Implementation of Product Service Systems by Technical Services Providers in the Industrial Sector.

An in depth case study conducted at EQUANS Nederland N.V.

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TU Delft

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by

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to obtain the degree of Master of Science in Management of Technology

at the Delft University of Technology,

to be defended publicly on Friday July 14, 2023 at 13:00h.

Student number:	4450825	
Project duration:	February 6, 2023 – July 14, 2023	
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Preface

Dear reader,

This thesis marks the end of my master Management of Technology at the Delft University of Technology. This thesis has been conducted in cooperation with Equans Nederland N.V..

This project allowed me to combine aspects of the energy transitions and business development, two great interests of mine. Therefore I want to express my gratitude to a number of people.

First of all, I would like to thank my TU Delft supervisors, Victor Scholten and Rudi Hakvoort, for guiding me throughout the entire master thesis project process. I would like to thank you for the frequent meetings and constructive criticisms that helped me shape this project. You always were available when necessary. It was a pleasure to work with you.

Secondly, I would like to thank Sabina van Driel from Equans for guiding me from the companies' perspective by helping me navigate throughout the company. Additionally, thank you for your tips and experience on the day-to-day questions that emerged while writing this thesis. Besides Sabina, I want to thank the people from Equans in general. Everyone I spoke to was interested in the topic and keen in helping me during my research. Moreover, I want to thank the interview and panel participants for allowing me to gather the necessary data to conduct my research and learn from such an impressive company.

Finally, I would like to thank my loved ones for their infinite support throughout the years. It is greatly appreciated.

B.H.R. van Versendaal
Rotterdam, July 2023

Executive summary

The industrial energy transition is a great challenge to achieve and at the same time offers great opportunities for decarbonization. This project is about how technical service providers (TSP) that are active in the industrial energy transition can implement a product service system (PSS). The problem that lead to this topic was a lack of coverage in literature and a case of a TSP, Equans, that experiences problems with realizing healthy profit margins, long term- and recurring revenue, and value based pricing of their products and services.

The main research question for this problem and thesis project is: ***What factors influence a successful implementation of a PSS by technical service providers that are active in the energy transition in the industrial sector?***

To answer this question, a literature study has been conducted that identified the characteristics of the industrial energy transition. The main characteristics and factors were related to the way the industrial sector is organized, and related to economical aspects of the industrial sector. Fossil fuel favorable regulations, interconnected industrial processes through flows of energy and mass, high usage of fossil fuels as feedstock, and high costs connected to the transition are the main influential factors. The characteristics show a great opportunity for reducing global carbon emissions but also the great barriers the transition is facing. Interviews were conducted with multiple Equans employees with different positions within the company to identify the problems and their causes they experience with their participation in the industrial energy transition market. To solve the problems mentioned earlier, Equans wants to realize recurring revenue, value based pricing, added value and client lock-in all while staying cash flow positive.

From literature an analytical framework is created to do the following: determine the profile of TSPs and its goals, assess potential case study candidates to extract success factors for a PSS implementation, generate scenario's for TSPs to identify the corresponding success factors for that scenario. In the case of Equans, a panel of Equans employees classified 14 presented scenario's on an Impact/Effort matrix and finally choosing two scenario's from the categories Low Effort/High Impact and High Effort/High Impact.

Success factors for PSS implementation are identified from conducted case studies on plant engineering companies, offshore industry and the automotive sector. The success factors cover the following criteria of a PSS, where the PSS is seen as a product: product orientation, contract term, product type, operations executor, ownership and financing. The success factors are incorporated in the analytical framework that helps the user identify success factors that correspond to scenario's that are also created within that framework. The most likely scenario's for Equans are also analyzed and it has been indicated which success factors belong to those scenarios, according to the analytical framework.

Following this research, it is recommended to Equans to implement a result oriented PSS because this includes their goals the best out of the three orientation options, also this type of service is most apparent in literature which can be used to identify more success factors for their implementation process. Also it is advised that Equans uses the analytical tool to help them implement a PSS in a structured way. Additionally, Equans should create a separate business unit that is focused solely on the development, strategy and implementation of PSSs.

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Introduction

1.1. Problem introduction

As is commonly known, the global green house gas (GHG) emissions form a problem for our planet (REN21, 2022). The global GHG emissions are rising every year. Research conducted by Olivier (2022) states that the total carbon-dioxide equivalent (CO2eq) emissions rose to 58.7 GtCO2 eq in 2019, an increase of 57% compared to 1990 and a 23% increase compared to 2005. According to data from Climate Watch, 73.2% and 24.2% of the total GHG emissions come from the total energy use and the energy usage in the industrial sector respectively (ClimateWatch, 2022). Energy usage and consumption reduction alone to bring these numbers down would not be realistic since energy is at the base of every production process. While energy consumption reduction will still have a positive impact on the reduction of CO2 eq emissions, it is necessary to find energy sources that can replace the current polluting fossil fuels. As Dincer (2000) mentioned over two decades ago: to tackle the current environmental problems, renewable energy sources are essential. Examples of renewable energy sources are wind, geothermal, hydro and solar. These sources can be used to generate heat, electricity and hydrogen. If the goals that have been set for net zero emissions by 2030 need to be reached, the annual renewable power additions must triple (REN21, 2022). This is also the case for the energy intensive large industry. In 2019, 16.1% of the total energy used in the industry and agriculture sector was from renewable sources. It is clear that the road to net zero emissions is still long.

The transition to renewable energies offers many business opportunities. Every company that applies industrial processes that uses fossil fuels is a potential client for companies that help to realize the current efforts for a more sustainable planet and renewable developments. It is estimated that the renewable market spending until 2030 is in the range between 763 billion to 1.8 trillion USD annually, in comparison to the estimated 366 billion USD that was invested in renewable energy in 2021 (REN21, 2022). This means an increase of 200% to 500% is necessary to reach the needed spending estimate to mitigate the climate change effects. It can be expected that the large estimated growth of investments will lead to more businesses entering the energy transition market. As mentioned above, the current percentage of renewable energy that is used in the industrial and agriculture sector is 16.1%. An energy transition of great scale still has to be made in the industrial sector.

These transitions can be interpreted as contradicting because heavy industry is being made sustainable using other heavy industrial projects. It is supposed to 'fix' a problem with the same means, heavy industry, that it swears to solve. Can the transition be sustainable? Are there (new) business models for the executing companies that can contribute to the transition being more sustainable? And additionally, can revenue for these executing companies be extended further than the initial operating costs of these transitions? These questions are the motivation for this thesis project, and will be touched upon later.

1.1.1. Technical Service Providers

For the transition between energy types in the industry, companies can choose different approaches. Some companies are large enough to lead their own transition. Companies like Shell, Exxon Mobil and Vattenfall make their own efforts to develop their own technologies and plans to reach their goals. However, many industrial companies do not have these in house capabilities and have to involve large consultancy-, and engineering companies. Examples of these companies are Royal HaskoningDHV, Arcadis and Equans. Similar companies can advise clients on specific problems and execute, or help execute their projects. These companies are often referred to as technical service providers.

Business models that are currently practiced by these companies are often the cost-plus model and the lump-sum model. These models have disadvantages for several reasons. The technical service providers (TSP) are therefore looking for ways to implement new business models. One of the options are service oriented business models. The transition towards service oriented business models is called “servitization”, which will be further addressed in section 2.5.

Such an implementation has has not yet been done at the scale these companies are normally used to operate in. In literature, these specific implementations have not yet been conceptualized nor analysed in case studies.

This research focuses on the implementation of a service business model for TSPs in the industrial sector that are active in the industrial energy transition. When a TSP is mentioned throughout this report it refers to TSPs in this context.

Following the introduction of this problem it will be supported with literature review findings in section 1.2.

1.2. Literature review

This section elaborates literature findings that were mentioned in the previous subsection. The goal is to identify the landscape of servitization and knowledge gaps concerning servitization by TSPs, from which research questions can be constructed.

1.2.1. Literature search methods and knowledge gap

A literature review was conducted to identify scientific knowledge gaps. For this literature review, searches were conducted in several academic databases such as Scopus and Science Direct. The search queries and their hits for the initial literature review can be found in section A.1.

The consulted publications resulted into identifying multiple knowledge gaps. After the literature review it is clear that there is substantial literature about business models and business models in the industrial sector. Also servitization is substantially covered, as well as in some industrial contexts. However, specific literature on servitization practices in the large scale industrial sector is scarcely available to non-existent. Also ways how different aspects from business models can vary when implementing a service oriented business model is not described. There are some publications on similar market segments and companies with low complexity services models, like replacing simple parts.

Another type of service business model, Product Service System, is also widely covered in literature with the first publications dating back decades, but again not specified on the application of such a business model by a technical service provider that is active in the heavy industrial sector, let alone focused on the energy transition of the industrial sector.

Concluding, literature that covers important factors concerning the implementation of service business models in the industrial sector, and how and what dimensions of these business mod-

els can vary is not available and is the research gap that is central to this thesis project.

1.2.2. Framework

Since literature on the service business model implementation in the above mentioned context and case studies are not available, a conceptual framework will be developed based on a literature study with a focus on PSS business model. The framework will be used to analyze PSS business models and how they are implemented in similar markets. Best practices of these implementations will be identified using this framework. To use a real life context and data, the study will be performed at a TSP.

1.2.3. Data collection

Besides literature, the framework is developed and tested using a TSP for real life context. This TSP is Equans N.V..

Equans is a technical service provider that is specialized in driving the three main transitions today: the energy-, industrial-, and digital transition. The branches where this thesis is conducted is Equans West Industry (EWI) and Equans West. Respectively, these branches focus on industrial sector in the west of the Netherlands, and the design, realization, maintenance and management of projects in the west of the Netherlands excluding the industrial sector.

Equans is a suitable company to conduct the study because the company has ambitions to change its business model as a result from problems the company experiences with the current business models. This is discovered during initial talks with employees of Equans. These problems are:

1. Low profit margins.
2. Highly competitive market.
3. Revenue for Equans vs rewards for the client.
4. Low to no recurring revenue from projects.

These problems will be further researched in this thesis. Additionally, Equans is a large active company in the industrial sector and this study can serve as an example for other technical service providers.

1.3. Problem statement

Following literature review and the problems that Equans pointed out, a problem statement is constructed combining all aspects. The problem statement is as follows:

Technical service providers are looking for new business models to implement in the industrial sector to attain recurring revenues and to close the gap between costs billed to the client and the final rewards (cost and/or energy savings) for the client. Key factors concerning such an implementation are absent in literature, as well as the description on how these PSS business models can vary when implemented in the industrial sector.

The objective is to find successful ways on how to implement a PSS for technical service providers (TSP) that are active in the industrial sector and generate recurring revenue for the TSP and value based pricing.

To conceptualize this, a framework will be constructed based on literature to help identify success factors for such an implementation. The framework will be tested by using it in an actual TSP, being Equans N.V..

The goal for this project is to contribute to literature by presenting a structured method to analyze success factors for the implementation of such PSS in the above mentioned context, different scenarios of such an implementation and success factors that are necessary for an implementation. This way technical service providers like Equans can strategize on the implementation of service business models.

Research questions are constructed to address the identified problem. The main research question for this thesis project is the following:

What factors influence a successful implementation of a PSS by technical service providers that are active in the energy transition in the industrial sector?

This research question will be supported by multiple sub research questions:
Sub Research question 1: What are the characteristics of the energy transition in the industrial sector?

Sub Research question 2: What are the current problems and their causes for Equans that arise in the participation of the industrial energy transition?

Sub Research question 3: What are the service and business models used in other relatable markets?

Sub Research question 4: What are success factors that technical service providers should implement in their organizational structure to achieve a successful PSS implementation?

The research design will be discussed in the next section: section 1.4.

1.4. Research methods and design

This section describes the research strategy and approach of the project. First, the approach per Sub Research question is described. In Figure 1.1 the research flow diagram is displayed and describes the content, input, processes, output and method of each chapter.

The research design for this project will consist of qualitative research methods, since the problem is of qualitative nature. Below, the research methods are described per research question. A more in dept description of the analytical framework that is used, can be found in section 2.8.

Sub Research question 1: What are the characteristics of the energy transition in the industrial sector?
This question will be answered through a literature review, using databases as Scopus to retrieve publications on methods that are used and factors and barriers that arise during the execution of the energy transition in the industrial sector. The main search subjects consist of combinations of the queries barriers, challenges, industrial, sector, energy transition, electrification, renewable energy (sources). Further, citations in consulted publications will also be examined if it seems applicable to answering the question.

Sub Research question 2: What are the current problems and their causes for Equans that arise in the participation of the industrial energy transition?
This question is specifically aimed at identifying what problems Equans encounters while executing projects as a technical service provider and what the corresponding point of improvement are at Equans. Interviews will be conducted with multiple employees with different positions within the company.

Sub Research question 3: What are the service and business models used in other relatable markets?
For this question literature will be consulted. An analytical framework will be created to ensure a consistent methodology in identifying and examining similar sectors and/or markets. This framework will be thoroughly addressed in section 2.8. First, comparable markets have to be found that implement servitization in their business models. Literature will be searched using Scopus and by entering combinations of the queries servitization, industrial sector, digital servitization, service models, business models, recurring revenue. After suitable cases have been identified, the service and business models in these cases are examined.

Sub Research question 4: What are success factors that technical service providers should implement in their organizational structure to achieve a successful PSS implementation? This question builds on the previous sub question and is also part of the analytical framework. The selected cases will be used to perform case studies on how the companies or industries implemented servitization business models successfully. Key factors will be identified and extracted in a way that Equans will be able to use these success factors by creating a method that links scenario's to the success factors.

Chapter	Input	Process	Output	Research Question	Method
Introduction Chapter 1	- Exploratory literature review - Equans problems	Give background to the problem and introduce the problem. Use literature and Equans input to construct research questions.	- Sub Research Questions - Main Research Question - Research design		Literature Research Desk Research Exploratory Qualitative Research at Equans
Literature review Chapter 2	Academic literature on: - Energy Transition - Business models - Servitization in the industrial sector - Product Service Systems (PSS) - PSS classification	Literature study to map the energy transition background and to map the servitization landscape. Focus on the industrial sector.	- Servitization background information and definitions - Industrial Energy transition characteristics - Analytical framework to analyze PSS implementation success factors	Sub Research Question 1	Literature Study
Methodology and data collection Chapter 3	- Analytical framework - Case study literature - Employee knowledge	Conduct interviews using the analytical framework from CH2 and identidy problems and causes within Equans regarding the execution of projects. Analyzing case studies using the analytical framework and identify success factors for PSS implementation. Generating scenario's based on framework and literature. Organize panel with Equans employees to evaluate scenario's.	- Equans problems and - Equans' scope - Business models of relatable markets - Success factors for PSS implementation in relatable markets - Scenario generation framework - Scenarios based on literature and Equans scope - Set-up for Equans panel for scenario evaluation	Sub Research Questions 2 & 3 & 4	Interviews Desk Research Qualitative Research Analysis
Results Chapter 4	- Interview results - Case study results - Success factors for PSS implementation - Equans panel set-up	Summarizing the data collection from CH3. Merging the identified success factors accross the three PSS dimensions. Conduct the panel and process the results using the analytical framework.	- Research results collection - Equans panel results - Panel scenario success factor list	Sub Research Question 4	Qualitative Research Analysis Desk Research
Discussion Chapter 5	- Research results collection - Analytical framework - Literature review	Discussing methodology Evaluating the scientific contribution of the report. Evaluating the value for Equans. Addressing the analytical tool. Reflecting on research. Recommending steps for future research.	- Methodology discussion - Scientific contribution - Value for Equans - Analytical tool for PSS analysis for TSPs - Research reflection - Recommendations for future research		Integration of Literature Study & Research Analysis
Conclusions Chapter 6	- Research results collection - Interview results - Literature review results - Analytical framework - Identified success factors	The research questions will be answered using the results presented throughout the report. Using the findings, recommendations for Equans will be given and elaborated.	- Sub Research Questions answers - Main Research Question answer - Recommendation for Equans	Main Research Question	Integration of Literature Study & Research Analtsys

Figure 1.1: Research Flow Diagram

2
Literature

As described in chapter 1, literature on the implementation of Product Service Systems by TSPs in the industrial sector is not available. In this chapter, a literature review is performed to gather information that is relevant to answering the research questions for this thesis. Background information on the industrial sector and the current state of servitization is necessary. The chapter is divided into multiple sections to cover the wide range of different topics that are relevant to answering the research questions.

In section 2.1 a brief history description of the energy transitions is described. The energy transition in the industrial sector is described in section 2.2. The cost-plus and lump-sum business models are described in section 2.3. In section 2.4, product service systems and different types are discussed. Servitization in the industry sector is discussed in section 2.5, followed by the servitization in the construction sector in section 2.6. How different kinds of servitization can be classified is described in section 2.7. Finally, the analytical framework is presented in section 2.8, along with the steps that make up the framework.

2.1. Energy transition background

To better understand the context that the TSPs in question operate in, background information and a description of the history of the energy transition is given in this section. First, a definition of an energy transition must be given. In this report the definition bySmil (2017) (page ix) is used. He states that an energy transition is "the change in composition (structure) of primary energy supply, the gradual shift from a specific pattern of energy provision to a new state of an energy system". Take a shift from wood to coal for heating as a simple example.

In the current times, when we talk about the energy transition, the transition away from carbon intensive energy sources is meant. Perhaps the most commonly known example is the transition from fossil fuels to renewable energies like electricity that is generated by wind or solar instead of natural gas or coal.

This transition is not the only energy transition the world has seen. Fouquet (2010) mentions energy transitions within heating, power, transport and lighting between the year 1500 till 2000. For heating, 70% woodfuels and 30% coal in 1500 transitioned to around 95% coal, 4% woodfuels and 1% gas in 1850. Eventually introducing oil and electricity and almost completely eliminating woodfuels and coal usage Fouquet (2008). Energy used for power transitioned from 'Food for labour' and 'Provender for animals' which accounted for 90% as sources supported by hydro and coal in 1800, to coal, gas, nuclear and biofuels around 2010 (Fouquet, 2008).

Fouquet (2008) mentions that after large transitions, major changes were identified during the switch between energy sources. These changes were occurred in the supply network, the energy source and the service provided. The energy source could change but the primary fuel was the same. For distributing the new sources, major changes and investments were necessary in in-

frastructure, like new gas or electricity networks. Lastly, consumers were using significantly more services and hence more energy.

The biggest drivers and catalysts for the diffusion of novel energy technologies were generally the technological superiority at first, followed by a positive economic factor like the price of the energy and economies of scale (Fouquet, 2008) (Fouquet, 2010).

