opened up through the effective use of social constructs to achieve sustainable development?"*

At the end of Chapter 2, the first set of research questions were presented in relation to Paradox 1. Adding on the studies conducted to answer these questions, a new set of questions is formulated. Consequently, the empirical studies will also follow the reasoning of the second paradox and the respective research questions that are listed as follows:

RQ2. How can a network perspective help explaining the social processes regarding innovation?

To be able to answer this question, sub-questions were developed that are explored respectively in chapter 4.

s-RQ4: What is the relationship between networks and innovation?
s-RQ5: How can multiplex relationships within a very large group of actors be studied?
s-RQ6: How can Frisian innovation system benefit from a network approach?

The first paradox is related to innovation, and to the interdependent nature of social and technical processes within innovation that has been explored through two different studies. The concluding propositions suggest a holistic understanding of the two processes in order to efficiate the output. Therefore, there is a clear relationship between the success of innovation and its perception by the society. Following that, the Paradox 2 explores the social relationships that influence innovative output by looking at the seemingly contradictory relationships within innovation processes.

Chapter 4

PARADOX 2: CONTRADICTORY RELATIONSHIPS WITHIN INNOVATION

"What is life without incompatible realities?"
Ursula K. Le Guin

4.1 Understanding Complex Innovation Processes Through Networks

Complexity is defined as "the degree of sophistication, connectivity and implications of a decision-based field of activity" (Willke, 2000, p. 22). A complex system on the other hand, "is a system composed of interconnected parts that as a whole exhibit one or more properties not obvious from the properties of the individual parts" (Koskinen, 2010, p. 32).

The word 'complex' is among the most used words within the definitions of innovation that were published in the last decade (Chapter 3). This mainly relates to the fact that society has been undergoing a series of cyclical and structural changes since the industrialisation, where societal roles and rules are not as clearly divided as it was (Harmaakorpi & Melkas, 2012). The ever growingly complex technological developments brought to the world by industrialisation gradually caused the emergence of new relationships within marketplaces, which made them more competitive and more connected. Fichter (2012) relates this remarkable acceleration of marketplaces to what he calls 'dynamisation of innovation' and gives two main causes for this: firstly, development of information technologies that results with greater availability of information and intense knowledge creation; and secondly, increasing competition that requires the creation of local innovation centres. With the addition of information and communication sectors to this development, marketplaces gained a rapid global touch and engaged into an ever-growing series of relationships where diverse actors came into play and each of them have different expectations.

In mathematics, the term 'complex' is used for problems with more than one solution (Gell-Mann, 2002). Similarly in societal systems where multiple actors are involved, more than one expectation has to be fulfilled as a result of a single action. Sometimes these expectations are not only diverse but also contradicting. This applies to the case of innovation as well, as discussed in the first part of this thesis.

Many scholars from the field of organisational management argue that it is the manager's task to reduce or possibly eliminate the complexity of the innovation process in order to be successful (Edquist, 2009; Koulopoulos, 2009; Goldman et al. 2009; Fitzgerald & Van Eijnatten 2002; Drucker, 1985). A quote from Drucker's famous Innovation and Entrepreneurship (1985) summarises this view as:

"An innovation, to be effective, has to be simple and it has to be focused. It should do only one thing, otherwise it confuses. If it is not simple, it won't work. Everything new runs into trouble; if complicated, it cannot be repaired or fixed. All effective innovations are breathtakingly simple. Indeed, the greatest praise an innovation can receive is for people to say: 'This is obvious. Why didn't I think of it?'" (p. 166.)

Complexity is sometimes even used interchangeably with the term 'chaos', which is commonly defined as a condition of disharmony. A second group of scholars talk about cha-ordic systems, which derives from the combination of the words chaos and order to indicate the simultaneous presence of both (Van Eijnatten, 2004). They argue that simplicity and order are not necessarily contradicting complexity and chaos but instead these terms are complementary to each other. The negative organisational vibe that originates from the surprising nature of complexity is old-fashioned and organisations must proceed by acknowledging the benefit of unpredictable yet patterned behaviour in systems (Van Eijnatten & Putnik, 2004).

The contradicting arguments from scholars that think different from both groups are abundant. Harmakoorpi & Melkas (2012) argue that complexity is in fact inherent to any human act and avoiding complexity cannot be the goal of any progressive organisation since complexity grows in parallel with social connectedness. The argument that relates to innovation here is that societal development of today reached such a level of complexity in itself that makes it impossible for a lone genius to be sustainably successful in anything (Laakso, 2017). Likewise, achievements are now only real when they are communicated, gain an audience, get accepted and used. Harmakoorpi & Melkas (2012) give the example of innovation in elderly care to explain the complexity, which is a case where various public and private sectors, a wide range of services and a number of experts are involved. While agreeing with Harmaakorpi & Melkas (2012) on the increasing complexity of innovation, Fichter (2009) details the complexity of innovation by dividing it in three parts as decision-relevant variables, the mutual reliance between and the number of actors that are actively involved in innovation projects.

In his paper from 2009, Fichter presents a study on the 'network' discourse in the field of innovation by looking at ten leading journals from the field of technology and innovation management. He reports that "collective constructs of innovation like 'teams'; 'networks' or 'communities' have received a growing attention since the early 1990s. Specifically From 1990

to 1995, some 175 articles focused on one or several of these three groups. This increased to 288 articles between 1996 and 2001, and to 425 articles between 2002 and 2007" (p. 2). The author also foresees an exponential growth in the number of studies in the following years based on the fact that such collective constructs are gaining more dimensions and therefore more attention everyday. (Fichter, 2009)

Although innovation and complexity are widely discussed among scholars even as a combination, literature that uses complexity theory for learning from innovation systems is scarce (Fenwick, 2008). Building on the thoughts of Harmakoorpi and Melkas and Fichter, this part acknowledges the complexity and aims at explaining the potential helpfulness of a network perspective in order to understand and work with complexity within innovation systems.

4.2 A Brief Summary of Network Theory and Its Applications

Social systems are defined as structures that facilitate communication and human behaviour (Parsons 1991). Within an organisation, social systems recognise officially defined and unofficial structures. Official structures would be the given roles, defined hierarchies and the relationships that occur around these. Unofficial ones on the other hand consist of social relations between actors that are informally established. Together, the official and unofficial relationships form social systems, although the two structures are rather challenging to separate from one another (Flap et al. 1998).

Communication is essential for the existence of living things and it by definition requires more than one side. For it to become a network, this number needs to exceed two (Monge & Contractor, 2003). The term network is used in various ways to describe complex and multi-actor systems (Aula & Parviainen, 2012). Although frequently used to describe the connections within systems in scientific and non-scientific world, scholars have not reached an agreement on what a network means. A variety of meanings have been assigned to the term network depending on the field. It may be used as actors and their relationships in-between (Castells, 1996). But it may also be used as "an analytic concept that is formed from methods of gathering, handling, and modeling action" (Aula & Parviainen, 2012, p. 53). Or it might be used to define the identity construction of organisations (Ibarra et al. 2005).

In their book Theories of Communication Networks, Monge and Contractor (2003) present a comprehensive overview of network theories in communication with a focus on structuralist approach. Structuralist approach suggests that the position individuals occupy within a network identify their values and stand point in life. Although earlier literature on network theory suggests contradicting arguments, such as the theory of social capital that simply suggests that the position individuals occupy within a network is the result of their formal and informal communications (Burt, 1992; Johansson, 2000). Until today, there has not been a clear consensus among researchers on the order of events regarding networks and positions of individuals. However, in complex systems, a certain pattern of occurrence is commonly absent. Especially in networks, which by definition exist as a result of and at the same time emerge through a multi-layered and multileveled series of relationships falls into this category. Rogers (2003) describes this cyclicality in relation to diffusion of innovation in networks by claiming that networks are formed through the interactions and therefore bring people together regardless of the formalities between them.

Monge and Contractor (2003) emphasise on the simultaneous occurrence of diverse relationships within the same group of actors, which relates to complexity of networks. They describe relationships as information exchange and define the networks through the constant transfer of message between actors involved, through which, people are gathered in a variety of different but overlapping networks. Building on this idea of diversity of relationships between actors, Barabasi draws the attention to the uneven distribution of connections.

Naturally, within a group of individuals some actors are more actively involved than others, which make their connections more diverse. Based on the differences in communication patterns and frequencies, actors in a network receive 'titles' in network studies, which describe their role for the network. For instance many scholars write about opinion leaders and opinion brokers within a network (Rogers, 2003). Opinion leaders are described as central, powerful and influential figures, who are well connected to a major part of the actors. Rogers points out the importance of these actors in early adoption of innovation. However, a network with only opinion leaders cannot function properly either. Strong figures with strong standpoints tend to have contradictions in between which will eventually lead towards segmentation and the loss of ties between actors. These inactive parts of a network are called structural holes. Opinion brokers take the role of standing in-between as catalyzers and potentially fulfilling the structural holes (Monge & Contractor, 2003). Yet, structural holes might not

always be destructive for a network. In his theory on structural holes, Burt (1999) suggests that the separation of certain groups might actually be more efficient as communication is time-consuming. Plus, he talks about advantage of the potential competition that might occur between disconnected groups. The application of this theory on the regional level instead of a corporate organisation is one of the propositions explored through the social network analysis presented in this thesis.

Social network analysis (SNA) is a method for describing the patterns of repetitive interactions between actors, and it is used to understand or speculate on the originations and consequences of these connections. Before going into details of the SNA presented in this thesis, the following chapter will give a brief introduction to origins of SNA.

4.3 Social Network Analysis as a Tool for Exploring Social Constructs

Analyzing networks has been used to understand social structures since ancient Greece. According to Prell (2012), it is not possible to describe a linear development of this discipline. SNA is built upon a variety of theories throughout the years and today it is perceived as a unique approach to understand the social world with its own societal, methodological and analytical tools.

Despite the lack of a clear origin, the major developments in the field arrived in 1930s deriving from the disciplines of psychology and anthropology simultaneously. Mainly triggered by the attempts to understand behaviour in relation to communication, from the psychological perspective the first study on networks was published by Moreno (1934).

Jacob Levy Moreno was a Romanian psychotherapist of the Gestalt tradition. Gestalt theory is described as follows by Wertheimer (1938, p. 2):
"There are wholes, the behaviour of which is not determined by that of their individual elements, but where the part processes are themselves determined by the intrinsic nature of the whole".

Building on Gestalt theory, Moreno simply asked people who their friends were and used this information to reason their psychological behaviour. Quite similarly to what is described in the empirical part of this thesis, Moreno believed in the systemic impact of small scale configurations formed by patterns of friendship and other relations (Prell, 2012).

Together with Moreno, Lewin (1948) studied group behaviour, which he described as a function of conflicting social forces. Another colleague of Moreno was Jennings, who wrote on psychological well-being in relation to social networks (Moreno & Jennings, 1938).

Also from the same generation, Heider (1958) worked on social conflicts, which he later developed into 'balance theory'. According to his view, people are in general inclined to avoid conflict in their minds and around themselves. Therefore he was interested in conflicts among groups that may cause segmentation. His theories form the base of the literature on segmentation and polarity in networks, which will be discussed and explored in the following chapters of this thesis.

With the rising popularity of network analysis, Moreno started the Journal of Sociometry, which enabled wider discussions on analysing large-scale systems. Despite the psychological discussion around social networks, mathematical approaches gained popularity in 50s. Mathematical concepts such as clique (a subset of vertices in a network) became discussion points (Festinger, 1949). Especially, the positions of actors or subgroups in networks in relation to their influence became a popular topic. Bavelas and Leavitt were working on mathematically formalizing the centrality measures (1952). The work of Bavelas (1950) and his team is still widely used as fundamental definitions of various network measures. Today, the social network analysis in the field of psychology continues expanding rather independently. The main subject of study is the role of networks in actor's behaviour (Friedkin, 1998).

While Moreno and his friends were emerging as network analysts of psychology, anthropologists were exploring new methods to analyse social structures. Alfred Radcliffe Brown was the main pioneer of this discipline, who was a UK born anthropologist. He was mainly studying social relations and how they transform into social structures. His thoughts on seeing the society as 'a complex network of social relations' have been followed by his well-known contemporaries Parsons and Malinowksi as well (Prell, 2012).

Unlike in the field of psychology, anthropologists collected empirical data. Mayo studied the relationships among the workers of Western Electric Company in late 20s, where he discovered an informal organisation or a hidden social structure. He reported the effect of this on workers productivity and hereby formed the basis of social network analysis in organisational management as we know today (Jones & Borgatti, 1997).

Similar to the field of physiology, in 50s Barnes, Bott and Mitchell looked at conflict in groups by investigating how the structure of relations among people affected the society as a whole. This way they formed a base for White's work on mathematically measuring and modeling social roles in 70s (Jones & Borgatti, 1997).

In 1974 Granovetter published a book titled as *Getting a Job*, in which he asked people how they got their jobs. Since most participants mentioned coincidental success rather than purposeful search, he developed his theory about information diffuse through social networks. A similar, yet controversial study was done by Lee in 1969 called *The Search for an Abortionist*. Lee found out that since abortion was illegal, and doctors could not advertise nor operate in clinics, women asked their own network to establish contact. She found that on average, the abortionist was four links away from the patient. This study forms the basis of the degree separation, which is today one of the key measures of SNA.

The anthropological trajectory was originated from Britain and until the new millennia British scholars were pioneered the field. Martin Everett (1985) with his work on network equivalence, Pat Doreian (1970) on mathematical modeling of social relations, Coxon (1982) on multidimensional scaling had major contributions to the field. And finally Quantitative Sociology Group was established within British Sociological Association. John Scott published the best-known handbook of Social Network Analysis as a part of this group in 2000 (Prell, 2012).

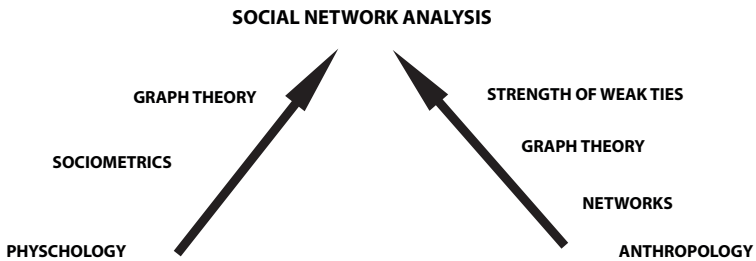


Figure 21. Evolution of social network analysis

Until the millennium, the term 'network' has become a buzzword and the popularity of analysing networks grew along. The term has been frequently used as a metaphorical noun and as a verb at the same time (Castells, 1996). With the rise of social media communication

among individuals peaked and so did potential information that can be gathered out of an SNA.

The roles that the actors are given (officially) or received (unofficially) determine the properties of a network. The openness of the network, which relates to accessibility of new information, is dependent on the actors. Similarly, the actors also determine how far this information can travel within the network and to what extend it can be influential for decision-making processes within the network (Barabasi, 2003). The process of studying these underlying dynamics and their effects to the social structure is called SNA.

Although traditionally used for interactions between individuals, SNA is used to map and measure the relationships and the patterns formed by these relationships between actors, organisations or other information sources. In fact, it is possible that entities of diverse characters are studied together such as people, organisations, companies or ecosystems. This means that relationships can occur person to person but also person to organisation so the limits of the analysis is not the relationships of a single actor, but the entire system consisting of all the entities and their connections (Wasserman & Faust 1994). Because, networks are not defined as groups of entities but as entities that are linked through a type of relationship (Monge & Contractor, 2003).

Typically the actors involved in the network are referred as nodes and the relationships in between these are referred as links, edges or arcs. Despite being a mathematical analysis of relationships, SNA potentially provides visual material that represents these relationships for qualitative analysis. These graphs or maps are commonly referred as 'sociograms' in the field of network studies.

Moreno was also the first one to create a sociogram where nodes represented actors and the links in between represented the relationships. He used these maps to identify leaders and isolated actors exactly as it is done in present time. He even identified centrality patterns similar to 'opinion leader' concept of Rogers (2003), he just named these nodes differently, such as 'sociometric star' which refers to an individual who is chosen by many others as friend.

SNA has basic characteristics that are identified through the collection and representation of relationships. The first one is the strength of relationships. Wasserman and Faust identify dichotomous and valued relationships. While in dichotomous relationships the

nodes are either connected or not, whereas in valued relationships the connection can gain a value based on its strength (Monge & Contractor 2003).

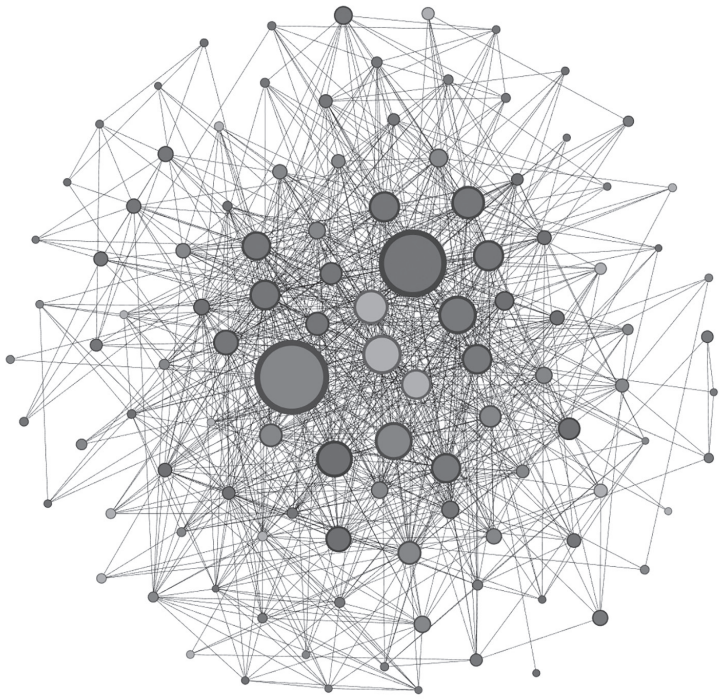


Figure 22. An example to a sociogram

Traditionally, standard SNA uses combinations of statistical calculations to determine properties of a network regarding the actors or regarding the system. Degree, betweenness or closeness are examples to commonly used statistical tools that are defined through a series of measures are used to explain actor level properties. Density or centralisation on the other hand, are measures that explaining the entire set of relationships between actors (Everett & Borgatti 2005). We will come back to this in Chapter 6.

SNA is most frequently applied within the field of organisational management for seeking answers to various problems such as improving collaboration, finding influencers, leadership development, performance enhancement and integration of units.

SNA has the potential to reveal unexpected dynamics that are not visible through organisational diagrams. In his book titles as The Organisational Network Fieldbook Rob Cross et al. (2010) explains the power of SNA by comparing the formal and informal structures within a company. In this self-explanatory illustration, it is possible to see that how a low-rank employee in formal hierarchy is in fact the most central employee to the company who provides the information flows between senior management and workforce of the company. This information is valuable for the company for understanding the collaboration, which in this case may be helpful to invest in correct employees for improving capacity.

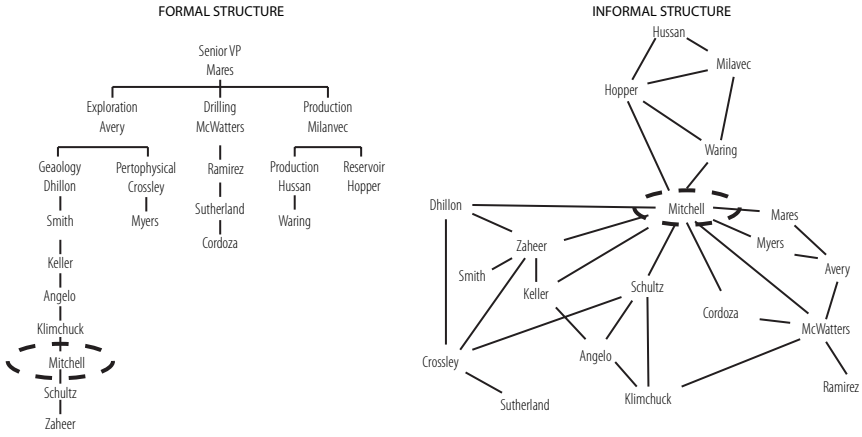


Figure 23. Formal vs. informal structures (Adapted from Cross et at. 2010)

Actor roles such as the centrality and connectivity can be used in SNA to describe how actors influence each other within a network. According to Aula & Paivioinen (2012), mapping the structural holes between these influential actors makes it possible to determine the unrealised power of networks, especially in relation to innovation. Since human interactions are not easy simulated, SNA provides a great opportunity for studying how innovations are diffused.

4.4 Relevance of SNA for the Research Questions

This chapter focuses on Paradox 2 of this thesis, which was identified through societal and theoretical perspectives as: contradictory relationships within innovation processes. The general research question that the thesis is trying to answer is: *"How can closed innovation systems be opened up through the effective use of social constructs to achieve sustainable development?"*

This general question was re-interpreted and a new set of research questions were formulated based on the paradoxes. The questions developed to tackle Paradox 2, which is the subject of this chapter are reminded once more as follows:

RQ2. How can a network perspective help explaining the social processes regarding innovation?

s-RQ4: What is the relationship between networks and innovation?
s-RQ5: How can multiplex relationships within a very large group of actors be studied?
s-RQ6: How can Frisian innovation system benefit from a network approach?

Innovation processes are defined as complex processes within the scope of this thesis. One of the major driving forces behind this complexity is the involvement of multiple actors throughout the phases of the process, who happen to have different methods of working, different way of processing data and also different expectations as output.

While engaging in the same process in multiple ways, these actors also engage into relationships of various natures with each other. It is essential for a successful output that the relationships evolve in harmony without disturbing the efficiency of the process.

There is a strong relationship between innovation and creativity. Creativity of human beings is fed by interactions with the outside world, which partially consist of human-to-human interaction, or in other words social relationships. The social relationships between actors create networks. Some of these relationships might be work related formal relationship, while the others might be informal relationships. Therefore, within the same group of actors it is possible to define multiple networks.

Relationships are also complex as they involve a mixture of attraction, repulsion, conflict and cooperation (Simmel, 1905). For an individual to explore the creativity by developing new ideas, these relationships must not be hindering. Studying the relationships between actors can reveal specific network dynamics that create a negative or positive effect on performances of individuals and the system as a whole. The aim of the study is to understand these dynamics and identify how they relate to the innovation process. SNA is a powerful tool to achieve this.

Social network analysis is a helpful tool for studying social constructs that hinder innovation. Another commonly used approach is to study the 'absorptive capacity' of an organisation that relates innovative potential of an organisation to its ability to realise the value of novelty and new information, in order to operationalise and benefit from it by applying to necessary ends. The absorptive capacity in relation to innovation also relates to individual capacity as it assumes the cognitive basis of the individual as one of the factors behind organisational absorptive capacity (Cohen & Levinthal, 1990).

The absorptive capacity models are based on the organisational context of firms. Although there are studied that apply the models on regional development, a majority of the studies refer to the combined absorptive capacity of the organisations as the regional capacity (Miguelez & Moreno, 2013). There are even studies that combine social networks with absorptive capacity, but these mainly focus on the impact of social networks on the resources of the organisations (Bosua & Evans, 2013).

Although highly applicable to regional context, the absorptive capacity focuses on utilizing the existing knowledge and skills for enhancing innovative output. Also, the method takes a top-down approach as it operates on a policy making level. Whereas in Fryslân, the necessary step to be taken is to generate the knowledge and the infrastructure to include necessary skills in the system, which seems to be one step before the absorptive capacity. The situation in Fryslân requires a holistic approach, where the actors of the system need to strive towards co-creating a solution.

SNA can expose the opportunities and constraints that networks generate for those involved in them with a relational approach. These properties might apply on an individual level, on a sub-group within the network or the complete network, or like in the case of this study they can apply for a system of multiple networks (Powell & Depelteau, 2013).

The case study of this thesis, the province of Fryslân, is a region that aims to become more innovative. The research questions behind this thesis derive from this challenge. Departing from this societal question in Fryslân, SNA helps understanding what is hindering the actors involved in a regional innovation scene to generate more output and points out potential points of improvement.

4.5 Networks in Relation to Innovation Process

Human beings are social creatures and communication is inherent to their existence. Communication plays a central role for knowledge transfer (Rogers, 1985). However, in this thesis is about enhancing the innovative potential of a region (which can be seen as an organisation but then with open systems) and innovation requires more than the knowledge flow.

Innovation is partly related to the creation of new ideas. Creativity is defined as "the creation of a valuable, useful new products, services, ideas, procedures, or processes by individuals working together in a complex social system" (Woodman et al. 1993, p. 2).

The question then should be about how does the creativity develop. Unlike the Platonic view, many scholars today suggest that creativity is not something a person is born with or something that can be acquired alone. Creativity is triggered and learned through encounters. Therefore it does not happen inside ones head but developed through interacting with the outside world, where a large position of these interactions are social interactions (Csikszentmihalyi, 1996).

Although it may look like new ideas emerge from individuals it has been argued that creativity is not a personal characteristic, but the outcome of the interactions between the actors of a system (Albrecht & Ropp, 1984; Nemiro, 2002). The level of complexity of the world at this moment does not allow an individual to develop, refine, test and implement the idea without interacting with anybody. When an idea does not find a breeding place, idea starvation occurs. And in contrast, more interaction is understood as the creation of more and better ideas (West & Farr, 1990).

Organisations need to facilitate the creation and breeding of new ideas to be innovative for a long term. Communication between members of the organisation has to be effective in

order to build knowledge and insights, which will eventually lead towards new, and more ideas. In fact, King and Anderson (1990) proposed that team creativity is enhanced by the informal discussion among team members.

There are also a number of scholars who separate innovation from creativity with very strict lines with the argument that creativity is about coming up with a new idea whereas innovation is executing it (Damanpour, 1991). According to the view presented in this story, the two parts cannot be separated from each other as here is an interdependency of both elements.

As described in the first chapter in this thesis, this research builds upon the situation in the province of Fryslân, which is the northernmost province of the Netherlands with rural origins. SNA is used as a descriptive tool to identify current dynamics regarding the innovation problem within the province.

Monge and Contractor (2003) describe networks as "patterns of contact that are created by the flow of messages among communicators through time and space" (p. 1). The messages form a relationship between the actors involved and they enable information exchange. The information that is exchanged between the actors can have multiple natures, or in other words have a different subject. To give an example, two colleagues can be working on the same project but they can also be friends outside of work. This situation will require them to communicate in two dimensions. One would then be communication in creative nature regarding the project they own. The second would be communication in friendship nature regarding the informal contact they have out of work. Monge and Contractor define the networks through these various relationships and claim that actors are connected in various networks that are commonly overlapping with each other. This means that social networks are bound to be multi-layered since even within a limited number of actors it is not possible to have a single relationship, therefore a single network. And most certainly, the defined networks also will differ in size, because the number of ties among the actors is unlikely to be evenly distributed (Barabasi, 2003).

Innovation is defined as the operationalisation of a creative idea at its simplest, which immediately underlines two different natures of relationships between actors involved: managerial and creative. Therefore, the first two relevant networks to be studied in the case of Fryslân were identified as such. However, through the course of this research,

especially during the expert interviews that were held while setting up the study, two other relationships were found relevant for this specific case.

The Netherlands operates through a provincial system, where provincial governments are highly influential in local politics. Also in Fryslân, the provincial government together with the municipality of Leeuwarden is seen as the major power holders, but also the direct address of access to the government. The two political entities are highly involved in the innovation scene as a large portion of the initiatives require the support of the local government not only economically but also for accessibility. This situation may also be present in central provinces of the Netherlands but the direct dependency and the directed control is less visible. This dependence makes the local government the centre of attention. Therefore, the third relevant nature of relationship was identified as the political relationships in this study.

As described in the first chapter, Fryslân is rather isolated geographically and demographically, where people share strong feelings towards their origins unlike the rest of the country, which is famous for lacking strong feelings towards ancestry (Kesic & Duyvendak, 2016). Together with the feeling of solidarity deriving from speaking the same language, the unofficial yet strong tie of 'being from Fryslân' creates an important bond that is traceable in daily life. Granovetter (1973) identifies these emotional relationships as family, friendship and spousal relationships as 'strong' ties and claim that the strong ties define 'who we are'. The particularly strong emotional ties among Frisians were included as the friendship network to be analysed in this study.

The unique method of SNA applied in this research is looking at four different networks emerging within the same group of actors. These groups of actors were brought together based on the interviews that were conducted during the data-collection phase of SNA. The methodology is explained thoroughly in Chapter 5 of this thesis. Before going in the methodological details, it is important to explain why certain natures of social relationships are relevant for innovation processes. Each of the networks formed by these relevant relationship natures will be explained in detail in the following sub-chapters.

4.6 A Critique of the Selected Perspective and Methods

SNA demonstrates mathematical properties of networks that have a sociological meaning and significance (Crossley, 2013). This relational approach SNA follows, gives valuable information on relational-sociological aspects of a network. In a sense it is a holistic approach since it looks at actors and relationships between them as a whole. However, SNA presents a static snapshot of a network in the time being. Relations (and therefore) networks on the other hand are ever evolving social structures. Therefore the holism that describes the inclusiveness of SNA is not the holism that is described as a combination of sociological and historical dynamics that are in constant motion. In his book-chapter Interactions, Juxtapositions and Tastes: Societalizing 'relations' in Relational Sociology, Nick Crossley (2013) criticises the holism of SNA for being mirror images of individualism with the following quote (p. 129):

"A properly relational sociology rejects the false comfort offered by both 'individual' and 'society,' when conceived as a fixed and stable 'substances' upon which explanations and analyses might rest. Rather it seeks to disentangle complex webs of interactivity whose nodes and overall structure both makes a difference and exert an influence while themselves are being shaped and reshaped in this process. Nothing is stable or fixed. Everything is tied to everything and everything is in-process."

Crossley (2013) is not the only one who emphasises the limits of SNA and suggest that SNA should be used in combination with qualitative methods that consider other social dynamics such as history as a part of elements that have an impact on how network are formed and operating. Emirbayer and Goodwin (1994) argue that social and cultural analysis can only gain meaning in combination with historical and socio-cultural development and become a strategy for historical explanation that formulates an emergent reproduction and transformation of network themselves.

The scope of the network analysis in this thesis does not go beyond trying to explain the relationship between networks and innovation process through SNA. However, the applied methodology of SNA is not only about the quantitative results that derive from mathematical properties of networks. In fact the study is trying to obtain a multidimensional approach by involving multiple networks to understand the interrelated dynamics that reflect o creative processes.

Moreover, the decision to apply SNA as a tool to explain the network dynamics that may be hindering the innovation process was a result of studying historical and socio-technical background of the case-study area. Accompanied with the abundant literature on the performance of innovation network in business environments, the interviews conducted with local experts for the overview study explained in the first part of Chapter 3 revealed the relevance of communication and directed the study towards the direction of SNA.

SNA often results in static maps of networks that only capture a moment in time, whereas networks themselves are in constant motion where actors, roles and relationships are changing. However, it is known that collective memory of an organisation exceeds memory of an individual, which means that despite the changing elements, the collective networks dynamic stays present (Bounfour, 2007). Yet, repeating the same study in the future has potential to reveal new dynamics. Especially in the case of regional studies, big local changes (such as elections) can have an impact on the network dynamics. The speed and effectiveness of the SNA method applied in this study makes this repetition feasible.

4.7 Conclusions and Propositions Deriving from Paradox 2

The paradox 2 is exploring the contradictory relationships within innovation. Literature shows a strong relationship between creativity and innovation. On the other hand, although often understood as an individual character trait, creativity is something that is triggered in the community. Facilitation of creative relationships is therefore essential for organisations that are willing to innovate. This is because innovation derives from a creative idea that is operationalised. However, it is not the only relationship that matters to innovation. Managerial relationships also play a role in the realisation of innovation.

A major portion of scholars acknowledges the role of creativity in innovation. Since creativity emerges from interactions, a dense network is essential for output (Albrecht & Ropp, 1984). It is known that individual attempts are less successful for many reasons varying from lack of expertise to motivational issues (Olson, 1965). Increasing the collaborative capacity is essential for increasing innovative output (Kratzer et al. 2007).

Havelock (1969) states that there are six interdependent factors for a system to resist innovation: functionality of the system, impact on existing social relations, local pride, social roles, division of labour and hierarchy. If analysed correctly, social networks have

the power to assess fairly all these factors and understand the systemic reasons behind low innovative output.

Using SNA within the field of innovation brings significantly useful results. Especially, analysing relationship patterns provides crucial information regarding the inclusion of actors in the network and the relationships between these actors (Kolleck, 2013). Innovation networks are dynamic systems made up by actors and connected by knowledge flows based on the relationships of these actors. The dynamism and efficiency of these can be studied through metrics obtained from Social Network Analysis (Tejero & Leon, 2016).

Innovation processes recognise two major types of decisions: authority and collective decisions (Rogers & Shoemaker, 1971). If managerial relations fall under the category of authority decisions, it is possible to say that creative relations operate as collective ones. Studies show that the relationship between managers and creatives determine the motivation of creative networks (Amabile, 1988). However, managers do not have a standard process to nurture the development of new ideas (Ashkenas, 2012).

Although innovation arises from unique ideas, not all ideas turn into innovation and in fact there is always a degree of risk included. Typically, managerial duties are based on launching the safest idea. However, ideas that play it safe are less likely to create a world-changing impact. Therefore, there is clash between the unreliable, collective nature of innovation and the output-oriented mind-set of managers that tends to immediately look for flaws in new ideas rather than tease out their potential. Since the output is expected out of creative relationships, it is possible to state that especially in the idea generation phases, managerial tasks should have minimal interference. This means that authority decisions should only have a supportive role to collective ones (Rogers & Shoemaker, 1971). The contrast between the two sides of innovation summarises the Paradox 2 of this thesis.

In order to summarise the outcome of the knowledge aggregation in relation to Paradox 2, a series of propositions were developed that derive from the literature and previous research. Just like the propositions presented at the end of Chapter 3, applicability of each of the propositions for the studies throughout the remaining parts of the thesis will be assessed. The applicability of the propositions will be discussed as a whole in the

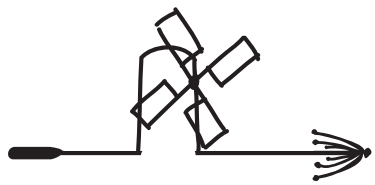
Chapter 7 of this thesis; therefore the propositions below are the continuations of the previous propositions.

6. **Innovation systems consist of multiplex relationships that operate together.**
7. **Main objective of innovation systems must be enhancing the creative relationships.**
8. **The isolated social character of province of Fryslân is hindering the implementation of an open innovation eco-system.**
9. **Bureaucracy suppresses the creative networks in Fryslân.**
10. **Social network analysis is an appropriate tool for studying the community dynamics regardless of the limits of the analysed system.**

The procedure the thesis will follow in finding empirical evidence to support the above stated propositions were explained in the methodology part of Chapter 1. The preliminary propositions here relate to the relevance of social relationships (therefore networks) to identify the reasons of lagging behind in innovative output are discussed thoroughly until here. The literature provides numerous examples and methods for studying networks. However a majority of studies are conducted within organisations with clear vision statements, organograms that define roles and access to expertise. The combination of the scale and the controlled structure of such organisations make it possible to perform a social network analysis where it is even possible to map each actor and every relationship. This kind of accurate data collection also makes statistical analysis possible. But what about larger and disorganised systems, where it is not an option to look at the complete set of relationships? The scale and structure of Fryslân, just like it would be for any other region, is too complex to be handled with classical network analysis tools. Therefore, a specific methodology was developed which we call the 'Network Representative Method' to achieve similar results by a studying only a small portion of actors and their relationships in the area. Chapter 5 gives a step-by-step description of this methodology by explaining data collection, preparation and analysis phases in detail.

Chapter 5

NETWORK REPRESENTATIVE METHOD: ANALYSING LARGE-SCALE SOCIAL NETWORKS



"I can calculate the motion of heavenly bodies, but not the madness of people."
Sir Isaac Newton

5.1 **Facts and Figures on the Research Site**[7]

Chapter 1 of this thesis started with an extensive explanation of the historical and demographical background of the province of Fryslân, which is where the research assignment originates. The region is experiencing (and expecting) severe issues such as poverty and population shrinkage (Chapter 1). According to an article in the local newspaper "Leeuwarder Courant' published on January 18th 2017, the population will rapidly decrease especially after 2040. In the peripheral areas not only the population of the province will decrease but also the number of elderly will increase. Lacking opportunities for youngsters in terms of academic education and employment are seen as the main cause of this situation.

However, the province, especially the provincial government, has a proactive attitude. Local government strongly associates innovation to regional issues. Becoming the host city of European Cultural Capital of the year 2018 with a socially inclusive proposal that underlines the importance of innovation for provincial resilience is a strong example of this acknowledgement. (LWD2018, 2013) Therefore, there is a shared vision among knowledgeable locals, which can be summarised as 'only innovation can save the Fryslân'. Since the main source of income in the province is originally agriculture (and recently tourism) that happens to be closed-like industry by nature for innovation, a local innovation culture has not developed and embedded in the cultural roots. This situation is also confirmed by official reports from local authorities and European Commission (2016). Departing from the earlier explained vision of strong socio-economic structures can only thrive through innovation; the provincial government is taking initiatives such as establishing innovation hubs and engaging into knowledge sharing activities. However, the innovation scene operates internally and shows the characteristics of a closed system, where collaboration between local parties and external partners are limited.

The networks study presented in this thesis is targeted towards this closeness within the province, by taking the acknowledged need for innovation as the point of departure. From the studies conducted in Chapter 3 of this thesis, we know the relevance of social context for innovation (Paradox 1). Additionally, Chapter 4 follows that achieving an open system can only occur through effective communication of actors within and around the system, because natural link of innovation to creativity, which is triggered by social relationships.

[7] The data in this sub-chapter is retrieved from European Commission's Regional Innovation Monitor on April 15th 2017.

Also, Chapter 4 points out the opportunities Social Network Analysis (SNA) brings for studying the necessary social communication networks. Therefore, while the practical aim of this study is to help the province of Fryslân to establish a thriving innovative ecosystem step by step, the study also aims to close a knowledge gap about the relationship between network characteristics and innovative output.

Although is SNA is concluded to be a helpful tool for studying local dynamics in Fryslân, as a method, SNA is commonly applied for systems with a given number of actors whose relationships are directly accessible to the researcher. However, the situation we are dealing in Fryslân is far more complex than that due to the number and availability of the actors and relationships, therefore traditional application of SNA is not suited to this context.

Before going into details of the method, it is essential to give additional information on the demographical and economical stand of the province to understand the scale of the networks we will be dealing with through this methodology. These facts and figures are taken from the reports of Regional Innovation Monitor of the European Commission (April, 2017).

Fryslân is the 8th largest province of the Netherlands with a population of 646.092 (2017). This number corresponds to 3.8% of total Dutch population. The capital city Leeuwarden has 96.000 inhabitants.

According to the Dutch Central Statistics Bureau, the regional gross domestic product (GDP) of €18b is 3% of Dutch GDP. GDP per inhabitant (GDP/inhabitant) of the region is €27.8k in 2013, which is below the Dutch average (€35.9k). The province is divided in 24 municipalities but intraregional differences are relatively small. Most employment and businesses are concentrated in the so-called 'A7' zone, referring to the highway between the cities Sneek and Drachten and the 'Westergo' zone (the region between the cities Harlingen to Leeuwarden).

Despite the agriculture and tourism being traditional sources of income, health and welfare (18%), mineral extraction (12%) and trade and repair (16%) (LISA, 2014) are also large economic sectors in Fryslân. Additionally, there is also a strong water sector that serves to 30% of the country needs. However, agro-food and financial sectors show a significant decrease in employment since 2010.

There is no academic university in the province of Fryslân but there are three universities of applied sciences. Therefore relatively few research activities are conducted in the area compared to the country average. However, efforts in the area of water technology R&D are increasing. In addition to water, the province has an innovation cluster in High Tech Systems based in the city of Drachten.

According to the Regional Innovation Scoreboard 2014, Fryslân is performing at the EU average but below the country average. The province of Fryslân is a part of the Northern Innovation Agenda 2014-2020, that is developed to enhance innovative output of the three northern provinces of the Netherlands (Drenthe, Fryslân and Groningen). The Northern Innovation Agenda 2014-2020 continues with the focus on the economic pillars that have been put into place in previous years, new technological developments and strengthening SMEs. The aim is to develop the North of the Netherlands as a resilient region that is known for its innovativeness.