Combined with three proposed factors that are common features amongst successful energy technologies, a general description can be made in the form of success factors for a successful energy technology implementation. These three factors proposed by Grübler, Nakićenović, and Victor (1999), are:

1. A successful learning curve. This will allow the technologies cost to decline.
2. The adoption of a successful energy technology tend to follow the S-shaped curve of technological diffusion.
3. Technological clusters are essential for dominance. 'Clusters' is the term for the related technologies that collectively deliver a technology it's value. As these technologies grow together in a synergistic way, network effects increase and are connected. This creates the technological cluster and will contribute to the success of a technology.

It seems that the remarks of Fouquet and Grübler state two different things while in fact the drivers Fouquet mentions, can be filled within the three proposed factors of Grübler. Technological superiority can be the result of the technological clusters that the technology in question is based in. The positive economic factors Fouquet mentions can be the result of successful learning curve that allows costs to decline, and the S-Shaped diffusion of the technology can cause economies of scale.

The above mentioned changes and factors have similarities with the energy transition we are currently in. For example, electricity grids need to be upgraded to handle (future) necessary demands and hydrogen networks (REN21, 2022). When looking at the past, we can analyze the lessons from previous transitions and apply them into the current approach on the transition to renewable energy. History tells us that economic drivers are one of the most important factors in the success of the technology.

It can be argued that a big difference between this transition and those of the past is that the current transition is motivated by an external force rather than technological advancements. This force being environmental changes that effect the global climate. There is a set time limit for this transition; 2030 REN21 (2022). If the transition is not executed fast enough, a possible consequence is that global warming can't be reversed. So besides an economic driver, a survival driver must be present to make this transition happen.

2.2. Energy transition in the industrial sector

To understand the sector the TSPs operate in, a literature review on the energy transition in the industrial sector is performed. Characteristics of the sector can have a great impact of the success of a new business model implementation.

Different methods on how to realize this transition, challenges and barriers will be touched upon in this section to answer the first sub research question: **What are the characteristics of the energy transition in the industrial sector?**

As is mentioned in section 2.1, shifting towards another energy source requires alternatives. For the shift away from fossil fuels multiple alternatives exist. IPCC (2022) lists the following as the most promising alternatives for fossil fuels:

- Renewable energy
- Biomass
- Nuclear energy
- Hydrogen
- Geothermal energy

As mentioned in chapter 1, the industrial sector is responsible for 24.2% of the total GHG emissions. This presents large opportunities for the sector to transition away from fossil fuels. Especially energy intensive industries can greatly reduce their carbon footprint by transitioning to alternative energy sources. IPCC (2022) and Wei, McMillan, and de la Rue du Can (2019) also mention suitable technologies to decarbonize these industries. Direct and indirect electrification, hydrogen, bio-based feedstocks and substitution, and carbon dioxide capture, utilization and storage (CCUS) are named as most promising solutions. However, many incumbent enterprises their financial risks are increased by institutional, economic, and technological restraints IPCC (2022) and thus these options are hindered.

Despite risks and constraints, efforts are made to transition heavy energy industries towards renewable energy sources. For example, Swedish steelmaker SSAB, mining company LKAB and energy company Vattenfall are collaborating on their joint project HYBRIT (Hydrogen Breakthrough Ironmaking Technology). In this project a steel production plant is developed and built where the furnaces are powered completely by green hydrogen (HYBRIT, 2022). This is certainly not the only effort that is being made towards a cleaner industrial sector. However, many challenges and barriers are still present that prevent a faster transition.

Mallapragada et al. (2023) is one of many who discuss the characteristics and barriers that arise in energy intensive industries, in this case the chemical industry. Firstly, fossil fuels are predominantly used as a feedstock with around 58%-70% of the total fossil fuels being used for that purpose. In some cases, also the byproduct of fossil fuels that are used as an energy source are used as a feedstock. Which makes it harder to strictly categorize fuels as an energy source or feedstock. (Eryazici, Ramesh, & Villa, 2021) (Administration, 2022). Another challenge is that historically the demand for chemical commodities have grown with gross domestic product (GDP). It is expected that this will continue (IEA, 2018). By 2050, it is expected that the demand for primary chemicals increases by 40%-60% compared to 2017. (IEA, 2018). Even if low-carbon technologies are adopted, this growth may result in an increase in GHG emissions from the chemical manufacturing industry.

The processes used in chemical manufacturing today are linked through flows of mass and energy, making it difficult to alter the production process for a single product independently (Lee & Elgowainy, 2018) (Zimmermann & Walzl, 2009). For instance, switching from naphtha from petroleum to ethane from natural gas in steam cracking results in higher ethylene yields at the cost of lower propylene and aromatics (hydrocarbons) yields. This requires new propylene and aromatics units,

as seen in the US over the past decade. (Lee & Elgowainy, 2018). The energy transition thus will cause imbalances in the industry, further complicating the situation and possibly resulting in a adverse reaction when the imbalance has to be restored.

The fourth challenge is that the most carbon-intensive chemical goods are produced manufactured in high volumes and low profit margins. This discourages investments by incumbents to innovate. The largest necessary chemical for plastic, ethylene, has a production of 150 MT/year a comparable magnitude of CO2 emissions (Eryazici et al., 2021), (IEA, 2018).

Also, chemical processes are critical for large economies, and regulators and policymakers have reluctantly suggested emission reduction changes to manufacturing processes due to perceived negative economic impacts (Mallapragada et al., 2023).

In addition, Wei et al. (2019) and Deason, Wei, Leventis, Smith, and Schwartz (2018) mention more characteristics for the electrification of heavy industry:

1. Usually higher operating cost of direct electrification in comparison with with 'own-use' fuel and natural gas.
2. Fuel-switching capital costs
3. Current active regulations and policies that favour one fuel over another.
4. Electricity network constraints and costs.
5. The industry is risk averse.
6. Electric process equipment availability in industry, as well as a lack of technical expertise or capability to develop industrial process lines and/or process integration.
7. The heterogeneity of industrial sectors.
8. Low margins for high temperature processes as a result of high energy costs.

Despite all these challenges, multiple studies have shown that low-carbon electricity can be a turning point in the effort to decarbonize the energy heavy industry, regardless of the feedstock that is used (IEA, 2018) (Meys et al., 2021) (Kätelhön, Meys, Deutz, Suh, & Bardow, 2019). This further emphasises the need for the electrification of the industrial sector.

Literature has shown that the industrial sector has multiple barriers that characterise the energy transition that has to take place in the sector. These characteristics are important to understand when a TSP wants to implement a new service oriented business model and are key factors that influence such an implementation.

2.3. Equans business model background

The current business models of Equans will be discussed shortly to provide background information about the business models Equans currently uses an are part of the reason Equans experiences problems.

Through interviews, reports on completed projects and informal talks with Equans employees, the implemented business models of Equans were identified. Equans applies mainly two different business model types: the cost-plus business model and the lump-sum business model.

The cost-plus business model, as described by Bogus, Shane, and Molenaar (2010) and Chen, Xia, Jin, Wu, and Hu (2016), is a billing model where the client pays the contractor for the actual costs (subcontractor, labor, and material costs) plus an additional fee to cover overhead costs and profit. The fee can consist of a set percentage of the cost or a fixed amount. With this model, every worked hour is billed and yields a profit, in theory. However, even though Equans applies this business model where in theory you always make a profit, not all projects are indeed profitable or less profitable than the fixed fee would suggest. This is because Equans delivers more work than they bill to the client, as will be indicated in the interviews in section 3.1.

Besides that issue, this business model does not allow value based pricing because the majority of the total billing amount consists of the actual made costs. But especially this model does not allow value based pricing when it comes to consulting projects because the client only pays the total worked hours for an advice from which the client potentially saves much more money than the actual cost of the advice, this is also mentioned in chapter 1.

Lump-sum is another business model but is not billed hourly. (Bogus et al., 2010) describes the lump-sum as a model where the contractor and the client agree on a fixed price wherein the project has to be completed, with very detailed contract agreements on what tasks fall in that agreement, which Hinze (2001) also describes as a requirement for the business model to be successful. Equans indicated that this model also contributes to low profit margins because the highly competitive market. To propose the winning bid, low offers are made which makes the realization of a project more difficult to achieve, especially making a profit.

2.4. Product Service Systems

As mentioned in chapter 1, Product Service Systems are the focus business model of this project. In this section provides background information on this business model type and discussed its potential influences on sustainability, which is of importance in an energy transition.

Business models have an influence on sustainability (Bocken, Short, Rana, & Evans, 2014). On how the energy transition can be executed more sustainable and on how this can be extended beyond only the switch from one energy source to another, research on a sustainable business model is conducted.

A product-service system (PSS) is a business model that is commonly used and has great sustainable potentials which will be addressed later. First, we need a definition for PSS. Tischner, Verkuijl, and Tukker (2002) describe a PSS as 'tangible products and intangible services designed and combined so that they jointly are capable of fulfilling specific customer needs'. According to Tukker (2004), a PSS does the following:

- It fulfills the clients needs in a way that is integrated and customized, which allows clients to focus on their core activities.
- It can build relationships with clients that are unique. This stimulates customer loyalty.
- It is more likely to innovate at a higher pace because a PSS closely monitors the needs of the client.

Multiple categories of PSS variants can be found in literature (Behrend et al. (2003), Brezet, Bijma, Ehrenfeld, and Silvester (2001), Tukker (2004)). The majority of papers that were studied, agreed on the main categories to classify the types of PSS. The main variants can be divided in the following categories:
1.**Product-Oriented Services.** The emphasis still is on the product, with some additional services. The product is in ownership of the buyer.
2. **Use-Oriented Services.** Here, the product still is the main focus, but in contrary with category 1, the provider is still in ownership of the product. The product is sometimes shared between users.
3. **Result-Oriented Services.** In this category, the user and the provider agree on a result without an initial product.

However, some authors do not completely agree with these classifications because they believe that other service types correspond with what a PSS does, like Sakao, Panshef, and Dörsam (2009). But mainly, the above mentioned categories are widely adopted.

According to Tukker (2004), these categories can be further divided in more PSS types. In total eight PSS types are mentioned, these will be described below.

Product-Oriented Services.

- **Product-Related Service.** Here, additionally to selling the product, the provider offers services that are necessary during the products' time of usage. For example a maintenance contract when renting a washing machine.

- **Advise and Consultancy.** Besides the product that is sold, the provider consults the client for the use of the product. For example, configuring the supply chain from which the product is a part off.

Use-Oriented.

- **Product Lease.** With this type, the ownership of the product does not change. The provider keeps ownership and the client pays a regular fee to use the product. The provider is also often responsible for maintenance of the product. The client has unlimited access to the product. The most commonly known form of lease is probably leasing of cars.

- **Product Renting or Sharing.** Here, the provider has ownership of the product and is responsible for the object/product when it comes to maintenance and repair etc.. The difference with Product Lease is that the client does not have unlimited access to the product. Also, it does not have individual access because the product is often used by multiple different users.

- **Product Pooling.** This is similar to product renting or sharing. The difference here is that the product is used by different users simultaneously.

Result-Oriented Services.

- **Activity Management/outsourcing.** With this type of PSS, a company can outsource a part of an activity to an outside company. Examples for this type are the outsourcing of transport or security.

- **Pay per service unit.** Here, the customer makes use of a product but only pays for the output of that product. Classic examples of this are the use of printers. The user only pays per copy, or a public coffee machine where the client only pays for the product chosen. The provider is still responsible for everything that ensures that the product is usable.

- **Functional Result.** In this case, the provider and the client agree on a result that must be delivered. The provider is free in how it will achieve the agreed upon result.

Tukker (2004) constructed the potential impact of eight types of PSS. See Figure 2.1. Clearly, the functional result type has the most potential to have a positive impact on sustainability. Types 4 till 7 have also a considerable potential for a positive impact on sustainability. Besides Tukker (2004), also Baines et al. (2007) and Li, Zhang, Li, and Tong (2010) stress the environmental impact PSSs can have. They state that reduction of consumption can be achieved through alternative product use that PSS can provide, as well as waste reduction through take-back programs.

PSS type	Impacts compared to reference situation (product)				
	Worse	Equal	Incremental reduction (<20%)	Considerable reduction (<50%)	Radical reduction (<90%)
1. Product-related service		←----------→			
2. Advice and consultancy		←----------→			
3. Product lease	←----------→				
4. Product renting and sharing		←----------→			
5. Product pooling		←----------→			
6. Activity management		←----------→			
7. Pay per unit use		←----------→			
8. Functional result		←----------→			

Notes:
- Renting, sharing: radically better if impact related to product production.
- Pooling: additional reductions compared with sharing/renting if impacts related to the use phase.
- Renting, sharing, pooling: even higher if the system leads to no-use behaviour.

Figure 2.1: Sustainability characteristics of different PSS types (Tukker, 2004)

When looking at the results from the findings on PSS, it is interesting to see if the different types can be used in, or turned into a business model for technical service providers that realize the energy transition in industrial firms. From the perspective of this paper possibly more sustainable results can be achieved in the industry sector by a technical service provider with a business model where, besides providing a product, they ensure the best possible outcome or are involved long after the initial 'job' is done. It is imagined that in the industry sector this will translate to a customized design for the most efficient use of renewable energy resources in combination with a long term maintenance contract and a result oriented compensation. In the next section, similar business models to the ones that were described prior, are addressed.

2.5. Servitization in the industrial sector

To identify current efforts to implement service oriented business models in the industrial sector, a literature review is performed on this matter. 'Servitization' was briefly mentioned in chapter 1, in this section an explanation will be given about the practice.

First, a definition for 'servitization' is necessary. As early as 1988, Vandermerwe and Rada (1988) defined 'servitization' as a movement from modern companies that switched from solely selling products to starting to offer more complete bundles of goods, services and support. It is a shift within companies and industries concerning their core business and generation of revenue. It can be seen as a restructuring of a business model.

Literature on the specific the specific topic of this research turned out to be scarce to non-existent. No publications addressed the servitization (to PSS) within the industrial sector for engineering companies and technical service providers that design, develop and build industrial plants. This proves to be a topic for further research. However, there is literature found on PSS in industry sector, but that is covering services for manufacturing machines and their maintenance (Meier, Roy, & Seliger, 2010). That paper addresses the shift from product to service but only applied in a manufacturing context. It is still useful for this research because principles can possibly be used and scaled to the extent of complete factories, instead of a manufacturing machine. Meier et al. (2010) further state multiple academic challenges that not have been answered yet. He states that the the impact of an industrial PSS on sustainability needs to be identified in further research.

Also, an academic gap is how industrial PSSs can be used for further revenue generation. At last, he presents scientific issues over the entire life cycle of industrial PSS as a result of the shift towards it:

- Arising complexity of processes by customer integration.
- Interdisciplinary issues.
- Stimulates the innovation capability.
- Know-how feedback.

These challenges are rather vague. In the next section, other more clear challenges are given.

In the absence of specified literature, industries that have resemblance with the industrial sector are studied to provide a more in line application of PSS and servitization in the development of industrial plants. Whereas the large industrial sector is absent on this matter, literature on servitization in the construction sector is available.

2.6. Servitization in the construction sector

The application of servitization in the construction sector has been introduced by Brady, Davies, and Gann (2006). They observed an increase in solutions that offered a combination of products and services to clients to meet customized and specified requirements. Since then, the interest in service oriented approaches have increased.

Challenges and drivers of implementing a service oriented approach can be found in literature. Drivers for product based organisations that want to move towards servitized operations are stagnated product markets, longer countercyclical revenues, better connected and active customers, potentially higher profit margins in after sale activities and being less imitable by competition (Robinson & Chan, 2014). Baines, Lightfoot, Benedettini, and Kay (2009) also mention factors that drive firms to a service oriented approach, namely: financial, strategic and marketing. The main financial drivers are a stability in income and a potential higher profit margin. The strategic driver is mainly a competitive advantage. And finally the marketing driver is that they offer opportunities to sell products through services.

Challenges for the implementation of servitization are as follows. Studies ((Neely, 2007) and (Lay, Copani, Jäger, & Biege, 2010)) show that servitizing companies were struggling to realize the promised financial rewards by previous literature. Contractual challenges are also an issue. For result oriented contracts it often appeared to be difficult to measure the promised results on which the contract was based (Robinson & Chan, 2014). With the latter it can be argued that it will also be a challenge for the implementation of result oriented service for technical service providers in the industrial sector as well. Finally, Robinson and Chan (2014) concludes in his paper that 'organizational routines at the the interface of design, construction and maintenance must be examined to establish how these affect the process of wider transition towards servitization'. Baines et al. (2009) also mention challenges that can be categorised in the following categories: integrated product-service design, organisational strategy and organisational transformation. The design is a challenge because services are often harder to define than products. Another challenge is that it is difficult to define a clear strategy that is necessary to support the customers. Also, the organisational challenge is difficult because a fitting structure is different than from a traditional product oriented firm (Baines et al., 2009).

Servitization in the construction industry is found to be small in presence. It appeared that a traditional mindset of companies in the sector are also a challenge to achieve servitization. It is suggested that for further academic research the factors that may cause a change in the traditional

views of the construction sector (Galera-Zarco & Campos, 2021) is studied. This recommendation can also be of use in the industry sector since that is a sector that is generally seen as a traditional and conservative sector that is hesitant to change its current way of working. Besides what Robinson and Chan (2014) have stated in the previous paragraph, also Liu, Wang, Zhong, and Ding (2021) mentions the need for change in organizational structure to achieve servitization in the construction industry: 'In theory, servitization in construction will spur a revolution in construction management to address unclear management problems. In practice, servitization transformation involves changing the organizational structure.' The article gives the following question that they think needs to be answered: 'what organizational structure should be adopted by traditional construction enterprises to promote the servitization transformation?' With this, they imply that the organisations that want to implement or start implementing a form of PSS first have to start with organisational structure. It can be argued that while it is important and necessary to adopt your organisational structure, it does not have to be the first step to initiate a servitization journey.

2.7. Classification of servitization business models

To be able to implement a PSS successfully, it is important to understand how PSSs can vary between each other. Not every PSS is the same and a different structure is necessary for different companies and markets. Therefore classification of PSSs is essential to understand differences between different types of PSS, how the PSS can vary between each other and how they can be constructed. This section describes the classification of PSS business models.

Different types of servitization exist, also their included business models. Literature describes multiple classifications . Weking, Stöcker, Kowalkiewicz, Böhm, and Krcmar (2018) mention servitization as one of the 3 'super-archetypes' for the Industry 4.0, along with integration and expertise as a service. Where with Industry 4.0 (I4.0) the fourth industrial revolution is meant, which is characterized by an application-pull that results in changes in operative conditions for frameworks, and a technology-push in industrial practices ((Lasi, Fettke, Kemper, Feld, & Hoffmann, 2014) (Xu, Xu, & Li, 2018)). Continuing, the super-archetype servitization is further divided in sub-archetypes: life-long partnerships, product as a service, and result as a service (Weking et al., 2018). This is partly in line with the types Tukker (2004) defined for the product service systems, where one type of PSS was also result oriented. Which overlaps with the sub-archetype mentioned before. It can be said that literature follows the same definitions in general terms. The same can be said for 'life-long partnerships', product service systems can also be long-time partnerships.

To further classify product service systems, a more in dept search on PSS classification models specifically was done. Also in this case multiple classification tools are present in literature. As already mentioned, a widely adopted classification method is the model of Tukker (2004). This theory presents three main categories of product service systems that are maintained: product-oriented, use-oriented, and result-oriented -services. However, this method does not address a dimension that includes smart solutions. The typology of Kohtamäki, Parida, Oghazi, Gebauer, and Baines (2019) does include such a dimension. On the other hand, Kohtamäki et al. (2019) do not include the ownership dimension. It is important to include both aspects since the digitalization of industry is apparent, as indicated with I4.0.

A taxonomy that addresses all these aspects is suggested by Aas et al. (2020). Their theory describes a product service system business model taxonomy with eight different categories along three dimensions. Specifically for manufacturing firms that are active in the digital era. These dimensions are a way of classifying different aspects of PSSs.

These three dimensions are:

1. **Value creation** The value proposition that a company provides to its clients is referred to as value creation.
2. **Value delivery** The way that a company realizes the value to its clients is referred to as value delivery.
3. **Value capture** The way the value is captured by the initiating company, whether the contract is built around a specific product or a specific result, is referred to as value capture.

In this model, a PSS is constructed using these dimensions with a point on each of the dimensions, creating a coordinate for a PSS. The dimensions are positioned as three axes with each having values. The ends of these axes are referred to as outliers.

Aas et al. (2020) further describe the two outliers of each dimension. For value creation, the first outlier is: the supplier does not transfer the ownership of the product to the client. Secondly, the supplier does transfer the ownership of the product to the client. For value delivery the two outliers are, one, smart digital services and, two, non-smart digital services. In this context, smart digital services refer to services that use digital technologies e.g. sensors and data analysis. For the last dimension, value capture, the two outliers are performance-oriented contracts and product-oriented contracts. In the paper, the dimensions are presented as a three dimensional cube of 2x2x2, where the cubes represent one of the two outliers of a dimension. This is pictured in Figure 2.2. In section 2.8, this framework will be adjusted for the analytical framework of this project. This model will be later referred to as the 3D model.

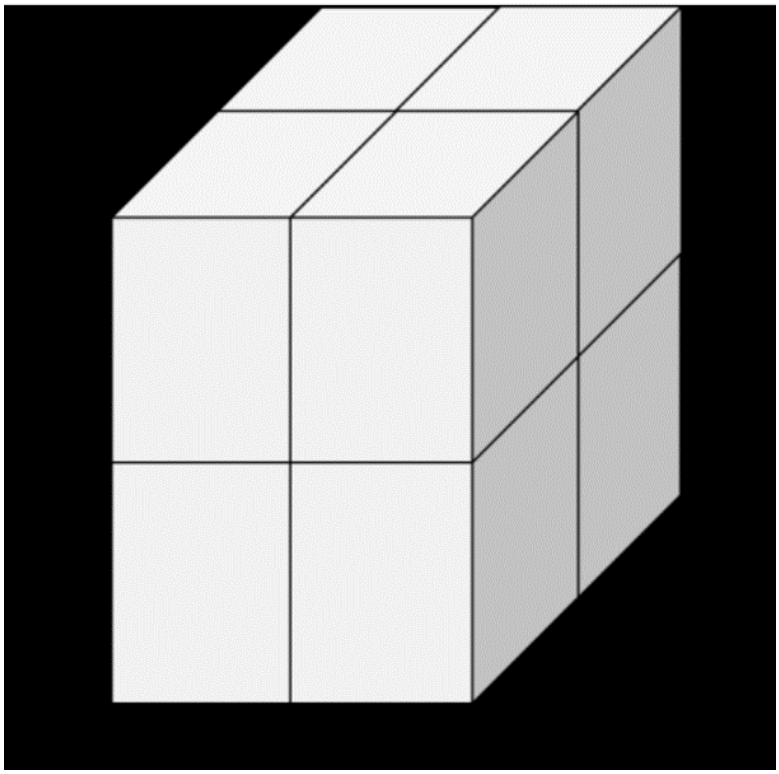

Figure 2.2: Product Service System business model taxonomy framework visualization Aas et al. (2020)

2.8. Analytical framework

As mentioned in section 1.3, a framework will be developed to structurally analyze PSS implementations and identify success factors for these implementations. In this section, the analytical framework for this thesis will be introduced and the design elaborated and clarified.

In the previous section, classification of product service system business models were discussed. When having the goal in mind of creating a conceptual framework that analyzes PSS implementations, classifications are a useful first way to analyze PSSs because it gives insights into how PSS are constructed and can vary. It is seen as a crucial part in the analysis of PSS implementations. Because to understand PSS implementations, PSSs have to be understood first.

Of the classification methods mentioned in section 2.7, the classification from Tukker (2004) and Aas et al. (2020) are used in this report. These two are chosen because Tukker (2004)'s definition and classification of PSS are widely adopted throughout literature, and Aas et al. (2020) offers a structured classification method with its three dimensions. These dimensions cover important aspects of a PSS that arise more often in literature: business model orientation, service and product type, and product ownership.

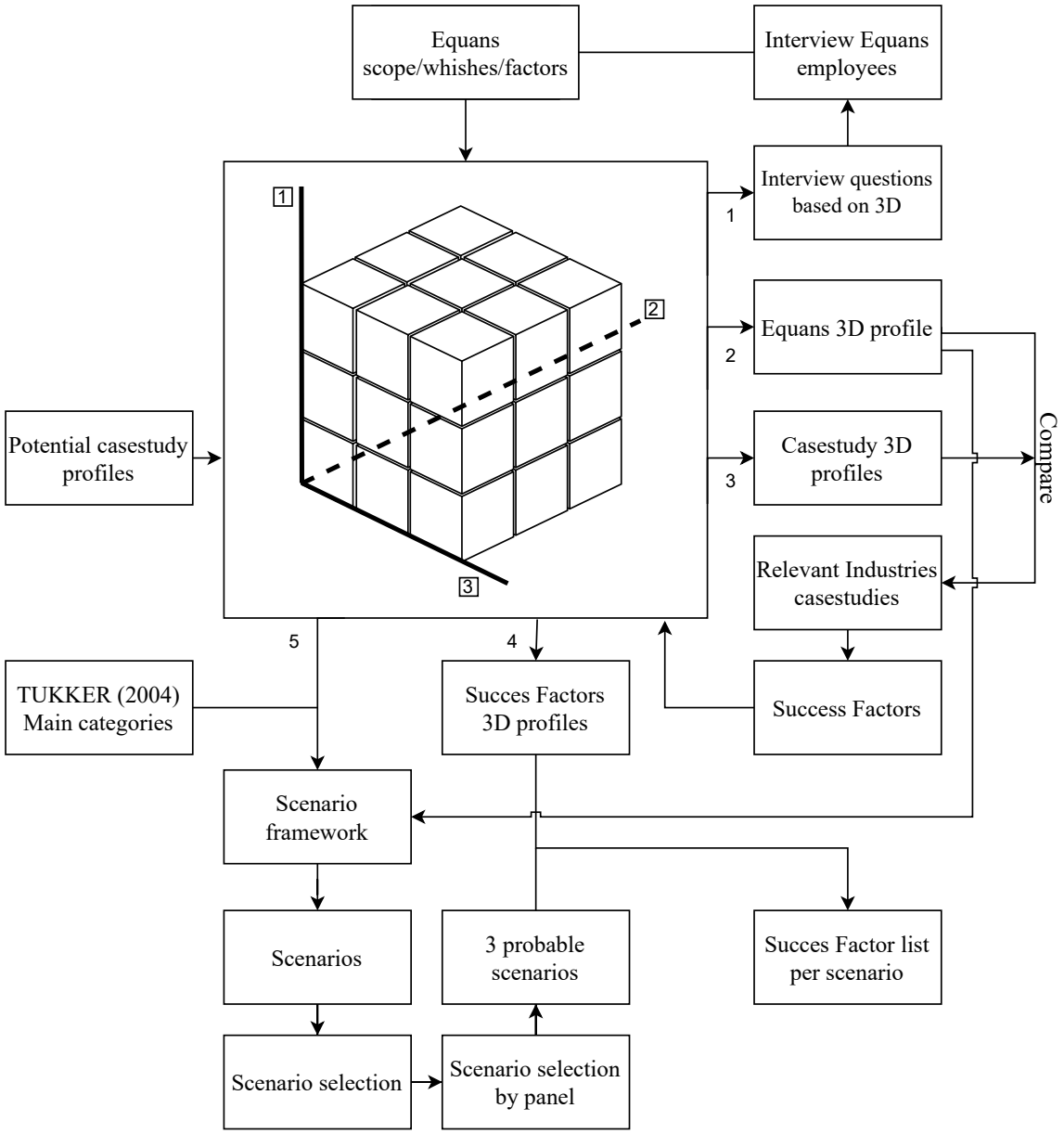

Figure 2.3: Analytical framework flowchart, adjusted parts from Aas et al. (2020) Tukker (2004)

Please see figure Figure 2.3. It displays the analytical framework that will be used throughout this report. Summarized, the framework consists of methods to:

- Create interview questions for the TSP (Equans) to be able construct a scope with goals that need to be reached for a PSS implementation.
- Identify possible useful case studies that fit the profile and scope of the user (Equans).
- Identify success factors for a PSS implementation of the selected case studies.
- Generate scenario's based on literature and the scope of the user (Equans) and select the most likely and realistic options.
- Match identified success factors to scenarios to focus on for a PSS implementation.

The core of the analytical framework will be an adjusted version of the dimensions model from Aas et al. (2020). Instead of only the two outliers on a dimension, three different categories will construct each dimension. This results into a cube of 3x3x3 instead of 2x2x2. This is done to create more possible combinations of PSSs that are more realistic than just the 8 that Aas et al. (2020) proposed.

The three dimensions will be used in every step concerning the PSS analysis throughout this report. This is done to create a structured and consistent way of analyzing information and comparing results. When the three dimensions are used, it will be mentioned and referred to the analytical framework.

2.8.1. Analytical framework: Steps description

These following steps form the process of analyzing the implementation of PSSs to identify success factors. This framework helps the user to find the success factors that should be focused on, according to literature. It allows the user to strategize a PSS implementation in a specific scenario. The framework can be used iteratively, as the scope or goals of a company can change during the implementation of a PSS.

Firstly, interview questions will be constructed using the three dimensions of the framework. This is done to ensure that all dimensions are incorporated in the interviews and it makes it easier to analyze the responses of the interviewees because the answers can be directly linked to the dimensions of that question, allowing for better result analysis.

Secondly, the results of the interviews are used to create a scope of the goals of the user, in this case it is Equans. The scope is used to create a profile of Equans using the three dimensions. Such a profile will be referred to as a '3D profile' and will be used more often throughout this report. What a profile looks like will be presented in section 3.3, where the 3D profile of Equans will be desribed and shown.

The third step is the analysis of potential case study options for the user. Firstly, case studies have to be selected by the user in literature from which it is thought that they match with the scope of the user of the framework. It is important to note that these potential case studies have to be selected by the user themselves. In this case, case studies have to be found that are similar to the scope of Equans. Only if the studies match the 3D profile of Equans, it can be used to conduct a deeper analysis of the case studies with the goal to extract success factors. This comparison is integrated into the framework to prevent the use of studies that are not useful for the user. As an extreme example, a case study on how a cosmetics company implements a PSS business model is highly unlikely to yield success factors that are of use for Equans.

After case studies passed the first judgement of the user and are deemed useful for the user case, an initial 3D profile is made of the case studies based on the first impressions of the article. If these 3D profiles are similar to the 3D profile of the user, the deeper case study is conducted and the identified success factors will be placed on the three dimensions (Value Capture, Value Delivery,

Value Creation) as the fourth step of the analytical tool. This way a collection of success factors is created that can later be compared to the 3D profile of Equans and 3D profiles of scenarios.

The fifth step is the creation of scenario's. This is done using the scenario framework that will be presented in section 3.6. Each scenario is constructed using the three dimensions form the analytical framework. This way, each scenario has its own unique profile that can be linked to success factors that corresponds to the unique profile of the scenario. A simplified example, a scenario's unique 3D profile is point 1 on dimension 1, point 2 on dimension 2, and point 3 on dimension 3. The success factors of this scenario are the success factors that are placed om these points 1, 2 and 3 on their dimension. This way, specific success factors for each scenario can be identified.

As part of step 5, the most likely scenario's will be chosen. In the case of Equans, the most likely scenarios are chosen by a panel of highly valued employees. Next, the 3D profiles of the chosen scenario's are used to identify the success factors that correspond to that specific scenario. For Equans, this is done in chapter 4.

This analytical framework will be used during this report with Equans being the 'user' for whom the analysis is conducted.

3
Methodology and data collection

As presented in the research flow diagram (Figure 1.1), the next step of this research approach is to conduct interviews, analyze case studies, generate scenario's and conduct a panel where scenario's are evaluated by selected Equans employees.

In this chapter the methodology of the project is presented, elaborated and executed to collect data that is necessary for the project. In section 3.1, the construction of the interviews is described, followed by the results of the interviews and the key take-aways. In section 3.3, a 3D profile of Equans is constructed, this process will be elaborated. In section 3.4, potential case studies are described and selected that will be further conducted in section 3.5. The generation of scenario's is explained and executed in section 3.6. The set-up from the panel with Equans employees will be elaborated in section 3.7.

3.1. Interviews Equans

To identify the problems that Equans is experiencing, interviews were conducted with employees. To receive multiple angles, employees from different teams and positions within the company are selected. The following sections summarize the interviews and give the key take-aways of the conversation. Some interviews are longer than others, because some positions appeared to be more applicable for the initial problems of Equans (described in chapter 1). The interviews are used to answer the second sub research question: **What are the current problems and their causes for Equans that arise in the participation of the industrial energy transition?**

3.1.1. Interview set-up

The goal of the interviews is to identify problems and their causes that Equans experiences with executing projects. Specifically financial results and business model related problems. These problems need to be identified to create a picture of the flaws of the current way Equans executes and manages their projects, to extract the goals to solve these problems, and finally turning these goals into a scope on what the company wants to achieve with a new business model.

To determine the interviewees non-probability sampling was applied, specifically judgement sampling. This is the selection of individuals who are expected to have expertise on the topic. A list of employees have been selected that were deemed suitable to approach for the interviews. Inspired by characteristics mentioned by Paredes, Ramírez, and Rodríguez-Sabiote (2021) on participant selection, employees were chosen. The points that the paper mentioned are:

- Their experience in making decisions and performing judgements, based on evidence on their expertise.
- Their reputation in the community.
- Their availability and willingness to participate.
- Their impartiality and inherent characteristics like self-confidence and flexibility.

Employees in different positions in the company were chosen to have views from different angles of the way Equans executes their projects. The positions of the interviewees are: Sales Manager (Front End, Equans West Industry), Commercial Director (EWI), Managing Director Equans West (part of General Management Equans NL), Innovation Manager (New Business Factory Equans). These positions cover multiple layers in the execution and development of projects and strategy. Also the operational distance to the projects differs between the positions. This gives a diverse view of the situation. More persons were approached but were not able to participate in the time frame of the interviews for the project. Still, it is believed that these participants are a diverse group to use for the interviews and shed light on multiple important sides of the story.

The interviews will be semi-structured, allowing for a steered conversation while also allowing a divergence from the specific topic of the question. The questions act as a way to spark a focused conversation while at the same time enabling the interviewee to speak freely. It is believed it will give more insights in the company since the questions alone will result in less problem and causes identification, limiting the research. The interviews will be conducted one-on-one.

3.1.2. Participant validation

In this subsection it is explained why the participants are suitable for this interview. Also possible weaknesses, shortcomings and biases that can influence their interpretation of questions and their answers, are addressed.

Sales Manager

A sales manager is chosen for the interviews because this position is active at the frond end of a project. The position manages the the sales process with the client, the project specification, product offering, project design, the contract construction and calculation. This provides a great insight in the activities that take place prior to the execution of the project since the position actually works on the execution. To see the broader picture, and not just front-end, more employees will be interviewed who have a more general overview of the execution of the projects.

Commercial Director

A commercial director from the industrial branch is chosen because the position is closely involved with the set-up and design of the execution of projects. The position is also partly responsible for business strategies for the projects and the branch, and the commercial part of the organisational structure of the branch. This results in the position being an important key to identify the problems in these processes. The position is thought off to provide useful insights in the commercial strategies for winning projects and the execution of these projects. This position functions also as a bridge between project developers and managers, and the directors. Allowing this position to experience multiple sides of the projects: information from top-down and bottom-up.

Managing Director

This position is chosen because it is responsible for and closely involved with the business development of the company. The insights of this employee is valuable for the problem and causes identification since the strategies for the company branches are determined at this level. People from different corners of the company all report to this position. It has to be kept in mind that this position, however, is of large distance to the actual execution of the projects. Resulting in the possibility that a managing director is not aware of the details that make up the problems and the causes. The director probably has a clear view of where the company needs to move, regardless of the details or hiccups that happen at 'lower' levels in the organisational structure. This countered by also interviewing employees that stand much closer to the project execution.

Innovation Manager
An innovation manager is part of the New Business Factory at Equans. This is a department that focuses on creating new business models and business strategies. It ranges from developing completely new products to the implementation of new strategies or business models to existing products or services. The position is deemed suitable for the interviews since it is closely involved with these topics. The department also allows experimental work with new ideas and strategies, which can be useful for identifying parts of a new scope for Equans to solve their problems. However, because is it mostly focusing on new products or models, the current issues that arise may not always be known to this position. That is solved by interviewing employees that are informed on the issues of the execution of projects.

3.1.3. Question set-up
The questions for the interviews are partially constructed using the three dimensional model from Aas et al. (2020) to create consistency throughout the project. Along the three axis Value Capture, Value Delivery, and Value Creation interview questions are made. Keeping in mind the goal of the interviews: firstly, constructing a scope of the goals of Equans regarding a new business model implementation. Secondly, discovering the current problems and causes that arise in their participation in the energy transition in the industrial sector. Some main questions were constructed, which can be found in Table 3.1. Per question, an 'x' indicates what dimensions the questions can touch upon. These questions form the basis of the interviews with the employees. However, the displayed questions are not explicitly the only questions that were asked during the interviews. Naturally, other questions will arise during the interview. The questions in Table 3.1 are present to give the interviews structure and a direction.