Furthermore, Fryslân's own innovation policy budget for 2014-2017 is €5m. The budget is mainly intended for projects that are developing from the idea-phase to a first prototype or demonstration model. Focus areas are defined as care economy, agro-food, renewable energy, water technology, and tourism and recreation.

In the remaining parts of this chapter, we will explain the unconventional method that has been used to map the Frisian networks that differentiates from traditional SNA studies with their scale and predictability. This new methodological approach has been developed specifically for cases where SNA is helpful but tracing each actor or relationship is not possible. This unique method will be explained thoroughly in this chapter and hopefully provide guidance for future applications of SNA on complex settings.

5.2 Multiplex Analysis of Social Networks on a Regional Scale

Social network analysis (SNA) is defined as "investigating social structures through the use of network and graph theories" (Otte & Russeau, 2002, p. 1) Social network analysis is a widely used tool in many fields and consequently, application of social network analysis on regional scale is abundant. However, a majority of such studies are single dimensional, in a sense that they provide an analysis of a group of actors and the relationships in between from a single

angle. But such a perspective limits the opportunities SNA brings along for portraying the dynamics within a group of actors.

A majority of SNA studies on a regional scale comes from the field of economic geography, which aims to reason local occurrences in a deterministic way. In fact, Broekel, et al. (2014) states that over 3000 articles are found when the terms SNA and economic geography are searched together in academic search engines. However, he also states that in this field, emergence and use of networks are almost always related to spatial characteristics. In the recent years, SNA techniques have slowly started to be applied to explore how the structure of interactions within regional clusters behaves (Ter Wal & Boschma, 2009). There are even studies that look at social networks regarding innovation to understand how physical proximity effects their performance (Boschma & Frenken, 2010).

This thesis on the other hand, uses the SNA as a tool to understand why, despite all the local efforts, there is not enough *emergence* that results in innovation. In a way, the aim is to explore the potential network-related blockages in front of output. For doing this, a multilevel understanding of local networks is necessary. Therefore, throughout the research a methodology corresponding to the complexity and multiformity of regional networks was developed.

During the research, various SNA studies were investigated from a methodological perspective. Most of the SNA studies deal with single layered networks that are formed through a single nature of relationship between actors such as family ties. However, social relations tend to be more complicated than that because in real life, actors are connected in multiple relationships of different natures; such as being family and colleagues at the same time. Or in other words, same actor is involved in more than one network.

The actors in social networks are frequently connected by multiple relationships at the same time, which means that there are multiplex relationships between two actors that result in multiplex networks. The methodology provided in this chapter aims to collect, analyse and understand the data of complex patterns that can emerge when there is more than one kind of relationship is operating between the same group of actors.

The Network Representative Method ensures the compactness of the dataset without sacrificing the quality and depth of the results. Consequently, the method enables the

effective of use of qualitative analysis through investigating network graphs. This way, even though the scale of the network is rather small due to the limited number of actors and relationships to be mapped, network graphs can be consulted to explore the patterns among multiple kinds of relations.

Applications of SNA are commonly limited to a single type of relationship in order to eliminate the complexity of multiplex data. Sociologists are convinced that actor's behaviour and traits are strongly shaped by the networks they are involved. The complex patterns that are results of interactions of various natures in these networks are also the source of a multitude of potentials and limitations (Hanneman & Riddle, 2005). Therefore, in Fryslân, which is the area of study this research, analysing the simultaneous operation of multiple networks that are relevant for innovation will be useful for providing answers on how to create the necessary stimulation to tap the underlying potential.

Multiplex relationships are commonly analysed quantitatively. Hanneman (n.d) states "the literature defines two general approaches when dealing with multiplex data: reduction and combination. The "reduction" approach seeks to combine information about multiple relations among the same set of actors into a single relation that indexes the quantity of ties. All of these issues are dealt with in the section on multiplex data basics. The "combination" approach also seeks to create a single index of the multi-plex relations, but attempts to represent the quality of ties" (p. 6).

However, the multiplex approach presented in this thesis does not adopt any of these conventional perspectives. Since the aim is not to merge all networks into a single type of relationship, but in contrary, to see how they impact each other, the specific characteristics of different networks are essential to the analysis. Therefore, also trusting on the concise sample set provided by the Network Representative Method that is explained in the following section, the analysis will be conducted on multiplex relationships. At the same time it will remain as a qualitative analysis that uses network graphs and the basic statistical data as the main source of information.

5.3 Detailed Description of the 'Network Representative Method'

5.3.1 Problem statement

Social network analysis (SNA) helps understanding social structures by looking at relationships between actors of a system. To do this, the researcher forms a dataset that consists of actors and the relationships in between, which are either collected through first hand data sources like interviewing the actors or gathered from various sources that display the connections between these actors such as messages, mails or any other form of social media connections.

However, in some cases, the entire set of actors and the relationships in between may not be available for research due to various reasons that we could list as:

- indefinable boundaries of the network
- high number of actors and relationships to be studied
- inaccessibility of required data
- multiple natures of relationships between actors

In case of studying networks in Fryslân all of these reasons applied and acted as an inter-dependent whole. First of all, although a province has physical and demographical boundaries, the fact that innovation systems involve external parties that play important roles in the area, the boundaries of the network was highly unpredictable, which potentially made the number of the actors and relationships in the network higher than a feasible batch. This feasibility is directly related to the possibility of reaching the actors. In addition, since innovation is not the result of a single type of relationship as concluded in the previous chapters, looking at multiple natures of relationships between actors required a detailed data set that cannot be directly gathered sources that define a single type of connection.

As a result of this feasibility check, it was quickly clear that standard application of SNA was not an option for this scale and this level of complexity. However, the undeniable opportunities that SNA provides for understanding local dynamics made us consider alternative approaches.

The Network Representative Method (NetRep) is the outcome of this consideration, which resulted in the development of a validated tool that makes multiplex studying of large, unpredictable and complex networks possible. The NetRep method provides the researchers

with decent qualitative network analytics in a rather effortless manner by taking away the burden of mapping each and every relationship in such a system to be able to derive conclusions.

This chapter is dedicated to explaining the data collection, validation and analysis phases of the NetRep method by guiding the reader, through the SNA conducted in the province of Fryslân step-by-step. In addition to explaining the why's and how's of this method, the downsides of a using such an eased procedure will be discussed as well. An elaborate reflection on the used methodology can be found in the concluding chapter of this thesis (Chapter 8).

5.3.2 Aims and objectives of the method

The NetRep method aims at easing the data collection, validation and analysis phases of an SNA study of large-scale, multiplex and complex networks, as a replacement of the conventional SNA methods. While doing this, the NetRep method focuses on providing a as accurate as possible picture of the societal reality at hand.

The NetRep method simply uses third party information given by the 'network representatives' to picture a network. The essence of the NetRep method is to analyse the social relationships of a part of the whole network through interviewing 'network representatives' that are selected carefully as sources of information. This means that after selecting a representative part of the complete network, through a series of strategic questions, representatives provide the necessary data on the actors and the relationships among them. After validating the reliability of the given answers, this third party information is being used for creating sociograms. This way, conducting a well-designed in-depth interview with a group of representatives, replaces the difficult process of contacting the entire group (in our case the entire province) of actors in a network.

First of all, for assessing the situation regarding the Frisian innovation networks, it was essential to define the relevant natures of relationships that may or may not exist among the actors. The literature studies in Chapter 3 and 4 of this thesis pointed out that innovation strongly relies on the operationalisation of a creative idea. When we break these two parts of innovation process into pieces, we can say that innovation has strong creative and managerial aspects (operationalisation). Without one of these, it is not possible to speak of innovation. Therefore,

we have first decided to look at creative and managerial relationships. Thus, first logical step of applying the NetRep method along with identifying network boundaries would be define which relationship natures are relevant for the problem at hand.

As we have concluded in the earlier chapters, the success of innovation has a strong relationship with the social context it is introduced to. Without the acceptance of the social unit, the process is not complete (Chapter 3). Based on this conclusion and the historical background of our case study Fryslân as an isolated region, where personal relationships are highly valued and being friends is culturally standing above all the other values, we have decided to look at informal relationships that operate at the background of every other relationship as well (Chapter 1). Throughout the thesis, such relationships will be referred to as 'friendship relationships' that form the 'friendship network'.

After deciding to look at the creative, managerial and friendship relationships, the data collection phase began. However, through the first series of interviews, a fourth relationship nature came into play that seemed to be very relevant to the subject of innovation: political relationships. We have realised that apart from the funders that relate to managerial networks, there is an external power that decides on the flow of the capital and personal relationships define a major portion of this flow through lobbying.

This way, out SNA set-up ended up with the aim of mapping four networks that are defined by four different sets of relationships. To define the relationships that fall into these four categories we have picked a few keywords for each of them.

- **creative:** brainstorming, new ideas, design, science
- **managerial:** hierarchy, time management, deadlines, reporting
- **political:** lobbying, politics, liaison, cooperation
- **friendship:** colleagues, family, love, acquaintance

The goal of the study has been re-phrased as mapping and analysing the creative, managerial, political and friendship networks in Fryslân to provide an accurate picture of the situation at hand regarding the innovative output in a rather short time, without having to talk to the entire province.

Although the NetRep method enhances the efficiency of the SNA study immensely, it must be understood that the elimination of actors or relationships means also the elimination

of certain opportunities that conventional SNA methods provide. Among others, the most important one is the accurate statistical analysis of network characteristics. In chapter 8, while reflecting on the boundaries of the method, these limitations of the method will be explained thoroughly.

After deciding four relationship natures to study, the second step was to select the 'representatives' that are going to help us depict the situation. In parallel, the part of the network that will be the subject of this study was to be selected. These two parts of the study will be referred to as Round 1 and 2 to be able to explain these parallel developing, yet parts of the NetRep method clearly.

5.3.3 Round 1: Defining the sample size and selection of the representatives

In the first round of data collection, our aim was to create a comprehensive list of names of actors that are influential in the field of innovation. This list is meant to serve as the base of the SNA study, as in, defines the final sample set where the NetRep method will be applied. Since this list defined the sample size to be studied, it was essential to compile a complete yet concise list of names. For this purpose, we have conducted this round with a diverse group of 15 experts who are active members of the innovative community in Fryslân, such as academics in the field of design and innovation, founders of innovation hubs, policy makers in the field of innovation and local entrepreneurs. Obviously, the criteria for the experts in the first round in this method are highly dependent on the subject of the network to be analysed.

In this round, the 15 experts were asked to write down the names of people who have any kind of (potential) influence on innovative fields in Fryslân. We did not specify a final number of interviewees for this round, however, after the eleventh interview the growth speed of the list slowed down significantly and the interviewees claimed the list to be complete. All interviewees have received the same explanation for this and they were encouraged to think inclusively and imagine actors that may have direct and indirect contributions to innovation.

As a result of this round, the fifteen interviewees compiled a list of 232 names of people from various professions. At the end, it was possible to divide the names on this list into the following five professional groups to make further studies easier. The numbers next to the groups refer to the number of actors in that group.

- academia (66)
- government (48)
- NGOs (33)
- creative individuals & SMEs (38)
- corporates (47)

Once the sample was defined, we have decided that it is not feasible (and probably not necessary) to interview the 232 actors on the list within the course of this research. In this defining moment of the NetRep method, the decision to select representatives to map the relationships of the 232 actors in the sample list was made.

During the creation of the list, the experts were also asked to give opinions on potential representatives who have the knowledge on the relationships of the actors on the list.

With these suggestions, we have also developed a set of criteria for the Network Representatives (NetReps, hence the name of the method) to be interviewed in round 2:

- five professional groups that form the sample list have to be equally represented
- the NetReps have to be able to provide reliable information on influential actors
- the NetReps have to be able provide accurate estimation on the relationships between the influential actors that they might not even know personally
- the NetReps have to be available throughout the project
- the NetReps have to be committed to the privacy throughout the project

With the suggestions of experts and the criteria, the first five NetReps were selected, from which three agreed to participate. From here and on, the selection of the NetReps followed a snowball method. Therefore, round 1 and 2 evolved simultaneously. Which means, once we interviewed the first three NetReps we have asked for additional names from the large sample list who can perform the same task. The names we received were also tested on the criteria developed. If the given name fulfils the criteria and agreed to participate, we moved on to round 2 and at the end asked for new names for NetReps again. We have repeated the same structure until we were satisfied with the amount of data.

At the end, the NetReps were individuals who are involved in creation, facilitation and management of innovation related projects or policies within the province. We paid special attention to the diversity of the professional background to be able to include many different

perspectives in this research. The NetReps were professionally affiliated with one or more of the five categories that are identified previously in the sample set as: academia, government institutions, NGOs, creative individuals & SMES and corporates. The study was conducted with 13 NetReps in total that are distributed among the five professional categories as follows:

- 4 NetReps from academia
- 3 NetReps from government
- 2 NetReps from NGO's
- 2 NetReps from creatives
- 2 NetReps from corporates

5.3.4 Round 2: In-depth interviews with network representatives

As round 2 of data collection, the representatives were interviewed one by one. Before explaining the questions that we have used, it is essential to explain the general structure of the conducted interviews. The set of questions used for this interview round can be found in the Appendix B.

In the NetRep method, the sample size is decreased to a minimum with the exclusion of a large part of the network. While doing this, a snowball approach was applied for gathering the information from the representatives, which means that it is not possible to talk about normally distributed data (Frost, 2012). Therefore approaching the data with standard statistical calculations will not be powerful enough to provide meaningful results. The data collected in this method can only be studied through non-parametric statistics (Wasserman, 2006). This is the reason behind using rankings instead of scores during the interviews. The fact that this study relies on ranking must be communicated very well with the interviewees, as it easily leads to confusion according to our experience.

In this round, the interviews with its pre and post informative processes were kept as identical as possible. All the interviews were conducted face-to-face, in one go and alone with a single NetRep at a time. All NetReps received the same written and verbal briefing about the study, and they all received assistance when confused during the interviews.

Each NetRep received a hardcopy of questions and a hardcopy of the list of 232 actors ordered alphabetically on first names that was created in the first round. The interviews

consisted of 10 questions of two parts in total and every question was formulated in the same style to avoid confusion.

In the first part of each question, the NetReps were asked to make a 'Top 10' list by ranking 10 names from the sample list of 232 names they have received. Lets imagine for a second that we are looking at a kitchen crew network as an example:
"Please make a top 10 list from the names on the Excel sheet, of people who are known to be the best at baking soufflé."

The NetRep is meant to write down 10 names, from which number 1 bakes the best "soufflé" in this case.

	1. Anne	2. Friso	3. Douwe	4. Joris	5. Jelle	6. Sietze	7. Wiebke	8. Femke	9. Auke	10. Elke
1. Anne										
2. Friso										
3. Douwe										
4. Joris										
5. Jelle										
6. Sietze										
7. Wiebke										
8. Femke										
9. Auke										
10. Elke										

Figure 24. An example for explaining the structure of interview questions with imaginary actors, part 1

In the second part of the question, the NetRep is asked to rank the relationship between all of these individuals on the Top 10 through a matrix created on the spot. Here, the NetRep is asked to assess the influence of 'baking relationship' between each actor based on his/her knowledge. However, this information was eliminated from the research due to reliability issues. The relationships were taken as 'existing' or 'non-existing', without looking at the strength. Yet, the method for collecting the strength data will be explained briefly.

The second part of the question says:
"Please rank the baking related communication between the people you have listed by using the matrix below."

	1. Anne	2. Friso	3. Douwe	4. Joris	5. Jelle	6. Sietze	7. Wiebke	8. Femke	9. Auke	10. Elke
1. Anne		7	1	5	8	7	1	1	9	1
2. Friso	6		2	6	1	6	2	9	1	6
3. Douwe	2	5		4	7	8	6	2	2	5
4. Joris	5	6	3		6	5	5	3	4	2
5. Jelle	7	1	8	3		1	4	4	3	3
6. Sietze	9	2	9	2	2		3	5	5	4
7. Wiebke	3	3	5	7	3	2		6	6	7
8. Femke	1	9	7	9	9	9	9		7	8
9. Auke	4	8	4	5	5	4	8	7		9
10. Elke	8	4	6	4	4	3	7	8	8	

Figure 25. An example for explaining the structure of interview questions with imaginary actors, part 2

In this example, Anne communicates with Femke the most about baking and the least with Sietze. Here, it must be made perfectly clear to the NetRep that they are assessing the 'baking relationship' only and other possible natures of relationships between two individuals do not matter. For example Anne and Femke being a couple should not affect their ranking. Moreover, it must be clearly stated that if two individuals do not have any relationship according to the NetRep, then the ranking does not apply. If the actor does not have any baking relationship with another actor on the matrix, the designated block is left blank and instead of ranking from 1 to 9, the rest of the matrix is ranked from 1 to 8.

A network map consists of nodes (actors) and edges (relationships between actors). The first part of each question defines the nodes (actors) in the network maps we will be creating. The ranking of them will tell us how big/central that node will become. The second part on the other hand defines which nodes are related to each other. The rankings of the relationships define the strength of these relationships, or in other words how thick the line will be between two nodes.

However, the weight of the relationships that we try to understand through the second part of the questions is a tricky step. First of all, this process is exhausting for the interviewee

since they are expected to assess the strength of the relationship between two people they possibly do not know. Therefore this is by far the most time consuming part of the interviews. Secondly, unlike the name rankings, this part of the study cannot be validated. The answers given by the NetReps to these questions demonstrated low reliability and therefore the ranking in this part was eventually used as binary data in our study. For this, we ended up translating the relationships ranking to 0 or 1 as existent or non-existent. It is possible to find a more detailed reflection on this limitation of the methodology in Chapter 8.

5.3.5 Data collection

After receiving consent of each NetRep, interview process began. All interviews were conducted face to face within time frames ranging between one to two hours. There was a written briefing that explained the process together with the consent forms. Later on, before the starting of the actual interview, there was an additional explanation that focused on the questions and the four relationship natures, therefore four networks we are looking at creative, managerial, political and friendship.

The questionnaire is divided in four parts (one part for each network) where first three parts consisted of two questions and the last part on friendship four questions. The NetReps receive the four parts of the questionnaire in random order, but the questions regarding the same network are given consequently. This way, we have made sure that all networks are treated equally.

The questions are formulated in a strategic way to make the NetRep think of multiple aspects of a certain network. Through different questions, at least two dimensions of each relationship are explored. The NetRep is made aware of these differences during the course of the interview and they were also reminded of the differences if it seemed necessary. In addition, the NetReps were given a set of keywords related to the diverse characteristics of each network as shown in section 5.3.2, to help the NetRep think of multiple dimensions of the relationships that form the relevant network.

The interviews consisted of 10 questions that focused on the following aspects that are related to the four networks:

managerial network:

Who are the people to include first when starting a new project?

Who are the best solvers of managerial problems

creative network:

Who are the people that are known to have the most original ideas

Who are the best solvers of creative blockages

political network:

Who are the people best lobbyers?

Who are the best solvers of policy related problems?

friendship network:

Who are the most popular people?

Who are the most liked people?

Who are the most trusted people?

Who are the best peacemakers?

Since the NetRep method is based on third party information on individual roles and the relationships that are shaped around this role, the questions were directed towards the 'reputation' of the actor within the network. Which means, instead of trying to determine the exact role of an actor, we chose to focus on the perceived role within the community. This choice did not only structured the questions we have compiled, but also made it easier for the NetRep to give specific insights on the positions of actors that they do not personally know.

5.3.6 Data validation

After completing the interview rounds with all 13 NetReps, a validation was performed on the gathered data. Since the NetReps were not trained in network analysis, and the method requires them to give third party information on the networks, a validation was necessary.

In this study we have validated the data in two steps that we will explain separately as quantitative and qualitative validation. The quantitative validation refers to the collected data directly and the reliability of answers given by NetReps, whereas the qualitative validation aims to validate the results of the analysis once it is completed.

quantitative validation:

The quantitative validation we have performed aims to check the consistency of the answers given by the NetReps in the questionnaires. Therefore it is a validation of the correct selection of NetReps as well together with the reliability of the information received from them.

In this methodology, as previously explained all the NetReps received the same questions and the same set of names to pick their answers from. The idea behind the validation is that, if a NetRep has given completely different answers from the rest, their reliability would be in question. This suspicion of the NetReps knowledge of the networks may lead to the elimination of the data coming from this particular NetRep. The way of retrieving such confirmation from the gathered results is explained here.

At first, all the answers given by the interviewees are placed on an excel sheet as shown in Figure 26. Answers given to each of the four networks are validated separately therefore it is necessary to create four separate sheets.

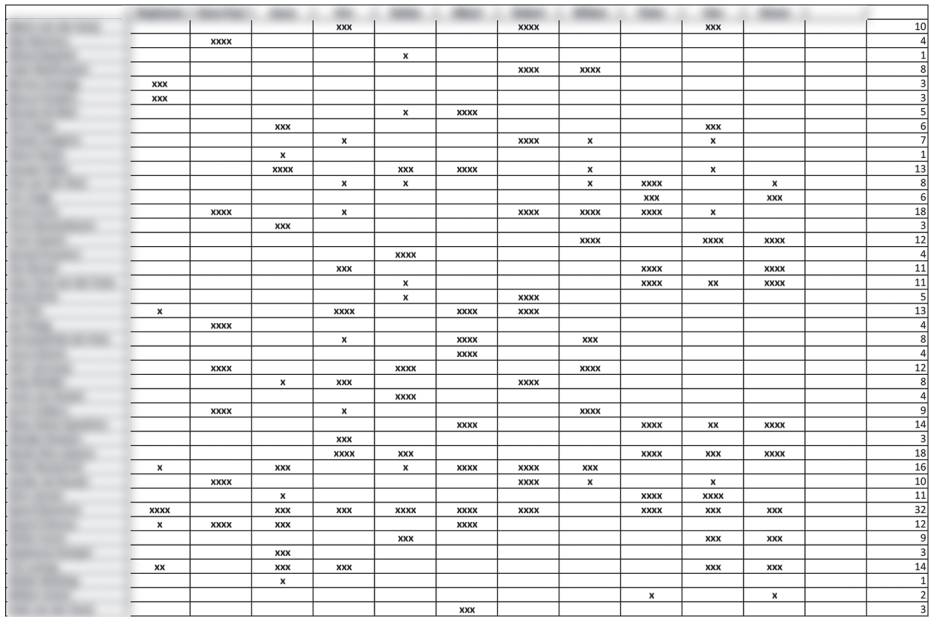


Figure 26. A partial screenshot of the validation study of the creative network (anonymity of the names are protected)

Figure 26 shows all the answers given for one of the networks by the NetReps. First column displays all the different names ever mentioned in any of the questions related to this particular network, alphabetically ordered. Top row shows the NetReps. In the matrix created, we see the 'frequency of occurrence' of each name per NetRep, represented with an "x".

The first validation has not shown any inconsistencies per NetRep. However, the sum of the mentioned actors that can be seen on the bottom right corner of the excel sheet seemed remarkable to us. Because, the actors mentioned in the managerial network revealed a greater sum than all the other networks.

To have a closer look at this situation and understand the cause behind this, the validation table was created. The table compares the ratio of the given actor names, to the total answers that were given per network. For example, all the NetReps together mentioned 183 names in the managerial network from which 68 were different. This gave a ratio of 0.37 while all the other three networks had 0.24 ratio.

Table 8 shows the number of different names mentioned per network (column 2), number of answers given in total (column 3) and the proportion in between these numbers (column 4). According to this information, managerial network cannot follow the consistency of the other three networks with having 1.5 times higher in proportion.

Table 8. Quantitative validation step 1: Comparing different names mentioned per network

	COMPLETE LIST (~10)		
NETWORKS	#different names	#total answers	diff.names / tot. answers
Managerial	68	183	0.37
Creative	35	146	0.24
Political	37	153	0.24
Friendship	41	173 (346)	0.24

On a side note, in the questionnaire, there were four questions asked on friendship network, while the other networks only had two questions. Therefore, while creating divided the validation tables, the number of total answers in the friendship network was divide by two in order to normalise the outcome.

The ratio difference in the managerial network and why NetReps gave a greater variety of names was still not clear. We checked the order the NetReps received the parts of the questionnaire, because we thought although we gave the parts randomly, it may have been coincidentally possible that the NetReps received the managerial network questions first and they were more enthusiastic at the beginning of the questionnaire. Because indeed it has been monitored that the enthusiasm of NetReps is higher with the first questions they answer and this reflects on the amount of names they can provide. It can be the case that most NetReps started the questionnaire with the managerial network and therefore the total number of answers is higher in this part. It has also been monitored that the NetReps tend to repeat the names they have already mentioned towards the end of the questionnaire, which causes the variety to decrease, probably due to focus issues. We ran an alternative validation round to check this possibility, which will be explained here as well.

Table 9. Quantitative validation step 2: Comparing different names mentioned per network to the truncated version when the lists are shortened to five answers

	COMPLETE LIST (~10)		
NETWORKS	#different names	#total answers	diff.names / tot. answers
Managerial	68	183	0.37
Creative	35	146	0.24
Political	37	153	0.24
Friendship	41	173 (346)	0.24

	TRUNCATED LIST (~5)		
NETWORKS	#different names	#total answers	diff.names / tot. answers
Managerial	48	102	0.47
Creative	29	108	0.27
Political	31	103	0.30
Friendship	32	108 (216)	0.30

During the interviews, it was possible to not to give a complete 'Top 10' list for each question. We have not forced the NetReps to fulfil the lists but asked to provide maximum 10 names for each question, which means there were lists made with fewer names. When we have observed that all interviewees provided at least five names per question, we decided to normalise the answers by 'truncating' the name lists. Therefore, in the second round of

validation, we have shortened the name lists to 5 ranks as if 'Top 5' lists were made instead of 'Top 10'. When we repeated the same validation as before, a second table was obtained. The previous validation (complete) is compared to the new validation (truncated) to realize the differences.

Despite the efforts to figure out the outstanding situation of managerial network, the variety ratios remained the same. Again, managerial network displayed a much higher variety than the other three networks.

Since none of the validation rounds revealed a reason behind why NetReps could not be consistent on which actors to name for the managerial network, whereas they were consistent for other networks, we have decided to look for answers within the results we found. Eventually, there were two possible reasons that the validation rounds could not eliminate, which we will elaborate further on in Chapters 6 and 7:

1. Despite the detailed explanations and keywords, the questions related to the managerial network were not clear, or very open to interpretation. This caused the NetReps to interpret the 'managerial relationships' in their own way. Therefore, the NetReps mentioned a variety of names with no consistency.
2. Managerial relationships mean different things to different people based on their position and field of expertise. This causes the inconsistent naming of actors in the managerial network, whereas there is a common and consistent understanding of creative, political and friendship relationships.

qualitative validation:

The second type of validation that was performed in this study was the qualitative round. However, this validation looks at the reliability of results instead of the reliability of NetReps and the success of the NetRep selection unlike the quantitative validation. These expert rounds have two purposes in this research. First of all, during the interviews the gathered data was validated by focusing on the completeness of the data and secondly, by discussing the conclusions derived from propositions, literature review and the SNA, the representativeness of the findings that are knitted together also assessed in these interviews. Chapter 7.1 is dedicated to these expert sessions.

5.3.7 Data preparation

This method performs an exploratory qualitative analysis that uses sociograms (network graphs) as the main source of information together with basic statistics. There is a number of software to create the graphs but in this study Gephi software was used to create the necessary graphs (Gephi, 2010). The reason behind this decision is that Gephi is open-source software that is the leading visualisation and exploration software for all kinds of graphs and networks. The simplicity of the Gephi interface and our familiarity with necessary tools to create the dataset were also additional reasons.

The sociograms that are developed based on the data consist of nodes and edges that connect these nodes. Depending on the network measures that are used, the nodes can vary in size and the edges can vary in thickness. Gephi requires two datasets for creating a sociogram: nodes and edges. The datasets are produced in Excel in this study as two separate files. On these files, all nodes and edges require an identification code (ID). In addition, if the sizes of nodes or the thicknesses of the edges are going to be studied, there must be attributes that define these properties in the file.

In the case of this study, the ranking of actors gathered from the NetRep interviews defines the node sizes (later the procedure of determining this value will be explained). The thicknesses of the edges on the other hand, is not going to be taken into consideration due to unreliability of this data as explained in section 5.3.4. In the binary analysis option that we preferred, we will only be looking at *if* a relationship exists or not.

In Gephi, edges are only defined by source and target. Also the dataset has to mention if the edge is directed or not. However, the datasets of this project do not contain the information on directedness, since it is not possible to assess the direction of a relationship through third party information that the NetRep method is built on. Here are two screenshots from node and edge files respectively, after importing into Gephi software.

Each node represents an actor from the large name list with 232 names that we have compiled together with NetReps at the beginning of the data collection phase. All actors are included even if they have not been listed in the Top 10 rankings by any of NetReps in any of the questions. Because, the disconnected nodes are still considered inactive parts of the network, that may play an important role while analysing the sociograms.

In network analysis, it is possible to define the node sizes in different ways. Here, node sizes will be defined by rankings of the actors assigned by the NetReps. If an actor is on rank 1 in one of the questions, the node receives 10 points, rank 2 receives 9 points and at the end the points each name gets from these ranks are added together. The sum value is used as an attribute in Gephi that defines the node size if necessary. This attribute is to be seen on the most right column of the screenshot of the nodes file. Once the datasets are imported and they are ready, Gephi visualises the sociograms.

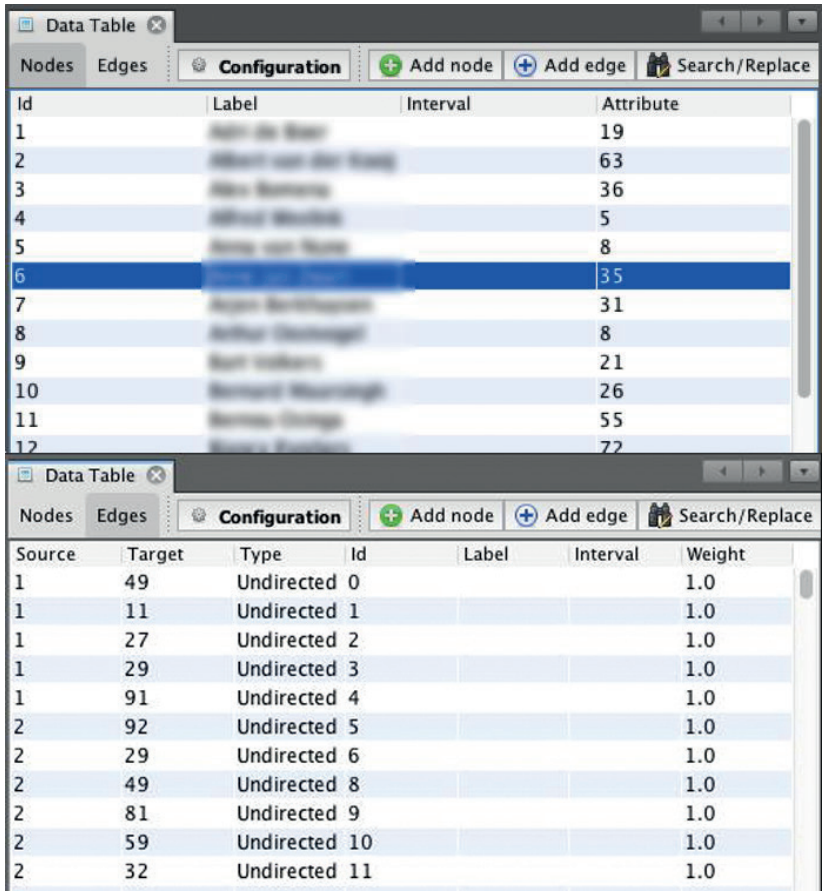


Figure 27. A partial and anonymous view of the Gephi datasets (nodes on top and edges on the bottom)

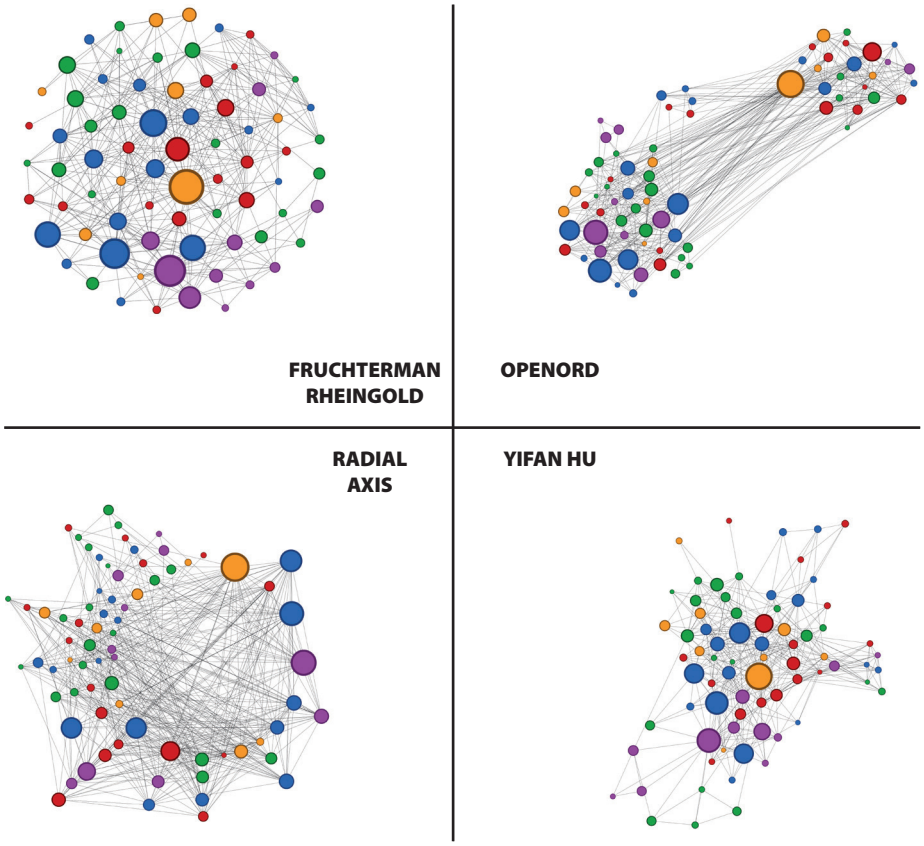


Figure 28. The same network displayed with four different Gephi algorithms used in this research

There are various options of visualizing the datasets in Gephi. In addition, it is possible to tweak specifications of standard options and create customised visualisation tools. Simply stated, all of the tools locate the most central nodes towards the middle and drags the nodes with similar connections towards each other. The basic principle is the same but in application, it is possible to realise different aspects of the networks with each of these methods. Figure 28 presents the same network depicted in four different ways. These four visualisation methods are selected for the qualitative analysis of graphs in this study. Although the graphs created with these four tools are highly divergent based on sample sizes and attributes, we will follow with a short explanation of the choices made:

- **Fruchterman Reingold:** This is one of the most common ways of visualizing a network. The most central nodes are located in the middle and the nodes are located in a spherical way. This method provides a good overview of the most prominent nodes in a network.
- **OpenOrd:** In the OpenOrd method the central nodes are located in the middle as well but also nodes with similar patterns of connection are closer to each other, which reveals the sub-groups within the network. This was of visualizing is for example useful for identifying parts of the network that do not get along well.
- **Radial Axis:** Here, the entire set of nodes is located around a circle. The most prominent actors are located closest to the centre of the circle. This method is good for seeing who are the gatekeepers of the network that connect the group to outlying nodes.
- **Yifan Hu:** Yifan Hu is similar to the Fruchterman Reingold but the method does not aim to create a spherical form. Also, the distances between nodes is not set to a standard which makes it possible to see the outliers and far corners of a network.

5.3.8 Data analysis

The following chapter (6) of this thesis gives a detailed description of the analysis phase of this SNA. In this part a brief overview of the analysis will be explained to clarify the structure.

The method follows two main parts of analysis that are interconnected to each other. At first, it is important to be able to 'read' the sociograms created via Gephi. Along with the graphs to be studied qualitatively, there are also basic statistics provided by Gephi. Therefore Chapter 6 presents a detailed guideline on 'how to read the graphs'. For this part, an adaptation of the Multi-theoretical Multilevel Model (MTML) developed by Monge and Contractor (2003) is used. This method functions as a standardised network analysis tool that looks at the network through various levels of operation and therefore provides a good basis for 'reading' what is happening in the produced sociograms.

After reading the sociograms and understanding the situation at hand, the NetRep method studies the networks with a three step-method based on the study described in InnovationNet book (Kratzer et al. 2007). InnovationNET method provides a hands-on approach towards tackling the networks by dividing the life-span of innovation network. The book suggests that establishing networks has three phases: creating a network, operating a network and benefitting from a network. With the help of this three-step approach, the NetRep method compares the situation in Fryslân to the ideal situation that is described in the book.

The three phases described in the book are defined through certain network characteristics that correspond to the activities that should occur in that phase. In addition, the book provides a tool for reflecting on the analysed situation that is called 'health check'. After explaining each of the network characteristics one by one, the book describes a healthy situation and compares this to the situation at hand. As the last part of the analysis phase of the NetRep method, a similar procedure will be followed to be able to give the community members in the province of Fryslân concrete feedback on the current status of the four networks we have been looking at.

5.4 Conclusions, Reflections and Discussions on the NetRep Method

The NetRep method was specifically developed for analysing very large social networks when regular SNA procedures are not applicable due to the scale and predictability. However, since the other empirical studies and literature reviews showed the relevance of studying network in the Fryslân setting, we have followed an alternative approach that is developed in this chapter.

The Network Representative Method that we have applied as a part of this thesis shows high potential to be very useful as an explorative study of large-scale social networks. The efficient data collection procedures and structured development of validation and analysis phases can provide insightful answers towards societal questions in a feasible amount of time.

In addition, if multiplex analysis of multiple networks at the same is necessary, often it requires various data sources to gather the information. This method on the other hand provides an effective tool for mapping multiple networks and relating them to each other.

However, the NetRep method is a simplified tool that aims to decrease the necessary effort for applying regular SNA processes in large scale, multiplex networks. The ease of the approach naturally has hold back on the level of detail in the results. First and foremost, the study remains an explorative study that makes effective use of non-parametric statistics instead of aiming for descriptive statistics. In terms of network measures that provide realistic depictions of the situation, the method has its limitations. In addition, some very important aspects of the networks such as weight of edges that refers to the intensity of the relationships between actors, or the direction of the relationships between actors are not available in this method.

Although the NetRep method makes it easier for the researcher to come to conclusions, since the study is a qualitative study of graphs, the results are highly dependent on the interview set-up, which may require multiple iterations especially if the validation round that we have explained fail. In addition, it is important to keep constant track of 'sufficiency of information' to decide when to stop the interview rounds. It might even be necessary to continue exploring after the last validation of results with expert rounds, if the experts think that large parts of the networks are missing.

Applying the NetRep method is expected to help us find valid answers to the research questions and propositions that were developed in this study. The power of this method to provide an accurate image of the networks efficiency by sparing the researcher the burden of tracing each and every relationship in the network is highly applicable for the societal situation at hand.

It is also a method that gives an important task to the Network Representatives, who are selected based on objective criteria, although the information they give has subjective elements. Yet, the validation rounds aim to eliminate this uncertainty and gives clear instruction on how the NetReps must be guided through the data collection.

The NetRep method provides an easy entrance to measure very large-scale social networks. The method consists of steps that aim at eliminating the unreliability that derive from the minimised sample size. If the points of attention that were described throughout the methodology are taken into consideration, we believe that this method is a major contribution to the field of network studies.

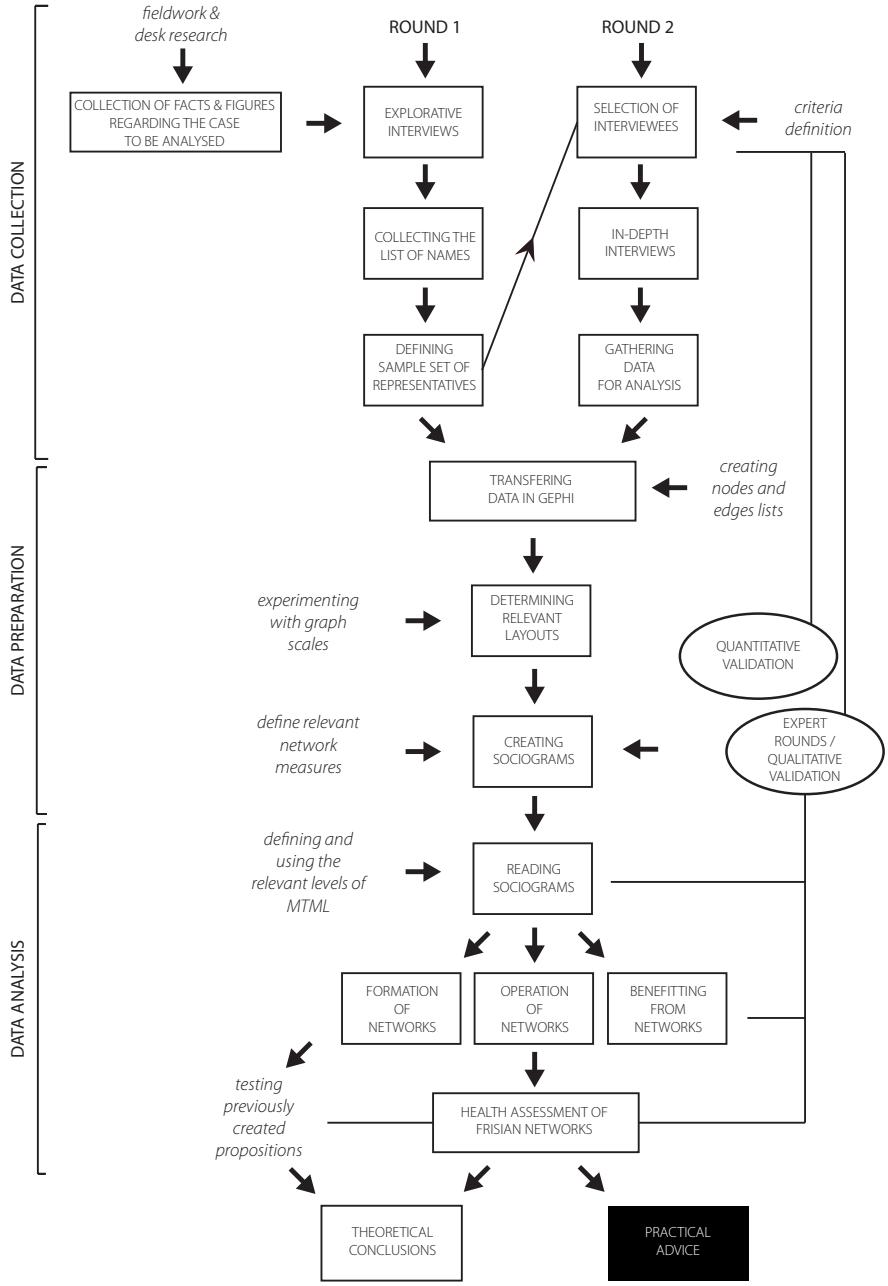


Figure 29. Flowchart of the NetRep method applied in this thesis to analyse social networks in Fryslân

Chapter 6

THE OPTOMETRIST

"The relation between what we see and what we know is never settled.
Each evening we see the sun set. We know that the earth is turning away from it.
Yet the knowledge, the explanation, never quite fits the sight."
John Berger, Ways of Seeing

Networks have emerged as a defining paradigm for how we see systems. In the case of this study, we analysed the innovation systems of province of Fryslân through a social network analysis (SNA). In Chapter 4, the relevance of network approach and the suitability of a SNA as a tool were discussed thoroughly. In Chapter 5 the data handling of this study regarding the phases of collecting, validating and displaying data have been explained. This chapter is purely dedicated to this analysis and reporting the results of the conducted study on Frisian innovation systems. The results will be explained using a metaphor of an eye examination done by an optometrist. It usually takes time for a novice reader to embrace the fact that, although we are talking about multiple networks and multiple measures, we are constantly looking at the same group of actors. Imagining a patient sitting in front of the optometrist and looking at a chart with letters through different lenses becomes an immensely helpful metaphor.

Many of us have sat behind a device operated by an optometrist to get our eyesight checked at one point in our lives. An optometrist is trained to examine the eyes for many defects such as sight, eye rest, postures, vergence, and more. In order to prescribe corrective equipment or treatment, an optometrist runs a series of tests. If these tests conclude that there is a problem with the eyesight, a lens has to be selected. The optometrist does this by letting the patient wear (or sit behind) an ophthalmic testing device, which is like a trial frame, and asks you to look through the lens at a chart full of symbols of various sizes. The idea is to find the perfect lens by assessing the clarity of our vision of the chart we look at. Although the digital technology behind the examination has improved, the basic principle of the testing device remains the same.

Throughout the examination, the optometrist lets the patient look through lenses or combinations of lenses that are located in the sockets in the front part of the trial frame (Figure 30). This way, although the patient is looking at the same chart, the combination of lenses determines the clarity of vision.

The social network analysis performed in this thesis metaphorically works the same way. Throughout the analysis, we constantly look at the relationships of the same group of actors, but through different perspectives, which will be our lenses. What we see through these different perspectives remain as filtered versions of the same reality.

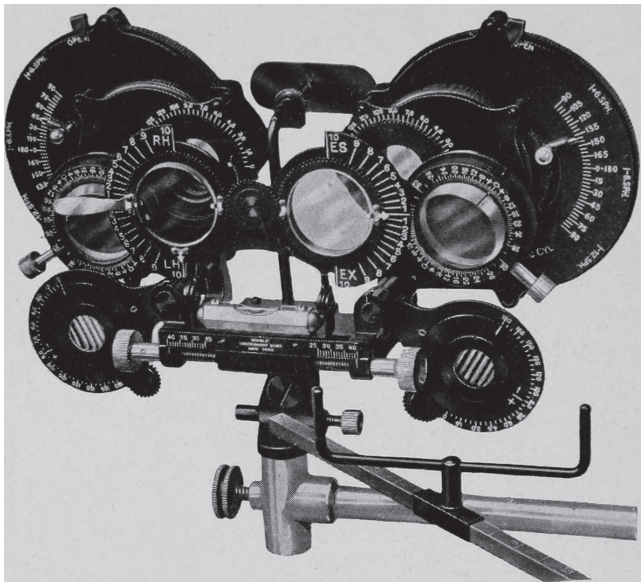


Figure 30. An ophthalmic testing device (Reprint from Wikimedia Commons, 2018)

Throughout the examination, the optometrist lets the patient look through lenses or combinations of lenses that are located in the sockets in the front part of the trial frame (Figure 30). This way, although the patient is looking at the same chart, the combination of lenses determines the clarity of vision.

The social network analysis performed in this thesis metaphorically works the same way. Throughout the analysis, we constantly look at the relationships of the same group of actors, but through different perspectives, which will be our lenses. What we see through these different perspectives remain as filtered versions of the same reality.

Social network analysis is a straightforward tool to understand a social situation; however, the situation has to be viewed through various perspectives at the same time. This is because a single perspective does not reflect the complexity of a social situation. Although having multiple perspectives creates numerous combinations (thousands in our case) and enhances the complexity of the analysis, it also helps to depict a holistic picture of the complete system. We will not be assessing each and every possible combination, but instead, we will be selecting a few perspective combinations that are helpful for the information we

are looking for, which have been derived from the prior studies, similar to the optometrist, who can create thousands of combinations by placing different lenses in the sockets of the trial device but tests only a few of the combinations based on his/her prior knowledge. The challenging part of the process of selecting the perspective combinations to view the networks in our case is to determine the appropriate views based on the questions we are trying to answer.

In this study, we will be using four types of perspectives to depict the social situation in Fryslân. Similar to an optometrist, who places (up to) four lenses in front of the trial glasses at a time, throughout this analysis, we will be pick one perspective from each of these four groups. These perspective groups are the level of analysis, type of network, network measures, and actor groups. These elements will be explained in the following sub-chapter when the optometrist opens up the lens cabinet.

Figure 31. Photo of an antique lens cabinet (Photographer unknown, retrieved from oldandeye.be in 2018)

6.1 The Lens Cabinet of the Optometrist: Analytical Perspectives

The optometrist has a cabinet of lenses that looks similar to the cabinet in Figure 31. The box is divided into multiple parts to preserve different types of lenses. Although they look the same, the different lens groups have different purposes. In this specific cabinet, there are convex, concave, spherical, prismatic, and coloured lenses. The optometrist can pick up to four per eye from these groups, put them on the trial frames, and ask the patient to look at a chart full of letters or symbols. The optometrist repeats this process by changing the lens combinations until the patient can see the chart perfectly.

In this study we also have four groups of lenses that we can combine in different ways to look at our data. Our lens cabinet, which is depicted in Figure 32, consists of four networks, ten analysis levels, twenty-one network measures, and five groups of actors. This sub-chapter explains these groups one by one.

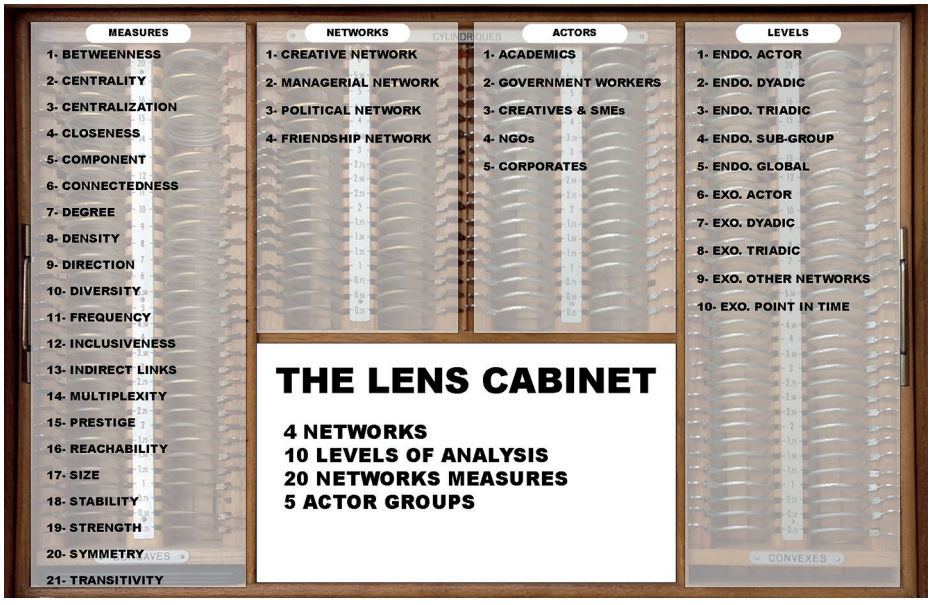


Figure 32. The lens cabinet used in this study

The Four Networks

In Chapter 5 of this thesis, it was concluded that multiple relationships play a role in the development of innovation systems. To give a quick recap, as the process of innovation refers to operationalisation of a creative idea, the involvement of creative and managerial relationships is inevitable. Additionally, from our fieldwork and literature review we have concluded that political decisions and bureaucracy have a great influence on innovation systems as well (Chapter 2). Finally, due to the historical background of our case Fryslân, the friendship between actors showed great importance as well (Chapter 1). Research also points to the relevance of informal contacts in innovative output (Kratzer, Leenders, & van Engelen, 2005).

In network theory, a network is defined by the relationships between actors (Monge & Contractor, 2003). Therefore, these four relationships defined through creative, managerial, political, and friendship related connections are going to be referred to as the creative, managerial, political, and friendship networks throughout this thesis.

The Ten Levels of Analysis

In their 2003 book *Theories on Communication Networks*, Monge and Contractor present the Multi-theoretical Multilevel Model (MTML) as a method for analysing networks by dividing them into levels. Despite its complicated nature, this method provides a useful first step for reading the network graphs. Although not all of them are relevant for our data set, the ten levels of MTML model (Table 10) form the second lens group of our lens cabinet.

Briefly described, MTML is a standardised network analysis tool that guides the network researcher through different levels of analysis by relating the network measures to theories deriving from other fields. The method does not operate on specific networks, but since the method uses theories to explain network dynamics, the analysis also provides a theoretical explanation.

The MTML method introduces two types of variables that provide data through all levels: *endogenous* and *exogenous* variables. Endogenous variables are relational properties that are inherent in the focal network, whereas exogenous variables refer to properties outside the focal network. Table 10 summarises the variables of the MTML method.

Table 10. Ten levels of the MTML model (Adapted from Monge & Contractor, 2003)

Summary of the MTML Framework to test Hypotheses About Organisational Networks		
Independent Variable	Examples of Specific Measures	Hypotheses
1. Endegenous (same network): *Actor level*	Individual network metrics such as choice actor centrality, structural autonomy	Graph realizations that have higher values of actor level measures have larger probabilities of occurring.
2. Endegenous (same network): *Dyad level*	Mutuality, reciprocation	Graph realizations that have more mutuality or reciprocation have larger probabilities of occurring.
3. Endegenous (same network): *Triad level*	Transitivity, cyclicality	Graph realizations that have more cyclicality or more transitivity have larger probabilities of occurring.
4. Endegenous (same network): *Global level*	Network density, centralization	Graph realizations that have more network centralization have larger probabilities of occurring.
5. Exegenous: Actor attributes *(actor level)*	Age, gender, organisation type, education	Graph realizations where there are ties between actors with similar attributes have larger probabilities of occurring.
6. Exegenous : Actor attributes *(dyad level)*	Differential mutuality and reciprocation	Graph realizations where there is a greater likelihood of mutual ties between actors with similar attributes have larger probabilities of occurring.
7. Exegenous: Actor attributes *(triad level)*	Differential transitivity and cyclicality	Graph realizations where there is a greater likelihood of transitive ties between actors with similar attributes have larger probabilities of occurring.
8. Exegenous: Actor attributes *(global level)*	Differential network density and centralization	Graph realizations where there is a greater likelihood of network centralization among subgroups with similar attributes have larger probabilities of occurring.
9. Exegenous: Network *(other relations)*	Advice, friendship network	Graph realizations where say, communication ties between actors co-occur with their ties on a second relation have larger probabilities of occurring.
10. Exogenous: Network *(same network at previous point in time)*	Communication network	Graph realizations where the ties between actors at one point in time co-occur with ties at preceeding points in time have larger probabilities of occurring.

Although our lens cabinet includes all ten levels, only four are relevant to our for describing the societal situation at hand. First, since our analysis focuses on the inherent properties of networks, the exogenous levels are outside the scope of this study. From the endogenous levels, we will replace the triadic level with another level introduced by Monge & Contractor in the same book but that was not included in Table 10: *the sub-group level*. The exclusion of the triadic level is mainly due to the sample size. The small sample size of our dataset makes it difficult to arrive at reliable conclusions at this level. Instead of looking at the triadic level, the sub-group level will be taken into account to deliver information on node groups larger than two.

The four analysis levels adapted from the MTML model that will be relevant are as follows:

- Analysis on the Actor Level: analysing the properties of a single node
- Analysis on the Dyadic Level: analysing the relationship between two nodes
- Analysis on the Sub-group Level: analysing the relationships between a sub-set of nodes
- Analysis on the Global Level: analysing the complete network

The Twenty-One Network Measures

Network measures (or metrics) refer to numerous mathematical calculations that are helpful for capturing properties of a network and the patterns within. There are many measures that focus either actor or network related (or both) properties of the network (Albert & Barabasi 2002; Newman, 2010). Brass's (1995) set of network measures was divided in three groups: (1) the relationship of ties between nodes, (2) node related, and (3) related to the complete network. This set of 21 measures will be used as the third set of lenses that will play a role in forming different perspectives.

To give an example to the network measures, one of the most used measures in this study is 'degree', which simply specifies the number of relationships connected to a node. However, some of these 21 measures are not relevant for the data collected in our study on Frisian innovation networks. For example, the measure of the *direction* of relationships cannot be assessed since the data collection did not include this information. Similarly, the measure *stability*, which looks at the resilience of a single relationship over time, does not apply to this study since such time-based data was not collected. In this way, the relevant measures for this study drops to nine, as shown in Figure 33.

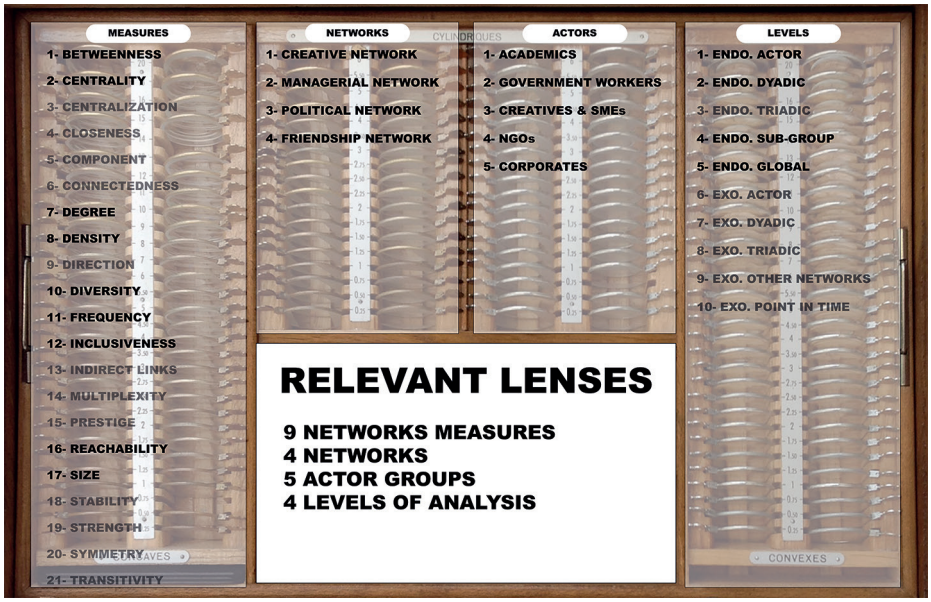


Figure 33. Relevant lenses in the cabinet

It must be noted that a majority of these measures can only be used on a single level of analysis. If we come back to the example of *degree*, which defines number of ties for a single actor, it can obviously only be analysed on the actor level, and, therefore, it can only be combined with the *actor level* lens. The network measures are explained in the glossary section of this thesis.

The Five Actor Groups

During the first round of interviews of the NetRep method data collection (see Chapter 5), a list of actors was compiled. Compilation of this list revealed a pattern regarding the professional affiliations of the actors. This pattern was used in the formulation in the five actor groups, named as follows:

- **Academics:** actors affiliated with various educational institutions or organisations with an academic orientation
- **Government workers:** this group focuses on civil servants of various levels that function in or around the province through election or not

- **Creatives and Small Medium Enterprises (SMEs):** this group focuses on the members of the small-scale creative industry, such as artists or designers as well as entrepreneurs who are in a scaling phase
- **Representatives of Non-Governmental Organisations (NGOs):** individuals that represent organisations that do not define profit as the primary goal
- **Corporates:** Representatives of large-scale businesses of various fields.

Each lens category in our lens cabinet has now been explained, but if we used all of them, the number of combinations would exceed 4000. Also, as explained, not all measures are relevant for our dataset. Therefore, the lens cabinet will be reorganised in the following section and only the relevant lenses for this study will be highlighted.

Even after the elimination of irrelevant lenses, the amount of meaningful combinations exceeds 800. Just like the optometrist, we will be selecting our lens combinations based on what we are looking for in the network graphs. The next section will be dedicated to reading the graphs through the various lens combinations and analysing the social situation in Fryslân.

6.2 Lens Combinations: Interpretation of the Network Graphs

The first part of this sub-chapter focuses on how to read the network graphs that were produced through the combinations of the perspectives (lenses in our lens cabinet) that were explained in 6.1. This is an important step, since these graph interpretations form the core of our social network analysis, which aims to assess and improve the situation in Fryslân. In addition, the previously defined propositions at the end of Chapters 3 and 4 will be used for understanding the situation at hand. But before everything, it is essential to interpret the network graphs correctly to be able to understand the results of the analysis.

The study takes a descriptive perspective towards understanding the networks through adopting the basics of graph theory. Graph theory is the study of points and vertices that describe combinatorial and algorithmic relationships between the elements that form the graph. Graphs are commonly used in network studies to picture and explain various elementary and complex notions (Paranyushkin, 2011).

A network graph (or a sociogram) is a composition of actors (or nodes or points) connected through relationships (or ties or edges). De Nooy, Mrvar and Batagelj (2011) state that a network is defined by a graph and additional information on the nodes and edges of the graph, which means that it is not possible to distinguish a network without being able to understand the graph. Due to the exploratory nature of this study, in combination with a data set that did not allow using descriptive statistics, performing a qualitative analysis on the network graphs was the only possibility. Therefore, this study aims to use the network graphs in combination with basic network measures as the main source of reading and identifying social structures.

This study presents a multiplex analysis of Frisian system, which means that we look at different networks formed by different relationships that tie actors (creative, managerial, political and friendship networks). However, in the main text of this thesis, we will only explain analytics of the creative network in-depth, because this is the most important network for innovative output. To avoid lengthy reading on the detailed analytics of other three networks, we will only summarise them shortly. However, the detailed studies on the other networks can be found in the Appendix A.

6.2.1 Interpretation of the creative network

In this study, we looked at four different types of relationships that form four different networks: creative, managerial, political, and friendship. In SNA, relationships might also have a direction or strength but in this study, there are no directions or strengths defined. The reason for this is explained in Chapter 5.

The data collected on the four networks was processed with Gephi, as explained in Chapter 5. This network interpretation section is devoted to explaining how to read the graphs created in Gephi.

The graphs produced in this study use labels to identify the actors so that their anonymity is protected. But because we are looking at more than one network, several actors come up in multiple networks. Since the positions of actors are important for our interpretation, to avoid confusion a number has been assigned to each actor in this study. This means that a node numbered as 1 always refers to the same actor regardless of which graph we are looking at (only visible in the sociograms that are printed large).

The metaphor of optometrist we have been using will continue to be helpful while explaining the interpretations of the network graphs. The interpretations will be guided through combining perspectives, which are the lenses in our lens cabinet in the previous section. As mentioned in 6.1, one of the lens categories in our lens cabinet is the 'networks'. This refers to the type of relationship identified between actors. In this part, we will share the analytics of the creative network only and the other three can be found in the Appendix A. Therefore, the lens of the creative network will be a given in all the combinations we will be looking at. It is good to remember the latest version of lens cabinet that highlighted the lenses we will be using to understand the social situation in Fryslân.

Between the thousands of combination the lenses in the lens cabinet can create, we will only be taking *meaningful* combinations for the questions we have been asking with the research questions and the propositions. Although the research questions and the propositions are the interpretations of the societal questions and the literature review, the new perspectives that meaningful lens combinations bring in make it necessary to broaden the scope of the conducted literature. Therefore, if the combination requires new knowledge to provide plausible interpretations, the theoretical scope will grow in the relevant direction.

Lens combination 1: size measure + creative network + academic actors + endo. global level
Let's start by looking at the first combination of four lenses to understand the content of the creative network: creative network (standard since we are only looking at the creative network in this section), global level, size measure, and the academic actor group. This combination shows us the total number of actors that have an academic position who are connected through creative relationship in the whole system: ten in total (see the red nodes). If we want to know the number of government workers, we keep the creative network, global level, and size measure lenses, but replace the academics lens with government workers lens. From this, we can see that there are six actors who have a position with the government that are also active in the creative network (blue nodes). If we apply the same procedure for creatives/SMEs, NGOs and corporates actor groups, we will see that there are fifteen from creatives and SMEs (green nodes), seven from nongovernmental organisations (orange nodes), and four from corporations (purple nodes) respectively. Therefore, in total, the creative network consists of 42 actors. Gephi also shows us that there are 229 ties defined between these actors.

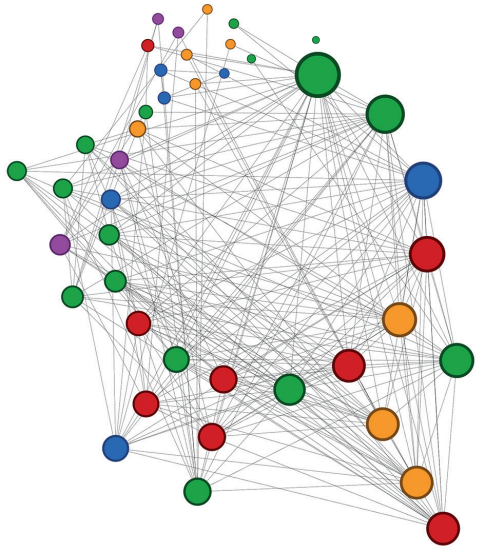


Figure 34. Size measure + creative network + academic actors + endo. global level

Lens combination 2: inclusiveness measure + creative network + all actors + endo. global level

Inclusiveness is identified as the proportion of actors that are tied to another actor and to the total number of actors (Brass, 1995). The total number of actors in this study is 232, defined by our sample set (Chapter 5). However only 42 of these are connected to each other with a creative relationship. This means that the inclusiveness is 0.18.

For an innovation network that only includes actors from relevant professional positions such as academia, this is a very low ratio. Creative relationships are the most essential relationships for innovation because this is where the work gets done. We will get back to this later in Chapter 6.3.

Lens combination 3: diversity measure + creative network + all actors + endo. sub-group level

Not only that the creative network is generally small, the first lens we used also shows that there is an imbalance between the number of actors, as in not all actor groups are represented equally. Our third lens combination will explore this through the diversity measure, the creative network, and the endogenous sub-group level in combination with all

actor group lenses one by one. The creative network in Fryslân shows a domination of the creatives and SMEs actor group (green nodes) with 36% of the nodes. This is not surprising since this group consists of representatives of design companies, artists, and other creative individuals. The second dominating group is academics (red nodes) with 24%. This is logical, considering that creative relationships also cover science and knowledge production. NGOs (orange nodes) are the third group with 16%, and in the province, they are rather involved in creative projects. Although all five professional fields are present in the creative network, the involvement of governmental actors (14%, blue nodes) and corporate actors (10%, purple nodes) are limited. Corporate actors in particular play an important role within innovation networks; therefore, their effective engagement in creative projects might be beneficial.

Lens combination 4: degree measure + creative network + all actors + endo. actor level

There are 229 ties defined between the 42 active actors in the creative network. This means that the average number of ties a single actor has is around five. The number of connections a single node has is identified as *degree*, which is one of the lenses in the measures category of our lens cabinet. The degree lens, the creative network lens, and the actor level lens will be used in combination with the actor group lenses. Figure 35 shows all the active actors of the creative network. Note that some nodes are larger than others. In this graph, degree defines the node size. Thus, more ties connected to a node means a higher degree value, and the higher degree value the larger the node.

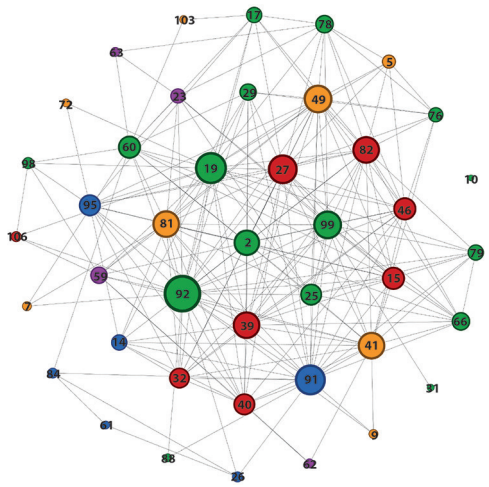


Figure 35. Degree measure + creative network + all actors + endo. actor level

The creative network, which is formed through creative relationships, is the most important network of the innovation system. This is because the innovative output comes primarily out of the relations that form this network. Therefore, a high average degree in the creative network where many potential relationships are realised points to vibrancy in exchanging creative thoughts.

Lens combination 5: frequency measure + creative network + all actors + endo. actor level
In SNA, the frequency measure is meant to identify how often a relationship has occurred; therefore, it operates on the dyadic level of analysis. Ties that occur more often are considered stronger, and they are shown as thicker lines in the network graph. However, in this study, we chose not to include relationship strength in the analysis, as explained in Chapter 5. But this does not mean we cannot use the frequency measure. Here, we will combine the lens of frequency with all the actors of the creative network to use the data derived from the NetRep interviews. This will show us the influence of an actor in the network. Influence can be determined from the node size in the network graph as well.

Degree is a common way to define node sizes in SNA. But in Gephi, the software used to create these graphs, there are other possibilities for defining node size. During the data collection, the representatives used a rank-based system to point out the reputational differences among actors they named (see Chapter 5). Two parameters were used to define the node size: how many times an actor was mentioned by interviewees (1) and what was the position of the actor in the rankings (2).

Let's say that actor X has been mentioned twice in total in the ranking answers provided by the representatives for the creative network. On one, he was ranked 1st and the on the other one 3rd. As explained in Chapter 5, rankings were translated into scores from 10 at the top to 1 at the end, so this particular actor would score 18 in the creative network (10 points from his 1st rank, and 8 points from his 3rd rank). The scores were then used to define node sizes later on. Figure 36 shows the difference in node sizes when degree (left graph) and ranking results (right graph) were used as input.

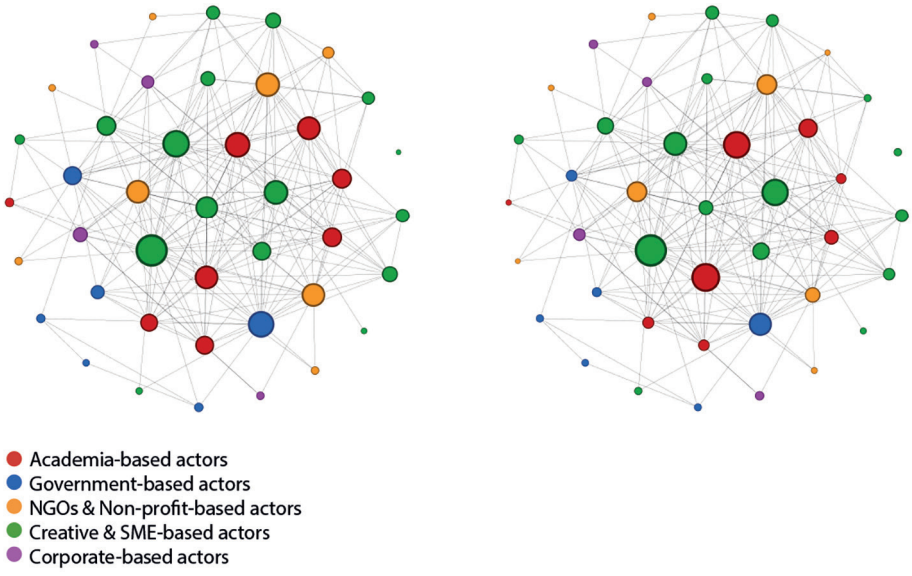


Figure 36. Frequency measure + creative network + all actors + endo. actor level

It is possible to observe that most of the nodes are larger when degree (left graph) is used as an input for node sizes. The degree of a node is defined through the number of ties that connect to that node whereas frequency is defined through the rankings. This suggests that perceived influence of an actor in the network are lower than the actual impact.

Lens combination 6: density measure + creative network + all actors + endo. global level

In the previous lens combination we looked at the minimal amount of connections between actors in the Frisian creative network. We concluded that actors were engaging in creative relationships with only five others on average. On a global level, it is possible to explore this further by looking at how *dense* or *sparse* a network is (Monge & Contractor, 2003).

Potential Connections:

$$PC = \frac{n * (n-1)}{2}$$

Network Density:

$$\frac{\text{Actual Connections}}{\text{Potential Connections}}$$

The ratio of the established ties to all possible ties is called *density*. The lens combination we use to assess this is the density lens combined with the creative network, the global level, and all actor lenses at the same time. The density value of the creative network is the second lowest among all networks with a value of 0.266. This is also clearly visible when the sociograms of four networks are compared because the creative network looks remarkably empty despite the comparable number of total active nodes, especially in comparison to the political and friendship networks, as can be read in the summary of the other four networks in section 6.2.2.

In Fryslân, the creative network is the second sparsest network. A sparse network suggests low ties between actors and, therefore, a lack of exchange of information, ideas, and knowledge. As explained in Chapter 2, creative ideas develop in parallel to communication. With such a sparse creative network, it is rather difficult to develop and scale innovative ideas.

Lens combination 7: centrality measure + creative network + all actors + endo. actor level
While creating the network graphs, most of the layout algorithms located some actors to central positions and others to peripheral positions. This was mostly based on the degree of the node (the number of ties attached to it). When we look at the graph of the creative network, there are a few larger nodes in the middle and a group of smaller nodes around them. We will combine the centrality measure with the creative network, all actors, and the endo. actor level to explore this situation.

In this graph, creatives and SMEs (green nodes) and academics (red nodes) occupy the centre, which are also the larger nodes. This is logical because these groups have a directly creative occupation. On the outer edges, we see authority figures as government (blue nodes) and corporates (purple nodes). Again, the fifth group, NGOs, has a balanced distribution throughout the graph (orange nodes).

Overlooking the fact that number of nodes is insufficient to form a vibrant creative network, the centrality measures of the nodes are favourable (Kratzer et al., 2007). According to the literature, creative professionals should have a central position, whereas professionals with operational tasks should remain in the periphery, which fits the situation in Figure 36. We will come back to this topic in Chapter 7.

Monge & Contractor (2003) associate the centrality measure with the global level instead of actor level. This is based on the collective action theory (Olson, 1965) that suggests that centrality is a result of collectively taken actions. However, many argue against this theory when it comes to complex, creative tasks because there is an individual authenticity involved (Reuben, 2003).

Lens combination 8: 'Reachability' measure + creative network + all actors + endo. global level

A commonly known theory on the reachability of networks is Karinthy's (as cited in Newman, 2006) 'six degrees of separation'. This theory suggests that all humans are six or fewer ties away from any other human. This is also called the *connectivity* or the *diameter* of a network. Gephi calculates the diameter of the creative network as four. Therefore, any given pair of nodes is connected to each other through a maximum of four nodes. Since Karinthy's theory suggests that the entire network of human beings in the whole world should have a maximum diameter of six, being able to reach an actor in Fryslân in four steps cannot be considered efficient.

Lens combination 9: Reachability measure + creative network + creative & SME actors + actor level

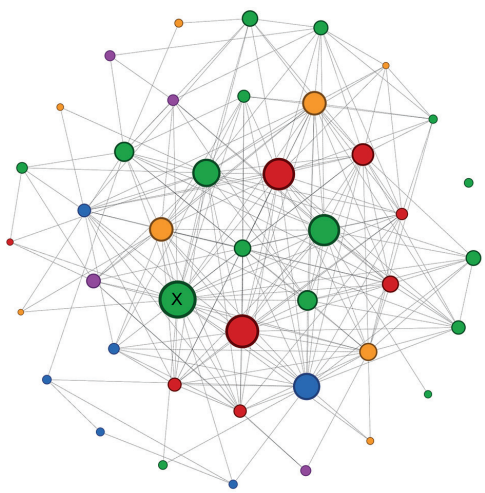


Figure 37. Sociogram showing the highly-connected (star) actor

When we use the actor level lens instead of the global level lens to observe this situation, we can see that there is a particular node that has a very high degree, and, therefore, a central position. Specifically, this node is connected to 28 of 42 nodes in this network, which is almost 67% of the nodes. Due to the central and connecting position of this node, the average network diameter would be between one and two in the creative network. Unfortunately, Gephi only gives information on the maximum diameter and not the average.

Lens combination 10: Reachability measure + creative network + all actors + sub-group level

The large maximum diameter of the creative network suggests that there are many weakly connected nodes present. When we use the same combination of lenses but replace the actor level with sub-group level, we can see the 13 weakly connected nodes of the network that have satellite-like positions around the network. Until now, we have been using the Fruchterman Reingold algorithm to produce network graphs, but this algorithm is not ideal for visualising the outliers. Instead we will be using the Yifan Hu algorithm.

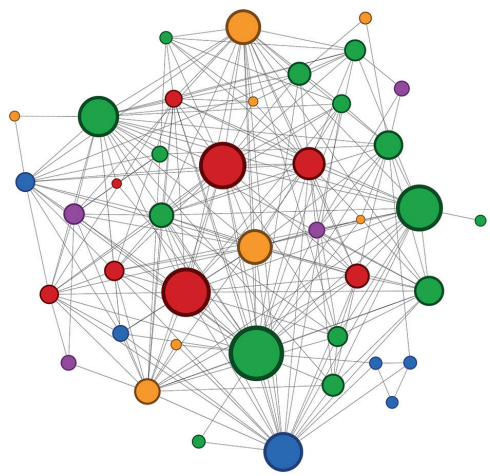


Figure 38. Reachability measure + creative network + all actors + sub-group level

Weakly connected components, or *outliers*, form 30% of the creative network. The visualisation of the network in Figure 38 shows us that some actor groups, such as government workers (blue nodes) and corporates (purple nodes), are especially poorly connected. However, there are also various creatives and SMEs (green nodes) that are connected to the network

through a single connection. According to this graph, the best-connected actor group is the academics.

In Figure 38 there is also a remarkable grouping between actor groups. Especially, the green nodes on the upper right corner, and the red academic nodes with central positions, but also the blue government workers are drawn closer to each other. The orange NGO nodes and the purple corporate nodes on the other hand have a rather even distribution. We will come back to the potential reasons behind this, such as physical proximity of workspaces and catalysing roles, in Chapter 7.

By going through the ten lens combinations that include the creative network, we now have an overview of what the social situation is regarding creative relationships and how to read the network graphs in this study. To spare the reader from going through this extensive analysis three more times by analysing the managerial, political, and friendship networks, we will only give a short summary of our findings. The following section gives a quick recap of the analysis conducted on the three remaining networks to prepare a base for the following sections. The detailed analysis of the managerial, political, and friendship networks can be found in the Appendix A.

6.2.2 Summary of the findings on the managerial, political, and friendship networks

The managerial network has 74 nodes and 428 ties defined. The nodes are distributed as follows: 16 from academia, 18 from the government, 9 from non-governmental organisations, 20 from creatives and SMEs, and 11 from corporations.

The managerial network is the most problematic network in this study. There are an unexplainably high number of active nodes compared to the other three networks. Our preliminary conclusion is that the address and character of managerial relationships within the province are not clear.

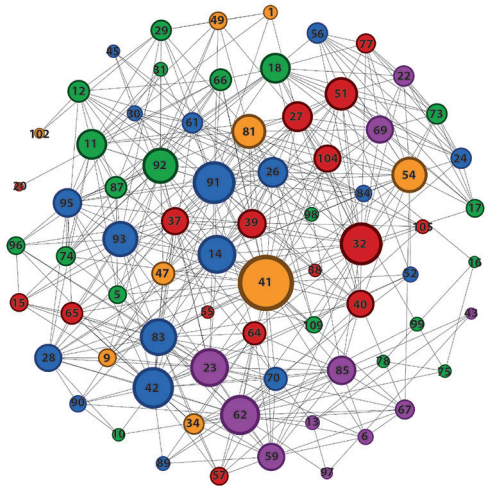


Figure 39. The managerial network

Looking at the managerial network in Figure 39, although we do see a few high-degree nodes that are larger in size, it is possible to identify three main sizes of nodes: around 14 very large nodes, 15 medium sized nodes, and 35 small nodes. The 14 large nodes are mainly blue, orange, and purple nodes, representing the government, NGOs, and corporates respectively. It is remarkable to see that the creatives and SMEs group, which is represented by green nodes, fails to have high degree nodes in the managerial network.

The political network has 41 nodes and 241 ties defined. The nodes are distributed as follows: five from academia (red nodes), twenty from the government (blue nodes), five from non-governmental organisations (orange nodes), six from small medium enterprises (green nodes) and five from corporations (purple nodes).

Although the density of this network is rather high with a value of 0.294, there is a clear imbalance of professional distribution of actors since half of the nodes in the network are from the government workers (blue nodes). At first glance, the dominance of governmental workers in the political network might not be a surprise, however, considering that our study is exploring the innovation systems, the political network also focuses on political relationships within the subject of innovation. Assuming that the relationships in this network define the main decision-making processes behind creative decisions, it is not favourable to exclude the creatives and SMEs from these decisions.