Question	Value Capture	Value Delivery	Value Creation
What kind of project have you worked on or are you involved with?		x	
Were the projects successful?	x	x	x
Were the projects profitable?	x		x
What are negative factors related to the end result of the project?	x	x	x
What are positive factors related to the end result of the project?	x	x	x
What business models were used for these projects?		x	
How is the business model decided for a project?	x		
How is a project budgeted?	x		
What are the problems that can arise when budgeting/offering for a project?	x		x
What are problems you experience with certain business models?	x		x

Table 3.1: Main questions for taking interviews

3.1.4. Interview analysis method

The answers of the interviews must be analysed thoroughly to extract the necessary information. To ensure validity and reliability, this will be done in a structured manner. For this analysis, a method from King (1998) will be used: the template analysis. A template analysis is a way of analyzing qualitative data with the help of a template consisting of themes that are used to identify information regarding those themes.

The interviews will be analyzed as follows:

- Analysis of interview answers based on the priori themes from the template analysis.
- Analysis of theme categorized data using coding.
- Select most important findings through recurring themes and codes.

The result of the analysis will be formed into a scope with clear goals that Equans wants to realize with a new business model implementation. Next, the themes of the template analysis will be addressed.

Priori Themes for the Template Analysis

The priori themes are in line with the analytical framework. Priori themes can be established because the direction this research is headed is determined. The priori themes will be broad, allowing to code the data more detailed in the second phase of the analysis. The three dimensions Value Capture, Value Delivery and Value Creation will form the basis of the priori themes to match the structure of the report and the interview questions. To define these dimensions more clear, themes representing these dimensions are used.

- **Value capture.**
  - **Business model**: Business model will be a theme because it is one of the cornerstones of this research since it is directly related to a PSS configuration. All information that is directly business model related will be classified under this theme. This also includes details about the mentioned business models.
- **Value Delivery.**
  - **Product and Service type**: All data and aspects that are related to a type of product or service that is mentioned will be classified under this theme. This theme is chosen because it is closely related to the structure of how PSS systems are constructed.
  - **Project Execution**: Information and aspects that are related to how projects are executed will fall under this theme. This concerns deals with the clients, how Equans offers value and if other parties are involved.
- **Value Creation**
  - **Ownership of the product**: All details about ownership of a product or service will be classified under this theme.

At the end of each interview, the interview analysis data is presented. Next, data from this analysis will again be analyzed and coded to identify the most prominent problems and causes for Equans. Once this is done, a scope can be created for Equans which will be the goal to achieve with a PSS implementation. In section 3.2, all analysis data will be combined and discussed.

3.1.5. Sales Manager, front end.

Commercial and sales representative of Equans West Industry, responsible for Petrochemical section. Below, a summery of the key takeaways of the interview are presented. The summary consists of sections that cover topics from the point of view of the interviewee.

Key Takeaways

- Equans takes big risks concerning bidding on projects that resulted in extremely low profit margins.
- The market is extremely competitive.
- Value addition for the client is a high priority.
- Moving away from business models like lump sum and cost+ is a high priority.
- Knowledge of project manager needs to improve to extract more out of contracts with clients.

Interview

The success of a project

A project can be successful in many ways. This also applies for the opposite. In the most recent projects, Equans was successful in keeping all employees occupied and working on projects. The client satisfaction was above expectation, resulting in another successful aspect of the project. However, financially the project was not a success because it was barely profitable. Equans didn't lose money but the only just avoided red numbers.

Reasons for unsuccessful financial result

From the front end point of view, Equans took some significant risks when pursuing the project in question. These risks were justified by Equans because of the highly competitive market in which Equans operates. In this case (as well as other projects), the price was kept lower than Equans would like in order to secure the project.

Another reason for less successful projects is a human aspect. Who is responsible for the project? How much time does he or she get to manage the project? Are there other projects that the person carries the financial responsibility? This points to the quality of the project manager and the situation in which he is placed.

As a third reason, the collaboration between the purchasing department and the project management was named. The focus for the purchaser is getting the best possible price, while the goal for the project manager is realizing the best project. This can cause problems internally since both parties have two different main goals. Ideally, both parties work together while considering both each others goals.

A goal of Equans is delivering 'Added value'; what does Equans do extra or better in comparison with the rest of the market? When a company adds more value over another similar company, an extra incentive to choose the latter is absent. This is exactly the case for Equans. Also, the companies that compete with each other for the same projects use the same workers to execute them. This is because a large portion of the necessary workers are from employment- and recruiting agencies. The only significant difference between the companies is the management.

Business models and budgeting

Usually, the big projects are done with a lump sum. This is a business model where the client pays a pre-determined price for the whole project. A scope is agreed upon which contains a detailed description on what will be done in the project. The lump sum fee covers everything within the scope.

This model has its flaws. It is possible that more work needs to be done than initially agreed upon, so this will not be included in the lump sum and has to be paid additionally. But both parties usually end up discussing if the additional work falls within the lump sum or not. This is time

consuming and the whole project can't be stopped until an agreement is reached. This would only lead to more delays. The final decision on the matter is often pushed back to the end of the project, hence compromises are made. This is a bad case for both parties. The client thinks he pays to much and Equans will receive too little for what is done. Another business model is the cost plus model. With this model, all work is billed hourly with a fixed profit margin. This is better for Equans because all performed tasks generate revenue with a known profit margin. The downside is that client do not prefer a cost+ model for large projects.

When budgeting the projects, the profit margin (EBIT) is small. Since the acquisition of Equans by Bouygues, Equans has the goal to realize 6% EBIT. This makes is difficult to realize profits when high risks are taken when taking on projects because of the small room for errors.

Solutions for financial success improvement
A point of improvement to reach the profit goals is the contract knowledge of project leaders. Often, more work is done than initially is agreed upon or Equans fails to utilize conditions that can work in the favour of Equans. The contracts need to be exploited better. The input for the cost control of the project is the information from the project leader. The cost can only be tracked effectively if the project leader provides accurate data.

Another suggested way to reach profitability is using a EPC model; Engineering, Procurement and Contracting. Also, a service where Equans provides 24/7 malfunction support with the best people in the industry. The client pays heavily and can call this service at any given moment. At the moment, companies cannot provide this service and are scared to do so. Equans can use this to create a new business model. In addition to the 24/7 service, the client is obliged to guarantee Equans certain projects. This way Equans can secure new projects without the high competition market.

Interview reflection
As indicated in subsection 3.1.2, the interviewee has a clear view and idea of the successes of the processes at the front-end of projects, not the whole picture. Hence his opinions on the compromises that are made during the realization of projects may not be completely accurate since this outside of his position coverage. However, the interviewee possibly heard opinions and information from project debriefs and word of mouth. From the key takeaways mentioned earlier, the last one does not weigh as heavy as the first four since those fall in the job coverage.

3.1.6. Sales Manager Interview Analysis
Based on the presented answers of the interviewee, the priori themes could be coupled using the take-aways presented below. In section 3.2, these results will be touched upon again and further processed for the analysis.

Business model

- Unsuccessful cost-plus projects due to high market competition.
- Unsuccessful lump-sum projects due to high market competition.

Product/Service type

- Problems creating added value through offered products or services.

Project execution

- Project managers that are unable to extract potential from the project contracts.

Ownership of the product
No information directly related to the ownership of the product was identified.

3.1.7. Commercial Director EWI

Key takeaways:

- Project managers can be the reason a project fails or succeeds. More competent project managers are necessary.
- The Equans 'engine' (workforce) is too large. This creates a hunger for volume or capacity driven projects.
- Change the volume driven structure of Equans. Focus on more continuous projects to better control the workforce.
- Create added value to separate Equans from the market.
- Business model change to profit more of additional work from projects.

Interview

When is a project successful?

"No injuries, at first. But overall a project is successful is at first realising what was initially determined and planned. And this success is measured by the difference between what was pre-calculated and what is eventually realised. Preferably there is a positive difference, so a profit. Realising this is the responsibility of the project manager.

Equans has done this in the past mainly through a lump sum. Here, risks are calculated into the sum. Another model is where Equans can bill the client based on the total hours worked, which carries almost no risk. So success for a lump sum project is realising the project with less costs than was initially calculated. For a cost+ model, a fixed profit margin is applied for every hour so it is almost always profitable. However, this can be extended when for certain roles (welders, fitters) Equans can charge a higher hourly rate which results in a high profit margin. The current projects are not on the course for profitability. We run into more costs for than that we can charge to the client."

Reasons for unsuccessful results?

"This can be caused through many facets. Sudden price increases for materials in comparison to what was pre-calculated. Sometimes this can't be charged to the client. This is a result of a low quality contract, and where certain assumptions and calculations are made which turn out to be wrong. Sometimes things are overlooked and can result in a fine."

"Bad project management, no grip on the project. Receiving the wrong workers for the job, people with the wrong certificate or with the wrong mindset. These are all reasons that can lead to less production output. It can range from a bad contract to the wrong welder to the supplier being late."

"A point of attention is also; how far can we hold the project manager accountable for commercial decisions that were made in the front end of the project. The goals have to be reasonable, and along the way some opportunities may arise and the project manager can work together with management to try and seize those."

What are in your point of view concrete solutions for this?

"If we knew this, we wouldn't have problems anymore. We try to be risk averse, but one person might consider something a risk and the other one doesn't. Equans tries to prevent this by providing guidelines, orders above 2.5M have to be approved by Bunnik, orders above 15M have to be approved by Paris and order above 30M have to be approved by Stubler (CEO). This way, risks are mitigated. To help secure project quality, a method called 'The Project Management Way' has been introduced to explain better how projects are done within Equans. But it is not a guarantee that mistakes are prevented or situations avoided. With calculations, mistakes can be made. Especially when another couple of price fighters are in the race for the same project. But we have to also trust our people. "

What are main reasons for not realizing the pre-calculations?
"Equans does not perform subsequent calculations on their projects. We should do that. A significant reason for not reaching the desired outcome are the project management skills that are essential to control the project, to be sharp on the contract with the client, to communicate effectively with your team that can be improved. We want to realise a significant quality improvement on that subject. So a more sharp, driven and eager project manager can make a big difference."

Main reasons for not being able to calculate offers with a large profit margin?
"For a part because we are not differentiated enough compared to our competitors. Ten companies can all do the same job. Within those companies are also smaller companies with less costs so they can offer lower prices. There is a lot of competition. A big way to differentiate us from the competition is price driven."

Is the current business model a reason for low margins?
"Our business model is capacity driven. Equans has 500 people in house which can be scaled to a 1000 through our planning department. That is our structure, we need to use our volume in these projects to keep 'our engine running'. We are volume driven. This often puts us in the situation where we say 'Well lets do this project, maybe with low profit margins but at least we keep everyone working.' So then Equans uses a bad or not good rendering contract just to keep Equans running. The engine might be oversized. A smaller engine might also be part of the solution because then we are less volume driven."

"So currently we are working on creating 'Added Value' for the client so we make propositions on the subject of high voltage or compliance as a service, or industrial automation. Projects that the smaller companies cannot perform. At the same time we maybe downsize our engine. How can be less volume driven? On the other side, how can we secure continuity in our projects? When continuity is created, there can be less hunger for large volume projects because a part of the workforce is reserved for the continuous projects or services."

"A way how we can increase margins is when a client requests additional tasks to be done or wants the prior agreed upon design changed, we say that we can realize that but for a much higher rate. So the extra work becomes a part of the business model, so called variation orders."

Interview reflection
As a Commercial Director, the position of this employee relative to interview and the problems of the company has to be taken into account when a interpreting the answers. It is clear that the person has a view and vision on that things have to change concerning the execution of projects and the business model Equans implements. While the employee probably agrees with the direction the company wants to go and or what has to be changed, it is likely that this vision is a top-down decision and projected on the person in question. This can result in biased and steered answers on the interview questions. Also, as a director, your position to the project managers is relatively large so it can be hard to truly understand the events that happen where commercial decisions are made by these managers that can result in an unsuccessful turnout of a project. It is not difficult to imagine that there are situations that are out of the control of the project managers and where they still get the blame for the unsatisfactory result. Besides this, the results of the interview give an important insight in the problems of the company. As a Commercial Director, the transition towards a new business model is crucial and their answers are of great value for this project because this person is up to date with the most recent developments in the company and market.

3.1.8. Commercial Director Interview Analysis

Based on the presented answers of the interviewee, the priori themes could be coupled using the take-aways presented below. In section 3.2, these results will be touched upon again and further processed for the analysis.

Business model

- Equans has a volume driven business model. Focus must be long term to ensure recurring revenue.
- Equans is not getting paid what the client might think the product is worth: cost-plus problems.
- Differentiation from market causes Equans to lower prices for projects.
- Business model has to change to profit from additional work which is a Lump-sum business model problem.

Product/Service type

- Value addition to separate Equans from the market is difficult. Equans does what everyone can.

Project execution

- Project management problems. More competent project managers needed.
- Equans' workforce is too large, must focus continuous projects to better control the workforce.

Ownership of the product

No information directly related to the ownership of the product was identified.

3.1.9. Managing Director West Equans, General Management Equans NL

Key takeaways

- Shift in the market from buyer bargaining power to supplier bargaining power.
- Risk aversion within Equans and of potential clients.
- Projects need to be cash flow positive. This is a demand of the owner of the company.
- Binding clients for multiple projects is a goal.

Interview

"At Equans we're noticing a shift in the market from a highly competitive market where too many companies are battling for too little potential clients, to a market where clients come to us and ask if we please can do business with them. Because the market doesn't have the capacity to fulfill the needs. This shift is starting to happen. We've had two potential clients where we in the position that we could demand other terms on the project than they initially demanded themselves. But because they had not other choice than to accept it, they agreed to our terms. The bargaining power is starting to shift from the buyers to the suppliers. This is also an opportunity to implement other business models. So instead of lump sum, a cost+ model or directors model. With a cost+ model, only the direct worked hours for executing the project are billed. With a directors model also all the other hours are billed, so also the purchasing department hours etc.. "

"Another thing that Equans is trying to do is letting our clients or potential clients commit to us and our services. So when a client wants Equans to execute a project, we want to say that we only agree to do the desired project if we are guaranteed to be able to execute also the following projects of that client. In a sense, locking in our clients and thus securing future revenue."

"Difficulties when implementing a service model in the large industry are the costs, the state of the factories/machinery, and the measuring of the assurance that the client pays for. If Equans guarantees a certain result, large investments need to be done. It is difficult to get clients on board with that for such large scale projects. The shareholder in Paris demands that we realize project with a positive cash flow. But we have some large scale cost+ projects secured where every hour is payed, with margins. So only the client bears the risk. We're not getting squeezed for every penny in these projects."

Successful projects?

"That is a data centre in Leiden. We're not losing money but we're also are just managing to make a profit. Equans wanted to win the project and took the project with a budget that was too tight. On the other hand, a project at an airport was completed with great profit. Because we had a competitive advantage we could apply a form of cost+ model where we bore minimal risk. The project was done in a collaboration with another company and the management board for this project was someone form us, the airport and the other company. So everyone had their say in the project, this worked really well."

Interview reflection

Similar as with the Commercial Director, perhaps even more, the position of the Managing Director of Equans West is far away from the execution of projects and more focused on strategy development. Again, the emphasis lays on new business model development, however here it is more focused on profitability as the end goal and not necessarily the means on how to achieve it. The answers of the director were strategy related, which fits the position of Managing Director. This indicates and confirms his distance from the work field where the projects are realized. The insights are valuable because the answers give insights in the strategic thinking of the company. It also is clear that the Managing Director operates at an overview level relative to the actual project execution, which is to be expected, and also the influence from higher management is apparent in the answers since the demands of the headquarters were frequently mentioned.

3.1.10. Managing Director Interview Analysis

Based on the presented answers of the interviewee, the priori themes could be coupled using the take-aways presented below. In section 3.2, these results will be touched upon again and further processed for the analysis.

Business model

- The bargaining power is shifting from the buyer to the supplier.
- Lump-sum business model causes problems that limit profitability.

Product/Service type

- Implementing service models are difficult because of costs, the state of factories/machinery and measuring the assurance that the client pays for.

Project execution

- Equans employees are risk averse.
- Clients have to be bound to Equans to ensure long term recurring revenues.

Ownership of the product

- Equans clients are risk averse when it comes to investing in projects.
- Projects need to be cash flow positive as per order from headquarters in Paris.

3.1.11. Innovation Manager, New Business Factory Equans

Key takeaways:

- A new service product causes issues on both the client and the Equans side.
- The sales team of Equans is unfamiliar with selling a product differently than a cost plus contract.
- Client spokespersons that are not in management are unfamiliar with acquiring and implementing a new product.
- Teaching mechanics within Equans how to work with a new product is not finished properly, hence the mechanics won't change their way of working.
- Pricing a new service product is seen as risky, hence it is avoided by Equans.

Interview

New product/project

"I (interviewee) am involved with a new product Equans offers, Equans Maintenance Insides (EMI). EMI is a product that was implemented through in 30 locations in the NL. It is a service that improves maintenance quality through predicting maintenance and its more efficient than sending service mechanics to the machines to control them in repeating rounds. The program can detect when problems are present or are starting to form. When selling this product we were thinking about how to sell it, do we sell cost plus or do we say to the client 'how much is this worth to you?'. Quickly we noticed the inexperience our sales people have with selling products and the corresponding services based on the potential value for the customer. This was also the case with the potential clients when we asked: 'What does it cost you when a machine breaks down? And how much are you willing to pay for a service that prevents that and/or can plan a moment to fix a machine so that a breakdown is prevented?'. On both sides inexperience is an issue. It has been sold in a pilot where instead of 100 euros per machine per month the client pays 400 per month per machine for a year. The 100 euros being calculated cost price, the 400 euros a initial values based price. At the end we will assess if it has added value and reassess the value in a good price. This way the client and Equans knows if such a system will add value. So value based pricing was applied instead of cost based and a small margins added to it. Besides the pilot experiment, the service has been implemented in existing running maintenance contracts where Equans raised the price with 100-200 euros per machine per month and 99% of the clients agree with it."

Problems with implementing such a service product?

"These are a couple of things. First of all, you need support from colleagues and in the workplace. It is a relatively new product, digital instead of mechanical so it is important that everyone sees the potential and agrees on the product and vision. This takes a lot of time and effort to teach these technicians, time of which cannot be written as effective and productive. At Equans, often it is decided to stop halfway of such a project to help implement the technology with these technicians and then the technicians think it is not important enough which leads to them continuing working the old way."

"Secondly, time and effort is required to think about the potential value it creates and a new business case of such a application. How are we going to measure the added- or saved value? Most of the time all the hours and individual tasks that are performed during the standard maintenance practices of the mechanics, are not being administered. If it is not clear what is done now, the potential value and business case cannot be calculated or designed."

"Also, such an implementation takes a lot of time within the clients company. Often the contact with a client is through a fellow mechanic or representative, not on the management level that has to decide whether such a system has to be implemented. This fellow mechanic often doesn't see the need to improve the current system and does not have the capability or possibility to address this to higher management. It never reaches the higher management. Additionally, within Equans

many people think: 'Right now we can send an invoice for every hour that is worked, so every time a task is performed, money is earned'. With a service contract this is not guaranteed. Also, valuating this and setting a price for such a service is seen as risky within Equans and therefore it is avoided. So the shift between contract types is difficult for the Equans employees and the clients. From Equans, the first reaction is that they say that their client does not want such a contract. Then it is already stopped immediately. It depends who you speak to at the client company, is that a production manager or a higher management level?"