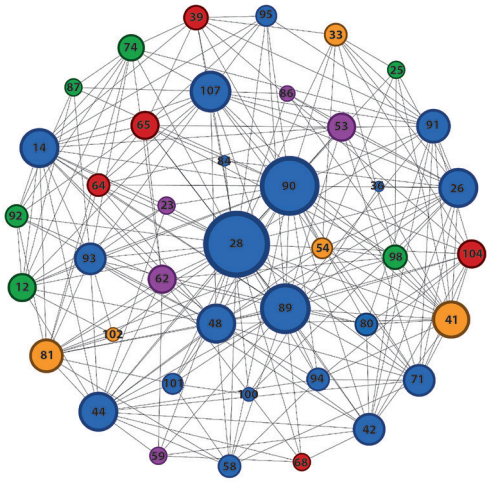


Figure 40. The political network

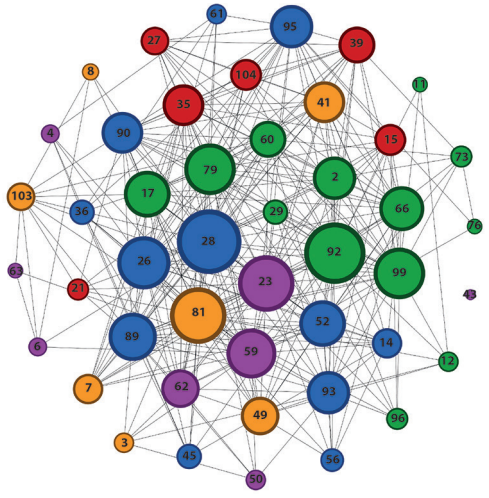


Figure 41. The friendship network

Finally, the friendship network has 46 nodes and 333 ties defined. The node numbers are comparable to the other networks (except for managerial), but the number of ties is much higher. Therefore, the friendship network is the best 'connected' network with a density value of 0.322. The vibrancy of the network compared to the other three networks is also

apparent from the visual density of the graph. This supports the observations and historical developments we presented in Chapter 1 and also the decision to include friendship networks in this SNA study. The nodes are distributed as follows: six from academia (red nodes), eleven from government (blue nodes), seven from non-governmental organisations (orange nodes), twelve from small medium enterprises (green nodes) and seven from corporations (purple nodes).

6.2.3 Multiplex analysis of networks

Multiplexity is defined as the existence of multiple relationships between actors. For example, two co-workers might also be family at the same time. In this part, networks resulting from the variety of relationships within the same group of actors are analysed.

Going back to the lens cabinet described in the previous sections, one of the categories of lenses was the networks. In this study, we have defined four different types of network relationships: the creative network, the managerial network, the political network, and the friendship network. In this section, we will try to analyse these as a whole to understand the impacts they have on each other.

When the four networks are combined into one single graph, there are 109 nodes and 983 edges defined. When you only have 109 active nodes in a sample set of 232, this means that more than half of the actors in the system are not contributing to innovative output, even though our network representatives identified these actors as influential members of the innovation community.

The nodes are distributed as follows: 22 from academia (red nodes), 29 from the government (blue nodes), 15 from NGOs (orange nodes), 27 from creatives and SMEs (green nodes) and 15 from corporate directors (purple nodes). These numbers point out the repetition of the same actors in multiple networks. This means that the actors in the province choose to tackle issues only within a small group of actors. This characteristic relates to the openness of networks. In Chapters 1 and 2, we discussed the ever-growing essence of open innovation and how it relates to communication. Not being open to new actors in the community might provide a comfort zone, but it is not advantageous in the long run.

Throughout the analysis of the four networks, a difference in diversity became apparent. Diversity refers to 'how well each group is represented' in the networks. Gephi does not directly calculate a diversity measure. Therefore, this measure was calculated manually through the help of Simpson's diversity index (Simpson, 1949).

According to this calculation, as the diversity index for each network is as follows: 0.79 in the managerial network, 0.76 in the creative network, 0.70 in the political network, and 0.78 in the friendship network. The political network is the least diverse network due to the over presence of politicians (blue nodes).

When we look at the nodes on each network, it is possible to see many overlaps among the managerial, political, and friendship networks' nodes, which is logical considering interviewees picked the actors for the four networks out of one list of names. Yet, it is possible to see a pattern within the distribution. The creative network, on the other hand, had very little overlap with the political and managerial networks. This could be a reflection of the minimal relationship between the actors who are busy with creating novelties and those who expect output. However, these two groups co-exist in social and informal network settings if we again trace the node numbers in the friendship network in the other three networks.

To quantify and verify this insight from the sociograms regarding the overlap of nodes on the four networks, an additional study was performed. In this study, we compared the top ten most central actors of each network to see whether there was any correspondence. Table 11 displays the outcome of this study.

Table 11 presents an overview of the ten most central actors per network; rank 1 being the most central. The professional origins of actors are again colour coded like the network graphs. What is immediately remarkable is that in the managerial network there are no creatives and SMEs (green) and almost no academics (red). In the political network, there are no creative and SMEs (green), academics (red), or NGOs (orange). Also, the creative network does not include any corporate nodes in the top ten most central actors (purple). This means that the diversity measure we talked about earlier becomes a crucial matter for creating inclusive networks where multiple perspectives are shared.

Table 11. Repetition of the top 10 most central actors in four networks

Rank	Creative Network	Managerial Network	Political Network	Friendship Network
1	92	41	28	92
2	39	59	90	28
3	99	42	89	59
4	27	91	71	99
5	19	28	26	23
6	91	70	44	35
7	81	39	41	93
8	54	62	42	62
9	82	23	91	89
10	41	14	48	81

The creative network has a 30% overlap with the managerial network, 20% with the political network, and 30% with the friendship network. If we consider the ranks into this as well, we can see that the creative network and the friendship network are quite connected to each other. This means that being informally affiliated with each other is directly proportional to engaging in creative relationships, to some extent, as the literature suggests (Kratzer, Leenders, & Van Engelen, 2005).

The managerial network, on the other hand, overlaps 20% with the creative network. This is a positive aspect according to the literature because managerial decisions should remain as separate as possible from creative decisions (Kratzer et al. 2007). The managerial network overlaps 40% with the political and friendship networks. This could possibly mean that the local government is highly influential on managerial decisions because the number of government worker (blue nodes) is quite high in the managerial network. Normally, in a business setting, the managerial network is busy with arranging the money flow, deadlines, work-flow, and similar operational tasks. However, projects related to creativity and innovation in the province, whether they are academically oriented or not, are mostly supported by governmental funds. Therefore, the local government runs the majority of such managerial tasks. This might explain the overlap between the managerial and the political networks.

Also, this active role of bureaucracy in managerial relationships explains the limited overlap between the creative and the political networks, which is only 20%. To understand this,

we should go back to Chapter 4 to the explanation of Paradox 2. We argued earlier that the contrasting pattern of work between creatives and managers is one of the greatest paradoxes of innovation. With creative work being iterative, discursive, and process-oriented, it rarely corresponds to the linear and result-oriented expectations of managers who keep track of money flows and deadlines. Therefore, it is common for these groups to alienate each other. Kratzer et al. (2007) suggested that the managerial bodies should have an active but peripheral position that does not interfere with creative processes but guides the process when necessary and brings in know-how to open the network up to new perspectives.

The friendship network overlaps quite highly with all except the political network. In fact, there is only 10% overlap between the friendship and the political networks. This could be interpreted as the distance of the governmental bodies to the actors when it comes to informal relationships. However, the literature suggests that actors that are informally affiliated with each other perform better together (Kratzer, Leenders, & Van Engelen, 2005).

The multiplex analysis provided a holistic interpretation of the impact different relationships have on each other. Now that the independent and multiplex 'reading' of the networks is complete, we will look at how to make better use of these networks in the province and the properties of the network graphs are translated into explanations of the reality in Fryslân, by using these explanations. We call this last step network interventions and through these give a practical opinion on the theoretical outcome in comparison to the propositions to provide feedback on the existing situation regarding the case.

6.3 Forming, Operating, and Benefitting from the Networks

In the previous sections, an analysis of the collected data was presented with the help of the optometrist metaphor. Through the analysis, we examined the social situation in Fryslân from multiple angles and discussed the consequences.

In addition to providing theoretical contributions regarding innovation processes and networks, the aim of this thesis is to help Fryslân answer the societal question regarding the innovative performance of the province, which could also be relevant for other social systems that experience similar issues. Therefore, this section is dedicated to explaining 'what to do' to make effective use of the creative, managerial, political, and friendship networks we

have analysed. The previous section, where we analysed the data, can be understood to be like the lab-work of the patient, whereas in this section we will prescribe a treatment.

The networks cannot be 'treated' only with the results of the analysis because social network analysis measures the status quo of networks. This status quo that was derived from our collected data cannot be used directly as a solution. The sociograms cannot be directly interpreted as 'cutting some of the ties' or 'adding new actors' to solve issues. From Chapter 1 and 2 of this thesis, we know the historical background and current dynamics of the province, and their relevance to innovation networks. To work with the existing networks, the social network analysis has to be considered in combination with societal dynamics. Social network analysis is about creating a set-up for the network by thinking about new people, new relationships, or new layers based on conclusions of the analysis. If the network requires new relationships between far agents, then this new relationship must be maintained by operating the network. Unless they are managed properly networks do not do the work on their own. Eventually, if there are benefits that the networks bring, these must be realised and harvested. In their 2007 book *InnovationNet: the Art of Creating and Benefitting from Innovation Networks*, Kratzer et al. provide a blueprint for using the social network analysis results in forming, operating, and benefitting from networks.

The InnovationNET method goes through the three phases of dealing with an innovation network: (1) NetFormations, (2) NetOperations, and (3) NetExploitations in the book. We will use simpler names for these: (1) forming, (2) operating, and (3) benefitting from networks. The book explains each of these phases and gives insights on necessary actions to be taken to deal with the networks.

Briefly, this method translates the complex process of creating innovation networks into a practical path. The book goes through the case of creating an innovation network for Innovation Process Development in the North of the Netherlands (IPONN), which is an experiment to bring employees of small medium enterprises together in a regional context. After the application of the methodology described in the book, a group of six companies managed to create and run a successful innovation network that led to knowledge creation and profit. Although this method was developed for creating an innovation network in a business setting, the create-operate-benefit structure is highly applicable to the societal setting as well.

Although the book has a straightforward yet scientific approach, the problem Fryslân is dealing with involves a higher level of complexity where multiple layers of networks are functioning together and sometimes against each other. The multi-layered structure of Frisian networks, or any regional setting for that matter, makes the direct application of the method developed by Kratzer et al. (2007) difficult. Therefore, only the methodological structure of the study will be adapted to the Fryslân project.

The InnovationNet method also assesses the healthiness of the networks (Kratzer et al., 2007). At the end of each phase, the favourability of the situation of the networks is indicated with a visual indicator (in the book, it is depicted as a thermometer). An interpretation of the health check indicator will be used to evaluate the situation regarding the networks in Fryslân. To follow up on the metaphor of optometrist we began this chapter with, we will use an indicator for vision health. Just like the thermometer in Kratzer et al.'s book, there are four levels of the vision health check assessment (see Figure 42). The ratings are listed from most favourable to least favourable: no myopia, low myopia, moderate myopia, and high myopia. The health indicator, in combination with the other conclusions, will be used for developing practical advice for the actors in Fryslân.

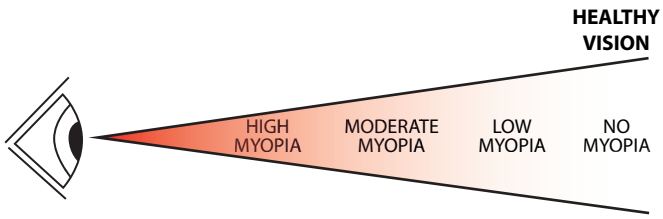


Figure 42. The health-check visualisation for assessing the networks (Adapted from Kratzer et al. 2007)

6.3.1 Forming the networks

Formation of networks is the first step towards setting up a network that function effectively. Building phase of networks is crucial for healthy operation. The InnovationNET method describes this process through three aspects: selection of partners, correspondence of motives, goals and the alignment of partners (Kratzer et al. 2007).

Actor selection is important for a network to function properly and achieve results effectively. Therefore, partner involvement is an essential step that must be taken before engaging in the forming process. In fact, various scholars see partner selection as the most important part of forming innovation networks (Parkhe, 1993; Sorensen & Reve, 1998).

Selection of partners determines the set of expertise and resources that will be included in the group. It is important that the partners have appropriate skills for the targeted field of creation, their role, and the potential tasks they will receive. Zaheer and Bell (2005) add that the skills and resources should be taken broadly here; it is not about the individual skill-set, but also the external set of capabilities that become available to the network through that actor. From lens combination 1 described in section 6.2, we know the creative networks in Fryslân are not large enough to have the necessary skill-set to cover all the fields of innovation in the area. It must be noted that adding as many as possible actors to any network is not the goal of partner selection. In fact, the same lens with the managerial network combination shows that there are indeed too many actors in this network, where straightforward managerial processes should have been followed.

There is plenty of literature that explains partner selection criteria for healthy network set-up. Geringer (1991) divides these criteria into two catedogirs: task and partner-related criteria. Task-related criteria focus on the operational aspects of the process, such as having resources or technical know-how, while partner-related criteria focus on intangible properties of the partner, such as company culture or past associations. Both criteria groups are highly dependent on the goal of the network and the ways of collaboration between parties (Glaister & Buckley, 2004). However, task-related and partner-related criteria are interrelated; therefore, the criteria must be defined prior to partner selection. Larson and Lafasto (1989) add another level to this by mentioning the necessary balance of task and partner related skills in creative teams.

When introducing the growing relevance of networks for innovation, Melkas and Harmaakorpi (2012) state that 'knowledge from different disciplines as well as practical and scientific knowledge should be combined' (p. 2). But the authors also underline that bringing a set of skills and expertise into the network does not mean 'pouring the knowledge in and leaving', as the network has to be maintained. Still, from this perspective, the creative network in Fryslân is doing quite well. The lens combination 2 used in section 6.2 showed us that the creatives and SME actor group (with practical knowledge) and the academics

actor group (with scientific knowledge) are equally engaged in the network. However, the complete disconnectedness of such skills from the political network, where future defining decisions are taken, is problematic.

In order to use relevant skills and expertise effectively, partners in an innovation network need to demonstrate two properties: absorptive and expressive capacity, which together add up to a collaborative capacity (Nooteboom, 2012). Cohen and Levinthal (1990) define *absorptive capacity* as 'the ability to value, assimilate, and apply new external knowledge' (p. 3), whereas *expressive capacity* refers to the ability to send clear messages that trigger understanding.

Larson and Lafasto (1989) bring this abstract description of partner qualities to a tangible level by listing individual qualities in partners that would be beneficial for creative tasks: cerebral, independent, tenacious, and self-starter.

In the case of Fryslân, partner selection cannot be analysed by looking at the networks separately. This is due to the complexity of innovation in an open system (province in this case) but also because of the importance of secondary and informal relationships in Fryslân. Although these relationships have a less direct relationship to innovative output, they have high influence on collaboration between actors, which relates to the social capital theory.

The InnovationNET book also refers to social capital theory to explain the links between multiple networks. *Social capital* is defined as 'the impact of acquiring those resources inherent in social relations, which facilitate collective action' (Garson, 2006, p.1). Kratzer (2001) suggests that social capital at the personal level also has an impact on social capital at group level. Kratzer takes this as a positive impact, since he is talking about creative groups. But when it comes to the managerial network, social capital does not necessarily have a positive influence at the group level. The multiplex analysis presented in the previous section, where we presented the overlap between the most central actors of the four networks, is a good starting-point for understanding this. The idea here is that since social capital refers to actor centrality, if social capital on the actor level has an impact on the group level, then the overlap must be high. However, the analysis showed that the highest overlap is between the political and managerial networks, which can be explained through the power structures that have an impact on decision-making processes. These two networks together are overruling the creative and friendship networks. The creative and friendship networks also have a relatively

high overlap, which means that actors are engaging into creative projects with the people they are informally close to. These networks must be encouraged to be opened up to avoid blockages that derive from lack of external skill-sets.

Rogers & Shoemaker (1971) state that innovation processes recognise two major types of decisions: authority decisions and collective decisions. Authority decisions should have a supportive role for collective decisions. In a corporate setting (as the case in the InnovationNET book), authority decisions primarily refer to managerial relations who have a higher place in the hierarchy of the organisation. However, as we mentioned earlier, in Fryslân, authority decisions primarily belong to the government. The occupation of governmental actors in the political network may not be surprising since political relationships are easily linked with actual politics; yet, this means that actors who are responsible for collective decisions are also the ones responsible for authority decisions. It would be advantageous to separate these, for example, through involving the audience that the decisions concern in the decision-making processes in a co-creative manner. We will come back to the practical advice regarding the findings of our analysis later.

Since Fryslân is a province, there are two organisations from which the blue nodes originate: the provincial government and the municipality. Both of these are well represented with a balanced distribution throughout. From a political perspective, this could be a positive departure point because it means that local governments are visibly collaborating with each other, and their influence is recognised by other sectors.

As mentioned in the first chapter, the historical and political background of the province has established a strong local identity that enables strong, friendly relationships between residents. Our assumption that friendship is a powerful source of information flow in this study was apparent from the density measure of the friendship network. The power of the friendship network for the provincial dynamics is supported also with the presence of all actor groups in the network. Therefore, selection of the partners regarding the friendship network can be considered a good start.

To summarise the findings that we have obtained by combining literature and the analysis described in section 6.2, an assessment of the status of all four networks regarding the selection of partners is presented through a vision health check. According to this, the creative and political networks present low degrees of myopia because of the under-presence of

certain actor groups and the size of the creative network. The managerial network is rated with high myopia because of the over-presence of all actor groups and the general scale of the network. The friendship network shows no myopia (healthy vision) with the balanced presence and distribution of all actor groups.

The second aspect of the network formation phase is motive and goal correspondence among partners. In open systems, parties involved in innovative projects can have different expectations of output from the same process and sometimes even contradicting expectations. The innovation process owes its complex nature to these diverse objectives. Emden et al. (2006) note that, in a healthy network, goal correspondence is essential for success. However, goal correspondence does not necessarily mean that all partners of the process need to meet at a single aim, it mainly means that the primary goals should not conflict with each other. Yet, it would be utopic to expect a conflict-free environment in a large-scale open system.

Conflict arises from disagreement and causes partners to take sides: 'The difference in opinions and perspectives among members of innovation teams in the process of systematic variation of problem solutions is defined as polarity' (Kratzer, Leenders, & Van Engelen, 2006, p.4). The literature suggests that polarity in creative teams can be beneficial for the output, especially when introducing new concepts and resources. However, disagreement is a risky subject in general for creative networks as it has a negative association (Kratzer, Leenders, & Van Engelen, 2006).

Measuring motive and goal correspondence in an open system through a single network graph is challenging. Therefore, we will look at the system as a combination of all four networks and look at the overall polarity of actors. To do this, we will use a graphical display (see Figure 43). As mentioned earlier, Gephi provides multiple layout algorithms. From these, the OpenOrd algorithm shows the polar sides of networks by separating groups with similar relationships from each other. We can interpret this as the groups who agree with each other and not.

In Figure 43, we can see that the actors are clustered in two groups with a few in-between actors. It is not possible to speak of a certain actor group that decided to stick together. However, the more central actors (larger nodes) are located in the left group. In such a situation, the conflict can originate from various topics. According to this graph, there might

be a certain conflict between governmental actors, since central actors were separated into two groups. The actors that are aligned on the inner edges of the two clusters can be understood as the ones that have the lowest degrees of conflict. Here we see that these actors primarily originate from corporates, government workers, and NGOs. These groups, if coordinated accordingly, can play a catalysing role between the two sides of the conflict.

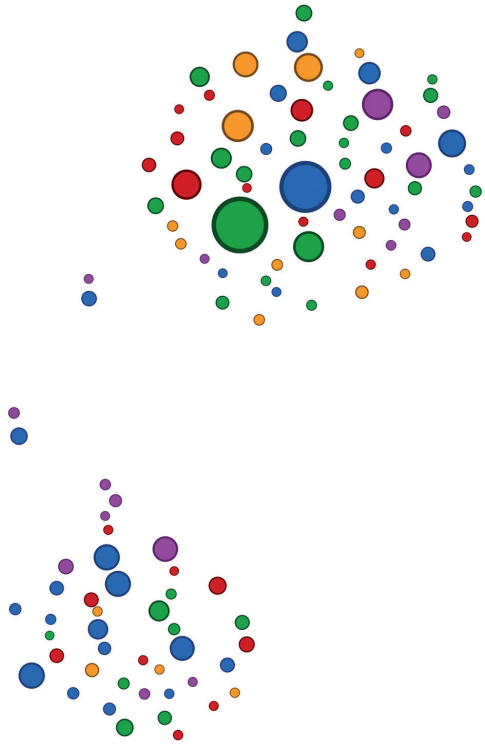


Figure 43. Clustering of all actors

Motivational development and commitment of partners, especially on non-managerial levels of an organisation, can benefit highly from key individuals (Zboralski, 2007). Since these gatekeepers or brokers enable the information flow between the otherwise disconnected parts of the organisation, it is important to utilise them in linking.

Kratzer et al. (2007) identify four possible motives for partners to join the network:

- Reducing risks through sharing resources: the high risk of failure at the early phases of innovation process
- Increasing innovative and collaborative capacity embedding innovation in organisational culture
- Infused external knowledge: the approachability of new skill set and knowledge that is otherwise unavailable to the organisation
- Organisational learning: creating conditions to enhance the ability to learn

Sharing this strategic vision that is referred as 'strategic alignment' in the InnovationNET method, is the third and last aspect of the formation of networks (Kratzer et al. 2007). Glaister and Buckley (2004) write on the necessity of partner alignment in creative teams as the most important step. Even if the individual goals for joining the network differ, the partners must be aligned strategically in the long-term.

Kratzer et al. (2007) define four additional types of alignment:

- **Technological alignment:** the technical capabilities and knowledge resources of the partners
- **Relational alignment:** the cultural values and characteristics of partners
- **Cooperative alignment:** the confidence and trust between partners
- **Commitment:** the involvement of the managerial and creative groups within the partnering organisations

When we layout the four networks with the same algorithm as we did in Figure 44, we can get an idea about on which subjects the actors do not align.

According to the separated graphs in Figure 44, although all networks have a certain degree of conflict, the misalignment mostly occurs on the managerial network. This corresponds to the commitment alignment from the four types Kratzer et al. (2007) describe.

In the managerial network, there are three distinctively separate clusters each with a few highly central actors. The exact origin of the misalignment should be discovered in every network. But, the conflict in the creative network is the most dangerous one for innovation systems, as it makes it impossible for actors to engage in creative processes together. The intuitive nature of creative relationships is more vulnerable to misalignments (Shalley, 2003).

In the political network, there seems to be no conflict within the current political environment at first sight. However, the political network shows the two most central actors (largest nodes) on opposite sides. This suggests a disagreement between the two actors with high political powers that has not caused a distinctive grouping of the whole network around them yet. Also, it must be noted that political networks have the potential to change rapidly with time-based dynamics, such as elections.

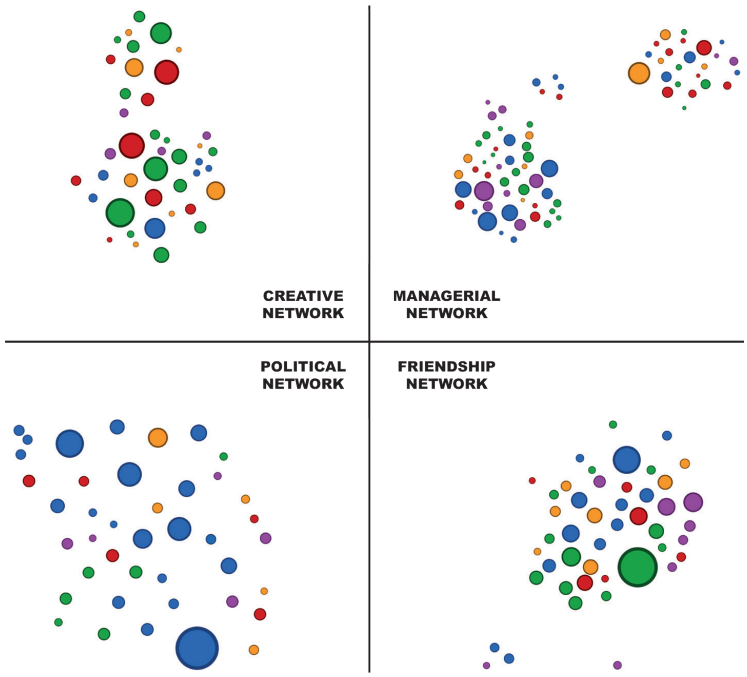


Figure 44. Comparing clustering of all four networks in Fryslân

In conclusion regarding 'forming' networks, it is essential to achieve a successful partner selection, optimise conflict, and facilitate solution-oriented approaches in all four networks. Regarding the formation of Frisian networks, we see that the friendship network is the only network that is not problematic. The power of being 'friends' in Fryslân was previously explained building upon expert interviews. High network density in combination with well-connectedness demonstrate that it is possible to use the power of this network to solve conflicts and enhance the output of other networks. We will come back to this in Chapter

8. Based on the overall discussion, the healthiness of the four networks in partner selection, motivation and goal correspondence and alignment are assessed in Figure 45.

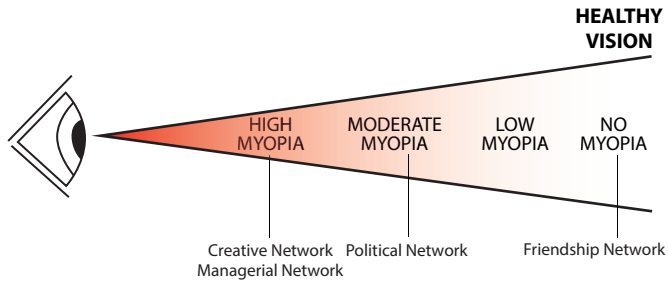


Figure 45. Healthiness of Frisian networks regarding the 'formation'

6.3.2 Operating the networks

Operating the networks is maybe the most crucial part of for the study on Frisian networks because how the networks function in their current state is one of the major points of attention of this study.

A properly operated network means that the network is in a balance where actors are stimulated enough to achieve success. Naturally, certain network measures that identify the level of collaboration between the actors have influence on this (Kratzer et al., 2007). The InnovationNET method defines three main aspects regarding the operation of networks: frequency, centrality, and segmentation.

Scholars take a critical approach towards frequency of relationships in groups that are engaged in creative relationships. While performing creative tasks where collaboration may last long and drag the partners to the point, there is very little left for sharing. Nooteboom (2012) claims that there is an optimal duration to such a relationship, which they define as:

..long enough to bring cognitive distance down to an optimal level, but not beyond that, to too little distance, stating that this principle is broken when the relationship is not exclusive, when both sides of the relationship also engage in other, non-overlapping partnerships, whereby both sides are rejuvenated with new knowledge from mutually unconnected outside partners. This in fact, relates to Burt's (1992) well-known principle of 'bridging structural holes (p. 22).

Frequency was also used in the previous section as one of the perspectives of analysis (frequency lens from the cabinet). There, it was concluded that the creative network in Fryslân does not have enough frequency to create 'emergence'. Since frequency refers to how often a relationship occurs and defines the strength of these ties based on that, our approach was an alternative one, since we did not include the 'how often' data in our analysis. Instead we looked at the reputation of the actors and defined how strongly they are connected to the network. To understand the strength of the connections, we can have a look at the weakly connected actors in all four networks together (see Figure 46).

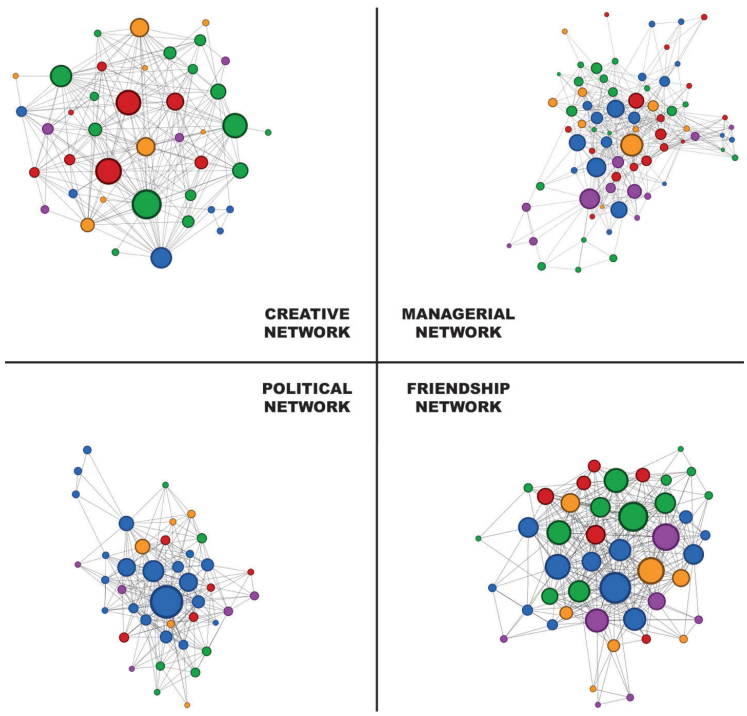


Figure 46. Weakly connected actors in all four networks

In the Yifan Hu (2017) algorithm used to create the graphs in Figure 46, outliers are defined as the weakest connected nodes that are separated around the more central group. We can see that the managerial network has the most outliers (22 actors), followed by the creative (13), friendship (10) and political (6) networks. However, percentage-wise, the creative network shows a more problematic situation due to its small size. As explained in section

6.2 under lens combination 10, this network has an outlier percentage of 30%. It must be noted that the creative network involves many actors who are alone in their businesses, such as artists, freelance designers, or researchers, and this could be the reason behind the high percentage. The reason behind this high outlier percentage can only be understood through further observation of the creative network because weak ties provide many opportunities for the network, as strengthening them will contribute to the performance of the network. Burt (2004) argues that the structural holes, the gap created by weakly connected ties, in the network play a large role in the emergence of novel ideas because they carry the potential to make new connections. Although structural holes suggest disconnectedness, innovation systems rich in structural holes offer a lot of opportunities for new ties (Cooke, 2011).

Granovetter (1973) has a different approach to strong ties and weak ties in networks. Unlike Jarvensivu et al. (2012) suggests, the strength of a tie is not only defined by the frequency, but it is 'a combination of the amount of time, emotional intensity, intimacy, and reciprocal services that characterise the tie' (Granovetter, 1973, p.1361). Many scholars believe that the strong relationships such as family ties or friendship are easier for innovation because they naturally come with goal correspondence, motivation, and trust. The actors who are engaged in such relationships are more likely to work together better. According to Granovetter (1973), however, having weak ties, or simply being vaguely acquainted, is more fruitful for innovations, because as distant two individuals gets, they are likelier to share novel information. In addition, since closely related actors tend to share a common base of knowledge, it is difficult for them to combine complete each other's skillsets, which is necessary for innovation to emerge (Schumpeter, 1934). In Fryslân, as concluded in lens combination 6, the density measures heavily differ between networks (see Figure 47).

The creative density is very low, and visually the graph looks almost empty. When looking at the creative network, it is possible to point out the checksum of the problem statement of this research. When we are looking at the innovative output through the lens of social networks, the creative network is supposed to provide the output. Although having high network density does not immediately mean productivity, it is not possible to expect output in a creative network where information flow is limited. The fact that the network density is the lowest among all four networks of Fryslân shows the relevance of this research and the network approach that was adopted.

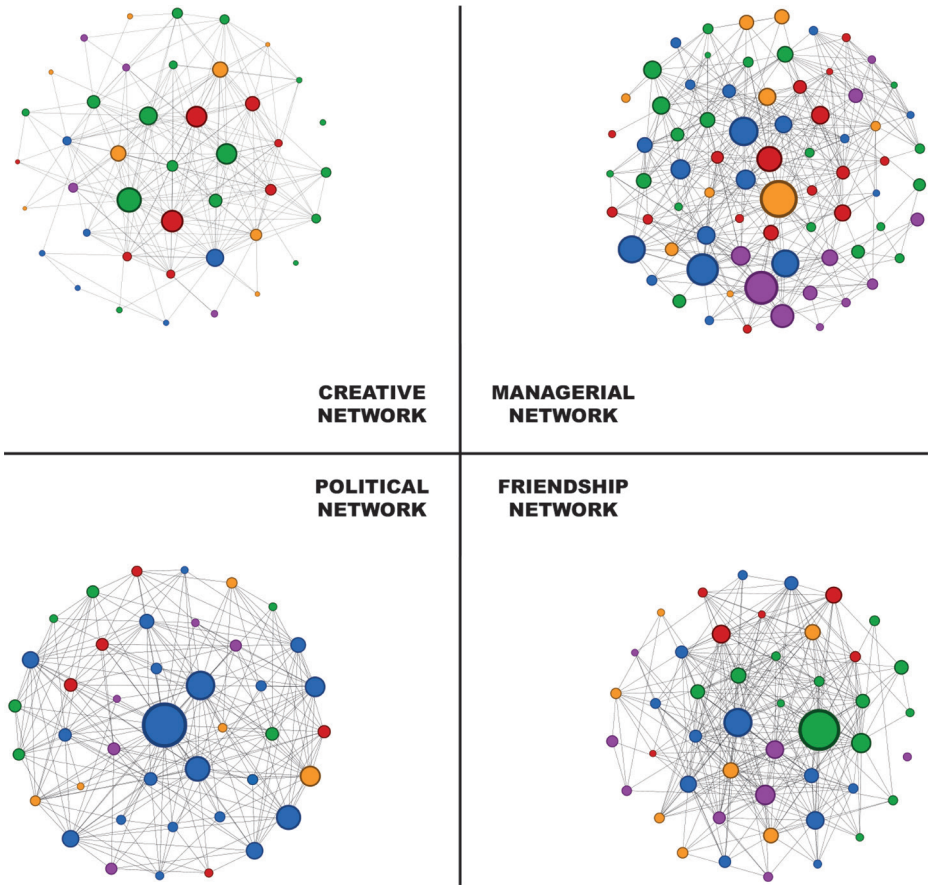


Figure 47. Comparative density of all four networks

Since creative output is expected from this network, a low-density value simply means 'not enough is happening' in terms of knowledge exchange and collaboration. In Chapter 1, we mentioned that young generations give the 'nothing is happening' reason for leaving the province when the time comes. In an ideal innovative environment, the creative network should be densest; therefore, this is a negative property of the Frisian innovation system. The reasons behind this situation could be two-fold. One option is that the density is low because knowledge exchange is happening but always between the same nodes; therefore, the density is not expanding. Or the motivation of creative relationships has been damaged by the unrest in the other networks, as Amabile (1998) argues.

Observing the other three network graphs (and talking to experts later on) shows that in Fryslân both theories apply, and, in fact, these two reasons go hand-in-hand. First, due to the unclear authority structure in the managerial network, which is apparent from its size and density and the high centrality of the political network, there is a lot of pressure on the creative environment in the province. Second, creative partnerships in Fryslân tend to repeat themselves because once a connection is made and is successful; it is much easier in this demanding environment to repeat an existing relationship than to form a new one. This causes the creative relationships to remain in the comfort zone and creates a low-density network that is closed to outsiders.

On the other hand, we mentioned that the managerial network shows a high density in Fryslân. However, within the managerial network this might not be beneficial. Managerial relationships represent a hierarchy and a linear flow of information. According to Kratzer et al. (2007) the moderate involvement of managers is preferred, especially at the starting phases of projects. Next to the density, the number of actors in the network is also problematic. Management requires centrality that defines the power structure. The fact that the managerial network has almost double the number of nodes as the other networks could be a sign of an authority gap where roles and expectation are not clear enough.

Network centrality is the second aspect of the operation of networks in the InnovationNet method. Olson (1965) suggests with the collective action theory that the existence of a power mechanism will help control the output; therefore, centrality is a necessity. But from a network perspective, Ibarra (1993) states that network centrality is a predictor of managerial, creative and political involvement. Ibarra argues that in managerial networks, centrality can be crucial for decision-making. However, that does not apply for creative tasks. Creative relationships typically do not represent a hierarchy and the flow of information is cyclical. Many scholars are against the collective action theory when it comes to complex, creative tasks in which collective action feeds creativity and argue that the hierarchy originating from centrality is not beneficial (Reuben, 2003)

According to Ibarra, maintaining a central position in a network is a sign of being influential. Social capital is simply defined as individual's connections that provide advantage within a group by OECD (2007). Since degree refers to the number connections of a node, this value can be related to social capital at group level. On the other hand, the attribute refers to perceived importance of a node, which is related to social capital at personal level. This is a

positive property of this network. Creative relationships typically do not represent a hierarchy and, therefore, in a favourable creative network, node sizes remain comparable.

According to Kratzer et al. (2007), the moderate involvement of managers is preferable for creative output. The peripheral positioning of actors responsible for managerial tasks, such as government workers and corporates that represent directory roles, fits Kratzer's description that states: 'the involvement of managers should be moderate and at a level where processes can be assessed and intervened when necessary' and in addition 'leaders having a peripheral position'.

This statement cannot be applied to every network. Managerial and political networks consist of relationships that are responsible for handling operational matters to help the output of the creative network. These operational matters are often straightforward tasks that make sure things happen on time and enable capital flow. Leadership is essential to such decisions and their effective development. Therefore, such networks should recognise a high centrality, where the 'people in charge' have central positions. This is indeed the case in the political network in Fryslân but not the managerial network because the managerial network is too fuzzy with only a few central actors. A useful approach could be to encourage the power holders in all networks to take the initiative and lead in bridging of the far corners in the complete system by using the existing connections they have.

The third aspect of benefitting from networks in the InnovationNet method is network segmentation. Segmentation can refer to a variety of different dynamics in a network. It could mean fundamental disagreements and, therefore, actors are not interacting at all, or it could simply mean that there are sectorial or geographical differences that limit their interactions.

In Figure 48, the network graphs were laid out with OpenOrd algorithm of Gephi to show the node clusters. In the case of the creative network, we see two clusters that are not completely separated. In fact, there is a gatekeeper (the purple node from corporate actors between the two clusters) that is the connection point of the two groups. In fact, the complete set of corporate actors (purple nodes) in the graph is aligned on the touch point of the groups. NGOs in Fryslân also appear to have a linking position between other sectors. This puts them on a gatekeeper status, where information flows between groups are dependent on this group. This means that the corporate actors in the province have the potential to play a catalysing role between the creative groups and the NGO actors (orange nodes).

The literature also points out that polarity is an important factor of innovation success; teams that agree on everything are less successful than those who fight sometimes (Kratzer, Leenders, & Van Engelen, 2006). However, the study also states that careful management of disagreement and encouragement for agreement is necessary. In a start-up situation like Fryslân is involved in, such a delicate situation can be dangerous because, at the moment, there are no intermediaries that are central or influential enough to manage polarity between those who are engaged in creative relationships.

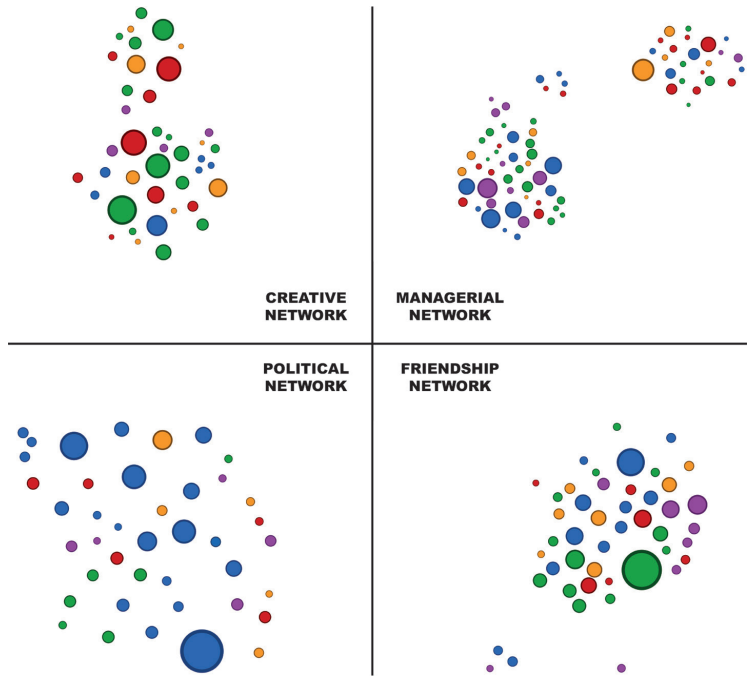


Figure 48. Comparative clustering of all four networks

The managerial network shows multiple clusters when we look at the graph in Figure 48. The clusters mainly originate based on profession groups, identified by nodes colours. Only the orange nodes that represent NGOs in the province are well distributed. This can be explained by the intermediary role of such organisations in Fryslân that bring government, academics, and creatives and SMEs together through collaborations. The clustering contrast between the managerial and friendship networks is remarkable. This contrast relates to the

contrasting characteristics of relationship. Friendship is highly informal, non-hierarchical, and has less direct influence on the innovation process, whereas the managerial network is highly formal, very hierarchical, and directly influences the innovation process.

Although too high centrality is not a preferred property of creative networks, having a few connecting nodes is handy for information flow. In Fryslân, it is possible to see on a daily basis how this connectedness helps people to reach each other through the central nodes. There is an especially clear need for bridging between certain node groups.