"A service model has to be supported with digital tools in MS opinion. We have to go to a digital operator model. We used to walk into the clients factory with tools, now we need to come in with sensors. And when it is applied properly, the digital operator model can be cheaper. The costs can come down and more value can be added to the customer."

What are problem with the current business model?
"We are a conservative company, this means we have to invest to go to new business models. You have to start small and think big in order to scale. This takes time and money. Equans must dare to scale, the technology is already available. This originates from the pressure of the company to perform well financially. We have orders to optimise on different aspects and need to reach a higher EBIT without having to make large investments."

Interview reflection
The Innovation Manager is not directly involved with the business models that are developed or implemented at EWI or West, but merely focused on developing new concepts and methods of new business models. It can be said that the answers are not as accurate or applicable to these branches. However, the person does have an insight in how business models are implemented in different segments and locations of Equans. The innovation manager has an overall overview, so to speak. This brings information about the general dynamics within the company and how other employees function within the company when it comes to developing and implementing change. With change, new business models, service models or products are meant. The person is also heavily informed about the state of the art of the available technologies Equans possesses, hence the answers related to what is possible within the company and what not, can be deemed trustworthy.

3.1.12. Innovation Manager Interview Analysis

Based on the presented answers of the interviewee, the priori themes could be coupled using the take-aways presented below. In section 3.2, these results will be touched upon again and further processed for the analysis.

Business model

- The bargaining power is shifting from the buyer to the supplier.
- Lump-sum business model causes problems that limit profitability.

Product/Service type

- Implementing service models are difficult because of costs, the state of factories/machinery and measuring the assurance that the client pays for.

Project execution

- Equans employees are risk averse.
- Clients have to be bound to Equans to ensure long term recurring revenues.

Ownership of the product

- Equans clients are risk averse when it comes to investing in projects.
- Projects need to be cash flow positive as per order from headquarters in Paris.

3.1.13. Concluding

First, interviewees were selected and validated. Secondly, the interview questions were constructed in a structured manner using the analytical framework. Third, an interview analysis format is created using the template analysis method. Fourthly, the interviews were conducted and analyzed a first time using the priori themes. Fifth, the most apparent problems were identified and classified per priori theme. As the last, sixth step, goals that Equans wants to achieve are constructed. These goals form the scope of Equans from which the 3D profile of Equans can be constructed using the analytical framework.

3.2. Combined priori theme data analysis

The next step in interview analysis is the analysis of the collected priori theme data of all interviews. The goal is to further break down the interview results per theme and identify the most prominent problems Equans experiences. Once identified, the scope of Equans can be constructed.

3.2.1. Identifying most prominent problems

In this section the most apparent problems are collected per theme.

Business model

Accross the interviews, multiple problems concerning the business models were identified. The most recurring problems were that of the cost-plus model and lump-sum model. The problems concerning these business models were: low profitability, the inability to implement value based pricing, the inability to generate recurring revenue and the lack of competent project managers that are able to extract the full potential from contracts which results in lower profitability.

Product/Service type

The inability to provide added value for the customer is a recurring answer amongst the interview responses. Equans does not succeed in creating a competitive advantage over the rest of the market. All competitors in the market are able to perform the the projects that are offered to the market. The only way Equans is able to differentiate themselves from the market is by lowering prices.

Another mentioned problem is that pilot projects with service oriented products on recurring contract types were successful but departments within Equans are risk averse and not willing to implement these products.

Project execution

For the problem execution, Equans has to focus on binding clients to them for multiple projects. Essentially locking-in the clients. At the moment, Equans is a volume driven company that focuses mostly on making sure the workforce keeps running to prevent losses. If clients can be locked in, the worry of securing enough project becomes less, and revenues can be predicted in the long term.

Another recurring problem is that Equans has problems with exploiting the current contracts with clients which results in failing to collect potential revenues. This is both the result of the business models that Equans used and that off performances of project managers not good enough.

Ownership of product

A very emphasized point that Equans does not want to invest in projects that they work on. This

means that the project have to be executed while staying cash-flow positive. This also means that the client will have ownership of the products. An exception for this are software products that Equans has developed and sells or licenses to the client.

3.2.2. Constructing Equans' scope and goals

The interviews have been conducted to identify the most important problems and causes that arise with Equans while participating in the energy transistion in the industrial sector. This has been done by analysing the interview results and responses and classifying these problems under the earlier mentioned priori themes. Now that the most apparent problems have been described in section 3.2, the goals and scope for Equans can be constructed to create the 3D profile of Equans that will be used in the analytical framework.

The identified goals that Equans want to reach and form the scope are the following:

1. Recurring revenue
2. Value based pricing
3. Added value

4.1 Positive cash flow on tangible projects

4.2 Lease on software (this relates to the previous point)

5. Client lock-in

Recurring revenue

Recurring revenue is the first identified goal. Multiple things led to this. Results from interview 2, 3, 4 point towards securing recurring revenue. From the 'Business Model' theme it was one of the most apparent aspects. Recurring revenue was also mentioned under 'Project Execution' because it is closely related. However, recurring revenue will be seen as a goal that will be placed on the Value Capture dimension because it is deemed more applicable as a 'Business Model' aspect.

Value based pricing

Value based pricing is the result of multiple mentions amongst the themes. Firstly, the Commercial Director mentioned that Equans is able to charge the client for what they think a project is worth. Clients pay Equans on a cost-plus or lump-sum basis, which makes it impossible to implement value based pricing. The result is that a project can deliver much more value than that it paid Equans for the project. Equans wants to profit from the value that they deliver as well. Value based pricing is a 'Business Model' goal and will be placed on the Value Capture dimension.

Added value

Added value is mentioned often in the interview results. It is detected in two out of the four interviews and both under the 'Product/Service type' theme, hence it will be placed on the Value Delivery dimension. Equans is not able to differentiate themselves with the market in the types of products or services they offer. They want to create added value for the customer to create an incentive to choose Equans over the other market competitors.

Positive cash-flow on tangible projects

One very emphasized problem was the demand of the headquarters of Equans that the projects must be completed with a positive cash-flow. It forms a problem for Equans because many potential projects must be turned down since the client does not yet accept service oriented projects when a large pre-investment must be made. A positive cash-flow means that the ownership of the product Equans delivers will be transfered to the client. Since it is classified as an 'Ownership of product' theme, it will be placed on the Value Creation dimension.

Positive cash-flow (lease of software)
One exception for the positive cash-flow demand is made for software related products. These require an initial investment before it can licensed. Equans already own software products, so these will be considered. The ownership will not transfer to the client when a software is licensed. Therefore this goal will also be placed on the Value Creation dimension.

Client lock-in
The final goal of the scope is client lock-in. It is mentioned multiple time under the 'Project Execution' and "Business Model' theme. It is a problem for Equans that is mainly caused by the volume Equans operates in due to the large size of the workforce. The problem was most apparent in the 'Project Execution' theme and hence will be placed on the Value Delivery dimension.

The scope of Equans can now be used to create the 3D profile of Equans for the further execution of the analytical framework.

3.3. Profile of Equans

In this section, the profile of Equans is created with the analytical 3D framework. It is necessary to create a profile of Equans' scope and wishes because success factors for a PSS implementation need to be identified from other markets and sectors. The profile of Equans will be used to compare possible case studies and decide whether the options fit the profile of Equans and thus will be a suitable and comparable example to extract success factors from and use them for a possible PSS implementation for Equans. The case studies will also be evaluated using the three dimensions for consistency. The profile of Equans will be constructed and elaborated below.

The scope and goals that were identified during the interviews are:

1. Recurring revenue
2. Value based pricing
3. Added value

4.1 Positive cash-flow on tangible projects
4.2 Lease on software (this relates to the previous point)

5. Client lock-in

Point 4.1 and 4.2 are two corresponding aspects in the scope because they are closely related. Equans wants a positive cash flow on their projects, however if Equans wants to sell software this first has to be developed. Which means initial investments have to be made before it can be offered to clients. Therefore an exception is made for the positive cash flow goal if it concerns software or other digital services. For tangible, non-digital products the rule of positive cash flow will be followed.

For the profiles of case studies, success factors and scenario's, not just Equans, a framework is designed to be able to compare different subjects with each other. Table 3.2 shows the three dimensions each with three options on that dimensions' axis. The numbers 1 and 3 are the outliers that were previously mentioned in chapter 2. To indicate the rest of the axis, a middle option is added to indicate the middle values of the axis. A combination of dimension points (1, 2, 3) for each dimension will form a footprint that visualizes a profile.

Dimension/Dimension point	1	2	3
Value Capture → **Why the value proposition is delivered to customers**	**Performance oriented** Recurring or long term	**Use** Pay for Use	**Product oriented** Buys product and additional services on case by case basis
Value Delivery → **How the value proposition is delivered to customers**	**Smart Digital Service** Digital solutions	**Hybrid** Combination between digital and non-digital	**Non-Smart Service** Non-digital solutions
Value Creation → **What a firm offers to its customer segments**	**Ownership not to client** Client leases from Equans	**Equans + Client** Shared ownership	**Ownership to client** Client takes full ownership

Table 3.2: 3Dimensions model with outliers. Adjusted from (Aas et al., 2020)

For the profile of Equans, a footprint is made from the identified scope and goals during the interviews. Each of the points is evaluated and placed on a dimension.

Profile attribute	Dimension	Where on dimension?	Outliers
Recurring revenue (1)	Value Capture	Result- to Use-oriented	1 to 2
Value based pricing (2)	Value Capture	On all types	1 to 3
Added Value (3)	Value Delivery	Digital to Non-digital	1 to 3
Positive cashflow on tangible projects (4.1)	Value Creation	Shared and solely client	2 to 3
Lease of software (4.2) (cashflow related)	Value Creation	Equans owns software	1
Client Lock-In (5)	Value Delivery	All types	1 to 3

Table 3.3: Equans profile attributes table

Each dimension then can be filled with the corresponding attributes and outliers to create the footprint of the profile. See Figure 3.1.

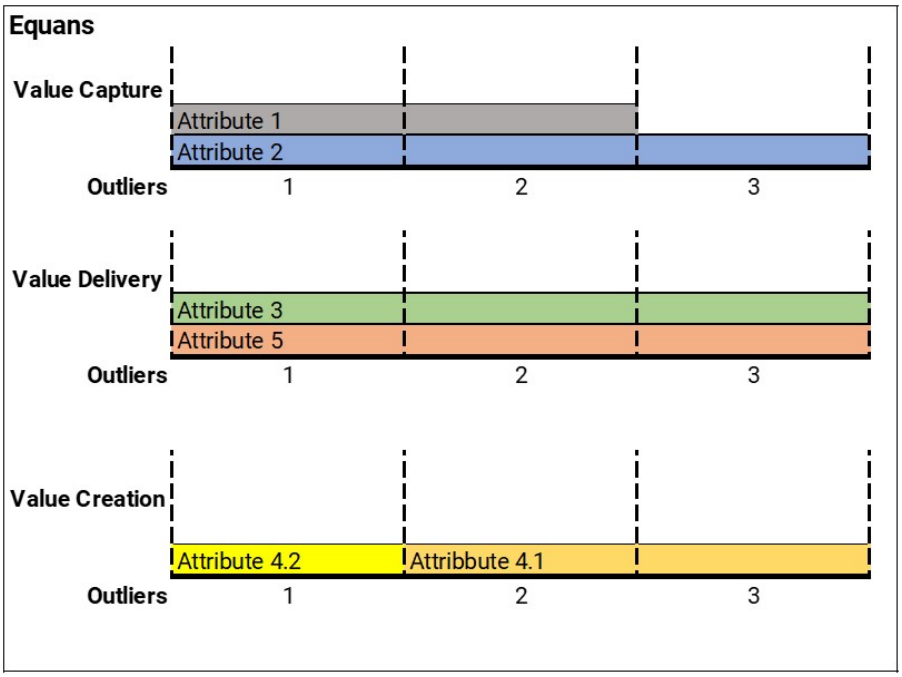

Figure 3.1: 3D profile of Equans

This figure will be used to quantify the profile of Equans. Every profile that will be created in this project will have the same structure to make sure a comparison can be made correctly.

3.4. Potential case study evaluation

To determine if other industrial sectors are suitable to study for success factors of an PSS implementation, the potential case studies are evaluated using the three dimension model in the analytical framework. The case studies are found with Scopus and are published papers. First, papers are evaluated with experience and context to limit the amount of potential case studies to make a profile of. If a study seems to be a fit for this project, it is taken to the next evaluation step. For the found possible case studies, an 'initial 3D profile' is made of the case to compare it to the 3D profile of Equans. To create this initial profile, the document is scanned to look for specifics of the case and place them on one of the dimensions, if possible. If the initial 3D profile is similar to the 3D profile, it will be used for a further case study on the success factors for a PSS and servitization implementation. In the following subsections multiple initial 3D profiles are displayed and compared to the 3D profile of Equans in subsection 3.4.4.

3.4.1. Plant Engineering Companies 3D Profile

A study conducted by Lay (2014) on servitization by plant engineering companies is evaluated in this section. According to the paper, plant engineering companies design and construct various plants e.g. power plants, petrochemical plants, steelmaking plants, drinking or wastewater plants, to name a few. It is a study on what types of servitization is successfully implemented by plant engineering companies. To assess if this case is suitable to eventually use for a case study, an initial 3D profile is constructed based on the contents of the study. First, a table based on the papers contents is drawn. See Table 3.4.

Dimension	Dimension options	Case points
Value Capture	Performance/Use/Product	1 to 3
Value Delivery	Smart/Hybrid/Non-Smart	2 to 3
Value Creation	Ownership company/Mixed/Ownership client	1 to 3

Table 3.4: Points on dimensions: Plant Engineering Companies

Next, the corresponding initial 3D profile figure can be made, see Figure 3.2.

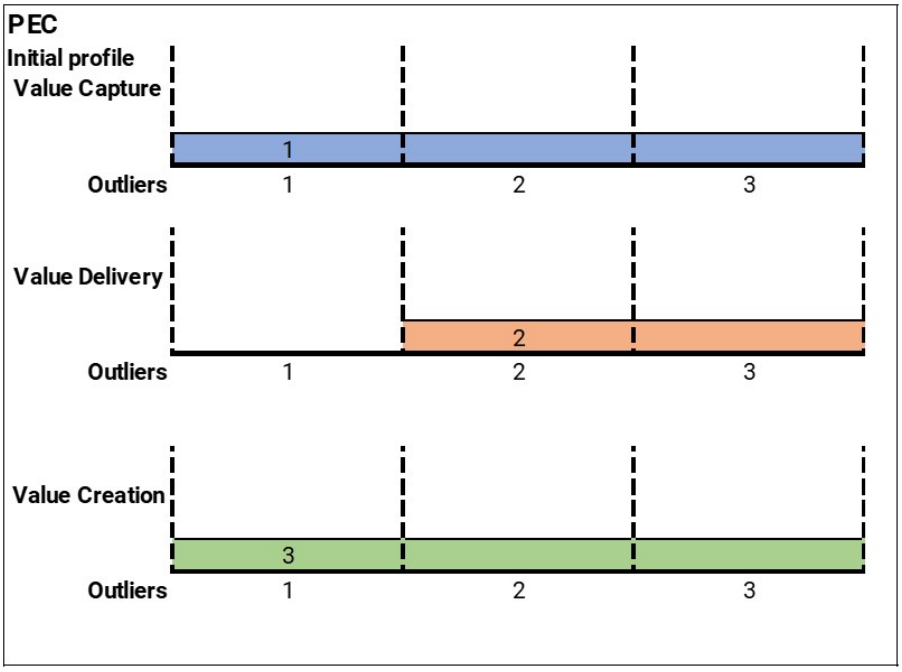

Figure 3.2: Initial 3D profile: Plant Engineering Companies

3.4.2. Offshore EPCI company 3D profile

The same procedure has been applied in this section as in the previous section. Frandsen, Raja, and Neufang (2022) studied the servitization journey of an Engineering Procurement Construction and Installation (EPCI) company in the offshore sector. It covers the steps that were undertaken that include the switch from non-digital products and services, towards fully digital servitization solutions. Table 3.5 indicates the points on the three axis to create the Initial 3D figure.

Dimension	Where on dimension?	Outliers
Value Capture	Performance/Use/Product	1 to 3
Value Delivery	Smart/Hybrid/Non-Smart	1 to 3
Value Creation	Ownership company/Mixed/Ownership client	2 to 3

Table 3.5: Points on dimensions: Offshore EPCI company

The contents of the table result in the profile that is pictured in Figure 3.3.

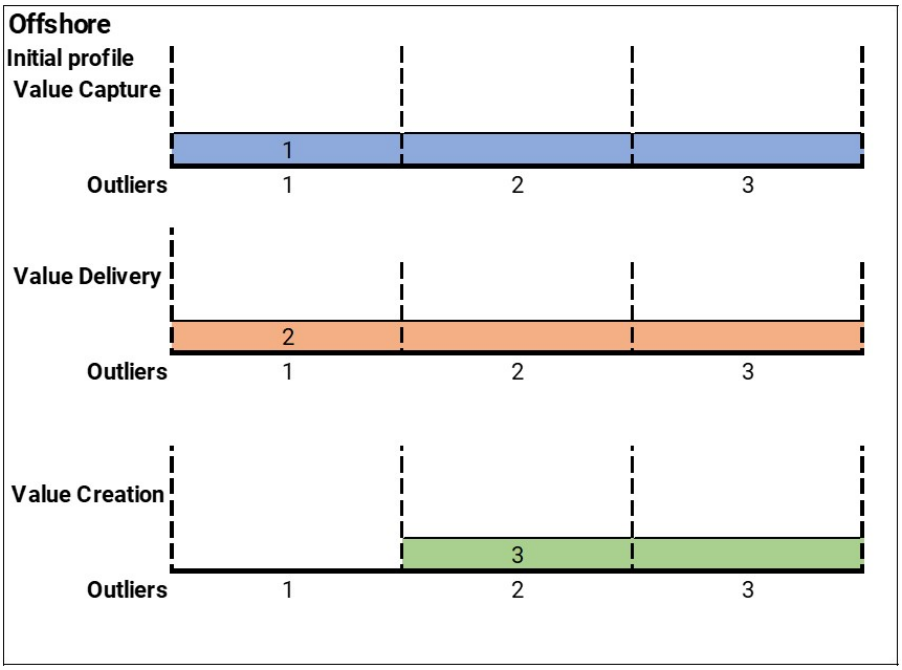

Figure 3.3: Initial 3D profile: Offshore EPCI company

3.4.3. Automotive industry 3D profile

A study on how the automotive industry moved towards servitization is conducted by Gaiardelli, Songini, and Saccani (2014). It describes how multiple car companies transitioned from a ownership oriented business model to a use and service based business model during as a reaction on economic headwinds. The dimension profile can be found in Table 3.6.