Another reason for segmentation can be physical proximity. Knowing that the creatives and SMEs at the larger cluster in the creative network originate from the Blokhuispoort, the creative hub of Leeuwarden, whereas the green nodes of the smaller cluster are independent artists who do not have a regular location, the groups hardly ever interact. Kratzer et al. (2007) state that 'at the start-up face-to-face communication should be highly prominent' in order to get to know each other and create a familiarity in communicating with each other. Considering Fryslân as a starting up innovation network, by looking at Figure 48, it is possible to say that the existence of a creative hub that allows face-to-face communication would be highly beneficial at this phase. However, it would also be advantageous to create additional opportunities provided for the rest of the network to get connected to these hubs.

The operation of Frisian networks shows signs of problematic development. Considering the low frequency of networks that are supposed to be frequent, the high centrality patterns in several networks that suggest a strong hierarchy, and finally the clustering of networks that suggests disconnectedness between different parts of the same network, the health of the operations phase is assessed in Figure 49.

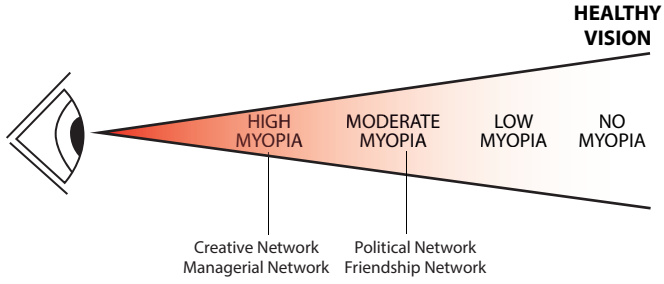


Figure 49. Healthiness of Frisian networks regarding the 'operation'

6.3.3 Benefitting from the networks

The networks that are formed and successfully operated must also be utilised for the system to benefit from them (Kratzer et al., 2007). Utilisation of networks refers to the continuity of innovation in relation to learning according to the InnovationNet method. The innovative output achieved by applying the previous two phases of forming and operation must be consistently carried out for the continuation of success. The methodology defines network learning as the crucial element of benefitting through carrying out an assertive learning cycle, sustaining motivation, developing a method to 'learn how to learn', and making 'learning' the central goal of the network.

This takes us back to the Chapter 1 of this thesis, where Deaton's (2013) arguments on the 'prosperity of regions' were explained. Deaton (2013) saw the 'chance to prosper' as the ultimate aim of socio-economic development of regions. A successful innovation network does the same by triggering an ever-growing cycle of learning of actors, which is beneficial for the regional development in the long-term.

Network learning is introduced under various other names such as diffusion, utilisation or valorisation in innovation studies. However, social networks' role in promoting the learning of innovation networks is commonly used more as a vague metaphor than an analytic concept. Nooteboom (2012) states 'organisations that are striving for innovation must not only focus on short-term practical use of the results, since this would kill the goose that lays the golden eggs', and focus on benefitting from these networks in the long-term as well' (p. 24).

Researchers agree on the fact that learning is a social process that consists on multiple cycles. Shortly stated, the two main cycles of learning are acquiring competences and achieving long-term development (Nonaka, 1991). Innovation networks must sustain both cycles simultaneously and support the learning process holistically (Bessant & Tsekouras, 2001). The only way to do this is to learn from each other and develop together by creating an open innovation network.

The necessity of openness of innovation networks was discussed in Chapter 2. Especially, the historical development in Fryslân that created an isolated character, and the closed-like structure of major industries such as agriculture, form the base of the arguments regarding the necessary openness. To understand how close the four networks of innovation in Fryslân

are, we can use some of the lens combinations from section 6.2. The first is the size of networks (see Figure 50).

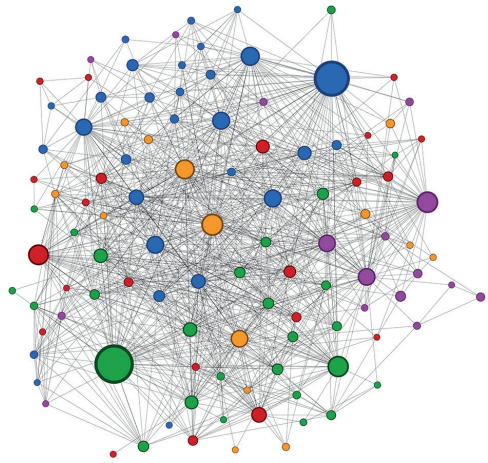


Figure 50. Hierarchy among actors in Fryslân

While looking at the size, we will combine all four networks that were analysed together. As mentioned in 6.2, from the main sample list of 232 actors, only 109 were connected. The remaining 123 actors, despite the fact that they were listed as important actors of innovation in the province, were not active in any of the creative, managerial, political, or friendship networks. Disconnected actors means unused potential. Each potential connection includes a new skill set, which could eventually be useful for the network. An actor must never be considered alone, since an actor gets connected with undiscovered networks that come along. Therefore, the network misses out on an even wider skill set. Fryslân needs to open up and develop a strategy for engaging the disconnected actors. This will require both a personal and a collective understanding of how opening up will provide collective benefit in the long run.

In innovation networks, many decisions are taken behind closed doors. From the perspective of the creative network, the reason behind the closed character (deduced from the small size) could be related to the financial or reputational difficulty of achieving success in creative projects because sharing creative ideas with new actors could mean sharing the funds for the projects as well. Thus, actors prefer not to take the risk. When we look at the size

and diversity, the only network that enables constructive sharing of ideas is the friendship network.

This 'sharing of resources' issue came up in multiple discussions in Fryslân. Since only a certain amount of governmental funds are available for innovation, the creatives & SME actor group and the corporates group are fighting for the same resources. This fight is not a direct one, but it takes place on a political level. Based on the network graphs in Figure 51, it can be seen that corporates are more likely to benefit from these resources compared the creatives & SMEs. As we can see, politicians (blue nodes) are in close contact with corporates (purple nodes) who are the only ones that were let in the central circle, while the corporates are very poorly connected to all the other networks.

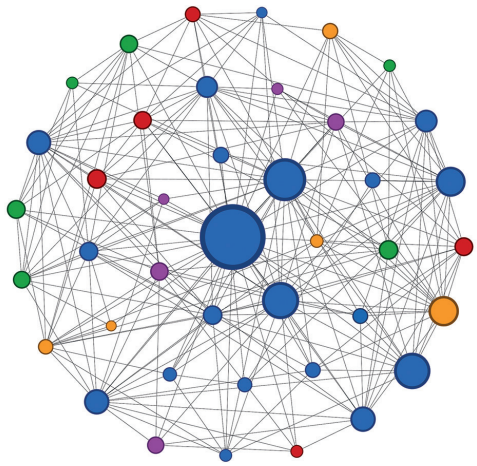


Figure 51. Hierarchy in the political network in Fryslân

The fact that creatives & SMEs are not well represented in the political network graph shows that the creative influencers are not let in the decision-making processes over matters that have an impact on their performance in the first place. The exclusion of creatives can form a discouraging atmosphere as suggested by Havelock (1970) in his theory of starvation of innovation. According to Havelock (1970), there are social relations, social roles, and hierarchy that have a negative effect on innovation systems.

It is important for each network to represent all professional groups to be able to facilitate all opinions. But as Kratzer (2001) suggests, there is an optimum level of involvement for each professional group in each network. This is highly dependent on the expectations out of a network, which can differ heavily due to the complexity of innovation processes. Networks in Fryslân must first of all understand the expectations of existing actors before trying to expand the networks. With the managerial network, in particular, where there is no clear authority figure regarding managerial tasks, the size of the network suggests the necessity of understanding the expectations of the actors.

Finally, the issue of network size relates to another problematic point other than the openness of networks: the sustainability of networks. Kratzer et al. do not include this aspect in the InnovationNET method, probably because of its low relevance to business settings. Since actors are not open for sharing ideas and involving new actors in existing projects (especially in the creative network), the knowledge that is created around these projects remains unshared. Because of this, knowledge development in the province does not present the cumulative growth it should. Practically, this means that if an actor decides to step out of a position, the collected knowledge will disappear along with him/her, since it has not been shared. Therefore, the knowledge must be collectively preserved and not be dependent on single actors.

In conclusion, the creative network is not functioning as open of a structure as it should, and the political network is not supporting the creative network through its transformation towards an open network. The friendship network is less problematic due its relatively large scale and diverse character. The managerial network, on the other hand, is in complete chaos with its size, density, and diversity. Therefore, benefitting from networks is assessed in Figure 52.

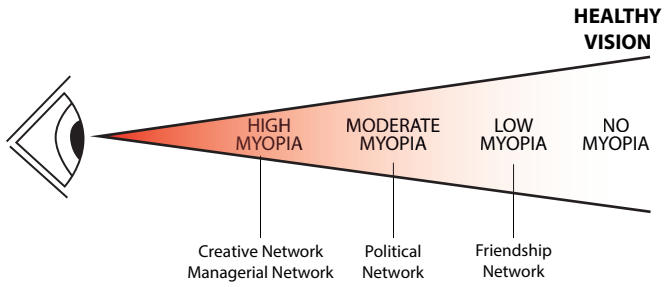


Figure 52. Healthiness of Frisian networks regarding the 'benefitting from networks'

6.4 Conclusions on the Analysis

In this analysis, first we have tried to understand the current social situation in Fryslân by looking at the social networks. Fryslân is trying hard to develop an innovation ecosystem with various projects but the desired results are still not available. In Chapters 1 and 2 we have argued the closed-like structure of the provincial systems that suppress the creative environment. In Chapter 6 we have tried to see if social network analysis can help achieving the societal goals.

However, networks display loads of information at the same time. The possible combinations of network measures, networks, actor groups and levels of analysis are endless, which makes the explanation of a simple procedure very complicated. To do this, we have used the metaphor of an optometrist who examines eyesight by making the patient look at a chart through various lens combinations. Finding the meaningful 'combination of lenses', which is a combination of perspectives we can adopt while looking a network graph, helped us to visualize the problem. The first step towards understanding this was to see where the blockages were by reading the network graphs.

Through these graphs, we came to several conclusions. Later, we used the InnovationNET method from Kratzer et al. (2007) to describe how to tackle the blockages we found in the analysis. Here we will summarize the conclusions regarding the overall status of the networks.

The networks in Fryslân are very compact. We found that not even half of the possible connections are realised (109 of 232). Specifically, the creative network that is expected to provide innovative output is the smallest of all networks. This suggests that Frisian networks are not open enough for external knowledge and miss on a large part of the skill set that would have been beneficial for the province. The actors from different professional groups must work together to define the missing skills and the missing parts of the networks to match the needs to opportunities. This is referred to as a low absorption capacity in the literature (Cohen & Levinthal, 1990).

The only relatively large network is the managerial network, which is not necessarily a good thing. The managerial network consists of almost double the actors compared to the other networks. This points to a lack of hierarchy, a required element for the decision-

making process in managerial networks, or perhaps a lack of consensus in the matters to be managed.

Not only are there not enough actors involved, the actors that are involved are also weakly connected. This suggests that the density of the networks is low, which could be caused either by the disconnectedness of actors or the repetitions of the same relationships. Either way, the actors in the network do not share enough, which further suggests an unwillingness towards risking capital resources by sharing ideas with others. Implementing policies that give a certain secure feeling would encourage connections and knowledge sharing, especially in the creative network.

The political network has a relatively low issue regarding density. Having frequent interactions could be a favourable network property in the case, considering that high-density measures suggest that, despite the hierarchical nature, there is an ongoing political discussion and the co-creation of solutions is present. However, the rather segmented structure with two central nodes on opposite sides suggests a disagreement.

Diversity is another measure that was taken into consideration when checking if all actor groups were presented enough in the networks. The political network is the most problematic network in this sense, since there are very few actors who are not government employees. The few remaining actors from other professions are in the periphery and do not seem to have an active role in the decision-making or lobbying. However, the corporate groups have a few highly central actors. Actively engaging creatives and SMEs, academics, and NGO representatives in political discussions could resolve this imbalance.

In addition, the low representation of corporate actors in the creative network shows a disconnection between dominant professions in the creative network such as creatives and SMEs and academic actors. Common ground can easily be found between these groups to share ideas on innovative output. The dense friendship network where the representatives of each three groups come together suggests that the potential of this network can be used more efficiently.

Remarkably, in contrast to the expectations, the water industry, which is one of the internationally successful sectors of Fryslân, did not occupy an influential position in any of the networks. The potential reason behind the exclusion of these networks is brought up

during the expert rounds to be explained in Chapter 7. Also, the reflection on the scope of the research and the sample size of the networks based on the scope are discussed in the concluding chapter of this thesis.

Finally, we have concluded based on Kratzer et al. that creating a healthy system goes through three phases with different characteristics: forming, operating, and benefitting from networks. These phases must not be understood as a linear structure that evolves chronologically. On the contrary, the cyclical nature of innovation enables simultaneous development of each phase. Each phase was given a healthiness score on a vision health indicator scale.

In this section, we have concluded that due to size, density, and inclusiveness of the four networks, the formation of creative and managerial networks was identified to be in critical condition, while the political network was moderately critical, and the friendship network was not critical at all. The operating phase was identified as the most unsuccessful phase with lowest health scores. Due to connectedness, the number of weakly connected nodes, and reachability, the creative and managerial networks were scored with low health, while the political and friendship networks scored a little better. In benefitting from networks, the creative and managerial networks were again identified as being in critical condition based on the openness of the networks, the density, and the ability to sustain knowledge, while the political network was a little less healthy, and the friendship network showed only small signs of unhealthiness. The summary health scale in Figure 53 shows the overall scores of all phases per network.

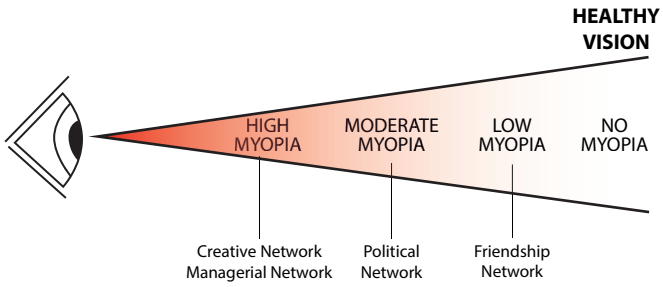
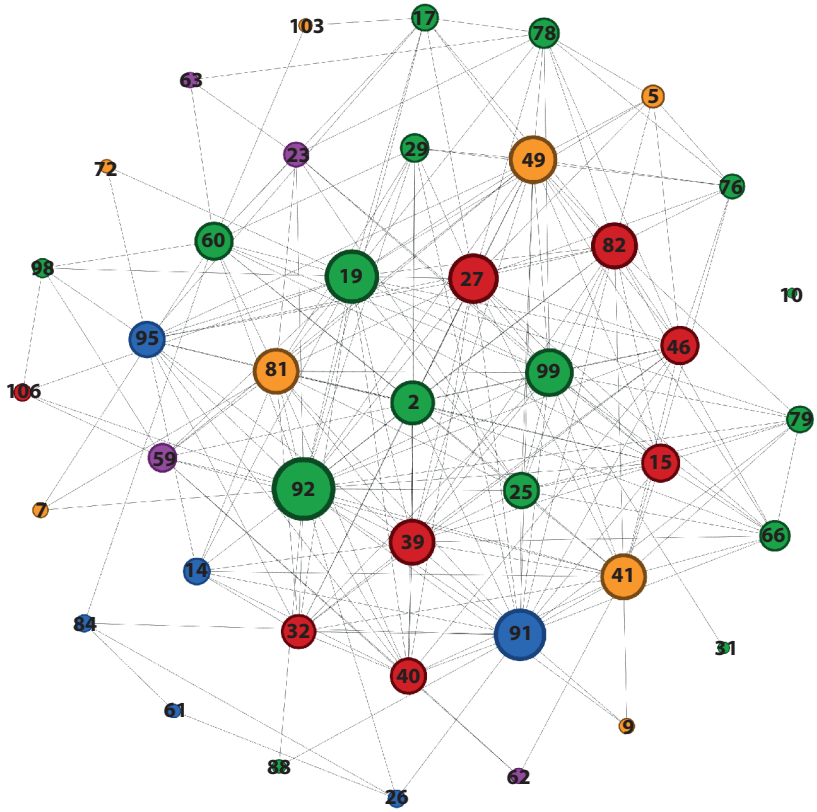


Figure 53. Overall healthiness scores of Frisian networks

The health-check on forming, operating, and benefitting from networks in Fryslân has concluded that, generally, the networks are not doing well. In Chapter 8, a series of recommendations on how to improve the health of the networks will be presented. These suggestive measures focus on the specific actions actors can take as soon as possible.

After identifying the outcomes of the research, the analysis was presented to selected experts and the findings were discussed. In the following chapter, a summary of these expert rounds will be explained. The expert rounds provided validation for the results gathered in the study. In addition, the following chapter will relate the previously formulated propositions based on the literature reviews in Chapter 3 and 4 to the findings of the SNA in Fryslân. The idea here is to see if the propositions from the literature apply to the case of Fryslân, and provide scientific contribution to the field of innovation by comparing business-management related literature to findings from a regional innovation system.

CREATIVE NETWORK



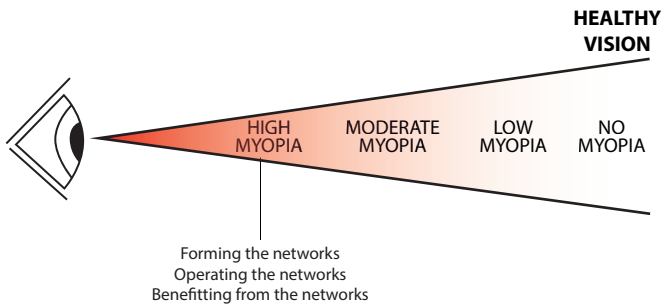
Number of Edges	229
Number of Nodes	42
Nodes from Academia	10
Nodes from Government	6
Nodes from NGOs	7
Nodes from Creatives & SMEs	15
Nodes from Corporates	4
Average Degree (connectedness)	10.905
Network Diameter (distance)	4
Graph Density (frequency)	0.266
Modularity (segmentation)	0.185
Average Clustering Coefficient	0.689
Average Path Legth (efficiency)	1.896

ACADEMIA
GOVERNMENT
NGOs
CREATIVE IDV. & SMEs
CORPORATES

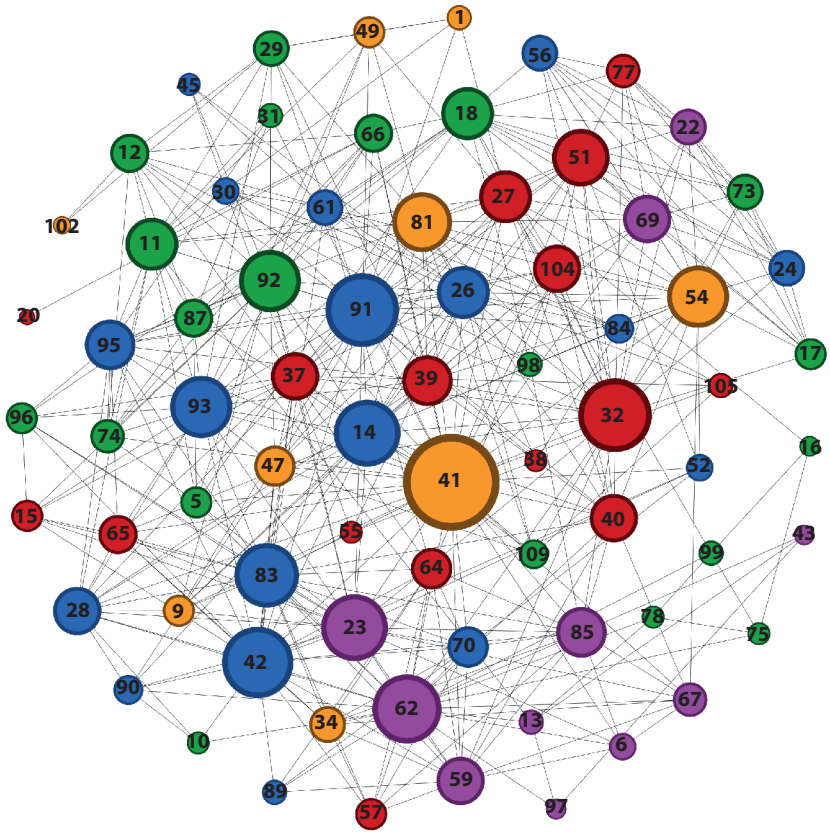
NODES
NODE DEGREE
EDGES

CREATIVE NETWORK

THEORETICAL OBSERVATIONS	PRACTICAL IMPLICATIONS
Creativity emerges from interactions, therefore a dense network is essential for output. (Albrecht and Ropp, 1984)	Low density of creative relationships shows either the presence of individual attempts or repeating relationships.
Individual attempts are less succesful. (Olson, 1965)	Once a collaboration achieves positive results, the non-risky path of repeating this relationship is preffered, whereas innovation is about taking risks.
Selection of partners determines the set of expertise and resources that will be included in the group. (Zaheer & Bell, 2005)	Network diversity is low. Creative ideas flow within and between academia and creatives & SMEs. NGOs, corporates and government remain as outsiders.
Practical and scientific knowledge interests should be combined. (Melkas and Harmaakorpi, 2012)	With the exclusion of actors with organisational knowledge, the practical skill-set is missing which is essential to achieve success in innovation.
Increasing the collaborative capacity is essential for increasing innovative output. (Kratzer et al, 2007)	Actors who are involved in taking managerial decisions should have a peripheral role for supporting creative output.
Relationships should exist long enough to bring cognitive distance down to an optimal level, but not beyond that. (Jarensivu, 2011)	



MANAGERIAL NETWORK



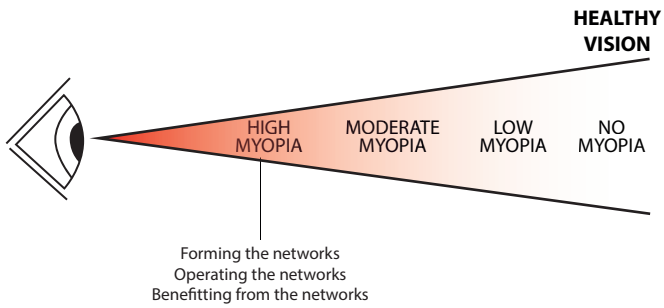
Number of Edges	428
Number of Nodes	74
Nodes from Academia	16
Nodes from Government	18
Nodes from NGOs	9
Nodes from Creatives & SMEs	20
Nodes from Corporates	11
Average Degree (connectedness)	11.568
Network Diameter (distance)	4
Graph Density (frequency)	0.156
Modularity (segmentation)	0.375
Average Clustering Coefficient	0.604
Average Path Legth (efficiency)	2.197

ACADEMIA
GOVERNMENT
NGOs
CREATIVE IDV. & SMEs
CORPORATES

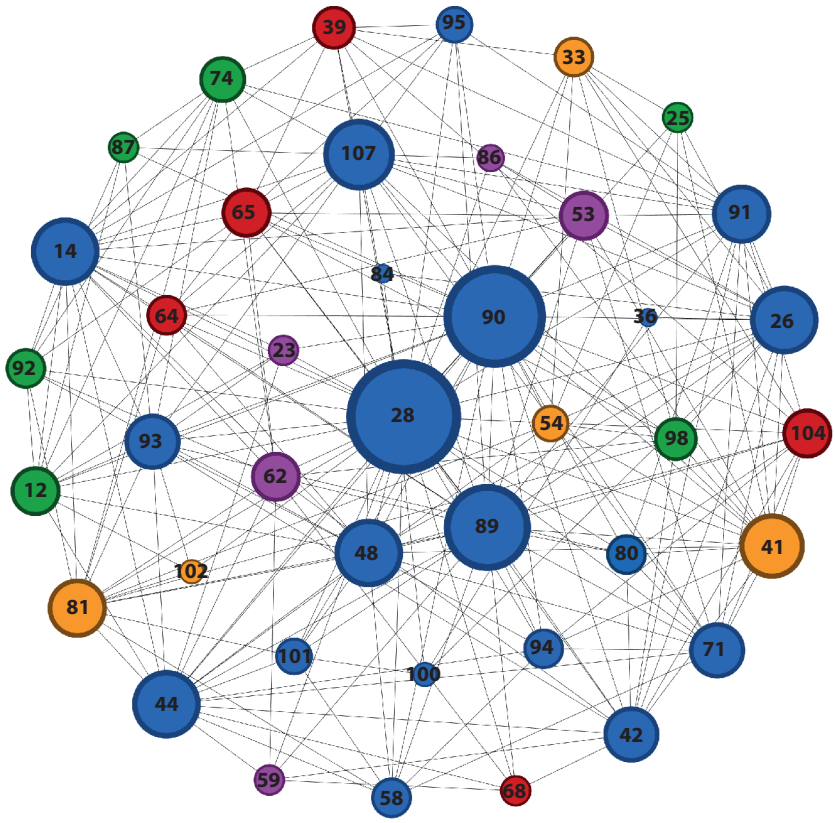
NODES
NODE DEGREE
EDGES

MANAGERIAL NETWORK

THEORETICAL OBSERVATIONS	PRACTICAL IMPLICATIONS
Managerial relationships are ideally highly central, less dense and consistent.	High diversity in the network suggests that the address and character of managerial relationships is unclear within the province.
Goal correspondence is essential for the efficiency of managerial tasks. (Emden et al. 2006)	High segmentation value causes sector-based clusters in the network.
Hierarchy is beneficial for the efficiency of managerial tasks.	There are highly central actors from each sector in the network but they do not have a relationship.
'Bridging structural holes' happens through the involvement of catalyzing actors. (Burt 1992)	In the managerial network actors from corporate sector are poorly connected to the creative sector and academia.
Structural holes offers a lot of new opportunities for innovation processes. (Cooke, 2011)	NGOs within the managerial network seem to have potential to bridge the gaps.
Actors of managerial network should be involved based on their operational resources not personal characteristics. (Geringer, 1988)	High density and diversity show that actors do not share a common goal.



POLITICAL NETWORK



Number of Edges	241
Number of Nodes	41
Nodes from Academia	5
Nodes from Government	20
Nodes from NGOs	5
Nodes from Creatives & SMEs	6
Nodes from Corporates	5
Average Degree (connectedness)	11.756
Network Diameter (distance)	3
Graph Density (frequency)	0.294
Modularity (segmentation)	0.209
Average Clustering Coefficient	0.669
Average Path Legth (efficiency)	1.788

ACADEMIA
GOVERNMENT
NGOs
CREATIVE IDV. & SMEs
CORPORATES

NODES
NODE DEGREE
EDGES

POLITICAL NETWORK

THEORETICAL OBSERVATIONS

Outliers in a network are as important as the central nodes because they act as catalyzers.
(Holland & Leinhardt, 1971)

Low absorptive capacity: value, assimilate, and apply new external knowledge.
(Noteboom, 2011)

High expressive capacity: ability of sending clear messages that trigger understanding.
(Noteboom, 2011)

Close to external knowledge: referring to the approachability of new skills and knowledge that is otherwise unavailable.
(Kratzer et al, 2007)

Actors must create conditions to enhance the ability to learn in a network.
(Kratzer et al, 2007)

PRACTICAL IMPLICATIONS

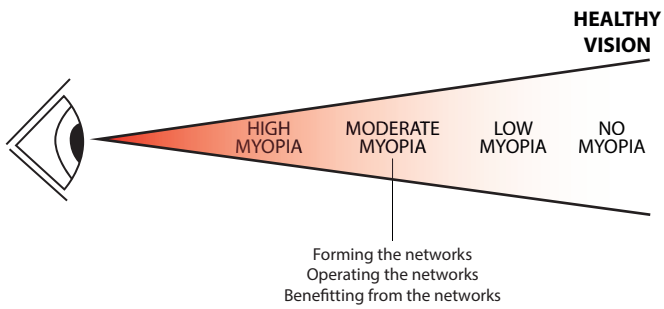
There are only six weakly connected nodes out of 41 nodes in this network, which suggests that the network is closed to external knowledge.

Network has low diversity. 50% of the nodes are government-based. Control of the governmental entities over actors who have the creative skill-set can lead to starvation of innovation.

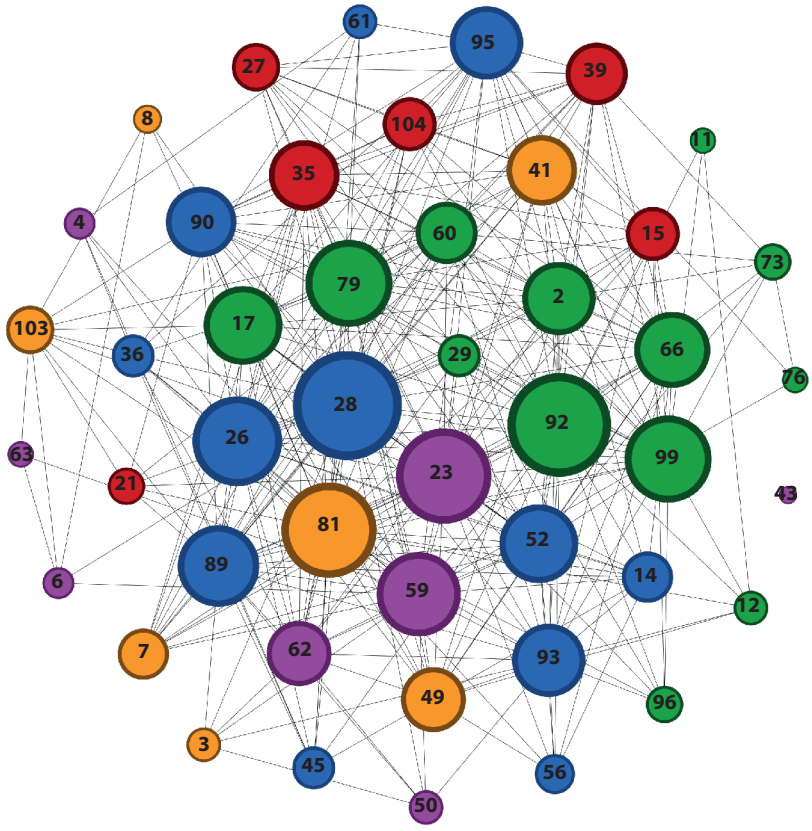
Dominance of governmental entities in the political decisions show that co-creation is not present. High centrality of governmental leaders makes them less approachable.

Collaboration of the goverment entities with corporates creates a non-approachable bubble for the small-scale creative sector.

Network sustainability is questionable due to presence of actors with high degree centrality.



FRIENDSHIP NETWORK



Number of Edges	333
Number of Nodes	46
Nodes from Academia	6
Nodes from Government	12
Nodes from NGOs	7
Nodes from Creatives & SMEs	13
Nodes from Corporates	8
Average Degree (connectedness)	14.478
Network Diameter (distance)	3
Graph Density (frequency)	0.322
Modularity (segmentation)	0.172
Average Clustering Coefficient	0.696
Average Path Legth (efficiency)	1.734

ACADEMIA
GOVERNMENT
NGOs
CREATIVE IDV. & SMEs
CORPORATES

NODES
NODE DEGREE
EDGES

FRIENDSHIP NETWORK

THEORETICAL OBSERVATIONS

'Strong ties' like friendship, family or love have a defining role in success of professional relationships.

'Strong ties' are easier for innovation, since they normally include a relatively high amount of trust, common aims, and the same kind of language for communication. (Granovetter, 1973)

Having a positive relationship outside of work environment positively contributes to the creative process.
(Kratzer, Leenders, Engelen, 2005)

Motivational development and commitment of partners on non-managerial levels of an organisation can benefit from key individuals.
(Zboralski, 2007)

PRACTICAL IMPLICATIONS

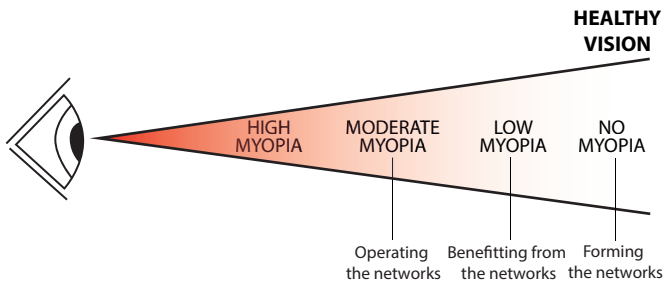
High degree: friendship network is the best connected network, friendship is important to Fryslan regardless of professional role.

There is diversity in friendship relations, all groups are well represented in the network.

Some presence of clusters based on actors out of same sector.

Actors with a central position in friendship network are also central in creative and political networks.

The key-actors enable the information flow between the otherwise disconnected parts of the organization, especially between management and creative networks, it is important to utilise these key actors in a linking role.



Chapter 7

THEORETICAL AND PRACTICAL IMPLICATIONS OF THE SOCIAL NETWORK ANALYSIS

"I've become convinced that understanding how networks work is an essential 21st century literacy".

Howard Rheingold

This chapter will discuss the results of the social network analysis presented in the previous chapter in three ways – expert rounds, reflections on priory-formulated propositions and new insights that emerged from the SNA. Also, the necessary literature review to understand the network dynamics is conducted as an addition to the existing desk research.

As mentioned in Chapters 1 and 5, the expert rounds have two purposes in this study. One is the validation of the collected data, as a checksum of the NetRep method, and the other is to discuss the plausibility of the results that have been knitted together through the SNA, the accompanying propositions, and the additional insights. For this purpose, after gathering the conclusions on the analysis of the social networks of Fryslân, three experts were asked to reflect on the validity of the gathered data and the presented outcome of the analysis. The first part of this chapter presents the outcome of these interviews in a structured manner.

In the second part, we will go through the propositions were developed at the end of Chapters 3 and 4 as a result of the literature reviews. The propositions were first developed as preliminary answers to research questions. We will go through them one by one here to see if they correspond to our findings in the social network analysis of Fryslân. In addition, throughout the analysis, and throughout the literature scan that accompanied the analysis, more insights emerged than expected in chapter 1. These will also be presented at the end of this chapter. In addition to the priory-formulated propositions, the new literature explored during the analysis phase of the study brought new dimensions and broadened the desk research. With the new scope the literature review has gained additional propositions were formulated, which will be gathered together at the end of this chapter.

7.1 Validation and Discussion of the Results with the Experts

The results and conclusions deducted from the social network analysis were discussed with three experts from different actor groups. The experts were selected from the most central actors in different networks, excluding the actors who have helped us during data collection. The selection criteria were to find individuals that could oversee the entire system as a result of their background, occupation, or their professional network. These three experts are not only central actors of more than one network, but also have the ability of providing insights on the validity and consistency of the collected data and the results of the analysis.

The network graphs were discussed with the experts one by one in an informal setting. After a brief presentation on the background of the study, the methodology we followed, and the results of the lens combinations presented in Chapter 6, they were asked to reflect on the collected data, the results of the analysis and the practical implications we have presented. The experts first reflected on the completeness of the dataset, then they identified which of the conclusions they agreed with or not, along with the argumentation behind their position. Later, they gave additional insights while looking at the graphs and presented conclusions from their own perspective.

This section presents a summary of the expert interviews that function as a quantitative validation of this explorative SNA study. Before detailing the interviews, Figure 54 shows the positions of the three experts on the four networks we have looked at.

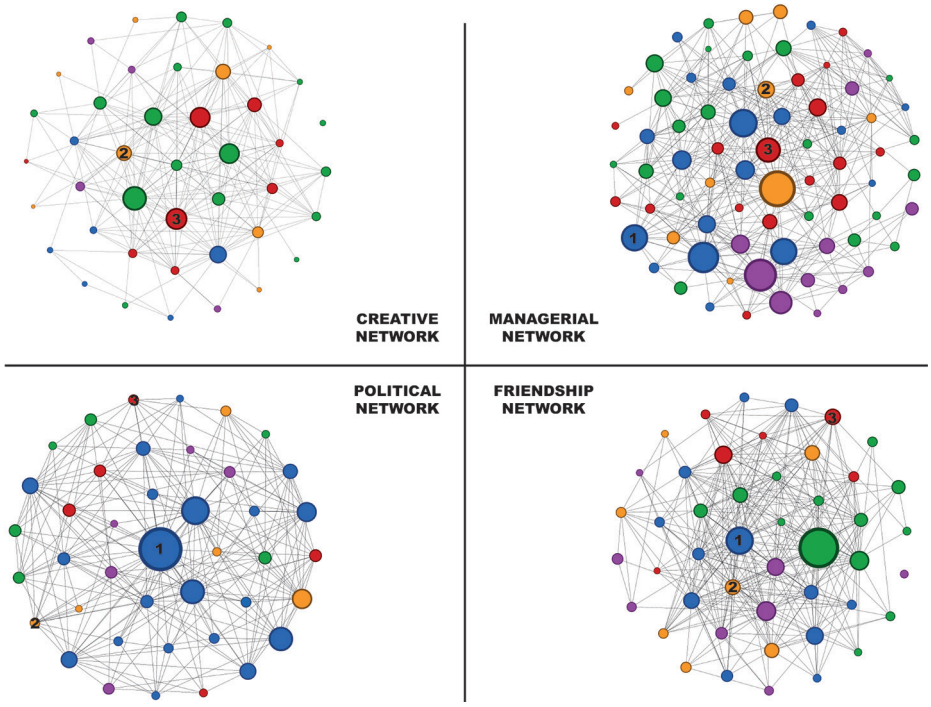


Figure 54. Interviewed experts

Expert 1

Role: Expert 1 is a prominent politician who appeared to be highly influential on political and friendship networks. This expert was also present with a rather large node in the managerial network. Expert one was absent on the creative network.

About their own position: Expert 1 recognised their position on all networks and fully agreed on their influence. Their prominent position on the political network to them was a result of their role. Also, related to their role in the political world, their position in the friendship network was central, which refers to properties like being trustworthy, popular, and well-liked. They also recognised their existence in the managerial network and noted that they do not have a managerial role but they might have influence on managerial decisions made within the province.

About their own relationships: Expert 1 thought the sociograms depicted their personal relationships very accurately. They did notice that organisations with multiple influential actors were represented with one or two very prominent actors in the sociograms. This issue was related to the ranking-based structure of the SNA study that directed participants towards creating diverse lists. When people are picking ten influential names, they are not likely to pick five of the ten names from the same organisation.

About the completeness of the networks: Expert 1 stated that the sociograms were very complete, however on the creative network the absence of the water technology sector that was quite important for the research output of the area was found remarkable, apart from a few managerial names of the water-related institutions. According to Expert 1, the reason behind this was not the incompleteness of the study but the isolation of such specialists within the province.

About the conclusions: Expert 1 easily recognised the density issue within the creative network. According to this expert, the density problem was a result of repeating relationships and strong friendship ties between creative individuals. The expert stated that a second reason could be the solitary work culture that has been adopted in creative industries that formed a large part of the creative network.

The expert agreed on the disconnected state between certain sectoral groups as well. They pointed out the gap between corporate leaders and other sectors. The expert also referred

to the 'invisible' doers of innovation within the corporate world who are overshadowed by the leaders and, therefore, are not included in the creative relationships.

According to Expert 1, the province is only connected to the outside world through semi-obligatory political activities and festival-like events, thus, it was rather normal that external know-how did not have access to any of the networks.

Another concern Expert 1 pointed out was the fact that some of the actors left or changed their position that enabled them to be included in the sociograms. However, Expert 1 also stated that this would not change the overall conclusions gathered from the results.

Finally, Expert 1 referred to another dynamic of the political network – the part based on political views – and how this influenced the proximity of actors within the same network. Expert 1 stated that they recognised certain clusters based on political views.

Expert 2

Role: Expert 2 is the leader of a large-scale creative project. They appear in all networks in quite central positions. Only in the political network are they located in a peripheral position.

About their own position: Expert 2 found it very normal to be central both in the managerial and creative networks as they were leading a creative project. Their position in the political network to them was a result of the project being funded partially by the government, which requires them to have regular contact with civil servants. Expert 2 attributed their central role in the friendship network to being a local for a long time and having a large group of friends in the area.

About their own relationships: Expert 2 thought the relationships marked in sociograms were correct, however, there were some relationships that were not present. This absence was related to the invisibility of some relationships from the outside. Since the methodology is based on asking a third person's opinion on two actors' relationship, this invisibility issue was discussed as a research limitation. Expert 2, however, did not believe that this would cause significant differences in the results.

About the completeness of the networks: Expert 2 stated that the sociograms are very complete in general. In the creative network, the Expert 2 thought that the sociograms

missed a couple of artists and directors of certain art organisations, who are very successful on a regional level. This absence was due to the perception of 'innovation' in the area and how art remains out of this perception. Although Expert 2 agreed on the actors involved in the networks, they stated that some actors' influential size does not represent reality.

Expert 2 found it remarkable that no actor representing the Parliament was present in the networks. According to Expert 2, this was related to the top-down hierarchy of governmental bodies and isolation of the province.

About the conclusions: Expert 2 easily recognised the density issue within the creative network. According to Expert 1, unlike Expert 1, this had a very straightforward reason: there are fewer creative individuals compared to other sectors. Expert 2 believed that creativity is something individual, like a talent, and they simply believed that there is a lack of creativity in the province.

Expert 2 agreed on the disconnected state between certain sectoral groups as well, especially the real-life presence of a gap between corporate leaders and creatives. Expert 2 thought this gap should be closed by the efforts of the political network because of its members' obvious connections to both with corporate leaders and creatives.

Expert 2 stated the positive aspect of 'monetary power' not being associated with any of the networks. This would, according to Expert 2, bring very different results. On a side note, this situation may also been influenced by the questions that were asked during ranking interviews since none of the questions referred to economic influences.

Another topic that came up throughout the interview was the tension in the relationship between the managerial and creative networks, which formed an important part of this thesis. The expert thought the bodies that control the money flow in the province (the managerial networks) have very strict requirements on how to use the money and this placed a certain pressure on the creatives, resulting in a 'loss of appetite'. Also, the fact that the funding parties do not tolerate failure prevents risk-taking initiatives from coming to light.

The starvation of creative thought, as discussed in previous chapters of this thesis, is apparently a well-experienced situation within the province. Expert 2 stated that creatives prefer seeking funding in other parts of the country that are more relaxed.

Finally, Expert 2 believed that, in fact, all the actors in all four networks knew each other and regularly met each other, even if it was by coincidence. These actors come together in informal, friendly environments. Their closure, and the fragile relationship that derives from this closure, prevents them from openly discussing problematic issues and especially failure.

Expert 3

Role: Expert 3 is a prominent member of academia who has multiple positions in research universities, universities of applied sciences, and scientific advisory boards. Expert 3 appears in all networks in quite central positions. Only in the political network are they located in a peripheral position.

About their own position: The expert found it very normal to be central in the creative networks, as they were involved in various scientific studies, which fall in the category of creativity. Also, having a central position in the friendship network of Frisian systems seemed reasonable since Expert 3 has taken an active role in many projects in the province throughout the years and has gotten to know many people. Their position in the political network was also normal to them since the projects were mostly government funded, which required Expert 3 to have regular contact with civil servants from all hierarchical levels. Expert 3 found it rather interesting that they have a prominent role in the managerial network, according to the analysis, as they are absolutely not involved with managerial processes or tasks. They considered this issue to be related to the potential confusion between running the projects and doing the projects, which is common for people in their position.

About their own relationships: Expert 3 thought their own relationships were quite accurate with some minor missing links. They attributed this issue to some links not being relevant to Fryslân, not being very public, or simply dating back to the old days. Similar to the Expert 2, here, the issue of invisibility of relationships was also discussed as a research limitation. Expert 2 pointed out the fact that big events that are obligated to occur at a given time, such as the elections, could have a significant impact on the results. However, Expert 3 stated that what should be considered early on as an issue in regard to the 'openness' of an innovation system is the secrecy of some projects that runs behind closed doors.

About the completeness of the networks: Expert 3 stated that the sociograms are rather complete in general. In the creative network, Expert 3 missed the water and dairy sectors that are quite important for the area. However, they attributed this absence to the understanding

of 'creative' relationships in the area that did not include technological development and businesses. They suggested that bringing these sectors in would open a whole new sub-group that would have almost zero connectedness with the existing network. Expert 3 also thought that the actual influence of some government officials that appeared to be highly central in the sociograms were over-exaggerated. According to Expert 3, this was due to the top-down hierarchy of governmental bodies and the isolation of the province.

About the conclusions: Expert 2 easily recognised the density issue within the creative network. According them, new projects tended to bounce around a select group of creative individuals. These individuals defended their positions carefully by being very active but also by being rather closed to newcomers. This was not because they were not willing to communicate their ideas with the outside but because they wanted to use the limited amount of budget reserved for such projects themselves.

However, Expert 3 did not believe in the monetary excuses behind this isolation and, in fact, thought that having enough budget created a comfort zone and discouraged taking risks. Expert 3 believes that money can be a tool to achieve goals but has nothing to do with establishing connections in order to create output.

Expert 3 completely agreed on the disconnection between the creative network and the political network and called it 'the biggest issue of the province'. According to Expert 3, there is also a large gap between certain sectoral groups, as can be seen in the sociograms. They saw also a generation gap in addition to this, especially between corporate leaders and creative industries. Expert 3 agreed with the previous experts on ideas of this gap being closed with efforts of the political network, which would have power to bring the both parties together. Expert 3 saw LWD2018 as a huge step forward in this matter and had a strong belief that corporates would not participate in LWD2018 activities unless they were involved specifically by the government.

Last but not least, Expert 3 stated that, despite their different sectors, relationships, and networks, all the actors in this system have an emotional bond with the area and with each other. This emotional bond is their weak point, but it is also what makes the community stronger. This should be recognized by enabler of innovation in the community and again LWD2018 is of great importance here.

The results of the expert round were positive, and a majority of the findings of the network analysis were validated. In addition, the experts provided some additional insights by combining the results seen in the network graphs with their personal observations.

The experts agreed on the actors, roles, and the relationships in general. By looking at their own positions and relationships, the experts confirmed the reliability of the results and were pleased with the accuracy in general. One of the experts mentioned the 'water sector' as a missing part of the network but also mentioned the closed-like character of this sector and the lack of interaction with the other actors on the network graphs. Finally, regarding the inclusion of actors, the experts referred to some 'invisible doers' who have an important role in the realisation of projects. The analysis did not shed light on who these actors were. There was a general consensus on the health assessment of the formation of the four networks, which showed that the creative network had poor connections (see Chapter 6).

The experts recognized the size and density issues in the networks, especially the creative network, but the experts' reasoning behind this differed from strong friendship ties between creative individuals to funding issues and even the citizens being not creative enough. However, all three experts mentioned observing a positive change in the recent years. Also, the fuzziness in the managerial network was attributed to the confusion in the province between running a project and doing the project. Therefore, the experts agreed on the rather poorly-rated health assessment of the operation of the networks in Chapter 6.

Experts stated that there is indeed a solitary work culture, where the actors are disconnected. The experts confirmed not only the disconnectedness of the sectors but also the disconnectedness of the province as a whole that limits the access to external know-how, referring to the isolation explained in Chapter 1 of this thesis. The experts mentioned that the province connects to the 'outside world' only superficially through day-events like festivals or semi-obligatory political activities. However, all the experts believed that this is caused by a prejudice in the Netherlands towards Fryslân developed over the last 50 years and that hopefully will change into a more positive image with the LWD2018 European Cultural Capital events. The experts agreed on the poorly-rated health assessment of the benefitting from networks in Fryslân but suggested that the study should be repeated after the completion of LWD2018 events to explore the impact of such an event.

Finally, the experts added new insights to the research by pointing out a few patterns they recognised on the maps, such as political views causing separation, the lack of parliament representatives in the provincial networks, and a generational bond between the prominent actors of the creative network. Also, the experts were pleased to see that capital power did not have an impact on centrality.

The expert rounds confirmed the reliability of the results and the data collection, with a few points of attention. The following section will re-visit the propositions that were developed based on the literature search in the first half of the thesis to see if they apply to the findings of the social network analysis of Fryslân.

7.2 Propositions Revisited

The propositions are the preliminary conclusions of the studies presented in Chapters 1, 2, 3, and 4 of this thesis. They can be considered as the researcher's interpretations of the combination of the literature review and the fieldwork conducted, which give preliminary answers to the research questions. In this section, we will go through the propositions stated at the concluding paragraphs of Chapter 3 and 4 to see if the empirical study on Fryslân innovation networks supports the theoretical findings.

The information in the literature cannot explain the situation in Fryslân directly due to the scale and complexity related differences. Therefore, we have chosen to use the theoretical findings as propositions as a means for stipulating the way of thinking. There are three types of propositions that were developed for this purpose: (1) propositions that directly originate from knowledge aggregation throughout the thesis, (2) propositions that aim to understand the social situation in Fryslân further, and (3) the practical propositions aimed at helping the situation in Fryslân. We will present the propositions one by one in the order of the logical argumentation behind them.

1. Innovation is complex because it is a reflection of complex social processes

'Change' is a commonly used word in defining innovation (Chapter 3). However, due to the nonlinear nature of innovation, 'change' can be a cause or a goal. From the literature review and from the field analysis in Fryslân, we have concluded that innovation derives from a need and aims at change. In fact, the main objective behind this research originates from the aims of Fryslân to achieve societal change through innovation. The societal dimension

refers to the strong relationship between innovation and social processes. However, this is a paradoxical relationship where the order of occurrence cannot be determined: is innovation triggering social change or is social change triggering innovation by creating new needs? The studies on the character and definition of innovation show that it is both. With the growing connectedness of society, innovation gets more complex as well. In addition, the social network analysis we have conducted also revealed that indeed innovation is a result of complex multilevel relationships between various actors that are constantly in motion. Innovation has to reflect the social complexity to provide meaningful change.

2. **Innovation cannot have a single definition because society constantly creates new needs, prompts, and mediums.**

The term *innovation* is used as a noun describing the final result, as an adjective describing the qualities of an organisation or as a verb describing the process. Scholars are consistently working on a new, common, multidisciplinary definition for the term *innovation*, however, converging the complexity behind innovation into a single definition seems to be impossible. Instead, Chapter 3 shows us that in the last ten years, various disciplines and fields are steadily coming up with their own definitions by adding descriptive words to this term regarding the discipline it originates from. Examples can be service innovation, eco-innovation or open innovation, which refer to the world trends such as technology, collective and sustainability.

From the first part of Chapter 3, we can also see diversity in the perception of innovation. The multiple categories of initiatives that define themselves as innovation refer to many aspects of the process from facilitating to scaling the novelty. In addition, during the data collection for the social network analysis, the interviewees' perceptions of what was 'innovative' differed strongly. Within the context of the province, some found technological developments highly innovative while others found artistic collaborations innovative. The definitions we have collected in Chapter 3 demonstrate a parallelism between the content of innovation studies and world trends, which determine the needs that innovation originates from.

3. **Innovation can only be considered complete if the social unit it is introduced to accepts it.**

Innovations start with a (social) prompt that defines a new need and aims at (social) change. The term 'change' identifies the impact of the introduced novelty on the social unit or, in a way, how this introduction changed the existing ways of doing things. This social unit can be limited to a niche group to an entire region, or even to the whole world. Also, the character

of innovation is irrelevant. Whether it is a product or a service, for an innovation to achieve success and sustain this status for a remarkable period of time, a positive response from the social unit it is introduced to is necessary. The literature review in Chapter 3 shows that the definition of innovation increasingly refers to it's scaling as a part of the process, rather than a result. This impact is measured by the change the innovation makes on the behaviour of people, organisations, and systems. Also, this change brings new sets of prompts, which trigger new innovations by creating new needs and re-starting the paradoxical cycle, as introduced in Chapter 3.

4. **There are two common ways to manage innovation: stage-gate (-inspired) models and milestone (-inspired) models but neither responds to the social complexity that is a part of innovation processes.**

Creativity and innovation are strongly linked in the literature. However, operationalising creative ideas requires management of the process. Management of innovation is today a field on its own with its own methods. The literature commonly mentions two origins for these methods: the stage-gate model and the milestone model. Both are aimed at simplifying a complex iterative process into a linear path of steps to create manageable bits of a whole. However, such an approach does not correspond to the interdependent development of technical and social lines of work within innovation, through which the existing models fail to represent the entire process.

5. **Social and technical processes within innovation develop together and, therefore, a holistic understanding is necessary.**

There are various models and methods that describe the innovation process. A majority of these methods are meant to help the management of the process, while a few others are meant to guide the creative process. These models, either cyclical or linear, refer only to the technical side of innovation where the focus is on the final product. A limited part of these models includes a scaling or valorisation phase that appears towards the end of the process (Buijs, 2012). From our research in Chapter 3, we know that technical processes will only gain meaning if they develop in combination with social processes. In addition, through our research in Fryslân, we determined the relevance of social processes for innovative output. The two parts of innovation complete each other into a meaningful whole, and, therefore a model that aims at practical use, regardless of it being meant for designers or managers, must include social processes to complete the technical side of work.

6. Innovation systems consist of multiplex relationships that operate together.

Innovation processes are getting increasingly more complex in parallel to societal development. Instead of being the task of a single inventor, innovation is teamwork where integrated effort of various disciplines is necessary, which is the primary reason behind its complexity. This is a positive aspect, as the involvement of various actors facilitates knowledge exchange and becomes the source of novel ideas. With their linear and hierarchical way of operating, formalities have a potential to disturb this richness, and, consequently, the complexity.

The complexity of innovation partially derives from the fact that involved actors have different expectations from the same process. These expectations are shaped by extrinsic and intrinsic motivations (Pelletier, Tuson, & Haddad, 1997). Extrinsic motivation refers to the reasons to perform well for an external and mostly tangible reward, whereas intrinsic motivations refer to personal fulfilment. For example, the extrinsic motivation of designers could be getting a patent of their product, scientists might be after a Nobel prize, or politicians could be interested in getting elected again. This variety can become a positive aspect of the system only if the intrinsic motivation of actors is mainly community oriented. Shared values and developing a suitable narrative between the members of the community is the only way to achieve this.

7. Main objective of innovation systems must be enhancing the creative relationships.

The contrasting nature of the managerial and creative lines of work is also represented in the network graphs. The literature suggests that, ideally, creative and friendship relationships have lower centrality but higher density, which is the opposite of the ideal situation in managerial and political networks. However, in Fryslân, the creative network is very small and lacks density, whereas the managerial network is large and dense.

The managerial and creative lines of work follow contrasting patterns in general. The linear, structured, and output-oriented path of managers can be defined as the opposite of the cyclic, iterative, and discursive path of creatives. Innovation processes require both these worlds to go hand-in-hand. However, creative ideas form the basis of innovation, and therefore, the creative line of work has a more delicate position. When over-interference occurs, the managerial tasks and demands, with their contrasting nature, tend to be in the way of creative ideas. Management should, therefore, play a facilitator role that intervenes only if necessary to support the creative process to a maximum extent.

8. **The isolated social character of the province of Fryslân hinders the implementation of an open innovation eco-system.**

The historical record presented in Chapter 1 regarding the social constructs, the character of local industries that are by nature rather isolated as presented in Chapter 2, and the fieldwork conducted for the social network analysis all point to the domination of a closed-like character in the province. This is highly reflected in the creative network, where the density is very low or, in other words, 'not much is going on'. As explained in Chapter 6, a low density of creative relationships shows either the presence of individual attempts or the repetitive pattern of relationships. The expert interviews have demonstrated that, in Fryslân, the second trait applies because once a collaboration achieves positive results, the non-risky path of repeating this relationship is preferred. Since innovation requires taking risks and trying paths that have not been tried before, it can be concluded that indeed the closed structures still play a role in the province.

9. **Bureaucracy suppresses the creative networks in Fryslân.**

In the literature, the difference between intentions and exploitations is defined as a performance gap. The results of the network analysis show a few possible drivers behind the performance gaps in Fryslân, which primarily influence the creative network. One of these is the individual resistance to innovation, which is defined by Argyris and Schon (1970) as the personal discomfort that severely occurs during implementation phases. He states that through the tension built up by the management-creativity struggle, feelings of mistrust, fear, and manipulation come to surface and lead the creative to give-up before implementation takes place. The fact that the creative network, especially in the 'operation' phase as described in Chapter 6, is not performing as expected can be attributed to the strong controlling mechanisms in Fryslân.

10. **Social network analysis is an appropriate tool for studying the community dynamics regardless of the limits of the analysed system.**

Social network analysis is commonly identified as studying the social constructs through mapping the interaction patterns of individuals, organisations or other entities. Conventionally this is done by collecting the data on interactions by retracting digital data or interviewing the entities. When the scale of the system grows, the analysis of networks, the data collection and handling phases become difficult. Also, exploring multiple relationships at the same becomes difficult, which means that data accuracy is sacrificed. Differentiating from traditional social network analysis studies with its scale, the SNA performed on the

innovation networks of the province of Fryslân provided a new methodological approach that enabled the researcher to grasp network dynamics without needing to map each and every single interaction that occurred in the province. In this method, third party information was used to map networks along with qualitative and quantitative validation of the collected data. The decreased number of interviewees and interactions made a drastic impact on the needed effort for a large-scale social network analysis.

To conclude, the social network analysis, in combination with the fieldwork and the desk research, confirms the propositions that were formed earlier. In this section, each proposition was discussed with the findings on the subject. However, while finding evidence to support the propositions in the Frisian context, new insights were observed regarding the social situation in Fryslân. The next section will introduce these one by one and discuss them by referring to the data collected for the network analysis.

7.3 Emerging Insights from Fryslân

In addition to finding evidence to support the existing propositions in 7.2 through our findings, the social network analysis and the accompanying desk research that was necessary to understand the graphs revealed additional insights regarding the social situation in Fryslân on various topics. Unlike the previous propositions, the following seven propositions were deduced directly from our observations in the area and the interpretations of the theoretical findings in relation to the area. They uncover tailor-made findings for the province that will not be validated further.

1. **Size, density, and centrality are the most necessary network measures to understand the dynamics of innovation systems on a regional level.**

SNA recognises multiple measures that give valuable information on the 'healthiness' of the network. Aula & Parviainen (2012) state 'measuring the width, density, centrality, and reciprocity of the network reveals issues that hinder or promote diffusion of innovations' (p. 60). Although reciprocity was not used as a measure in this SNA, the following measures were used to gather qualitative conclusions: the *width* of the network, which Valente (1995) defines as the extent of the network in comparison to the sample size; the *density*, a measure that shows the vibrancy of a network, that is, 'how much is going on'; and finally, *centrality*, which refers to the key actors of the network and their behaviour through the different networks.

2. **Actors that have multiple professional titles have the highest potential to be the gatekeepers between subgroups of a network and close structural holes.**

Valente (1995) defines having a high degree and low centrality as a 'brokership' status, which indicates that the actor has a wide range of possibilities to bridge the gap between the various parts of the network. Such a combining nature of an actor is also present in the Frisian networks. Burt's (1992) theory of structural holes mentions that actors with such connecting potential also have a competitive advantage because they make the two parts of the network dependent on their personal relationships.

Networks that are relevant for innovation processes might show sub-group divisions in environments (such as Fryslân) where disciplinary differences are present or collaboration between organisations is limited. The sub-groups are either weakly connected or completely disconnected, which is called a structural hole. Bridging structural holes happens through the involvement of catalysing actors (Burt 1992). However, it must be noted that networks that rely on a single actor's connections are fragile (see proposition 6).

However, there are a few actors in the Frisian networks who have multiple projects that could be categorised under different actor groups, for example, having an academic position, owning a company, and being involved in a non-profit organisation at the same time. Naturally, such multitasking brings a wider set of relationships and a brokership status as described by Valente (1995). Although it is not possible to show proof of this due to the anonymity of the network graphs, Frisian networks have a few actors that have a catalysing role. It would be beneficial for the whole system to detect and invest in these actors. Zboralski (2007) suggests that motivational development and commitment of partners, especially on non-managerial levels of an organisation, can benefit highly from key individuals.

3. **Segmentation of the friendship network has a negative effect on the density of creative network.**

There is plenty of literature on the impact of segmentation on creative output. Actors who do not get along well on a personal level have little chance to initiate collaboration. In fact, if optimised, segmentation can be a positive factor for innovative output, as teams that agree on everything tend to be less successful than those who fight sometimes (Kratzer et al. 2007).

However, actors should also not be complete enemies. Relationships should exist long enough to bring cognitive distance down to an optimal level, but not beyond that (Nooteboom, 2012, p. 22). However, in Fryslân, this does not apply. In the isolated construct of the society, contrasting beliefs are alienating actors, including political or religious beliefs. Conflict derives from disagreement and causes partners to take sides. The amount of disagreement between partners among team members is defined as polarity (Kratzer, Leenders, & Van Engelen, 2006). The literature underlines the benefits of polarity in creative teams, especially in the starting phases of the innovation processes. However, disagreement is a risky subject in general for creative networks as it has a negative association, especially in small communities as Fryslân. Actors of innovation in Fryslân choose to work with people that share a similar world vision and tend to repeat these collaborations when they click. A certain degree of segmentation may only be useful if the actors are engaged in a creative team that shares a common goal. In Fryslân, there is an additional phenomenon present, which we could name 'influential segmentation'. This means that there is the 'enemy of my friend is my enemy' rule applies, and actors choose not to collaborate with other actors who are not welcome by their friends.

4. **As the 'managers' of a province, the provincial government has to look for searching and combining expertise to fulfil structural holes of the creative network without interfering with the creative activity.**

Before analysing the networks in Fryslân, the managerial and creative networks were assumed to play the most important role for determining output. In fact, at the beginning, the political network was not considered as an influential set of relationships regarding innovation. However, the research has shown that the political network indeed operates as a decision mechanism with central authority. In a way, in Fryslân, the role of the political network replaces the managerial network. Kratzer et al. (2007) state that the involvement of managers in searching and combining expertise should be moderate. A healthy innovation network brings correct skills and expertise together for the information to flow in a sustainable way. Structural holes are defined as the parts of a network where the information flow is disturbed. It is the task of the manager to monitor the efficiency of the process and make sure that the network is facilitating the correct set of actors and relationship. Therefore, the actors of the political network must play the role of connector and facilitator of necessary skills in the network.

5. **Working in close proximity that enables daily communication has a positive influence on network emergence.**

In social networks, visibility has the potential to overrule output. Ibarra (1993) points out that physical proximity of actors can be crucial for innovation because, in terms of exchanging knowledge, actors who are closer to the source have a greater advantage for accessing information. Being present and investing time for establishing connections through engaging in collectives sends a positive message by making the actor reliable and approachable for the rest of the network. In this sense, spaces that bring actors of innovation together, such as innovation hubs, have an important role. In case of the creative network in Fryslân, it is possible to see that actors who share the same working location are strongly connected to each other and have the densest sub-group. These individuals are also the most central figures within the whole network.

6. **A network that is dependent on individual nodes rather than relationships are not sustainable.**

SNA is often criticised for capturing a timeframe in the life span of a network and jumping to conclusions through this limited vision, whereas roles, names, or relationships might change throughout the time. Bonfour (2015) states that collective memory of an organisation (Fryslân, in this case) exceeds the memory of an individual. Regardless of the context or scale of the network, individual roles are subject to change. Since network analysis looks at the interactions between actors, when an actor stops fulfilling a certain role, the relationships that evolve around that actor also move along or even vanish. Even if there is a replacing actor, relationships will differ, and the centrality might not be the same. The dependency of a network on central actors is therefore a risky situation. Each central position in a network should have an alternative that can sustain the relationship when the individual roles shift. The case in Fryslân also falls into this risky category. Individual clinginess to positions and relationships will not benefit the collective success in the long run. Especially the central nodes in each network should ask themselves, 'Who will replace me when I am gone?'

7. **Fryslân and Silicon Valley have a lot in common when it comes to gender disparity.**

A remarkable finding of the social networks analysis on Fryslân was the number of women actively involved in the field of innovation. A quick look up has shown that only ten percent of the actor sample is female, and the percentage of connected female actors is only five percent. As we have concluded in Chapter 6, diversity is an important success factor for innovation networks, since diversity brings new skills, knowledge and perspective in to

the network. However, in Frisian networks, also due to strong friendship ties, actors prefer to interact with those who are similar to them. Frase-Blunt (2003) calls this the mini-me syndrome, in which managers prefer to hire or work with those who are similar to themselves in various ways such as in generation, attitude, and, most importantly, gender.

The gender gap was discussed informally with the locals after the completion of the studies. It was stated that, especially in the corporates and creatives and SMEs actor groups, there are barely any women to be found. The limited number of women is distributed between governmental, academic, and NGO-related actor groups. Silicon Valley businesses are internationally criticised for not taking measures to close the gender gap (Observer, 2017). Pye (2015) states that Fryslân, and the coast of Northern Sea is the birthplace of women's rights. Industries should be encouraged to take measures to include women in the innovation ecosystem.

After presenting the theoretical conclusions of this research, along with emerging insights directly from the fieldwork and from the complementary literature review, it is important to summarise the practical implications of these findings for the province of Fryslân and other regions or organisations that are experiencing similar problems regarding their innovative output.

7.4 Practical implications of SNA and Recommendations for Actors in Fryslân

The practical implications of the theoretical findings in this research and our recommendations for the actors of innovation networks are presented in this section for each of the four networks analysed in this study.

Creative Network:
The creative network is the core of innovation systems. This should be where everything happens. All the other networks are in the system to support the creative network. Ideally, this network should have many nodes, with few or no central nodes, and should be highly diverse and very dense. The Frisian network is almost exactly the opposite, and this must be taken care of.

Low density of creative relationships shows either the presence of individual attempts or repeating relationships. Actors in the creative network must be encouraged to participate in co-creation or adopt a collaborative strategy. Even when they are not engaged in collaborative projects, the province must provide enough opportunities for bringing these actors together. That being said, the definition of creative networks should be kept as wide as possible, since the definition of innovation is increasingly broad.

If creative relationships are repeated, the reason behind this should be identified. Sessions with different actor groups can be helpful to understand the motivation behind this phenomenon. If the reason is to minimise risks that will rise from making new collaborations, the risks must be lowered by giving space for failure when needed.

The creative network must include other actors than creatives and SMEs and academics. There is plenty of space for innovation in the public sector and the NGO world as well; therefore, the creative network should become more diverse and inclusive. Also, the exclusion of corporate actors means the exclusion of actors with organisational knowledge. This practical skill-set, which is essential to achieve success in innovation, is not yet available to the creative network. The corporate world in Fryslân should also be aware of the benefits of being involved in the creative network that could open up new perspectives.

Once included in the creative network, corporate or governmental actors should not micro/macro manage the creative processes; unless they will be actively engaging in the development of the creative projects non-hierarchically, the managing actors should remain peripheral and jump in only in case of crisis situations.

Managerial Network:

The managerial network exists to makes sure that the operational processes behind innovations go smoothly. These can be related to controlling money flow, catching deadlines, or involving the correct people. The way of working must be direct, quick, and efficient. The network ideally should have a few central nodes, not much diversity, and low density. The managerial network in Fryslân is almost exactly the opposite, which put pressure on the performance of the creative network.

High density in the network creates a fuzziness in the network through which the address and character of managerial relationships becomes unclear within the province. The actors who have managerial tasks must come to a consensus on 'who is managing what'.

There are highly central actors from each actor group in the managerial network, but they do not have a relationship with each other. Actors in the managerial network can also benefit from an open network by sharing knowledge with each other, whereas in Fryslân, there is a high segmentation of sector-based clusters in the managerial networks that creates many structural holes. Still, the sociograms point out the existence of a few key actors who have central positions. Most of these originate from NGOs actor groups and therefore NGOs could play a role in cross-sectoral bridging.

Specifically, in the managerial network, actors from corporate sector are poorly connected to the creative sector and academia, have very few ties to NGOs, and have strong relationships with governmental actors. NGOs within the managerial network seem to have a gatekeeper role that creates a weak connection between different parts of the network. This role can be utilised for a better-connected managerial network.

Political Network:

In Fryslân, political entities also operate as managers to a certain extent. Creative relationships do not correspond to the top-down methods of policymaking, but there is a certain dependency of the creative network on the public workers due to the funds ran by the government and the determining power of the local government. Ideally, the political network should have many nodes that represent different ideas, a few central nodes of influential actors, a diverse profile, but relatively low density. The Frisian political network is quite far from the described ideal situation.

The network is very well connected with a low number of outliers but as Burt suggests, outliers provide opportunities for external knowledge to be included in the network. In the case of the political network, the outliers also mean the representation of different perspectives in crucial decisions. Unlike the described ideal state, half of the actors in the political network of Fryslân are government workers. This dominance of a single actor group suggests the lack of participatory policy making concepts that can be beneficial for creative output. Unless the authority is shared to a certain extent, such power can be used to control the actors in the innovation system, which might lead to the starvation of innovation. It

would be advantageous to adopt an open-source mind-set to make the creatives and SMEs and the academics a part of the decision-making processes. A council where these groups are actively engaged in the policy-making can potentially trigger this collaborative spirit.

There is a strong hierarchy in the political network that is understood from high centrality measures. This will not only make governmental leaders less approachable but will also risk the sustainability of the network. At the moment, the network evolved around a few central actors. If at a certain point the actor steps out of the current role, the relationships of that actor are at the risk of diminishing. The central actors must make sure that they reinforce the existing network with additional connections between actors around them.

Friendship Network:

The friendship network is the most powerful network in Fryslân. 'Being a local' overrules everything and opens all the doors. The sociograms show that it is almost as ideal as a friendship networks get, as there are many nodes, high diversity, high density, and a moderate centrality of trusted and liked individuals is visible. Key elements of friendship such as trust, solidarity, and sharing are present in the network.

The high connectedness of the friendship network shows that informal connections such as friendship, family ties, and romantic relationships are important in Fryslân, regardless of the professional role. This is what makes Fryslân unique. Informal relationships are considered as strong ties and they are also long-lasting. Moreover, the bond is not only towards each other, but also towards the culture and physical surroundings. Such strong bonds occur organically, and they cannot be forced. Instead, they must be preserved because many other relationships can grow based on them.

All actor groups are well represented in the network, which indicates a diverse network. However, some presence of clusters based on actor groups out of the same sector can be found. It would be beneficial to open these networks up even further and make sure actors from different sectors interact informally as well.

The actors with a central position in the friendship network are also central in the creative, managerial, and political networks. This suggests that Frisians decide to do business with those they trust and like. These central actors can play a role in using the friendship network further to enhance the output of creative network by bringing disconnected actors together.

Since organic ties such as origins, language and values bring these people together, their power should be utilised.

The social network analysis of Fryslân ends here with constructed recommendations on the four networks of the analysis. The thesis ends with a concluding chapter that presents overall conclusions of the conducted studies and discusses the findings. Also, the final chapter reflects on the output and the applied methodology in the thesis. The chapter closes with a series of recommendations for future research.

Chapter 8

ON THE PARADOXICAL NATURE OF INNOVATION

"I am looking for friends. What does that mean -- tame?"

"It is an act too often neglected," said the fox. "It means to establish ties."

"To establish ties?"

"Just that," said the fox. "To me, you are still nothing more than a little boy who is just like a hundred thousand other little boys. And I have no need of you. And you, on your part, have no need of me. To you I am nothing more than a fox like a hundred thousand other foxes. But if you tame me, then we shall need each other. To me, you will be unique in all the world. To you, I shall be unique in all the world...."

Antoine de Saint-Exupéry, The Little Prince

8.1 General Conclusions

The ever-growing industrialisation of society is creating prosperous communities all over the world, but not all regions are able to keep up with this. With the development of technology, the global connectedness of individuals took on a new dimension. This connectedness brought new needs and the availability of knowledge along. The media to share this knowledge triggered humanity to fulfil these new needs with novel solutions or, in other words, innovation. But innovation is never the end of a need-based path; instead, it is a cyclic process that growingly creates new needs. As a result, being able to 'innovate' became the ultimate goal to create advantage for organisations, regions or countries.

In this thesis, we have focused on the regions that were not benefitting from the innovative development of the world, to see how we can help them. Fryslân, the northernmost province of the Netherlands, has been experiencing socio-economic struggles in the recent decades. Through our brief historical research, we have determined two reasons for this. The first reason for the struggle is the internally oriented social system that, due to historical origins and the geographical condition of the province, did not let in the external information necessary for creating a knowledge infrastructure. The second reason is the closed-off nature of the primary economic resources of the region, such as agriculture, that do not correspond to the open character of innovative communities (Omta, 2017; Chapter 1).

On the relationship between innovation and resilience
As an answer to s-RQ1: *How does technical innovation relate to social change?*

The Netherlands is the third most innovative country in the world. However, this innovative culture is limited to certain provinces that function as the innovative hubs of the country (EC, 2015). The provincial government in Fryslân acknowledges this and shows high levels of awareness towards developing the provincial potential in various fields and scales.

Being innovative is important to Fryslân, firstly because the lack of opportunities available for personal development of younger generations causes them to leave the province. Innovation has the power to strengthen industries to provide more positions. Secondly, since humanity is fully immersed in a technological era, being unable to contribute to the technology that daily life is dependent on will make regions dependent on those who can produce it.

Regional resilience is, therefore, strongly linked to innovation. Next to 'being prone to external impacts', from a societal perspective, ***resilience*** refers to coping with change positively. Regional transition plans that focus solely on technological development display minimal chances to create resilient futures. In todays interconnected society, change requires being open to new ideas and knowledge. A closed system is by definition closed to growth.

On socially oriented innovation

As an answer to s-RQ2: *What are the state-of-the-art examples of relating innovation to social development?*

In recent years, industries, but especially the creative industry, have become less individualistic with the emergence of collaborative initiatives aimed at innovation to tackle societal questions. However, there appears to be a multitude of initiatives that associate themselves with socially oriented innovation. Therefore, it is not possible to define a single structure for these collaborative initiatives. The study presented in Chapter 3 identifies seven categories of practices of socially oriented innovation (Celik, Joore, & Brezet, 2014):

1. **Create:** Organisations that gather innovative ideas directly through social design, co-creation or crowdsourcing.
2. **Facilitate:** Spaces or organisations that provide platforms for creative activities.
3. **Stimulate:** Inspirational organisations or activities that lead individuals towards innovation.
4. **Efficiate:** Initiatives that help innovators to reach correct tools they need and work more effectively.
5. **Educate:** Organisations that prepare research-based grounds for innovation and its integration.
6. **Associate:** Platforms that bring people together and enable communication between disciplines.
7. **Corporate:** Entrepreneurial initiatives that innovate socially beneficial products or services (p. 8).

On the diverging definition of innovation

As an answer to s-RQ3: *How has the definition of innovation become more socially oriented in the last decades?*

Regardless of origin, each and every innovation derives from a prompt and seeks to create change. The prompt is a derivative of technical and social conditions of the time and place with the aim of creating change in or having impact on the social unit it serves. This relationship that innovation has with society results in new social dynamics that require new innovations. Therefore, it is not possible to create a single definition of innovation and expect it to apply to every novelty that is successfully implemented. Just like the world and society, innovation is in a state of constant change.

The study presented in Chapter 3 explored 273 definitions of innovations that were published between 2006 and 2016. The word-use in these definitions shows a clear correlation with worldwide challenges, such as sustainability, change, and societal problems. Instead of coming to a consensus on what innovation means, however, throughout the years, the definitions diverged, following social trends regarding the 3 Ps (people, planet, profit) and their technical implications on daily life.

A comprehensive innovation approach must consider social processes as a part of the innovation process that develops hand-in-hand with the technical processes to form the conventional, tangible result of innovation.

On the complementary approach towards innovation

As an answer to RQ1: *How can the relationship between social and technical innovation be operationalised?*

Many of the categories mentioned above refer to 'making innovation possible' through creating knowledge exchange. This is because innovation is a process that evolves in the dynamics of a complex ecosystem. But in the literature, innovation is widely studied within corporate settings only. The level of complexity in corporate settings does not correspond to the level of complexity that has to be considered in a region. Therefore, innovation approaches developed for enhancing innovative output of businesses cannot be expected to help regional problems. It is necessary to develop a holistic understanding of complexity to study innovation systems on a regional scale.

Another disadvantage of conventional innovation approaches is that they do not fully acknowledge the societal dimension of innovation processes. Such models basically can be divided into two categories: stage-gate and milestone-based models. In these models, terms such as *market introduction, scaling,* and *adoption* are used to refer to social processes. But, they remain as a step within the technical process rather than being described as a separate process that the technical processes depend on. Because social processes are continuously influencing technical processes, these two parts cannot be separated from each other when the innovation process is described holistically. The complementary approach towards innovation introduced in Chapter 3 summarises the findings regarding the parallel development of social and technical processes that complete the cycle together.

On the complexity of innovation in relation to social networks

As an answer to s-RQ4: *What is the relationship between networks and innovation?*

The social processes of innovation relate to the acceptance of innovation in the community. Social processes are critical success factors for innovation and even more so in Fryslân where the society is internally oriented. Interdependency of social and technical processes underlines the important role of the community in innovation. Especially regarding the innovative capacity of a region, the community is the main stakeholder of a regional transition. Thus, the dynamics of the community need to be taken into consideration while working towards establishing an innovative environment.

Also, innovation relies heavily on creativity obtained through the interactions within the community. Providing possibilities for interaction is an important part of facilitating an open innovation ecosystem. Creativity is what makes people, firms, and regions unique, and without creativity, it is not possible to speak of innovation. Creativity is an unplanned, impulsive occurrence, and it cannot be fruitful when iterative character is not supported. On the other hand, to be able to benefit from a creative idea, innovation processes also have to be managed. Management recognises straightforward patterns of planned activities. In innovative environments, managerial and creative actors have to be in constant interaction. This complicated relationship is an additional reason for the complexity of the process.

Relationships among a group of individuals are commonly identified as networks. The process of 'causing' something (in this case innovation) refers to the unplanned occurrence of newness as a result of the interactions that form the network. Therefore, studying

networks has the potential to give plenty of information on the social constructs that trigger innovative cycles.

On studying large scale networks

As an answer to s-RQ5: *How can multiplex relationships within a very large group of actors be studied?*

Social network analysis is a highly informative tool when it comes to studying social constructs. This tool is commonly used to map and statistically evaluate the relationships between actors in a system. The data is mostly derived from communication tools, such as mails or texts between actors, or it can be gathered through interviews. However, the literature provides no clear methodology for collecting and handling data on large-scale networks where it is not possible to ask every actor about their relationships.

The Network Representative Method (NetRep method) introduced in Chapter 5 makes the studying of large, unpredictable, and complex networks possible. The NetRep method provides the researchers with qualitative network analytics in a rather effortless manner by taking away the burden of mapping each and every relationship in such a system to be able to derive conclusions. This is accomplished by mapping a representative part of the complete system by asking a few knowledgeable actors, the Network Representatives (NetReps).

Since innovative output is highly contextual, the relationships to be mapped with the NetRep method also differ per problem at hand. For assessing the situation regarding the Frisian innovation networks, it was essential to define the relevant relationships that may or may not exist among the actors. In this study, creative, managerial, political, and friendship networks were identified as relevant networks to be studied.

Innovation strongly relies on the operationalisation of a creative idea, which is a definition that breaks down to a strong creative aspect and a strong managerial aspect. In addition, because historical research on Fryslân showed the importance of personal relationships, informal relationships were included as the third network to be studied. Political relationships were discovered to be relevant as a decision-making mechanism in relation to capital.

The first round of network analysis was conducted on a sample set of 232 actors divided in five professional groups: academics (66), government workers (48), non-governmental

organisation based actors (33), creative individuals and small-medium enterprises (38), and corporate based actors (47).

Within this sample set, the NetReps provided information on influential actors and the relationships in-between according to their own knowledge. These data, which were later validated, were used for creating network graphs. The Network Representative Method that was applied as a part of this thesis has proven itself to be very useful in an explorative study of large-scale social networks. The efficient data collection procedures and structured development of validation and analysis phases provided insightful answers towards the societal question we have been dealing with in a feasible amount of time. In addition, if multiplex analysis of multiple networks at the same time is necessary, it often requires various data sources to gather the information. This method, on the other hand, provides an effective tool for mapping multiple networks and relating them to each other to develop holistic conclusions.

On the social networks in Fryslân

As an answer to s-RQ6: *How can the Frisian innovation system benefit from a network analysis?*

Networks have emerged as a defining paradigm for how we see systems. In this analysis, we have tried to first understand the current social situation in Fryslân by looking at the social networks. Fryslân is trying hard to develop an innovation ecosystem with various projects but the desired results are still not available in relation to the closed-like social construct. The analysis aimed to determine how social networks influence this and if reconstructing them would help the situation.