Dimension	Where on dimension?	Outliers
Value Capture	Performance/Use/Product	2 to 3
Value Delivery	Smart/Hybrid/Non-Smart	2 to 3
Value Creation	Ownership company/Mixed/Ownership client	1 to 3

Table 3.6: Points on dimensions: Automotive companies

The corresponding initial 3D profile along the three dimensions is displayed in Figure 3.4.

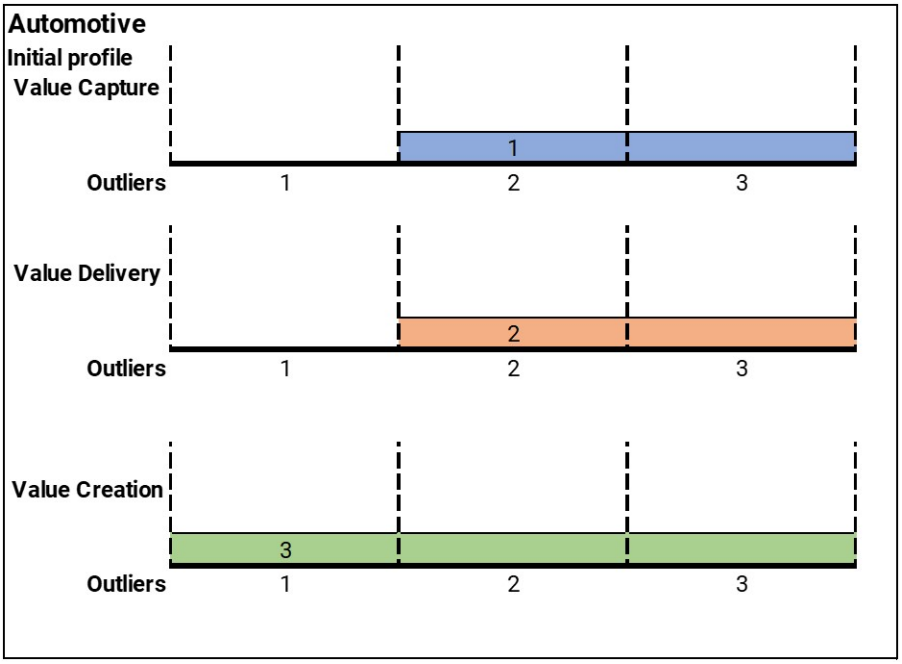

Figure 3.4: Initial 3D profile: Automotive companies

3.4.4. 3D profile comparison

In this section, the 3D profiles of the selected potential case studies are compared to the 3D profile of Equans to determine if they are similar and thus suitable to use as case studies for this project. In Figure 3.5 the profiles are displayed. As can be seen, Equans has attributes that have different positions along the dimensions. The goal is to find profiles that have the same or similar positions on the dimensions. It can be said that Equans has ambitious goals since all point on the axis are occupied. None of the potential case studies covers all possible positions on the dimensions. However, if the case studies are combined, all positions are covered. Besides that, Plant Engineering Companies, Offshore EPCI and Automotive their individual profiles have a similar profile to Equans for around 78% to 88%. Hereby it is concluded that these cases can be used for a further case study to extract their business models and success factors on how to implement a product service system.

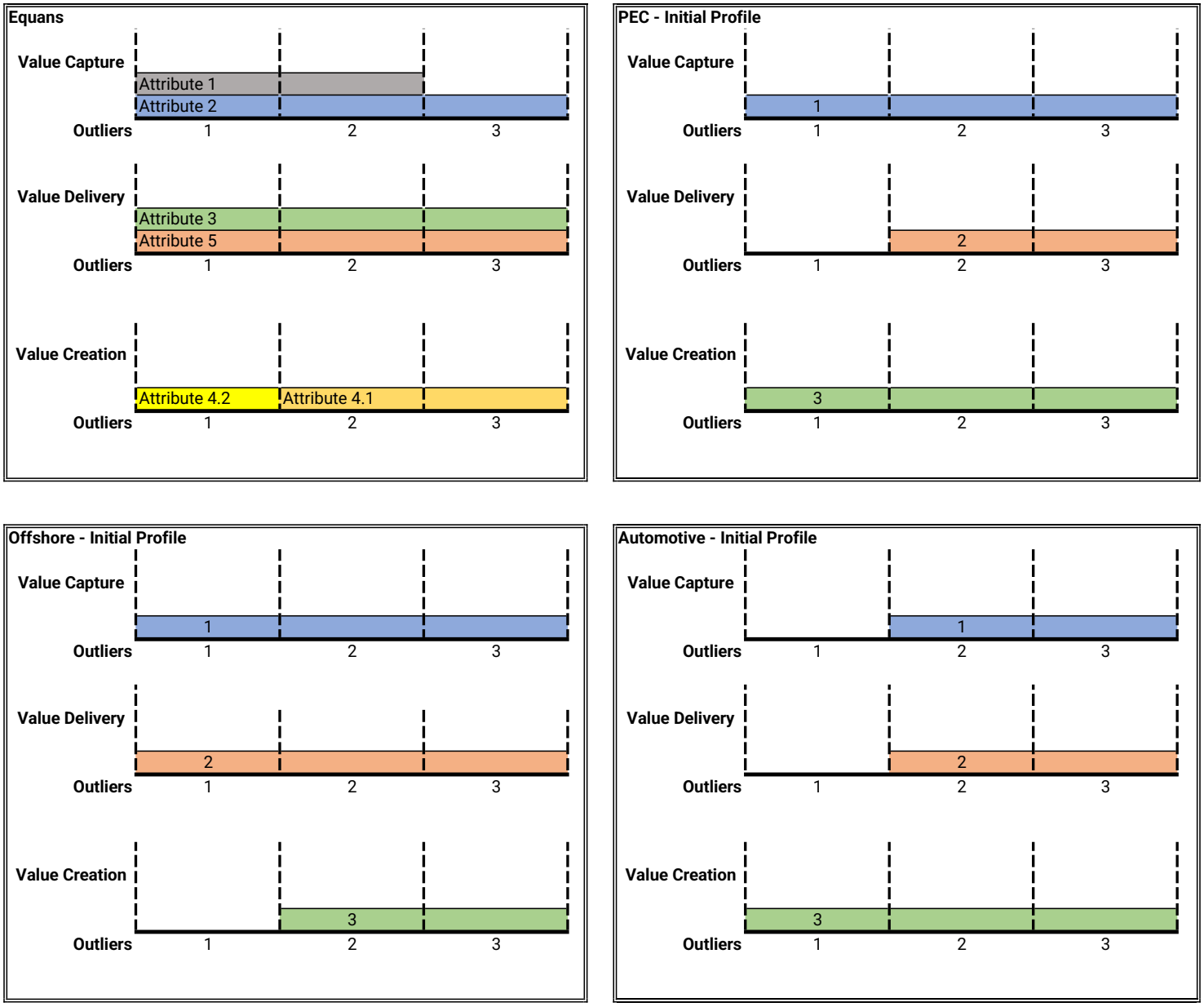

Figure 3.5: Comparison of 3D profiles - Equans, Plant Engineering Companies, Offshore EPCI, Automotive Industry

3.5. Case studies

3.5.1. Plant Engineering Companies

As described in subsection 3.4.1, many different forms of plants exist. Plant engineering companies are involved with practically all of the projects to design and build such plants and have major industries as their clients. As Lay (2014) states, a market fragmentation is implied by the diversity of clients, their stochastic need for new plants, and the specialization of plant engineering firms for the requirements of various client industries. Plant engineering items are sold in various sub-markets, each with a small number of suppliers and buyers. Bidirectional dependencies are created by this oligopolistic structure: Their bargaining stance during contract negotiations is strengthened by the small number of clients. Contract terms and conditions which favor demand-side interests are frequently imposed on suppliers by clients.

Business wise, pre-sales services must be included in every offer and contract since the plant engineering industry demands customized solutions for each client. Plant engineering traditionally includes analyses for requirement requirements, R&D, consulting, and individual engineering services as key components. In addition, after-sales services like plant building, installation, employee training, and start-up help are typically offered. Equipment plant engineering businesses must provide replacement parts, maintenance, and repair services for the duration of the installed plant (Lay, 2014). Dachs et al. (2014) further showed that 74% of manufacturers of simple products, 88% of producers of medium-complex products and 94% of manufacturers of complex products offer at least one service.

It is clear that plant engineering companies do indeed practice servitization. However, the type services vary greatly. Next, types of operational services that exist with plant engineering companies are discussed according to the study from Lay (2014). The study fixates on plant operation services.

- **Plant operation services push new technologies to market**
  This variant is focused on pushing new technologies to the market. In this case the engineering company, ALD Vacuum Technologies, Germany, takes on loan to build facility for their client and operates it with their own employees. An important aspect here is that the engineering company is also owner of the facility. The facility is financed through bank loans and solely bears the risk. The contract with the client doesn't specify a fixed number of parts that have to be purchased, again the engineering company takes on market risks from the client. This approach also gives the company the opportunity to acquire the know-how that is required to run innovative industrial plants and equipment. This allows the plant engineering company to improve the performance and can realise a competitive advantage.

  Lay (2014) further states that value is created in two ways using this approach. Firstly, customers avoid start up problems and start up costs. This is only the case because the technology needs to be proven successful. If the product is demonstrated to be superior to other technologies, this value addition disappears. Secondly, the plant engineering company can achieve enduring added value when the operational know-how exceeds the know-how of the customer due to the complexity of the technology. This creates a lock-in scenario.

- **Plant operation services forced by financial and rating motives of customers**
  This is a customer driven service model. Customers sought to strengthen their balance sheets by reducing fixed capital, establishing new methods for financing their projects, or slashing salaries to capitalize on pay disparities between the automotive and engineering industries. This operation oriented business model was developed by Dürr. Dürr is an assembly factory engineering company from Germany. Their specialized business unit 'services' created a sub unit called 'operating models'. Because of the demand for this type of

services, such a reorganisation was necessary. The main motivations for the inquiries Dürr received for such an operating model were financial and balance sheet related (Lay, 2014).

To meet the customer requirements, Dürr developed operating models that consisted of 4 different components which are again consisting of different options Lay (2014):

- **Equipment:** Multiple supplier alternatives. The building can be included or excluded.
- **Financing:** Operating lease, joint venture or full ownership.
- **Services:** Managed services, different maintenance levels, cleaning, full service.
- **Operation:** Managed operation, full operation, management of supplier network, quality management.

The solution for the client can consist of combinations of these components. Not all 4 categories have to be chosen. This construction of different models indicates that customizability is of importance. Based on this concept, realized multiple operation projects. An example is a project executed for IBC Vehicles in Luton, Great Britain. In this project, Dürr was responsible for engineering, manufacturing, the delivery and the financing. In addition Dürr provided full services, maintenance, operations and the cleaning for the production line Lay (2014). This lasted for 13 years where 22 full time employees from Dürr worked in 3 shifts. Dürr received payment on a cost-per-unit scheme.

- **Plant operation services to compensate for shortcomings of clients' employees.**
Customers can approach engineering companies to use their service to compensate for shortcomings of the clients' employees. This can be the case when the client feels that their operating plants cannot be exploited enough with their current in house personnel. Particularly in developing countries where the necessary skills are not met by the workforce. WABAG Group is an example that provides such services. WABAG is a leader in water treatment solutions.

  WABAG used the following models:

  - **Build-Own-Operate and Transfer (BOOT).** This is a complete solution for financing, constructing and operating a plant. The engineering company has overall responsibility for the building and the operational management. Additionally, the engineering company secures the financing that is required. When the contractual period ends, the plant becomes the property of the customer.
  - **Design, Build, Operate (DBO).** This model consists of planning, designing, constructing and operational managing of new plants.
  - **Plant Operation/Outsourcing (O&M).** This model transfers the operational management of existing wastewater plants to the engineering company (WABAG). In this model WABAG is responsible the success of the technical process and the commercial results of the plant.

  More plant engineering companies offer such operational services as a result of unqualified personnel, this is also confirmed by Kujala et al. (2011). This case study indicated that 3 out of 5 operation and maintenance services from the Consolidated Power Company (CPC) were initiated to overcome a lack of skills from the employees of their customers.

- **Plant operation services to achieve benefits from co production**
Engineering companies build, own and manage production facilities next to customers industrial plants that need parts of the produced products by the engineering companies facilities. Customers don't need all produced products by engineering company plant, but engineering company can capitalise on all produced products. This prevents the customer

from being also a manager/owner of an extra plant that produces more different products than they need. These extra unused products are then let go, or the customer also has to be a trader in the unused products (Lay, 2014). Examples of such projects are from Linde Gas Group. Linde consists of two divisions: an engineering department and an industrial gas department (Linde, 2023). Both divisions work closely together as more than 20% of the engineering revenue comes from orders from the gas division. The plants are not being sold to the clients of Linde Gas, but are owned and operated by Linde Gas and provide the required gasses for clients of Linde Gas. In this model, Linde Gas builds plants to produce gases that are in high demand of a client and besides the required gas for the client, the plant also produces additional gases to supply other regional demands. An example of a successful implementation of such a model is the construction of a large air separation plant to supply a steel production plant in Indonesia (Indonesia, 2011). Such an project can realise economies of scale because the plant is not solely constructed for the initial client, but also for the regional demand (Lay, 2014).

- **Plant operation services for increasing customers' plant utilisation**
  The final service type aims to help customers designing their plant capacity. The fifth operational service category offered by plant engineering firms addresses the issue of customers not properly dimensioning plant capacity. Customers can select a configuration that is intended to satisfy the estimated average capacity demand when planning a new plant. Such a choice will result in capacity utilisation rates that are momentarily over the optimal level for the economy. Customers can also select a smaller configuration, which can only accommodate the smallest expected demand. Spot demands could not be satisfied, but the plant would be operating at its most efficient economic level. As a result, rival businesses might enter the market and pick up customers. Customers of plant engineering businesses typically select the first option in this scenario. Numerous plant engineering corporations make use of the adaptable capacities in their own facilities and run these plants to meet the immediate needs of different clients in order to let customers choose the latter option without running the risk of negative outcomes (Lay, 2014). The paper mentions an example of such business model, executed by Rohwedder Micro Assembly from St. Leon-Rot, Germany. Rohwedder and Jenoptik worked together on a project. The businesses sought to create technology and financial models that would meet Jenoptik's specifications for assembling regular and spot capacity.

  One of the proposed models involves the implementation of an automated assembly line at Jenoptik's facilities, specifically designed to handle regular capacity demands. Furthermore, it is suggested that a modular assembly technology, capable of fulfilling various customers' assembly tasks, be installed at a separate Rohwedder plant. In this arrangement, Rohwedder would retain ownership of the aforementioned assembly technology. Whenever there are sporadic demands and Jenoptik's assembly facilities are operating at maximum capacity, the parts requiring assembly would be shipped to Rohwedder. Subsequently, Rohwedder would undertake the assembly process using its own personnel, and payment would be made for the service rendered. In situations where there are regular capacity demands, Rohwedder would have the option to utilize the assembly line for fulfilling spot demands from other customers or for activities such as testing and demonstrations (Lay, 2014).

A summary of the discussed types are displayed in Figure 3.6

Type characteristics		Type of plant operation service provided by plant engineering companies				
		1	2	3	4	5
Initiator of plant operation service		Plant engineering company	Customer company	Plant engineering company and/or customer company	Plant engineering company	Plant engineering company and/or customer company
Motive for supplying/ demanding operational service		Marketing for innovative plant technology	Financial/rating problems on customers' side	Lacking employee skills on customers' side	Only partial demand for products from combined production on customers' side	Decrease of customers' plant capacity to increase utilisation rates
Form of operational service	Ownership of plant	Plant engineering company	Plant engineering company	Predominantly customers	Plant engineering company	Plant engineering company
	Personnel for operation	Plant engineering company	Plant engineering company	Executives and first-line management: plant engineering company	Plant engineering company	Plant engineering company
	Payment for operation	Pay per part/use/ unit	Pay per part/use/ unit	Investment plus pay per part/use/unit for suppliers' operational costs	Pay per part/use/unit	Pay per part/use/unit
	Location of operated plant	Fence-to-fence with customer site	Customer site	Customer site	Fence-to-fence with customer site	Plant engineering at company's site
Source of value added for plant operation service		Additional sales by developing larger markets	No value added (zero sum game)	Optimised exploitation of plant technology	Commercialisation of all products from combined production plants	Increased utilisation of investments

Figure 3.6: 'Types and characteristics of operational services provided by plant engineering companies' (Lay, 2014)

Important from these examples for servitization from plant engineering companies is that the financial risk and ownership of these forms of servitization is carried by the engineering company itself. The engineering company invests heavily to be able to provide the service to its client. This is not a risk averse approach. However, the agreement between the engineering company and the client are long term and the added value the plant engineering company delivers is significant in multiple cases: additional sales in developing markets, optimization, increased commercialization and higher utilisation of the plants (Lay, 2014).

Multiple factors that were a key for the implementation of such service models were mentioned throughout this case study and during the evaluation of the five different models. Summarized, these success factors can be found in Table 3.7. These success factors will be used to create a 3D profile of the success factors for the Plant Engineering Companies. This profile will later be used to assess different scenario's for Equans and point out success factors for that specific scenario. This will be elaborated in section 4.4.

Success factors	Description	Dimension	Where on dimension?	Outliers
Push to market	Firm is owner, not client	Value Creation	Company ownership	1
Make initial investments to convince customers of the added value of the service.	Firm is owner, not client	Value Creation	Company and shared ownership	1 to 2
Create and maintain a knowledge advantage over the customer.	How is service delivered to client	Value Delivery	Non-Digital	3
Create a wide range of possibilities for services for the customer.	High customization	Value Capture	Result to Product oriented	1 to 3
High quality personnel, exceeding that of the clients. Client owner of factory	Non-digital service quality	Value Delivery/Creation	Non-Digital + Ownership to client	3
Financing (part of) the project to become (part) owner.	Ownership of the company	Value Creation	Shared ownership	2
Pay per part/use/unit	Contract Orientation	Value Capture	Use oriented	2
Long-term strategy focused (20 years)	Contract type	Value Capture	Result oriented	1
Added value creation.	Value through service provision	Value Delivery	Non-digital	3

Table 3.7: Success factors table: Plant Engineering Companies

3.5.2. Offshore EPCI

In the offshore sector, a movement towards digital servitization is emerging. According to Kohtamäki et al. (2019), digital servitization is the transition towards product-service-software systems. This enables new ways of value creation and capture by monitoring, control, optimization, and autonomous functions. Three time periods can be identified that show the digital servitization in the offshore industry according to a study by Frandsen et al. (2022), which focuses on SeaCo, an engineering, procurement, construction, and installation (EPCI) company (OffshoreTechnology, 2022). Period 1 (2015-2016, P1), from technical systems configurations to offshore wind installations servicing. Period 2 (2017-2018, P2), from offshore wind installations servicing to responsive service arrangements facilitation. And finally, period 3 (2019-2020, P3), development of autonomous solutions for offshore wind farms with high customizability. Period 2, the move from servicing offshore installations to responsive service arrangements facilitation, is rather interesting because it relates to the issues of Equans. SeaCo focused on offering more extensive service agreements and service products with high customizability. SeaCo's Service Department developed a remote monitoring system for the offshore wind farms. This allowed them to digitally and remotely monitor the installations for (predictive) maintenance (Frandsen et al., 2022). This is sold as an additional service to their installation projects for the client and enables a business model that generates recurring revenue.