However, networks display loads of information at the same time. The possible combinations of network measures, networks, actor groups, and levels of analysis are endless, which makes the explanation of a simple procedure very complicated. Therefore, this analysis looked for the relationships present among the sample set of 232 actors through combining different aspects. These aspects can be identified as follows:

- four types of networks: creative, managerial, political, and friendship
- five professional origins of actors: academics, government workers, NGOs, creatives and SMEs, and corporations
- ten network measures: betweenness, centrality, closeness, degree, density, diversity, frequency, inclusiveness, reachability and size
- four levels of analysis: actor , relationship, subgroup, and global

The social networks of Fryslân were analysed by making meaningful combinations from the elements of these four groups and creating graphs based on the information sought. The results of the analysis were discussed with experts who have prominent positions in the area, which led to conclusions and recommendations.

The analysis revealed the conciseness of the networks in Fryslân, and not even the half of possible connections were realised in the representative network that was mapped. The creative network, which is expected to provide the innovative output, is the smallest of all networks, suggesting that Frisian networks are not open enough to receive outside knowledge, and, thus, the networks miss out on a large part of the skill set that could have been beneficial for the province. The analysis showed that the actors of innovation in Fryslân must work together to define the missing skills and the missing parts of the networks in order to match the needs to opportunities.

The managerial network consists of almost twice as many actors compared to the other networks and, therefore, the network presents a lack of hierarchy that is required for essential management processes such as setting deadlines, arranging contracts, and controlling the outcome.

Frisian networks are disconnected from each other to a large degree due to their low density in the province. Low density of networks in a region causes disconnectedness of actors and repetition of the same relationships. As a result, actors in the network do not share enough out of an unwillingness to risk the capital resources by sharing ideas with others. The managerial and political networks must implement policies that make the actors feel secure enough to encourage connections and knowledge sharing in the creative network.

In Fryslân, the disconnectedness of the actors is a result of a solitary work culture. This causes disconnectedness of local sectors and also limits the province's access to external know-how. The main connection of the locals to the rest of the country occurs through events that are hosted in the province. The province hosts various festivals every year that attract thousands of visitors. Until recently, such events provided a superficial communication ground for only a couple of days. However, local initiatives, such as the Innofest initiative, are aiming to create a long-lasting impact by utilising these events (Innofest, 2018). With the European Capital of Culture of 2018 events that are hosted in Fryslân, the experts believe that the high disconnectedness of local networks to each other and to the outside world will decrease.

Diversity is also another measure that was taken into consideration to check if all actor groups were presented enough in the networks. The political network is the most problematic network in this sense, since there are very few actors who are not government employees. The few remaining actors from other professions are in the periphery and do not seem to have an active role in decision-making or lobbying. However, the corporate groups have a few highly central actors. Actively engaging creatives and SMEs, academics, and NGO representatives in political discussions can resolve this imbalance.

In addition, the low representation of corporate actors in the creative network shows a disconnection between dominant professions in the creative network such as creatives & SMEs and academic actors. A common ground can easily be found between these groups to share ideas on innovative output. A dense friendship network, where the representatives of each three groups come together, suggests that the potential of this network can be used more efficiently.

The list of actors that forms the sample set for social network analysis included only five actors from the world famous water and dairy sectors of Fryslân. The closed-like character of these sectors and their lack of interactions with the rest of actors in the innovation system were concluded to be the reason for their absence in the network graphs.

With the expert rounds, the research gained new influential perspectives that explained the sociograms. First and foremost, the experts pointed out that the monetary power of actors did not have an impact on their centrality. One of the less positive observations was that the political views (right or left) of actors were causing the segmentation, primarily in the friendship and political networks. Also, despite the numerous government workers in the sample set, the lack of parliament representatives was related to the political isolation of the province. An additional cause of segmentation that was not directly visible from the data was lack of communication between different generations in the province. These observations not only provide valuable insights to explain the social situation in Fryslân, but also show the advantage of finalising the social network analysis with the expert rounds.

On the implications of the network analysis

As an answer to RQ2: *How can a network perspective help explain the social processes regarding innovation?*

The network perspective helps to see the historical origination of current blockages in the innovation system in relation to the current social dynamics and shows a direction towards the possible. Based on the literature, creating a healthy innovation system requires three phases with different characteristics: (1) forming networks, (2) operating within networks, and (3) benefitting from the networks. The cyclical nature of innovation makes the simultaneous development of each phase necessary. The analysis of Frisian networks, together with the interviews with experts, revealed the points of attention through picturing the properties of the networks in each phase and assessing the healthiness of the situation. This holistic picture is used to present a series of recommendations, not just for the actors of innovation in Fryslân, but also for the actors in other regions that are experiencing similar societal issues.

Based on the analysis results, each phase was given a health score. The forming and benefitting from the networks phases in Fryslân were graded as unhealthy, whereas the operating phase was graded as very unhealthy. The operation phase was identified as the least successful phase with lowest health score due to the disconnectedness of the actors, the high number of weakly connected nodes, and the reachability of actors in the all four networks.

When looking at the specific scores per network, the creative and managerial networks were scored the lowest in general, due to the highly problematic size and density measures. The creative network especially signalled the urgency of taking measures regarding the density of relationships. In addition, the creative network was also in critical condition in relation to the openness of networks and the density and the ability of sustaining knowledge. The political networks on the other hand, scored slightly better, but still presented some problems regarding the openness of the network and the diversity of the actors involved. The openness of political networks is related to the transparency and inclusiveness of policy-making processes in the province. Since policy-making in this study relates strongly to the development of innovation systems, the political network should be developed in a way that includes non-governmental actors who work on innovation in the decision-making processes.

The friendship network in Fryslân scored better than the other three networks. A friendship network includes a series of informal ties such as trust, popularity, friendship and love. Typically, well-constructed friendship networks are large, dense, and inclusive. The Frisian friendship network is the network closest to the ideal situation. However, the close-knit

society is known to be rather closed for growth, which closes up the local economy as explained in Chapter 1. Also, from the historical research it was determined that in Fryslân local identity is an important value that brings members of the community together. This is a unique property of this province, and the power of friendship in Fryslân must be utilised to create strong bonds of collaboration between all actors regardless of the industry, position, or motivation.

8.2 Discussion

The conclusions derived for the studies that were conducted in this thesis touch several interrelated subjects. In this section, these subjects are presented in the form of discussions that provide new areas of study for academic research and insightful points of attention for the actor of innovation processes.

A social approach towards sustainable futures

Sustainability is described as a multifaceted vision for constant, uninterrupted development that cannot be undermined by environmental protection. When holistically described, it refers to the self-generated development of the condition of living things that must be at the core of any strategy aiming for economic and cultural growth (Raskin, 1993). A development strategy that intends to continuously and holistically improve life and that considers human values without risking the systemic balances. Therefore, the research presented in this thesis is aimed at the socio-economic development of regions through innovation and strives to find a sustainable way for regions to flourish.

In this thesis, creativity is seen as the most important element of innovation. Without a creative idea that corresponds to the situation at hand, it is not possible to speak of innovation. Therefore, the conclusion is that the ultimate aim of innovation systems must be to trigger, enhance, and facilitate creative thinking.

Creativity is one of the most discussed phenomena in literature. This is mostly a nature versus nurture discussion because there is an unexplainable, intuitive side to creativity that brings multidisciplinary discussions along, such as the existence of 'creativity genes' or hormonal abnormalities (especially regarding serotonin levels) that make some people simply more creative than others.

However, although there is no consensus on the origin of individual creativity, a majority of scholars agree that creative thinking can be learned and expanded. Essentially, creativity is not defined as a spontaneous burst of ideas, but it is an ability to constantly reassemble information already possessed (Cox, 2013). This suggests that creativity, regardless of it being in the genes, can be shaped through the information individuals are exposed to. This information is not necessarily knowledge, but the information that is acquired through experiencing new things, thoughts or places. Therefore, what individuals interact with has a large impact on the extent of the development of their creativity.

Society is increasingly connected, which provides more channels for interactions in addition to the physical encounters that are a natural part of human life. Regardless of the use of online or offline channels, a large part of these interactions are social and enable humans to share ideas with each other. Individuals who are connected to each other are constantly being exposed to new ideas that become elements ready for reassembly in form of creativity.

Members of online and offline communities interact with each other. In fact, a community is defined as a social unit of durable relations (James et al., 2012). The interactions that feed these relations that trigger creativity, emerge from social connections that are facilitated by the community. Therefore, the community-life must provide enough opportunities for knowledge exchange between members. Interacting with each other leads individuals to learn, think, form different opinions and eventually to create. The new perspectives that emerge from this process are the source of creating of new solutions to problems at hand, which turn into innovation if operationalised.

In regimes that aim at stopping the community members from seeing things from a new perspective and creating their own solutions, the first things to be cut are the communication channels. Not being able to exchange information not only has a negative impact on the creative processes but also damages the solidarity between the community members.

The stipulation that is presented here regarding the relationship between community, interaction, creativity, and innovation, in fact, completes a cycle. Throughout the thesis, change' has been pointed out as the ultimate aim of innovation. This is because, regardless of its character or field, any innovation aims to create an impact on the intended target group. Therefore, innovation is meant to change the 'old ways of doing' within the community.

Communities provide means for interaction with their members and enable information exchange. Social interactions expose individuals to new ideas and contribute to their creative thinking. Creative thinking, when combined with a prompt, can be operationalised into an innovation. A successful innovation will be accepted by the community and have an impact on the old habits of the members. This cycle has the potential to sustain itself and create constantly prosperous development. However, the communities themselves must be open to the outside world to enable external ideas. In the growing connectedness of society, communities should never be limited to physical or emotional boundaries that are created through local values, because the opportunities for interaction are now limitless.

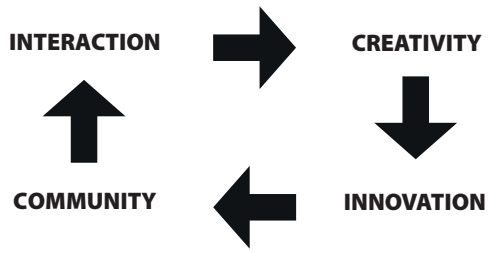


Figure 55. A social approach towards a sustainable future

Utilising the friendship network

Zaltman, Duncan, and Holbek (1977) state that the complexity of an innovation process is inversely proportional to the formality of the process. Among the four networks that this thesis considers as the most influential networks for innovation, the managerial and political relationships that form the managerial and political networks have a formal character. These two networks commonly accommodate relationships that are result-oriented, hierarchical, and objective in nature. Therefore, these are the less complex networks within the set of four. The creative and friendship relationships, on the other hand, are not goal-oriented, are cyclically organised with a collaborative spirit, and are also subjective in nature. According to Zaltman et al.'s (1977) definition and the findings of this research, these are most the complex networks in this study.

In a study based on qualitative interviews, the distinction between four networks may not be identified very clearly from a formality perspective. When trying to summarise a series of relationships that identify a single network, multiple relationships are grouped under that particular network. For instance, during the interviews regarding the political network,

lobbying and policy-making were combined, which might be going in the same direction, but these two relationships cannot be compared in the grade of formality. Yet, it is possible to make a differentiation of formal and informal relationships between the four networks.

The SNA results from Fryslân show that the creative network is the most problematic network, even though it is the most important network for innovative output. Changing the course of development in the creative network is the responsibility of all actors, but, in regard to operationalising innovative development, the political network has the greatest responsibility. This is because the actors and relationships in the political network have the power to implement new policies regarding the creative networks of the province.

However, the analysis showed that there was limited connection between the actors of the creative network and the actors of the political network, which makes it rather difficult to exchange information regarding 'what has to change?'. Since there is disconnectedness between these two groups, another network that has a better relationship with both creative and political networks comes into picture: the managerial network.

The managerial network as the catalysing body between political and creative networks is not uncommon. Even within the structure of a single company, policy related matters do not reach the creative employees, even though they are under the direct influence of the policy-making. The managerial level is the direct contact of the political level. These matters are communicated to the creatives through the managerial level, once the decisions are taken.

Especially in today's interconnected society that values collaborative processes, such hierarchical and non-transparent procedures cannot be expected to help the creative processes. Also, since the formal structure of such decisions does not correspond between the political/managerial networks and creative network, it is difficult to communicate the decision-making process.

In the case of Fryslân, the current states of the creative, managerial, and political networks that experience problems regarding the number and connectedness of actors in different ways make healthy collaborations impossible. Therefore, the least problematic network of Fryslân, the friendship network, must be utilised for this purpose.

The interviews with local experts also confirmed that friendship comes first in Fryslân. The friendship network in particular has an impact on the creative network of the province because when actors collaborate on a project, they seek a partner from their friendship network before anywhere else.

Therefore, instead of following the traditional path and communicating with the creative network through the managerial network, the political network must seek opportunities to utilise the friendship network. Although friendship does not have a direct link to innovation, the power of existing networks and local dynamics makes the friendship network the best way to innovative progress.

Figure 56 shows the positions of the four networks on a scale of formality and the relationship to innovation. On the axis of 'formality', the political and managerial networks on the positive side, whereas on the managerial and creative networks are on the positive side of the 'relation to innovation' axis. The traditional path of policy making follows the upper arrow that gets connected to creative network. However, considering the findings, the political network should connect to the creative network by utilizing the friendship network. There can be multiple ways to achieve this. First, bringing the actors of the creative network and political network together in non-bureaucratic environments is necessary to build up informal interactions between the actors that will contribute to information exchange. Second, engaging the most central actors of the friendship network, which also include members of the creative network, in a council where co-creative policy making tools are tested can help to bridge the gap between the political and creative networks.

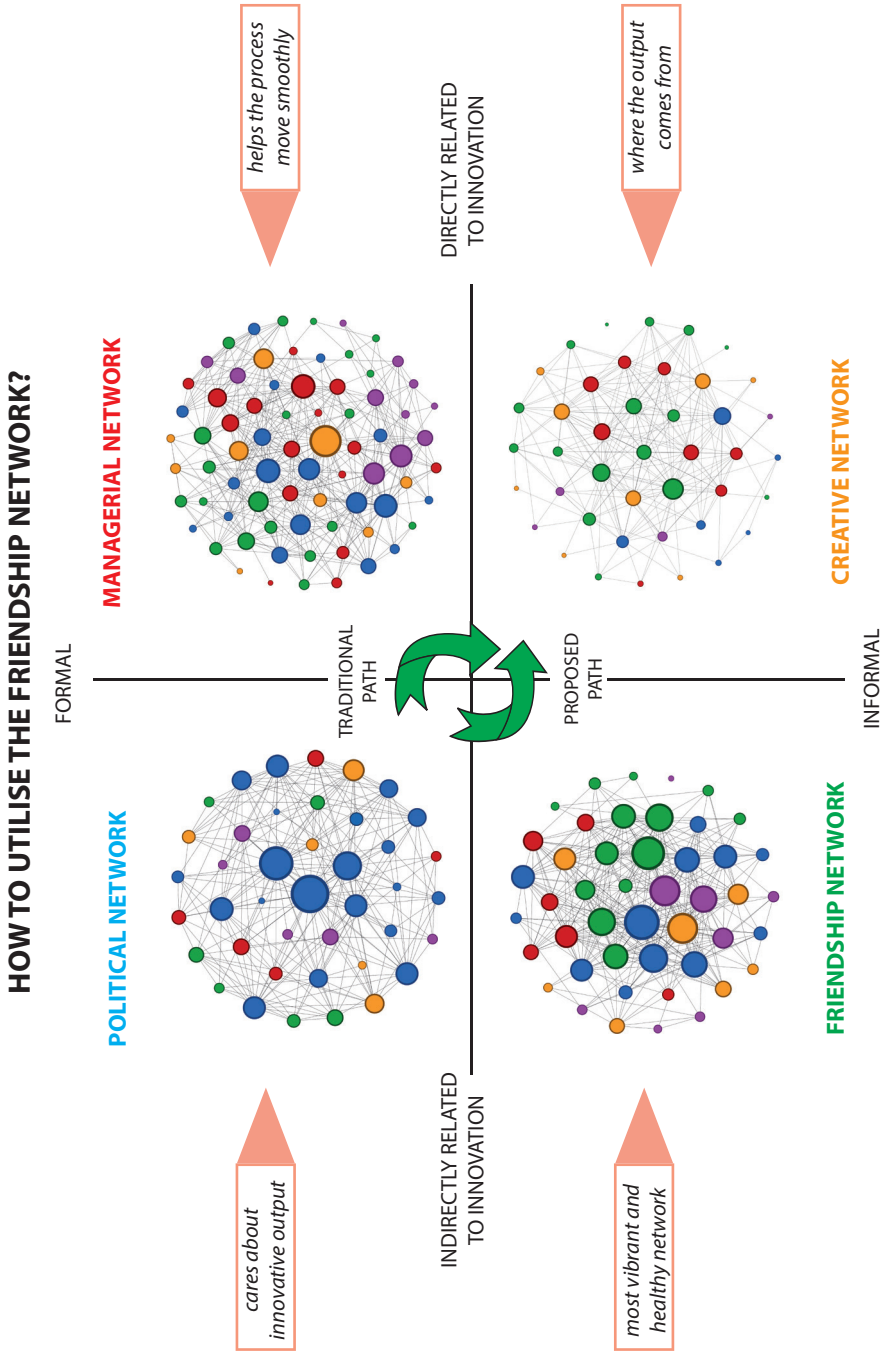


Figure 56. How to utilise the friendship network?

8.3 Implications of the Research

In this section, implications of the theoretical and practical outcomes of all studies done in this thesis are explained respectively. The thesis provides a series of valuable findings that contribute to the fields of regional development, innovation studies, and network studies. However, from the beginning, a major objective of this study was to provide practical insights to the situation in Fryslân and develop a series of advising conclusions targeted at helping the regional issues.

8.3.1 Theoretical implications

The research started with studying the geographical and historical background of Fryslân to understand the reasons for its lagging behind the country average in innovative output. As Deaton (2013) argues, innovation is not a result, but a steady progress of societies who are constantly developing. And only regions that provide its citizens opportunities to prosper manage to 'escape' societal issues.

In Fryslân, an example of rural Europe, societal issues, readily acknowledged by the locals and the local government, are primarily related to the lack of opportunities for upcoming generations. One of the major findings of the literature review in this thesis is the parallel development of societal and technical lines of work within innovation processes, which means that without societal involvement, it is not possible to speak of impactful technical development.

This link between social and technical development underlines the importance of social constructs in relation to innovation. The social constructs must facilitate the development of creative ideas that will eventually turn into successful innovations. Therefore, to create the innovation culture that Fryslân wishes for, it is essential to create the necessary environment, where the sharing of ideas and knowledge is optimal. Such an efficient flow of information can only occur in open systems. Openness of innovation systems is a highly acknowledged field of study in the business management context, but it is a rather new and scarcely studied phenomenon on a regional scale.

From the literature review at the beginning of this research, in combination with the interviews with the locals that were conducted in order to gain acquaintance in the field,

two interdependent reasons were detected in relation to the closed social constructs that operate against innovating. The first is the historical isolation of such areas. In the case of Fryslân, this occurred as a result of trying to survive all the external pressure coming from surrounding enemies as a minority culture. As a result, the locals stuck together in the form of small groups with little to no managerial structure and lived as a community of communities for many years. This self-sufficient culture created an internal orientation. The second reason, which evolved hand-in-hand with the first, is the closed-like nature of industries, such as agro-food, that form the main economic resources of Fryslân. The agro-food sector is known to be one of the most closed systems, along with defence and medical sectors, where ideas and creative thoughts are not easily shared. These two reasons, which are contextual but potentially applicable or expandable to other rural regions, contribute to the theoretical research by forming a new perspective towards the main hindrances that must be eliminated in order to achieve a fruitful innovation ecosystem.

This thesis follows an argumentation constructed through two consecutive paradoxes regarding innovation to form the structure of this thesis. From the field research in Fryslân, the study concluded that, contextually, innovation includes social systems in the process. In the first part, the social and technical processes within innovation and their parallel development were identified through a combination of multiple studies. This is the first of the two paradoxes that were identified as conditions for innovation.

Building upon the contextual development of innovation, the study then underlines the relevance of social constructs. When talking about regional innovation systems, where indeterminable sets of actors are involved with different perspectives, expectations, and goals, the already complicated process of innovation becomes complex. This complexity that is derived from the varied, or even contrasting expectations of actors out of the same process is defined as the second paradox of this thesis. To be able to study these social constructs that impact each other, the SNA approach was adapted in this research.

The complexity of innovation does not only rise from the differences between actors but also from the multiplex relationships between these actors. This thesis also contributes to the studies on innovation networks by determining relevant relationships that have an influence on the performance of these networks. The validated influence of creative, managerial, political, and friendship networks included in the empirical study in this thesis explain why such relationships are relevant for the contextually of innovation. Also, the

study for determining these relationships will guide future researchers for selecting relevant relationships to be analyzed.

In addition to providing practical insights to Fryslân on enhancing the innovative output of the province through using social networks more effectively, the network analysis also contributes to the field of network studies by determining certain ties between multiplex properties of networks. An example of these findings (described in detail in Chapter 6) is the hindrance that managerial and political processes cause on creative networks. While the relationship between managerial and creative networks and friendship and creative networks are commonly studied, the literature on these studies that have a regional scale is scarce. Also, the impact of political relationships on creative networks has rarely been studied. Another remarkable finding is that the provincial government and civil workers in this study are partially taking over the managerial tasks, creating unexpected dynamics between actors, and also causing confusion in the managerial network. Since such a multiplex study on diverse relationships among the same group of people has rarely been conducted, these findings provide important insights for network studies.

On the subject of network emergence, the thesis combines various schools of thought to create a line of argument that links innovation to network studies from a societal perspective. Following the argument, a major theoretical contribution of this thesis is the development of the Network Representative method (NetRep method) explained in Chapter 5. The method was developed as an alternative way to collect and handle the data on large-scale social networks when the conventional social network analysis tools were not helpful. The method provides a qualitative approach towards studying complex networks by studying network graphs in combination with basic network metrics.

The analysis on Frisian networks were conducted on various levels, from which, the actor level shows a number of interesting findings as well. One remarkable finding is the fact that actors who have multiple titles – such as professor, entrepreneur, and board member – at the same time, play a gatekeeper role in the networks. In addition, in Fryslân, the majority of these actors have a non-governmental role in non-profit organisations. Gatekeepers are commonly studied in network studies but not in multiplex large-scale networks.

Another commonly studied aspect of networks is the effect of informal relationships on creative relationships. But again, the literature mainly looks at small scale or closed systems

to explain the impact of the friendship of colleagues on the creative performance. A region is more complex than that, and there are multiple dynamics that have an effect on this relationship. The analysis pointed out that, indeed, when a group of actors does not have informal connections, the coherence of the network is decreasing.

The study on the definitions of innovation in the second half of Chapter 3 presents a comprehensive overview and analysis of 273 definitions of innovation published in the last decade. First, this study forms a basis for future researchers who are willing to study various aspects of defining innovation in multidisciplinary fields. In addition, the study takes an important step towards explaining the role of innovation in societal transitions. From this perspective, the study is not only relevant for the innovation field, but also for organisational sciences and transitions studies. Instead of accepting the complexity of innovation processes as a whole, the study identifies the reasons behind this complexity through performing literature studies in Chapter 3.

The empirical study presented in Chapter 3, which focuses on the categorisation of the innovative initiatives, provides an overview of the projects that combine innovation with social processes. While providing an overview of various examples of what innovation can mean for social development and how it is applied in practice, the research also presents a new way of clustering such initiatives based on their functional properties. Such a categorisation for socially oriented innovation has not been studied previously.

As a result of the findings, the study contributes to the fields of innovation and societal transitions by presenting a complementary approach towards innovation. After presenting a critique of commonly used innovation models in business settings, the research also discusses the inapplicability of such linear models in complex innovation processes. The model presented in the concluding section of Chapter 3 opens up a new discussion on relationship of innovation and social change.

Finally, but most importantly, this thesis presents an easily applicable methodology for collecting data on large-scale social networks. Studying social networks is incredibly relevant and informative for many fields. However, collection and handling of necessary data is rather difficult and time consuming for the researcher. As a result, researchers tend gather their data from online resources that often only provide input for a single relationship nature and does not allow the researcher to work on the multiplexity of networks. The NetRep method uses

a representative part of a given network by collecting data through third party information. Through in-depth interviews with a limited number of actors, a representative image of the complete network(s) can be created and studied. This method has been thoroughly introduced, explained, and applied in Chapters 5 and 6 of this thesis.

8.3.2 Practical implications

From a practical perspective, the thesis first presents an overview of historical development of the province of Fryslân in relation to innovation by providing essential discussion points regarding the isolation of the area. This short study opens the door for many other researchers or governmental organisations that are trying to identify the societal constructs that have an impact on development for an innovative culture.

The first study is the empirical study presented in Chapter 3, which focuses on the categorisation of the innovative initiatives and presents an overview of the projects that combine innovation with social processes. While providing a new way of looking at the classification on such initiatives, the overview also provides unique list of various examples of what innovation can mean for social development. In this sense, categorisation can be used as an exploratory short list of example projects by initiatives that are trying to position themselves in the field of socially oriented innovation. The second study in Chapter 3, which analyzes 273 definitions of innovation from different disciplines, is one of the most elaborate theoretical outputs of this thesis. The study can be used in the market to identify a company's view on innovation or how innovation is defined for the specific field.

Another major theoretical contribution of the research done is this thesis is the Network Representative method, which was used for data collection for the social network analysis. In practice, this method has potential to help those who are willing to perform a social network analysis but lack time or resources or both to adopt conventional techniques. Whether this is in the context of academia or business, the developed data handling method makes it much easier to achieve meaningful results.

The results of the social network analysis conducted in Fryslân (discussed in detail at the end of Chapter 7), yielded valuable practical implications and insights in regard to social constructs in the province. Also, the results are highly applicable by the actors of innovation

in the area, especially the findings regarding the lack of activity in the creative network and the advice on how to tackle this issue.

In addition, the research shines a light on the domination of the political and managerial networks in the area, which puts a lot of pressure on creative output. The 'friendly' approach provided in the conclusions section of this chapter functions as a guide for how to do manage this issue in a productive way.

The results of the social network analysis also show the positive impact of creative/innovative hubs that have recently become popular establishments in Europe. These results show clearly that people who are physically near each other while working under the roof of such spaces collaborate more than those who do not. In this sense, this thesis forms a well-formed argument for enhancing the investment in such spaces.

In the analysis, a link was found between the successful water sector and the rest of the innovation scene in Fryslân. The question is why such an important establishment that contributes to the sector worldwide did not appear as an influential part of the social networks in this study remained unclear, despite the discussions with the experts. From many possible reasons behind this, two connected reasons appear to be most plausible. First, this study investigated the impact of various social relationships on creative output. The creative output we measured had to be visible to the outside, because the data collection was based on the reputations of the individuals and the organisations they represented. Being heavily involved in technology and being distantly positioned to the rest of the creative groups, the water sector may not have been understood as a creative network. Due to this double-sided exclusion, the water sector fell out of the scope of this research. However, the results must be discussed within this scope. In addition, the high technical novelty created in the water sector follows rather closed working principles with patent applications and developing new technologies. But the social relationships that form this network are unfortunately not exposed to the entire system. Therefore, it must be considered that the results gathered at the end of this study are only applicable to the networks within the defined scope of this research. The claims presented beyond the limits of the scope are only additional recommendations that may be helpful according to the experience we have collected.

Last but not least, the research identifies a series of catalysing actors that have potential to become the 'gatekeepers' of the innovation systems in the province, who connect the

disconnected parts of all the networks. The research shows that the representatives of non-governmental organisations have the best potential to play this role, as they form the least clustered actor group in the analysis.

8.4 Suggestions to Actors of Innovation in Fryslân

The social network analysis (SNA) of the Frisian innovation system revealed various issues regarding forming, operating, and benefitting from networks, which were explained in detail in the last section of Chapter 6. In this section, the possible implications of these findings will be explained, along with a few suggestions for the actor groups that are involved in the innovation eco-system. It must be noted that these potentially helpful suggestions are given based on the experience gained through this research without any professional background in such an advisory position.

Until now, the SNA described in this thesis has evolved through studying relationships. However, the necessary actions to be taken in order to create a healthier innovation system can only be initiated by individuals (Arampatzi, Burger, & Novik, 2016). To be able to perform better in all phases of innovation, it is essential to share potentially helpful pragmatic steps to be taken by the actors of innovation.

To examine the performance of Frisian networks through the SNA, the InnovationNET method described by Kratzer et al. (2007) was adopted. This method divides the process of establishing innovation networks into three functional phases – formation, operation, and benefitting from networks – and explains the necessary components of each phase. The method explains these steps, with the help of a case study, and assesses the 'healthiness' of the networks in this case. Similarly, in Chapter 6, the networks of Fryslân were also assessed based on their formation, operation and benefitting from networks. After going through all the components described by Kratzer et al. (2007), the study also assessed the healthiness of the current situation of the networks in Fryslân on a scale of four health grades. According to this analysis, the networks were evaluated on average as follows.

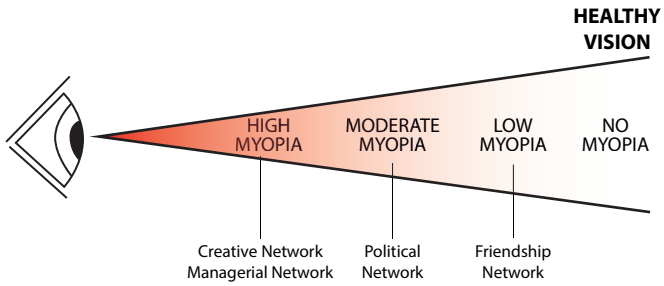


Figure 57. Overall healthiness of Frisian networks

Creative and managerial networks seem to be the least healthy networks of the system, followed by the political network and the friendship network. In Chapter 6, we explained the theoretical meaning of what this unhealthy situation means and where it is derived from. From a practical perspective, a healthy situation on the formation phase refers to openness of networks by looking at the criteria of involvement of correct actors, having the correct skill set in the network, and agreeing on a common vision. However, in Fryslân, looking at the size and characteristics of the networks, the necessary openness is not visible. The networks are compact and repetitive. This suggests that the networks are not open to external knowledge and, therefore, do not have access to new skill sets that would have been beneficial for innovative output. To bring the formation of the networks to a healthier state:

1. Actors from different professional groups (academic, creatives, corporates, politicians, and NGOs) should come together regularly to gain access to each other's networks.
2. Different professional groups should be encouraged to work in the same teams through incorporating the advantageous position of diverse partnerships in policies.
3. Missing skills in the province should be identified collectively, so that external expertise can be considered.
4. A common uniting vision should be co-created for the long term that includes every actor's needs regardless of their operational scale.

The second phase is the operation phase of the method, which is the most problematic aspect of the networks in Fryslân. This phase focuses on how diverse, frequent, and strong the relationships are within the networks. Also, in relation to these impact-related measures, influence measures of actors were also studied. According to this, Frisian networks resemble

low healthiness with the sparse and steady networks where all relationships are formed within a small group of people. For the creative output, the relationships should become diverse and dense so that the network can benefit from an information exchange. However, high frequency and centrality on all networks is not always beneficial. For example, on the managerial network, since there is an acknowledged hierarchy with straightforward decision-making processes, high centrality and low frequency are expected. Unfortunately, in Fryslân, this is the opposite. For the healthier operation of innovation systems, following suggestions can be presented to the actors of all networks:

1. Actors should be encouraged by catalysing professionals to communicate their creative ideas openly with each other regardless of their professional position.
2. These creative ideas and processes should not be micro-managed by funding parties that expect output.
3. The necessary risks to be taken in order to realise creative ideas should be encouraged by the funding partners, managers, and policy makers.
4. The iterative nature of innovation should be acknowledged and there should be mental, economic, and social space left for small failures.
5. Decision making processes should be as transparent as possible and exclusionary 'club' culture should not be encouraged in the province.

The third phase of the InnovationNET method developed by Kratzer et al. (2007) is related to benefitting from these networks. In this phase, the authors refer to the learning abilities of the network and sustaining the growth and operational success through the time. Frisian networks present low health scores on this matter due to their closed-off nature, which operate in an ad-hoc manner. This means that the feedback system that enables the system to learn from the previous actions are lacking. In addition, throughout the fieldwork, it was clear that in Fryslân, the established relationships are highly dependent on the position of the actor. This means that when an actor steps out of a specific position, the relationships are not sustained. Therefore, with every circulation, which occurs quite often in academic, corporate and political worlds, the relationships have to be built over and over again. Although there is plenty of literature that argues collective memory exceeds individual memory, in a province with such a well-functioning friendship network, realising the potential that derives from this strength should be encouraged. Therefore, following five suggestions were developed to help benefitting from Frisian networks:

1. The legacies left behind should be evaluated carefully in an open-source mind-set so that the new generations are able to learn from their positive or negative aspects.
2. Relationships should not be position-dependant; social relationships among individuals should outgrow the professional boundaries.
3. There should be a hands-on research committee that is assigned to track the needs of the provincial networks and link external expertise when necessary.
4. The existing emotional bond between locals and the attachment towards the local culture should be the main connection point between (even disagreeing) parties.
5. It should be understood that sharing, creating, and developing ideas in a closed group of friends is less fruitful than running into conflict.

During the research on Frisian innovation networks, the operation phase was identified as the unhealthiest phase with lowest scores. Due to connectedness, diversity, number of weakly connected nodes and reachability, the creative and managerial networks scored low health grades, while the political and friendship networks scored a little better. However, the InnovationNET method presents the formation, operation and benefitting from networks as the parts of a whole, that do not necessarily operate in a chronological manner. Therefore, the suggestions that are given here do not represent a certain chronological order either. In fact, the suggestions given above are only meaningful if understood holistically and put in motion together.

8.5 Reflection on the Research Strategy and Methods

The research presented in this thesis is based on the societal question that was defined by the initial assignment regarding the innovative performance of the province of Fryslân. This section will walk through the methodological steps taken in the research to give a reflection on the process and the outcome. A reflection provides a critical approach towards the work that has been completed and explains points of attention for the sake of the repeatability of the results.

At the beginning, field research was conducted to identify the historical and demographical reasons of running behind in innovation. This exploration was done by speaking to the locals and referring to the literature. However, the locals could not present a consensus on the historical development of the area and neither did the literature. Although in Chapter 1 a flow of events and how these had an impact on today's Fryslân was discussed, this was

created based on a combination of somewhat controversial historical facts. Creating a highly reliable timeline of events in the area is only possible through an in-depth study of the local archives. A researcher with a working knowledge of Dutch, Frisian, and German languages should do this.

Through compiling a historical development story by digging through various resources and talking to locals, the given societal question was translated into a preliminary research question. This research question was explored by creating a societal and theoretical perspective, which together helped formulate a path for tackling situation in Fryslân through targeted literature studies. Although a part of the societal perspective was dedicated to studying other regions in the world that experience similar issues, this knowledge was not fully operationalised through implementing the lessons learned from other regions in the propositions of this thesis.

The societal and theoretical perspectives, which were divided in multiple concepts, gave the research a new direction to explore societal constructs that have an impact on innovative output. In fact, it was concluded that societal constructs and innovation have a mutual interdependence, identified as the first paradox of this thesis.

For studying this first paradox, two different studies were conducted. In the first study, innovative initiatives from Fryslân, the Netherlands, and the rest of the world that identify their goals as social change or progress were explored empirically (Section 3.1). Since the cases were selected by randomly browsing through initiatives, the scale of the study had the potential to grow very large. The selection could have been done structurally, especially if this study was not a part of the explorative phase of this research. Also, it must be noted that the aim of the study was not to come up with a categorisation method initially, but to identify common properties of such initiatives. The growing scale of the project made it impossible to track the properties and how they defined the impact of the initiatives. Instead, the general properties were used for grouping similar initiatives together and created a categorisation method. Additionally, only one of the seven categories was taken into the validation round, which could have been extended to all categories.

In the second part of Chapter 3, an extensive analysis on the definition of innovation was conducted to complete the previous study with an empirical overview. Although a growing divergence in the definition of innovation was observed during the previous study, the

researcher's personal interest in defining innovation was also influential here. The literature review on innovation followed up on a paper published by Baregheh et al. (2008) that aimed to create a new inclusive definition of innovation by studying the words used for defining it in the literature. Although the study in this research was based on this publication, the aim was not to add yet another definition or a model to the existing ones, but instead to show a general direction of development among the existing definitions. While looking at the definitions, only the last ten years were taken into consideration, since Baregheh stopped there, and the medical fields were excluded. The medical field also includes bioengineering and pharmaceutical developments, which are highly innovative fields. Excluding these left a very innovative field outside of the scope of this study.

The conclusions that innovation develops in parallel to social processes led to a second paradox related to complexity of innovation. Innovation heavily relying on social processes immediately related the research to the existence of multidimensional relationships that form social processes, which were determined as the main direction of study (Chapter 4). However, studying these relationships and therefore the social networks was not necessarily the only way to go. Complex questions can be studied through multiple perspectives. For instance, it also would have been possible to study the direct impact of innovative projects in Fryslân on the social development of the area without going into the relationships.

As a result of the literature studied in Chapter 3 and 4, a series of propositions were developed that served as preliminary answers to research questions. The research was set in a way that the propositions, which resulted from the conducted literature reviews and personal conclusions of the researcher, mapped the knowledge towards the empirical work. The character of propositions is rather flexible; some come from the literature directly and some refer to the situation in Fryslân through the literature. The idea behind creating these propositions was to combine the theoretical and empirical knowledge in a way that provided theoretical contributions and practical recommendations at the same time. The conventional research models work through hypotheses that are strict checks of the application of theoretical findings in a given context. However, the exploratory nature of this study and the non-descriptive statistical findings regarding the social network analysis made this impossible.

Last but not least, although briefly discussed in Chapter 5, a reflection on the data handling method is presented for the social network analysis in this thesis. This method, or the Network

Representatives method, as it is named in this research, aims to enable multiplex social network analysis for large-scale networks. Instead of mapping the relationships of every actor in the system, the method maps a part of the network by consulting representative actors who have knowledge over the system.

The ease of not having to map the entire network naturally has its downsides. There are four major downsides identified. The first is the necessary elimination of several network measures such as direction of relationships, symmetries, and transitivity (and a few more), which are measures that are found very helpful by analysts. The second downside relates to the difficulty of assessing the intensity of the relationships because the representatives are not able to assess the strength or frequency of two actors' relationships that they may or may not know personally. Despite the difficulty, we have tried to extract this data in the interviews with the representatives. However, we have decided to not take it into account because the validation of the data was not possible. We chose to use the data in a binary form and only look at if the relationship exists or not. The third downside is that since the method collects the information regarding the relationship of two people from a third party, what we can analyse is the reputation of the actors and their relationships, which might differ from the reality. The fourth and possibly the most crucial downside is that due to the small sample size, it was not possible to run a descriptive statistical analysis of the network, and the analysis will remain on an explorative level.

Despite the downsides that originated from the simplicity of data collection compared to the conventional social network analysis tools, as it has been validated with the experts, the method provided reliable information while making the data handling of large-scale networks incredible efficient.

8.6 Recommendations for Future Studies

In addition to the recommendations based on the outcome of empirical study that were discussed at the end of Chapter 7, there are also additional opportunities regarding the continuation of this research.

The research presented in this thesis was formulated through two paradoxes. The first was related to the complementary development of social and technical innovation and was presented with a conceptual model in Chapter 3. In this thesis, we looked at how this parallel

development affects large-scale innovation systems, departing from the situation in Fryslân. But large-scale innovation systems consist of a variety of organisations and institutions that are individually working on innovative output. The application of the complementary model in business settings has not been studied. Studying how social processes are handled in such settings will provide important insights related to our findings.

Regarding the SNA, from a methodological perspective, a comparison of results gathered by the application of conventional SNA studies to the NetRep method that was used for data handling in this thesis would be a useful addition to the developed method for studying large-scale social networks. Not only would such comparison provide statistical validation for the results that were gathered, but it would also reveal the limitation of the NetRep method from a statistical perspective.

During the discussions of the results with experts, it was mentioned that a few groups in the networks (such as the water network) were not adequately represented although they had an influential position in the province (Chapter 7). Experts stated that the addition of these groups would not change the overall results, but it may be beneficial to grow the sample size of the network study to reach all possible sub-groups.

As mentioned in Chapter 4, SNA is often criticised because the method only captures a specific timeframe, whereas the relationships and the involved actors are in constant change. Our research has shown that this can be true for certain relationships such as political ones for instance, where events like elections can make major changes. This relates back to Granovetter's (1974) theory of strong and weak ties. Weak ties are subject to change but strong ties, such as one's friendship network will remain the same. Repeating this study after a period of time would help the researchers to understand how time influences the outcome.