Equans can, aside from their EPCI activities, provide additional service contracts. Ideally long term contracts to secure recurring revenue. However it will be necessary for them to distinguish themselves from the competition and deliver added value to the customer to bind them to Equans, or another TSP. It is important to note that the paper also confirms the difference between the offshore wind industry and the oil and gas industry, whereas the offshore wind industry is eager and more innovation and future driven, the oil and gas industry is a slow moving conservative industry were less likely to approach such services. This is an important note to take into account for technical service providers in the industrial sector. Another difference the paper mentioned,

is that oil and gas companies often have the inhouse capability to service their infrastructure, as they have done for decades. The offshore wind industry often does not have this capabilities, also because these wind farms are difficult to access.

For every time period (P1, P2, P3) and the corresponding transition/evolvement SeaCo created value for its customers to excel the transition and adaptation within the offshore sector. This value creation was partly enabled by the emergence of novel instrumentality. Instrumentality is the usefulness of a technology or system, or the quality of being of practical use of something. In this case it is the emerging usefulness of technology concerning (digital) servitization.

The identified success factors and characteristics from the Frandsen et al. (2022) paper are shown in Table 3.8:

Success factors	**Described**	**Dimension**	**Where on dimension?**	**Outliers**
Willingness of offshore sector to move to ways to improve maintenance.	Delivery of new service to client	Value Capture	All orientations	1 to 3
Remote control demand of offshore sector.	Remote service options	Value Delivery	Hybrid and Non-Smart	2 to 3
Personnel capacity: Offshore sector often does not have inhouse capabilities for construction, control, maintenance.	Superior personnel	Value Delivery	Smart Digital to Non-Smart	1 to 3
Personnel quality	Right licenses to execute projects etc.	Value Delivery	Non-Smart	3
High customization	Many options for client	Value Capture	All orientations	1 to 3
Clearly defined service options	Option clarification	Value Capture	All orientations	1 to 3
SeaCo; specialized service development initiative	Value development	Value Delivery	Non-Smart	3
Co-ownership of installations/sensors	Shared ownership	Value Creation	Owner + Client	2
Service offering after EPCI	Follow-up services	Value Delivery	Smart Digital to Non-Smart	1 to 3
Long term contracts	Long term or lifetime contracts to mitigate own risk	Value Capture	All orientations	1 to 3

Table 3.8: Success factors table: Offshore EPCI

3.5.3. Automotive Industry

The European car sector went through a difficult period. After 2007, demand for new vehicles fell swiftly, particularly in the truck sector. Decline and stagnation have resulted in significant structural overcapacity of manufacturing plants, threatening the existence of businesses such as component suppliers, car manufacturers, dealers, and repair shops (authorized or independent). Concentration and alliances are pursued in order to benefit the bottom lines of the various participants. Services allowed these automotive companies to survive the difficult economic climate, hence servitization of the industry started (Gaiardelli et al., 2014). A case study conducted by Gaiardelli et al. (2014) showed the emergence of services in the European automotive industry for cars and heavy-trucks. The services can be classified along three dimensions, namely:

- **The offering focus.** The move from products to the process; from vehicles to driving and people focused services (Windahl & Lakemond, 2010).
- **The nature of the interaction between provider and customer.** The interaction was transaction-based or relationship-based (Penttinen & Palmer, 2007). Each interaction has its own way of pricing the service. Transaction-based would be paying for labour hours and materials. Relationship-based would entail a fixed all inclusive price over an agreed period.
- **The offering orientation.** As mentioned in chapter 1, these are the three groups of services types as mentioned by Tukker (2004): product-, use-, and result-oriented services.

Key importance of the transition from product-orientation business model to a customer focused model with bundles of products and services, is that the customer can actually achieve an advantage form this servitization. The new services must provide added value. This is, in this case, created by offering a wide selection of customization to fit their desires. Most services either support or improve vehicle availability and dependability. Other services, like vehicle upgrading and outfitting, vehicle cleaning, the provision of refurbished spare parts, and initiatives to support the management of the vehicle end of life, are examples of how automotive companies have been diversifying their offerings to help customers in managing their vehicles throughout the whole lifecycle. The majority of services come with a variety of options (or features) the consumer may select from concerning the length, performance guarantee, terms of payment, and other factors (Gaiardelli et al., 2014). This demonstrates even more the efforts OEMs of cars and heavy trucks have made to find answers to the demands of various consumer groups.

The industry offered besides the vehicles also services to improve the quality of the customers' operations, the efficiency effectiveness of their tasks, or to help the customer advance their skill set. Examples are driving courses, fleet maintenance training, and consultancy practices (Gaiardelli et al., 2014). These are all efforts that create value for the customer and set the brands apart from other market competitors. It is also clear that the industry offered their services in multiple ways for the customers. Many varieties of services, packages, use-, product- and result-oriented services indicate a high level of customization. However, as Cohen, Agrawal, and Agrawal (2006) mention, offering too many services to customers or a customer segment can have a negative impact on the quality and the profits. Also, a too customizable offering of services can be too costly to realize.

Gaiardelli et al. (2014) mentions that a vertical integration of a company is necessary to achieve higher levels of servitization, the automotive industry is an example of a service chain that is scattered over multiple third-party suppliers. This decreases efficiency and allows for competition. A move towards a vertical integration can result in lock in of customers, thus a lock out of the competition. Additionally, the difficulty faced by OEMs and service networks in distinguishing between offering 'the core physical product' and the 'product-service' bundle, as well as underestimating the strategic, tactical, and operational difficulties included by this transformation, can be identified as an important barrier.

Success factors	Described	Dimension	Where on dimension?	Outliers
Vertical integration	Using less middlemen to execute services	Value Delivery	Hybrid to Non-Digital	2 to 3
Alliances	Form alliances with relevant companies to complement each other's services and thus	Value Delivery	Hybrid to Non-Digital	3
Value creation for customers	Give the customers a wide range of services	Value Creation	Smart-Digital to Non-Digital	1 to 3
Willingness of customers to adapt to services	Focus on the type of service the market wants and exploit this. Also introduce new service products	Value Capture	Performance and Use	1 to 2
Relationship based	Engage to establish relationships with clients	Value Capture	Performance and Use	1 to 2
Customizability for customer → value addition	Create the possibility for customers to put together the services as they wish	Value Capture	Performance and Use	1 to 2

Table 3.9: Success factors table: Automotive Sector

3.6. Scenario's

Since PSSs can be configured in many possible ways, and not all identified success factors fit all types of PSSs, different PSS configurations are generated in the form of scenario's. These scenario's will be assessed by an Equans panel to identify the most probable and realistic scenario's for Equans. Thereafter, the corresponding success factors to these selected scenario's can be identified.

Every scenario is drafted within the same framework. The framework is built using the different PSS orientations as described by Tukker (2004), and the model of Aas et al. (2020) (3D model). This way, the scenario's have the same set up along the 3 axes, just as the Equans scope, the success factors and the case study industries. The scenario framework criteria are chosen with the scope and wishes profile of Equans in mind. This profile is the result of interviews and own experience of working and talking with people at Equans. To limit the amount of possible combinations further, drafted scenario's will be assessed to determine if the combination is realistic i.e. a real life possibility, based on knowledge from literature, interviews and experience. The final scenario's will also consist of the same 3D model from the analytical framework as used throughout the thesis. The scenario 3D profile can then be compared with the overall SF 3D map to determine the overlap on each dimension. The overlapped areas will correspond with success factors that can help for a implementation along that same dimension. This way, for each scenario, a custom set of success factors based on literature will come forward from the framework.

3.6.1. Scenario framework

The scenario's have to be comparable and thus have to be created using a consistent structure with the same variables. A framework is created to assign boundaries in which each scenario will be constructed. The framework, as previously mentioned, is created using the 3 dimensional model by Aas et al. (2020), as every other step in this thesis, and the three main orientations within the product service system classification of Tukker (2004). In Figure 3.7 the process is displayed.

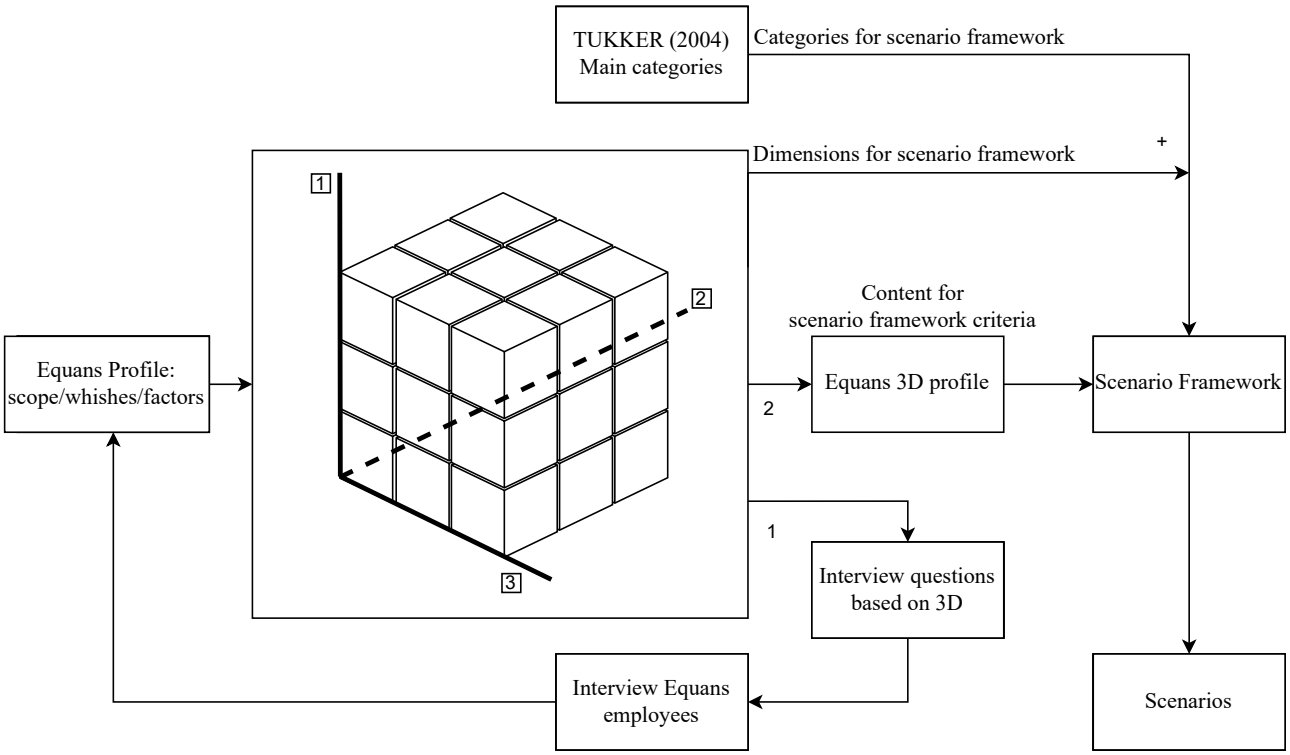

Figure 3.7: Scenario framework Aas et al. (2020) Tukker (2004)

The dimensions of the 3D framework form the three main categories on which the scenario's will be formed. In Table 3.10 For each dimension, two separate criteria are chosen; one 'main criteria' that corresponds with the points on the dimensions as described earlier throughout the project, and a second criteria to further incorporate the wishes of Equans in the scenario's. 'Orientation', 'Product' and 'Ownership' are the main criteria for the dimensions Value Capture, Value Delivery and Value Creation, respectively. These main criteria will be the decisive criteria which the scenario's will be based around. The second criteria will be addressed in a moment.

Three dimensions consisting of three different options each will result in 3x3x3=27 different combinations and in this case; scenarios. The reason that the scenario's are based on the three criteria and not the total six is to limit the amount of scenario's possible to a reasonable size, 27 instead of 729 ($3^6 = 729$), also because otherwise many unlikely and unrealistic combinations will be generated. For example, a scenario where Equans finances a production plant that will be owned by the client and has a recurring contract that is product oriented. This will probably never occur in a real life scenario. Limiting the scenario generation to the 27 options keeps the total amount of scenarios reasonable to work with and prevents many different unlikely combinations of criteria. Of course, also within the 27 scenario's there will be unlikely combinations, these will be addressed.

After the scenarios are generated based on the three main criteria, the three remaining criteria will be chosen based on the context the main criteria create. These decisions will be made based on knowledge from literature and on the wishes of Equans. The decisions on the three remaining criteria will be elaborated. Additionally, an example of a possible real world product or model will be given with each scenario to give a better idea of what that scenario can look like if Equans would indeed apply it.

Dimension	**Criteria**	**Option 1**	**Option 2**	**Option 3**
Value Capture	**Orientation**	Result	Use	Product
	Contract term	Recurring	5y	10y
Value Delivery	**Product**	Digital	Hybrid	Non-Digital
	Operations	Equans	Equans + Client	Client
Value Creation	**Ownership**	Equans	Equans + Client	Client
	Financing	Equans	Equans + Client	Client
Example		x	x	x

Table 3.10: Scenario framework criteria, Aas et al. (2020) Tukker (2004)

3.6.2. Scenario generation

To generate all possible combinations of scenario's between the three main criteria 'Orientation', 'Product' and 'Ownership', the criteria were assigned the numbers 1, 2 and 3 respectively. Next, Microsoft Excel was used to generate all possible combinations between these numbers. Each combination represents a scenario. All possible scenario's can be found in section A.2, including the decisions that were made for choosing the second criteria for each scenario and it is indicated whether a scenario is deemed unlikely or per definition not possible. After removing all unlikely or impossible scenarios, 14 scenario's remain. These scenario's will be presented and assessed by the Equans panel.

3.7. Panel Equans employees

For the Equans panel, a meeting will be held to let the participants rank the shortlist of scenario's. The used scenario's are displayed in Table 3.11, Table 3.12 , Table 3.13 and Table 3.14. To explain, the first two rows of these tables refer to two different types of numbers. 'Number in generation' refers to the number this scenario has in the generation of the initial 27 scenarios, as is shown in section A.2. 'Number in presentation' refers to the number this scenario has in the shortlist that is presented to the panel. The tables continue after this page.

Number in generation	1	2	4	5
Number in presentation	1	2	3	4
Orientation	Result	Result	Result	Result
Contract term	Recurring	5y	Recurring	5y
Product	Digital	Digital	Hybrid	Hybrid
Operations	Client	Equans + Client	Equans	Equans
Ownership	Equans	Equans + Client	Equans	Equans + Client
Financing	Equans (client lease)	Equans + Client	Equans (client lease)	Equans + Client
Example	Software for building insights	Custom software	Customer pays for lower energy usage. Equans delivers using own sensors, etc.	Lower downtime machinery of client
Decisions on criteria selection	Recurring because it is result and software lease	5Y because shared ownership and shared financing	Recurring because it's result-based without deep costs for client	5y because lower downtime needs to span over a longer period
	Operations done by client as they use it on their own, for their insights	Operations are done together	Operations by Equans because result-based	Equans operations because they take control of machinery
	Equans finances because they develop software. Client leases	Shared financing because long-term revenue can be secured. Also opportunity for Equans	Financing of sensors, software, etc., done by Equans because the client pays for the result. Equans owns the product	Financing is shared because Equans uses own equipment. Client pays for the service

Table 3.11: Scenario shortlist for Equans panel - 1 to 4

Number in generation	7	9	10	12
Number in presentation	5	6	7	8
Orientation	Result	Result	Use	Use
Contract term	Recurring	10Y	Recurring	5y
Product	Non Digital	Non Digital	Digital	Digital
Operations	Equans	Equans + Client	Client	Equans + Client
Ownership	Equans	Client	Equans	Client
Financing	Client	Client	Equans	Equans + Client
Example	Stand by service in case of service need of client	More efficient production machine	Client uses test software that is paid per use	Custom software. Long term commitment
Decisions on criteria selection	Recurring because it's service-based and result-based	10Y because Equans gets paid for result of built machine. Needs guaranteed revenue	Recurring since it is user-based and software	5y because Equans also financed and it is use-oriented
	Operated by Equans because it uses only Equans mechanics	D2D: Client. In case of service: Equans	Operations by client because they use it	Operations done by both because Equans can assist
	Client needs to pay for service	Client finances because they want new factory part and positive CF for Equans	Financing by Equans because they developed the software	Equans and Client both pay because it is custom ordered and Equans can secure long-term revenue

Table 3.12: Scenario shortlist for Equans panel - 5 to 8

Number in generation	13	14	17	21
Number in presentation	9	10	11	12
Orientation	Use	Use	Use	Product
Contract term	Recurring	Recurring	10Y	5Y
Product	Hybrid	Hybrid	Non Digital	Digital
Operations	Equans	Equans + Client	Equans	Client
Ownership	Equans	Equans + Client	Equans + Client	Client
Financing	Equans + Client	Equans + Client	Equans + Client	Client
Example	Emergency service of monitoring and service	Monitoring software + emergency service. Based on usage	Custom developed factory rig	Custom software. With support
Decisions on criteria selection	Recurring because it is membership-based	Recurring because based on usage	10Y because revenue needs to be secured after investment from Equans and since it is use-based	5Y because that is the span Equans will support the software
	Operations done by Equans	Client operates monitoring software, Equans delivers emergency service if necessary	Can only be operated by Equans personnel. Lock-in	Client operated since they use it
	Equans pays for equipment and development, and the client for the use of the service and a fixed fee for participating	Financing is both because Equans pays for development and the client pays for usage and sensors	Both pay for development. Client pays for use	Client pays because it is a custom project

Table 3.13: Scenario shortlist for Equans panel - 9 to 12

Number in generation	24	27
Number in presentation	13	14
Orientation	Product	Product
Contract term	recurring	10Y
Product	Hybrid	Non Digital
Operations	Client	Equans + Client
Ownership	Client	Client
Financing	Equans + Client	Client
Example	Client buys monitoring package with software, sensors, and support if needed	Factory rig + operations
Decisions on criteria selection	recurring because the client buys software and sensors once. Additional services are recurring	10Y because Equans secures long-term service through lock-in
	Client operates for own application	Equans operates because they designed and built it
	Equans pays for software development. Client pays for package and services	Client pays because it is a custom order and design

Table 3.14: Scenario shortlist for Equans panel - 13 and 14

These scenario's were shown to the panel one by one. Each participant had to classify each scenario on the Effort/Impact matrix which is shown in Figure 3.8. This matrix consists of two axes: the Impact- and the Effort-axis, which range from 'Low' to 'High'. Four combinations can be made between these values: Low-Low (C), High-Low (A), Low-High (D) and High-High (B). For each scenario, the scores of each scenario were tracked and using a voting system the final classification was decided. The results of the ranking of the scenario's can be found in section 4.3. After the scenario's are classified, the panel will be asked to point out the 2 most likely scenario's from the 'Quick Wins' and the 'Major Project' category. These four scenario's will be worked out in the success factor framework.