The potential influence of time on the outcome of SNA studies relates to changes in the social constructs that can occur as a result of various happenings. Fryslân is hosting a major international organisation LWD2018, the European Culture Capital in 2018. Throughout the year, a series of art, culture, and technology events will be taking place in Fryslân. These events will be visited by millions of visitors, and new relationships will emerge from these visits. In addition, the preparation of an activity and hosting an event together on such a scale will create a new bond between citizens. In fact, the theme of the organisation

relates to empowering the solidarity among locals to grow further together. LWD2018 has a potential to change the results of this social network analysis we have presented in this thesis. Therefore, also to measure the impact of events on such a scale, the study can be repeated when the event is finalised and the impact of it is being digested.

Finally, the problems Fryslân is experiencing are not unique. A majority of rural Europe and other non-metropolitan areas overseas experience similar issues. Adapting this social network analysis to other problematic settings will not only provide helpful recommendations for enhancing innovative performance of these areas, but also develop the NetRep method into a practical guide for forming, operating, and benefitting from networks for enhancing innovative output.

GLOSSARY

Community

A group of people living in the same place or having a particular characteristic in common, or both.

Region

Large official areas into which a country is divided (in this case the Netherlands).

Sustainability

A multifaceted vision for constant, uninterrupted development that cannot be undermined by environmental protection.

Resilience

Being prepared to the impact created by external and internal matters through renewing existing conditions and creating alternatives for survival.

Creativity

Unleashing the mind's potential to conceive new ideas although it remains as a subjective and immeasurable phenomenon (Marshall, 2013).

Innovation

Technical and social operationalization of a creative idea.

Innovation process

A series of purposeful acts that involve knowledge exchange and contributing to permanent change.

Paradox

A self contradictory or unacceptable conclusion deriving from true premises (Oxford dictionary, 2018)

Social Interactions

Interactions between a variety of actors and social practices involving perceptions, meanings, experience and bodily competences, purposes and values, materiality and acts (Shove et al., 2012, p.24-25).

Networks

Social interactions among a group of individuals or entities.

Complexity

Characterises the behaviour of a system whose components interact in multiple ways.

Relationship

The state of being connected in one or multiple ways.

Multiplexity

The multitude of relationship forms contained in a tie between two nodes. For example, two people can work together and be friends at the same time and they would have a multiplex relationship.

Social Network Analysis

Exploring the structure of social relationships between entities.

Node

A node is a connection point in a network and in this case this term refers to individuals in the system. Also mentioned as actors, points, entities, parties in this study.

Tie

The connection between two nodes. In this study, the terms relationship, edge and connection also refer to a tie.

Sociogram

A network graph (or a sociogram) is a composition of actors (or nodes or points) connected through relationships (or ties or edges).

Network measures

Certain attributes that can be calculated to analyse the properties and characteristics of networks.

- Betweenness: A measure of centrality based on shortest paths (to outliers).
- Centrality: How influential a node is in a network.
- Degree (centrality): A centrality measure that counts the connections a node has.
- Density: The ratio of the established ties to all possible ties.
- Diversity: Understood as the diversity of connected nodes in a network in this study.
- Frequency: Perceived influence of a node.
- Inclusiveness: The proportion of nodes that are tied to another node, to the total number of nodes.
- Reachability / Distance: The number of ties required for a connection.
- Size: Number of nodes and ties in a network.

LIST OF FIGURES

Figure	Year	Source
1	2018	https://upload.wikimedia.org/wikipedia/commons/9/99/Europe_blank_map.png
2	2018	https://commons.wikimedia.org/wiki/File:Frisia_716-la.svg
3	2014	http://www.pbl.nl/infographic/krimp-naast-groei
4	1623	https://commons.wikimedia.org/wiki/File:Universiteit_van_Franeker.jpg
5	2018	https://commons.wikimedia.org/wiki/File:Sustainable_Development_Goals.jpg
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Appendix A

ANALYSIS OF MANAGERIAL, POLITICAL AND FRIENDSHIP NETWORKS

Managerial Network

Managerial network has 74 nodes and 428 edges defined. The nodes are distributed as 16 from academia, 17 from the government, 9 from non-governmental organisations, 20 from small medium enterprises and 11 from corporate companies.

The managerial network is the most problematic network in this study. There is an unexplainably high number of active nodes compared to other three networks. As explained in Chapter 5, the validation showed that this does not originate from a flaw in the interview phase but from a worrying confusion regarding the address and character of managerial relations within the province.

On the actor level, the MTML looks at node centralities, structural autonomy and holes in relation to social capital theory. When we look at the graphs, we see that there are various node sizes and colours. The colours relate to the specific field of expertise in this study. Red nodes represent academia, blue nodes represent government, orange nodes are NGOs, green nodes are creative freelancers and SMEs and finally the purple nodes are directors of corporate companies.

The node sizes are defined based on two parameters in this study: degree and attribute. On the left we have the node sizes defined through degree, which represents the amount of edges connecting to a node and on the left the node sizes are defined through the attribute, which is the sum of ranking points that node has received in the interviews. It is remarkable to see how the names that are large in the sociogram on the right are smaller in the left. This difference has potential to tell us something about the actor's position in the network on an individual level. If the degree-based size is larger, it means that the node is well connected to the network but did not get ranked in high positions during the interviews with network representatives. If the attribute-based size is higher, it means that the node is quite important

for the network, however it is badly connected, maybe always collaborating with the same people and not expanding its outreach.

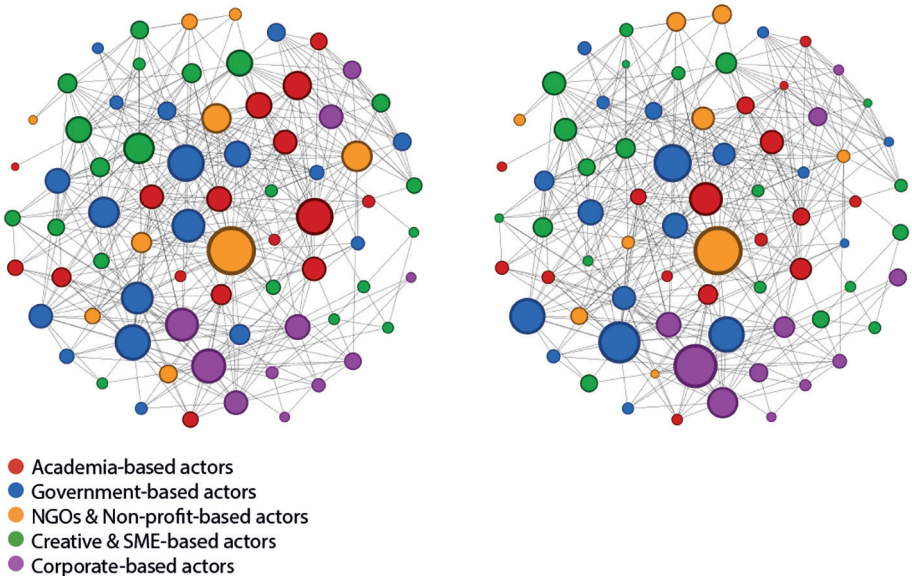

Figure 1. Degree-based node (left) sizes in comparison to attribute-based node sizes for the managerial network

The node sizes in the managerial network sociogram also show a balanced distribution. We can see this by looking at the density that is created by the edges through the network. All parts of the graph are covered with a certain amount of edges and no parts were left out. Density calculations of Gephi also confirm this. Graph density in managerial network is given as 0.158. This value is calculated by dividing possible number of edges to existing number of edges, which means that in a complete graph where all possible edges are present the density value would be 1.

Looking at the managerial network sociograms, although we do see a few highly central nodes that are larger in size, the difference is not drastic. It is possible to identify three main sizes or nodes, around 14 large nodes, 15 medium sized nodes and 35 small nodes. The 14 large nodes mainly originate from blue, orange and purple nodes, which represent

government, NGOs and corporate directors respectively. It is remarkable to see that the SMEs which are represented in green fail to dominate the managerial network.
In a network analysis, outliers are as equally important as central nodes because they form and visualise the poorly connected parts of the network. Within the managerial network there are 21 'distant members' out of 74 nodes. This is the second highest value of badly connected nodes compared to all four networks. Although it is not possible to speculate directly on the possible effects of badly connected nodes in a network, this value gives an idea about network segmentation which is not a favourable property.

The MTML model looks at networks distance, symmetry (reciprocity) and mutuality of networks under the dyadic level. All these measures derive from the exchange theory, which explains social transformation and stability processes as a result of information exchange between parties (Emerson, 1976). The symmetry and mutuality of networks both relate to the satisfaction of relationship within the network, but these can only be measured in a network analysis with directed edges therefore these cannot be considered in this study.

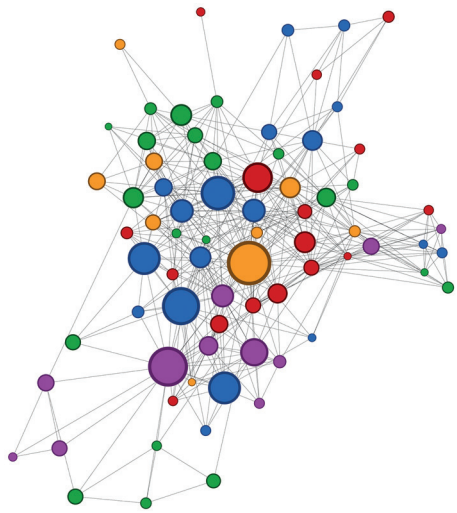

Figure 2. YifanHu algorithm displaying the distant actors in the managerial network

As mentioned actor level analysis, the managerial network has 21 distant members. On the dyadic level this situation refers to asymmetric relations, where one node perceives more interaction than the other.

Gephi measures the network diameter of the managerial network with a 4. The diameter of a network refers to the length of the longest of all the paths between all pair of nodes in the network. This network measure has other names in other sources such as separation or connectedness (Monge & Contractor, 2003). In practice, this measure means that any given pair of nodes in the managerial network are connected to each other through maximum four nodes. This concept is similar to the six degrees of separation theory of Karinthy (1929), which is defined in Wikipedia as "the idea that all living things and everything else in the world is six or fewer steps away from each other so that a chain of "a friend of a friend" statements can be made to connect any two people in a maximum of six steps" (2018).

Considering the number of nodes (74) in the network, which is a significantly small batch compared to every human on the planet that are six steps away, network diameter signals a problematic situation. First of all, it is a sign that managerial network is lacking a major ideal trait, which is centrality. Also, since managerial decisions require a certain linearity to be able to function efficiently. These issues in the decision-making processes can be seen as hindering properties.

Sub-group level of the MTML method looks at how clusters are positioned and also strong and weak components of the network. In graph theory, a clustering coefficient is "a measure of the degree to which nodes in a graph tend to cluster together" (Holland & Leinhardt, 1971, p. 2). In other words, degree defines the connections of a node among its neighbours, in proportion to the total number of possible connections. Gephi calculates the average clustering coefficient of a sociogram with the embedded statistical calculations. This value can be qualitatively verified by looking at the graphs or by looking at a contradicting measure. Higher the clustering coefficient in a network means the network is less likely to be segmented. The equivalence of segmentation in Gephi is modularity. In the case of managerial network Gephi calculates a clustering coefficient of 0.604 (lowest between all four networks) and a modularity value of 0.375 (highest between all four networks.

However, the segmentation can also be visualised through the sociograms. On this level, when we look at the Fruchterman Reingold layout, it is possible to see that managerial network presents clusters based on fields of expertise of nodes identified through node colours. This clustering can simply be read from the close proximity of the nodes with same colour. The most remarkable clustering occurred within purple nodes that represent the

corporates, as they all are located around each other. In fact, only the NGOs (orange nodes) are distributed without a significant cluster in the managerial network.

Another useful layout algorithm that shows clusters clearly is the OpenOrd method. The OpenOrd graph of managerial network shows five clear clusters. The intermediary position of NGOs is again clearly visible here as almost all the orange nodes are located on the borders of clustered nodes. This makes NGOs the gatekeepers between the other nodes.

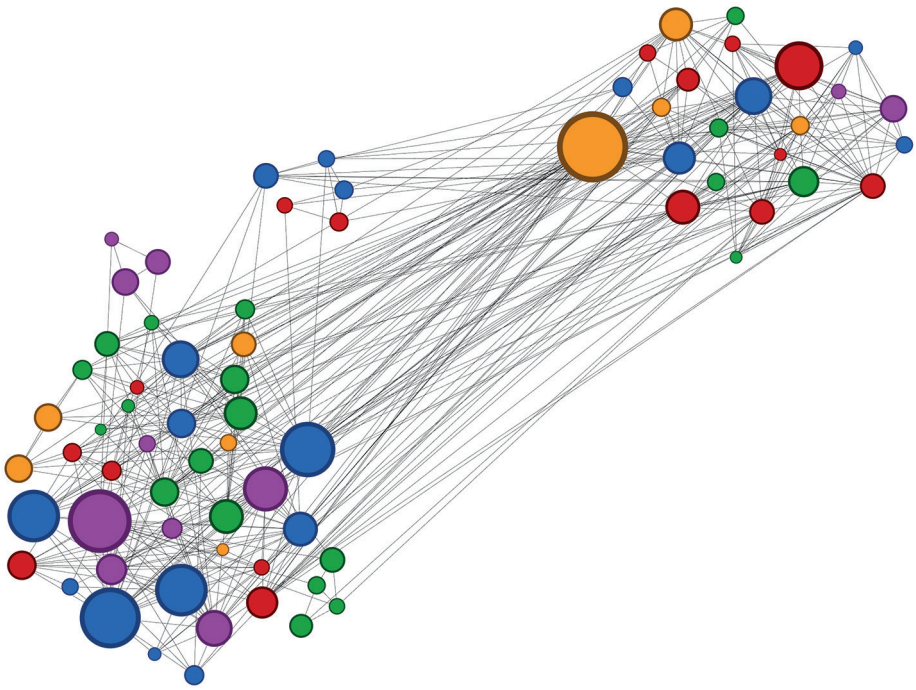

Figure 3. OpenOrd algorithm displaying the clustering of the managerial network

In the MTML density and centrality are associated with the global level. Network density refers to established relationships in proportion to potential relationships. In a way, density indicates how much of network's 'potential' is used. The theory behind this association is the collective action theory of Olson dating back to 1965, where he suggests that groups of individuals attempting to provide good are less likely to succeed. Innovation by nature requires a series of skills and knowledge that does not allow a single person to succeed. The

complexity level of society, and therefore innovation does not allow individual attempts to be consistently successful anyway.

There is a significant presence of central actors in the managerial network. This is not a negative aspect of the managerial network, since managerial relationships are hierarchical by nature. However, the fact that multiple highly central actors point out a confusion regarding the decision-making process as mentioned earlier.

Managerial network is the least dense network with a value of 0.158. As mentioned previously, network density is the ratio of existing connections to potential connections. Lower density measures also reflect on average degree measures. Gephi's own statistical algorithm calculates the average degree as 11.568 in the managerial network. Practically this means that each node is connected to an average of 11.568 other nodes out of 74 nodes. This is the second lowest degree between all four networks.

Political Network

Political network has 41 nodes and 241 edges defined. The nodes are distributed as 5 from academia (red), 20 from the government (blue), 5 from non-governmental organisations (orange), 6 from small medium enterprises (green) and 5 from corporate companies (purple).

Although the density of this network is rather high with a value of 0.294, there is a clear imbalance of professional distribution of actors since half of the nodes in the network are from the governmental organisations (blue).

On the actor level, the MTML looks at node centralities, structural autonomy and holes in relation to social capital theory. Although the interview questions were not directly related to political activity, the interviewees related the political network to politicians easily, which explains why half of the nodes are government related (blue in colour).

This is the network with highest centrality in this study. Since political relationship refer to a certain level of authority together with lobbying and power holding, the dominating node in the sociogram in the middle represents the authority figure in charge.

The other half of the nodes in the managerial network is distributed evenly. However, when we look at the graph we can see that these nodes are much less connected and have peripheral locations. While reading the graph we could understand this situation as peripheral nodes not being included in the decision making process, as they cannot penetrate the cluster of blue nodes.

When we compare sociograms of degree as a node size value and attribute assigned by interviewees as a node size value, things get even more interesting in the political network. We can see a clear enlargement of political nodes (blue) in the degree-based graph. This could mean that the perceived influence of politicians is much less than their actual influence.

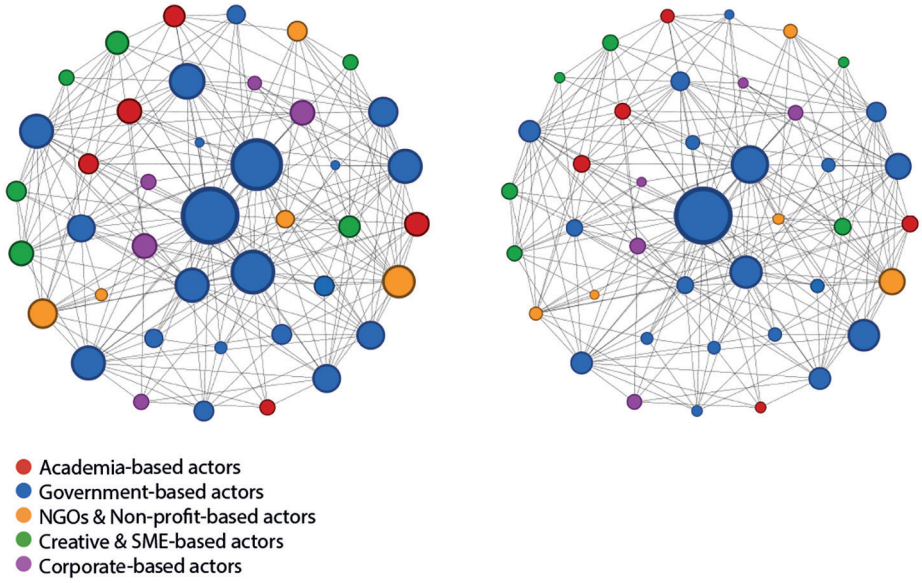

Figure 4. Degree-based node (left) sizes in comparison to attribute-based node sizes for the political network

The node sizes in the managerial network sociogram are not balanced. It is possible to see a few nodes in the graph that are connected to a large part of the network. These central nodes act as the gatekeepers of the system.

The political network is the least diverse network between the four and consequently it is also the most connected network. When a certain cluster of nodes occupy a large portion

of the graph like the blue nodes do here, the connectedness also grows. Because in reality these people have a day-to-day interaction due to their professional position and this gives them the chance to interact. The number of outliers is only 6 out of 41 nodes in the political network. This well connectedness also tells us that this network is less segmented.

The MTML model looks at networks distance, symmetry (reciprocity) and mutuality of networks under the dyadic level based on the exchange theory of Emerson from 1976.

Gephi measures the network diameter of the managerial network with a 3, this is the lowest diameter value in this study. In practice, this measure means that any given pair of nodes in the managerial network is connected to each other through maximum three nodes.

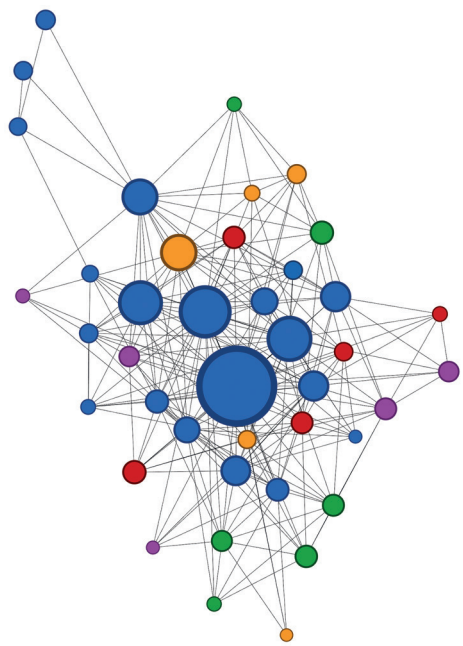

Figure 5. YifanHu algorithm displaying the distant actors in the political network

Sub-group level of this method looks at how clusters are positioned and also strong and weak components of the network based on the graph theory (Holland & Leinhardt, 1971). Gephi calculates the average clustering coefficient of a political network as 0.669, which is the second lowest. However, since clustering relates to segmentation, it can also be visualised

through the sociograms. The network is highly dominated by nodes (blue nodes) out of a single organisation; it is difficult to realise clusters in the Fruchterman Reingold layout. This value can better be qualitatively verified by looking at the sociogram laid out with OpenOrd algorithm. There is only one separated part in the sociogram, which is three nodes in the top left corner.

Higher clustering coefficient means less segmentation. The equivalence of segmentation in Gephi is modularity. In addition to clustering coefficient of 0.669 (second lowest between all four networks), the political network has a modularity value of 0.209 (highest between all four networks).

As mentioned earlier there are not many weak nodes in this network (only 6 weakly connected). Another difference is that the intermediary position of orange nodes (NGOs) that was present in other networks is not present here. Instead we see the corporates standing between the strong and weak nodes (purple nodes).

In the MTML density and centrality measures are associated with the global level. The theory drives from collective action theory of Olson (1965). Obviously the centrality is of a political network is higher than all the other networks, due to the strong hierarchy in the system. In this case, the difference between centralities is also much greater than other networks.

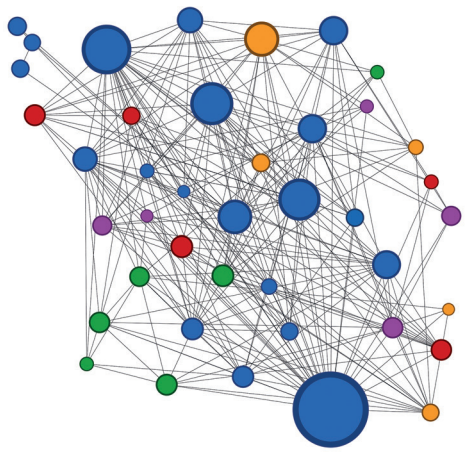

Figure 6. OpenOrd algorithm displaying the clustering of the political network

Network density and average degree measures help explaining the underlying dynamics. Despite to the direct hierarchy in political relationships, this is the second densest network of this study with a value of 0.294. This relates to the fact that more than half of the nodes belong to the same organisation, which is the government (blue nodes).

Political relationships also recognise a similar formality to managerial relationships and this is also visible in average degree measures. Gephi's own statistical algorithm calculates the average degree as 11.756. This means that each node is connected to an average of almost 12 other nodes out of 41 nodes. This is the second highest degree between all four networks and together with density a favourable aspect.

Friendship Network

Friendship network has 46 nodes and 333 edges defined. The nodes are distributed as 6 from academia (red), 11 from government (blue), 7 from non-governmental organisations (orange), 12 from small medium enterprises (green) and 7 from corporate companies (purple). The friendship is network is highly connected with a network density value of 0.322. This means that friendship network is the most vibrant network between the four analysed networks, which is also visible when we look at the remarkable amount of edges on the graph. The vibrancy of the friendship network supports the decision of including friendship networks in this SNA study.

Just like the political network, friendship network was added later to the study upon the realisation of its contextual relevance. Unlike managerial and creative network, friendship network has no direct influence on creative emergence. However, being 'friends' or in other words 'having a relationship outside of professional environments' has an indirect effect on how people collaborate (Kratzer, Leenders, & van Engelen, 2006).

On the actor level of the MTML model, node centralities, structural autonomy and structural holes are stated as relevant network measures. Distribution of nodes shows a good balance in the friendship network. All professional groups are well represented as can be seen from the presence of identifying colours. There is no significant over or under presence of any professional group.

When we look at the nodes individually, we see that a combination of most central nodes in the other three networks, which can be done by tracking the node number in the graphs, occupy the middle section of this network.

When we again look at the difference between degree-based node sizes and attribute-based node sizes, we see that degree-based sized nodes are remarkably larger. Especially the nodes in the centre display a significant difference. This could again be related to the difference between perceived and actual influence of a node in the network. Obviously, the nodes that appear larger when their size is based on the number of connections they have (degree-based) are more influential than perceived by the interviewees.

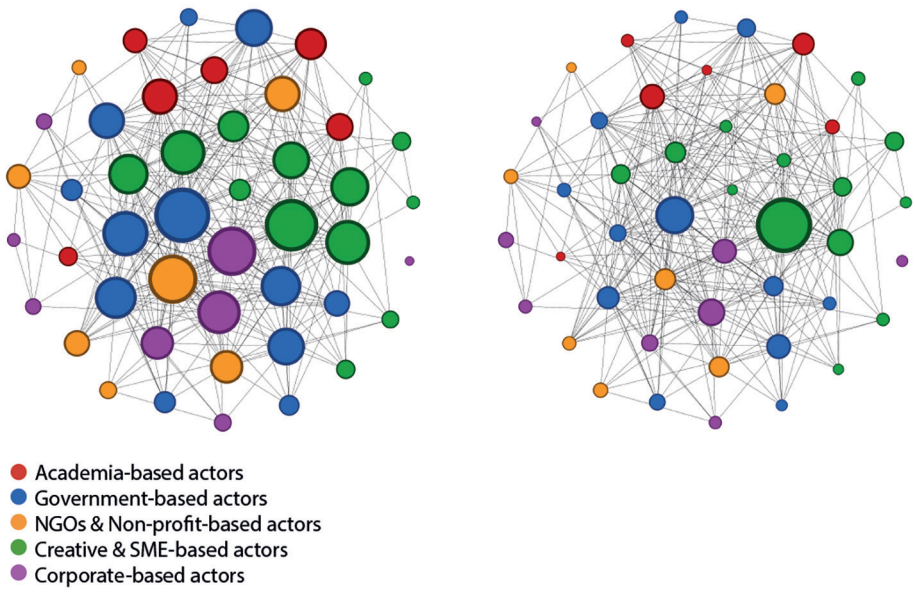

Figure 7. Degree-based node (left) sizes in comparison to attribute-based node sizes for the friendship network

The distribution of node sizes shows a significant difference in the friendship network. It is interesting to note that there are large nodes from all professional fields, unlike the other networks. This is favourable aspect of the friendship as it suggests a certain degree of trust and approval between various actor groups.

In the friendship network there are very few outliers. There are only 10 weakly connected nodes from 46 active nodes; this makes the friendship network the second most connected network between all four. Throughout the graph we also do not see many nodes that are the sole enabler of data flow unlike the other networks. These are called gatekeepers and except for one significantly large node (green number x) the friendship network does not recognise any.

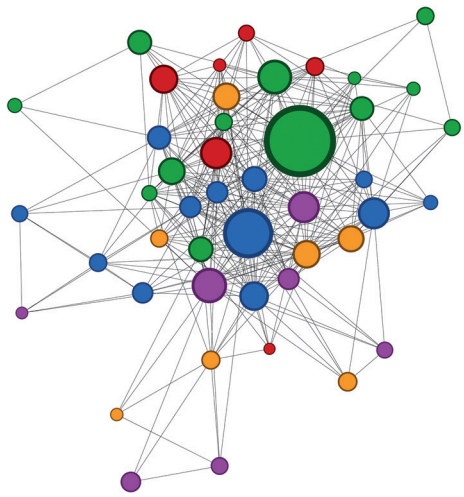

Figure 8. YifanHu algorithm displaying the distant actors in the friendship network

The MTML model looks at networks distance, symmetry (reciprocity) and mutuality of networks under the dyadic level based on the exchange theory by Emerson (1976).

Gephi measures the network diameter of the friendship network with a 3. This means that the largest path that information has to travel consists of 3 edges.

Sub-group level of this method looks at how clusters are positioned and also strong and weak components of the network based on Holland & Leinhardt's (1971) graph theory. To understand the likeliness of clustering, it is possible to look at the clustering coefficient calculated by Gephi's standard statistical set. Clustering coefficient is the ratio of realised connections of a node to the number of potential connections the node could have. Therefore, higher the clustering coefficient in a network means there will be low segmentation. The

equivalence of segmentation in Gephi is modularity. In the case of friendship network Gephi calculates a clustering coefficient of 0.696 (highest between all four networks) and a modularity value of 0.172 (lowest between all four networks).

Qualitatively, when we look at the Fruchterman Reingold layout, it is possible to see a slight clustering of SMEs (green nodes) that are positioned closely. However, when we look at the individual information regarding these nodes, we see that geographical proximity could be the factor behind this clustering, since most of them are located in the same building complex.

A better view of the clusters can be seen in the OpenOrd layout. Here we see two main clusters of nodes, one being as small as three nodes. Again, it is important to know that the three separate nodes we see on this graph in fact are external actors qua proximity, yet have many relevant connections.

This network also shows a completely disconnected node. This means, the interviewee ranked the node, but no knowledge of personal connections was indicated. Since friendship network purely relies on personal connections, it is possible that this particular actor, despite being liked and trusted, does not have immediate connections to any other of these nodes.

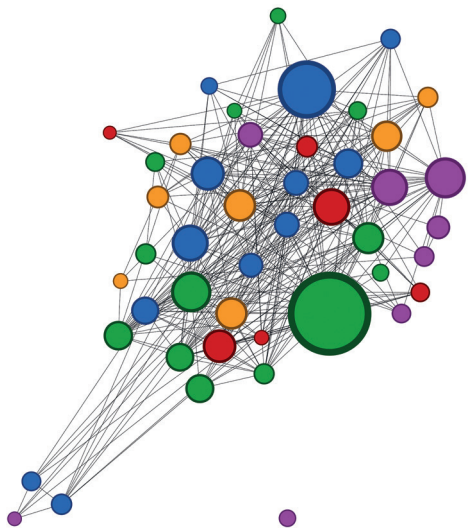

Figure 9. OpenOrd algorithm displaying the clustering of the friendship network

In the MTML density and centrality are associated with the collective action theory introduced by Olson in 1965. The theory supports the necessity of centrality for efficiency. In the case of creative relationships, which are also a form of informality, the study showed no proof of positive influence of high centrality on creative output. However, the success of friendship network can indeed be positively influenced indeed if relationships that form this network are enhanced.

In combination with centrality, the network density and average degree measures help explain the underlying dynamics. Friendship network is the densest network of this study with a value of 0.322. The informal and subjective nature of friendship breaks the hierarchical boundaries between individuals and creates a more connected group of individuals.

This informal and non-hierarchical character of friendship relations is also visible in average degree measures. Gephi's own statistical algorithm calculates the average degree with a 14.478, which means that each node is connected to an average of 14 others out of 46 nodes. This is by far the highest degree value between all four networks and a favourable aspect that can be used for improving the properties in other networks.

Appendix B

INTERVIEW USED FOR DATA COLLECTION DURING THE NETWORK ANALYSIS

Dear participant,
Thank you for taking the time to contribute into this research for enhancing innovative output of Province of Fryslan, conducted by TU Delft & NHL University.

This project departs from the fact that the future of strong socio-economic structures will be highly dependent on their innovative output. Especially regions with agricultural or touristic backgrounds, such as Fryslan are subject to transition. There is strong proven link between creativity and innovation. Knowing that the upcoming generations that own the future (Y-Z) value creativity, creative industries are expected to lead the innovative transition of these developing regions.

While collective creativity is a cultural matter, individual creativity is shaped through our physical and emotional encounters. A significant part of these encounters are social interactions that occur naturally within the community. Developing regions must first ensure that the individual creativity is triggered, fed and facilitated through the community. Only then we can speak of creativity leading towards an innovative region that is self-sustainable.

This research focuses on the interactions and the networks that are formed within a community. Collecting empirical data on network dynamics will help understand the optimum interaction between actors of innovation systems. Therefore, this network study, which you are now a part of, will generate new knowledge on how relationships affect innovative output; and most importantly on a practical level it will also generate applicable feedback on innovative systems of the province of Fryslan.

Innovation is defined as operationalization of a novel idea. Managerial and creative tasks cover the majority of the work. However, research shows that there could be other influencing factors that have an effect on the innovative output such as policy-making, which influences the money-flow or friendship, which influences decision-making processes. This research focuses on four types of relationships that form four major networks of innovative systems: managerial network, creative network, policy-related network and friendship network. The questions are divided into four sections respectively.

Once again, thank you for your interest and your help.

Your answers will not leave the secure environments of TU Delft and NHL.

Question 1

P1: Please make a top 10 list from the names on the Excel sheet, of people **who would be invited first when starting a new project in Fryslan.**

P2: Please rank the **managerial communication** between the people you have listed by using the matrix below.

who would be invited first when starting a new project										
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										

Question 2

P1: Please make a top 10 list from the names on the Excel sheet, of people **who are known to be the best solvers of managerial problems.**

P2: Please rank the **managerial communication** between the people you have listed by using the matrix below.

best solvers of managerial problems										
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										

Question 3

P1: Please make a top 10 list from the names on the Excel sheet, of people **who are known to have the most original ideas.**

P2: Please rank the **creative communication** between the people you have listed by using the matrix below.

who are known to have the most original ideas										
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										

Question 4

P1: Please make a top 10 list from the names on the Excel sheet, of people **who are known to be the best solvers of creative blockages.**

P2: Please rank the **creative communication** between the people you have listed by using the matrix below.

best solvers of creative blockages										
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										

Question 5

P1: Please make a top 10 list from the names on the Excel sheet, of people **who are known to be the best lobbyers.**

P2: Please rank the **policy-related communication** between the people you have listed by using the matrix below.

who are known to be the best lobbyers										
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										

Question 6

P1: Please make a top 10 list from the names on the Excel sheet, of people **who are known to be the best solvers of policy-related problems.**

P2: Please rank the **policy-related communication** between the people you have listed by using the matrix below.

best solvers of policy-related problems										
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										

Question 7

P1: Please make a top 10 list from the names on the Excel sheet, of people **who are known as the most popular.**

P2: Please rank the **friendly communication** between the people you have listed by using the matrix below.

who are known as the most popular										
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										

Question 8

P1: Please make a top 10 list from the names on the Excel sheet, of people **who are liked the most.**

P2: Please rank the **friendly communication** between the people you have listed by using the matrix below.

who are liked the most										
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										

Question 9

P1: Please make a top 10 list from the names on the Excel sheet, of people **who are trusted the most.**

P2: Please rank the **friendly communication** between the people you have listed by using the matrix below.

who are trusted the most										
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										

Question 10

P1: Please make a top 10 list from the names on the Excel sheet, of people **who are known to be the best peacemakers.**

P2: Please rank the **friendly communication** between the people you have listed by using the matrix below.

who are known to be the best peacemakers										
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										

Appendix C

VALIDATING FUNCTIONAL CLUSTERING OF SOCIAL INNOVATION NETWORKS

Question 1/12

The main purpose of the organization I work for / I work with / I own can be summarized as…

- *finding a solution to a given problem*
- *facilitating creative ideas or creative people*
- *making life easier for creative people*
- *bringing creative people with same interests together*
- *inspiring the society through art design or culture*
- *providing academic insight*
- *making profit and contribute in the society at the same time*
- *none of the above*

Question 2/12

…% of employees and partners that my organization works with are professional designers.

---
0 25 50 75 100

Question 3/12

Can you pick one of following keyword groups that define your organization the best according to you?

- *competition* | *challenge* | *co-creation*
- *meeting/working spot* | *incubation* | *knowhow*
- *funding* | *matchmaking* | *improving skills*
- *networking* | *sharing common interests* | *knowledge exchange*
- *inspiration* | *cultural exchange* | *free time*
- *research* | *academia* | *theory*
- *entrepreneurship* | *spin-off* | *start-up*
-

Question 4/12

Which of the below listed organization types have most in common with your organization? (please pick max. 2)

- *online challenge platforms*
- *design competitions*
- *creative collectives*
- *physical meeting places*
- *incubators / accelerators*

- *cultural organizations*
- *art related events*
- *creative collaboration platforms*
- *funding programmes*
- *artist/designer-customer matchmaking communities*
- *academic research groups*
- *independent research organizations*
- *labour unions*
- *knowledge sharing networks*
- *corporate networks with a societal consideration*
- *small medium enterprises with a societal consideration*
- *spinoffs*

Question 5/12

Please indicate your acquaintance with the 14 organizations below.

1- Innocentive

- *never heard of it*
- *sounds familiar*
- *have seen their work*
- *regularly come in contact*
- *worked with them*

2- Solar Decathlon

- *never heard of it*
- *sounds familiar*
- *have seen their work*
- *regularly come in contact*
- *worked with them*

3- Seats2Meet

- *never heard of it*
- *sounds familiar*
- *have seen their work*
- *regularly come in contact*
- *worked with them*

4- YesDelft!

- *never heard of it*
- *sounds familiar*
- *have seen their work*
- *regularly come in contact*
- *worked with them*

5- Slow Cities

- *never heard of it*
- *sounds familiar*
- *have seen their work*
- *regularly come in contact*
- *worked with them*

6- Greenwish

- *never heard of it*
- *sounds familiar*
- *have seen their work*
- *regularly come in contact*
- *worked with them*

7- Wetsus

- *never heard of it*
- *sounds familiar*
- *have seen their work*
- *regularly come in contact*
- *worked with them*

8- UNESCO – IHE Delft Institute for Water Education

- *never heard of it*
- *sounds familiar*
- *have seen their work*
- *regularly come in contact*
- *worked with them*

9- BNO – Bond van Nederlandse Ontwerpers

- *never heard of it*
- *sounds familiar*
- *have seen their work*
- *regularly come in contact*
- *worked with them*

10- European Network of Creative Small Cities

- *never heard of it*
- *sounds familiar*
- *have seen their work*
- *regularly come in contact*
- *worked with them*

11- European Cultural Capital

- *never heard of it*
- *sounds familiar*
- *have seen their work*
- *regularly come in contact*
- *worked with them*

12- Lowlands

- *never heard of it*
- *sounds familiar*
- *have seen their work*
- *regularly come in contact*
- *worked with them*

13- Shapeways

- *never heard of it*
- *sounds familiar*
- *have seen their work*
- *regularly come in contact*
- *worked with them*

14- Friesland Campina

- *never heard of it*
- *sounds familiar*
- *have seen their work*
- *regularly come in contact*
- *worked with them*

Question 6/12

Which one of the above listed 14 organizations has most common properties with your organization according to you?

- Innocentive
- Solar Decathlon
- Seats2Meet
- YesDelft!
- Slow Cities
- Greenwish
- Wetsus
- UNESCO
- BNO
- European Network of Creative Small Cities
- European Cultural Capital
- Lowlands

- Shapeways
- Friesland Campina

Question 7/12

Can you specify in which way this organization is the most similar one?

- *similar business plan*
- *similar end products*
- *similar hierarchy*
- *similar design methods*
- *similar budget/size*
- *other (please specify)*
  ……

Question 8/12

Are there other organizations you are familiar with that do similar type of work as your organization? If yes, can you name a few.

……

Question 9/12

Below you will find three definitions for innovation. Please select the one you are most comfortable with.

- *any change that creates a new dimension of performance*
- *generation, acceptance and implementation of new ideas, processes products or services*
- *effective application of processes and products new to the organization and designed to benefit it and its stakeholders*

Question 10/12

Below you will find three definitions for social innovation. Please select the one you are most comfortable with.

- *new ideas (products, services and models) developed to fulfill unmet social needs*
- *new ideas about social systems and social interactions, while rare, can have a tremendous impact on our lives and world*
- *innovations in our capacity to organize social and financial resources to achieve large-scale social impact*

Question 11/12

Can you rate the 'innovativeness' and 'social innovativeness' of your organization based on the definitions you have just selected?

Innovativeness

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0 1 2 3 4 5

Social innovativeness

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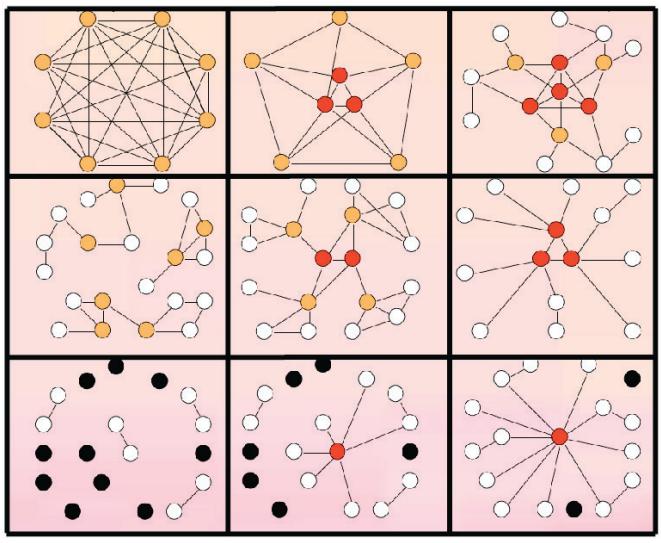
0 1 2 3 4 5

Question 12/12

Can you look at the images below and choose the most representative model for your organization?



Thank you!
If you would like to hear about the further phases of this research please leave us your e-mail address.

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