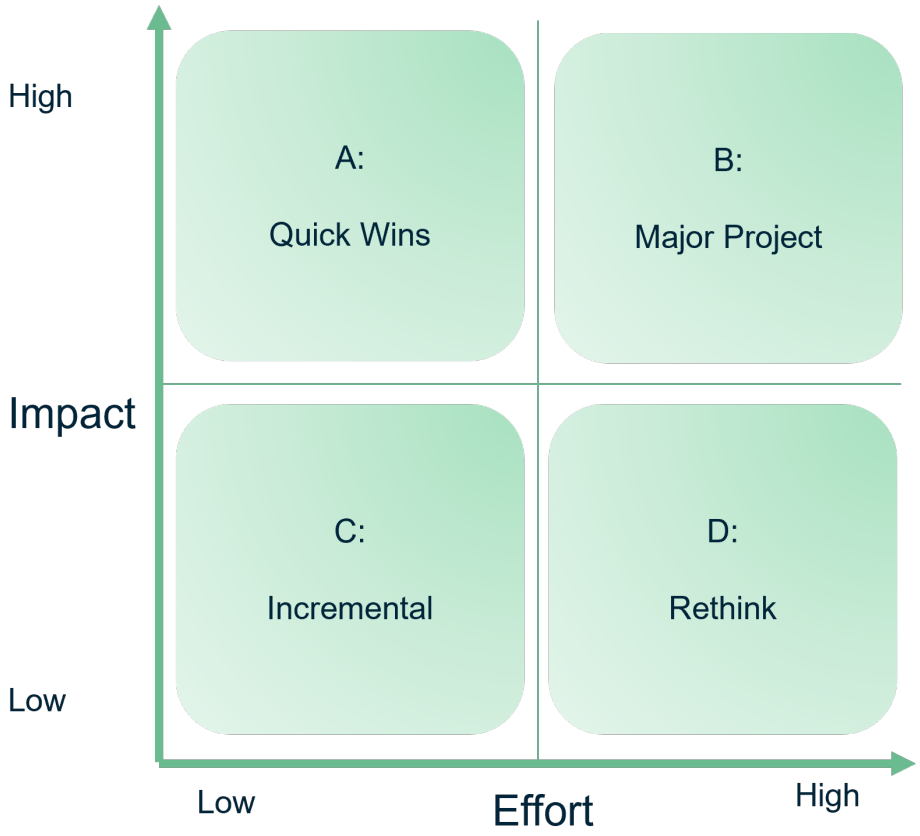

Figure 3.8: Impact/Effort matrix for Equans panel

4
Results

In this chapter, the results from the case studies and the Equans panel are described. First, a summary of the data that was collected during chapter 3 will be given. Secondly, an overview of the all success factors is given, followed by the combined framework of all success factors along the three dimensions from Aas et al. (2020). In section 4.3, the results from the panel meeting are presented. The chosen scenario's by the panel will be worked out in section 4.4.

4.1. Data collection summary

In chapter 3, the methodology of the project is described and executed. Also, the results of the methodology were immediately presented to improve the readability since the data was generally necessary for the following steps of the methodology. To still collectively present the results in this chapter, a summary is given of the results of the data that was collected during the methodology.

Interviews
Firstly, interviews were conducted with Equans employees to identify the problems and causes that Equans is experiencing. These interviews are processed in section 3.1. The key take-aways from the interviews are condensed into a scope consisting of multiple goals to solve their problems, these are: creating recurring revenue, value based pricing of their products an services, creating added value for their clients, cash flow positive projects (exeption for software), and lock-in of clients.

Profile of Equans and comparison with potential case studies
These attributes are also used to create the 3 dimensions profile of Equans, that follows from the analytical framework. The profile is displayed in Figure 3.1. This 3D profile matched with the 'initial 3D profiles' of plant engineering companies, EPCI company active in offshore industry, and the automotive sector. The comparison is made in subsection 3.4.4. These cases were used for the in depth case studies.

Case studies
Per case study, multiple success factors were identified that contributed to a successful PSS implementation in those cases. From the success factors, 3D profiles were also made to make scenario's, profiles and success factors comparable. The identified success factors can be found in Table 3.7, Table 3.8 and Table 3.9. In section 4.2 the combined success factor axes along the three dimensions from the analytical framework are shown.

Scenarios
Scenario's were created using the 3D model from the analytical framework. The framework for the scenario generation can be found in section 3.6. 27 scenario's were generated from which a shortlist was made of 14 scenario's to fit the profile of Equans and to eliminate unlikely and unrealistic scenario's. These scenario's were presented during a panel with Equans employees where the scenario's were classified on an Impact/Effort matrix. This will be addressed in section 4.3.

4.2. Success factors

In chapter 3, three case studies were conducted which from each a list of success factors was identified for a successful implementation for Product Service systems. These factors were all placed on the three dimensions of the framework that is introduced in section 2.8. The success factors from every case study are combined and placed on an axis of for each dimension. This will create an overview of all success factors per dimension and per outlier, which is displayed in Figure 4.1.

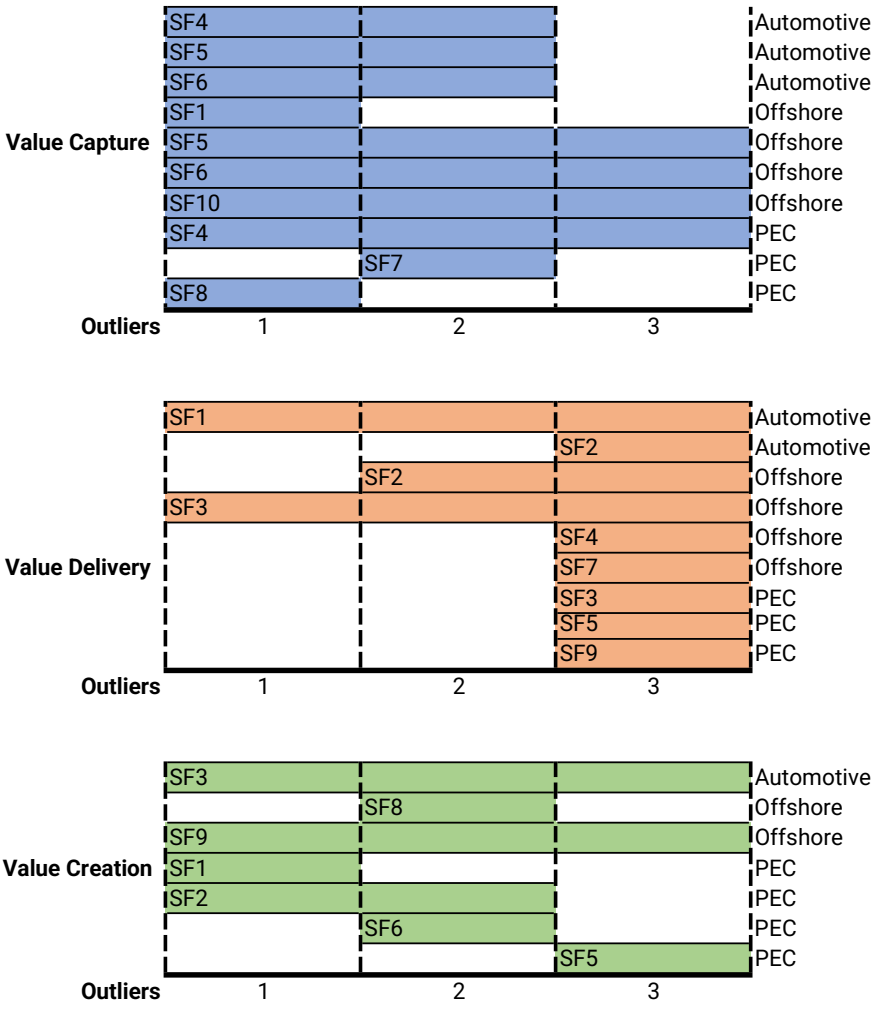

Figure 4.1: Combined success factor dimensions

This success factor overview can be used to assess what success factors correspond to a scenario.

Since the scenario's are structured along the same dimensions a 3D profile of the scenario can be placed on the combined success factor dimensions and will match with certain factors. The matched factors are suggested success factors that have to be focused on for the implementation of that scenario. This will be done with the scenario's that are chosen by the Equans panel, in section 4.4. In section 3.5, all the identified success factors are collectively presented.

4.3. Equans panel

The results of the scenario ranking during the panel is summarized in Table 4.1. It can be seen that the scenario's 6 and 7 are missing in the result table. This is because Equans already offers products that consist within these scenarios. It can also be pointed out that the majority of the scenario's are perceived as scenario's with a high impact, which indicates that the scenario's are desirable. From the 'Quick Win' category, scenario 3 and 13 are chosen to be the most likely and most diserable by the panel. The panel chose these two because scenario 3 is something they can easily realize and can be highly profitable and recurring, and scenario 13 because it is recurring and a hybrid product. For 'Major Project', scenario 12 and 14 were chosen. Scenario 12 was chosen because they want to move into digital services and it is long term, 14 was chosen because they really desire long term execution and maintenance projects. These for scenario's will be turned into 3D profiles placed on the combined success factor axes. This will be done in section 4.4.

Category	Scenario numbers
Quick Win	3, 9, 10, 13
Major Project	1, 2, 4, 12, 14
Incremental	
Rethink	5, 8, 11

Table 4.1: Scenario Categorization - Equans panel

4.4. Panel scenario's in frameworks

In Figure 4.2 the previously selected scenario's are displayed as 3D profiles to be able to compare with the combined success factor axes as displayed in section 4.2. In this section, this will be done for each of the selected scenario's.

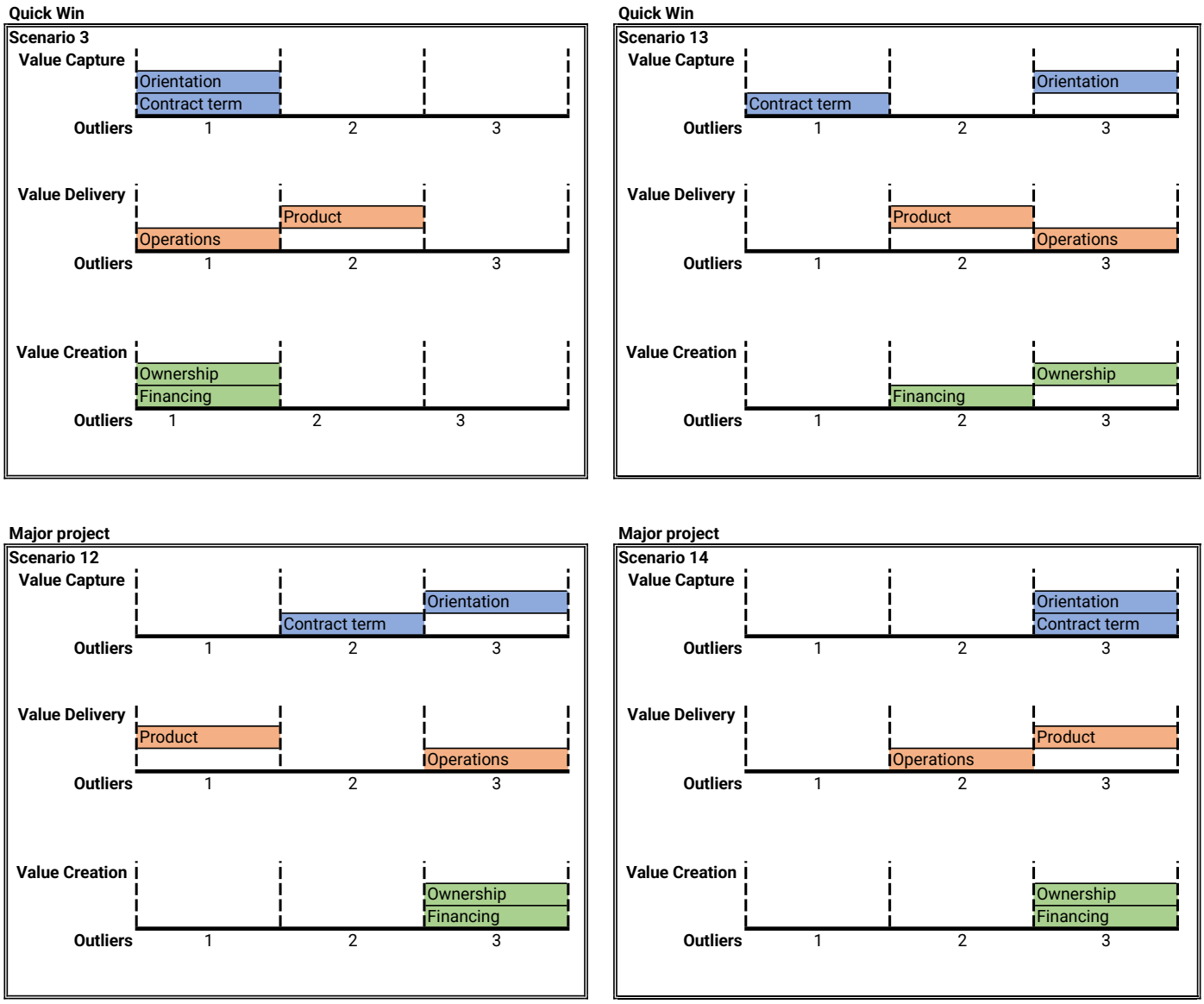

Figure 4.2: 3D profiles of chosen 'Quick Win' and 'Major Project'

Scenario 3

The corresponding success factors of the 3D profile of 'Quick Win' scenario 3 are:

Dimensions	SF number	Sector
Value Capture	4, 5, 6	Automotive
	1, 5, 6, 10	Offshore
	4, 8	PEC
Value Delivery	1	Automotive
	2, 3	Offshore
	/	PEC
Value Creation	3	Automotive
	9	Offshore
	1, 2	PEC

Table 4.2: Success Factors for Scenario 3

Scenario 13
The corresponding success factors of the 3D profile of 'Quick Win' scenario 13 are:

Dimensions	SF number	Sector
Value Capture	4, 5, 6	Automotive
	1, 5, 6, 10	Offshore
	4, 8	PEC
Value Delivery	1, 2	Automotive
	2, 3, 4, 7	Offshore
	3, 5, 9	PEC
Value Creation	3	Automotive
	8, 9	Offshore
	2, 5, 6	PEC

Table 4.3: Success Factors for Scenario 13

Scenario 12
The corresponding success factors of the 3D profile of 'Major Project' scenario 12 are:

Dimensions	SF number	Sector
Value Capture	4, 5, 6	Automotive
	5, 6, 10	Offshore
	4, 7	PEC
Value Delivery	1, 2	Automotive
	2, 3, 4, 7	Offshore
	3, 5, 9	PEC
Value Creation	3	Automotive
	9	Offshore
	5	PEC

Table 4.4: Success Factors for Scenario 12

Scenario 14
The corresponding success factors of the 3D profile of 'Major Project' scenario 14 are:

Dimensions	SF number	Sector
Value Capture	x	Automotive
	5, 6, 10	Offshore
	4	PEC
Value Delivery	1, 2	Automotive
	2, 3, 4, 7	Offshore
	3, 5, 9	PEC
Value Creation	3	Automotive
	9	Offshore
	5	PEC

Table 4.5: Success Factors for Scenario 14

The tables present the suggested success factors that have to be focused on per sector, for each of the scenario's that was chosen by the Equans panel.

5
Discussion

To evaluate the research process and the research findings, this chapter will present the discussion of the research project. Presented literature and the used methodology will be discussed in section 5.1. The contribution of this research project will be discussed in section 5.2. The value that this research project delivered for Equans is discussed in section 5.3. A reflection on the research will be given in section 5.4. And lastly, recommendations for future research are presented in section 5.5.

5.1. Discussion of literature and methodology

The objective is to find successful ways on how to implement a Product Service System that generates recurring revenue for and value based pricing for technical service providers that are active in the industrial sector.

Firstly, literature was consulted to identify the characteristics of the energy transition of the industrial sector, these can be classified in two categories: characteristics of the organization of the industrial sector, and characteristics of the economics of the industrial sector. These two characteristics point out that the current status of heavy industrial sectors are stuck in their own format, and disadvantaged by policies. Additionally, the transition is still not economically viable and interesting enough for incumbents to execute this transition. These economic findings agree also with the findings from the literature review in section 2.1. Here Fouquet (2008) mentions that economic factors like the energy price and economies of scale are the biggest catalysts of diffusion of new energy technologies.

Also found during the literature study, three main factors that Grübler et al. (1999) mention as important for successful energy technologies match the findings for the characterisation of the industrial energy transition. They state that a learning curve is essential and technology clusters to reach dominance as an energy technology. The current industrial structure is dominant because of the technological clusters that it exists of. The novel energy technologies have to undergo the learning curve which allow the industrial energy transition costs to go down, which allows for an S-shaped technological diffusion (adoption) curve, and finally technological clusters can form to increase the value of the technology. As stated also during the literature review.

Secondly, an analytical framework was constructed to analyze PSS implementations from other markets and sectors to extract success factors that match the goals and scopes of TSPs that want to implement a PSS. To test the framework, Equans is used as a case study.

For Equans, the identified success factors are classified along the three axes 'Value Capture', 'Value Delivery' and 'Value Creation'. The most important success factors are focused on the way the service is delivered to stimulate willingness of the clients to adapt, the customizability of the product, personnel quality of the company, value creation for the customer, and long term focused relationships with clients.

In the 'Value Capture' dimension, the most success factors were identified. The majority of these factor covered the first outlier of the axis, followed by the middle, and ending with the least factors in outlier point 3. For the 'Value Delivery' axis it is exactly the other way around, where the most success factors cover the 3 point on the axis, and the least on point 1 on the axis. For 'Value Creation', the distribution of the success factors is almost even, with 4 success factors for outliers 1 and 3, and 5 success factors for point 2 on the dimension axis.

Combined, the dimensions with their success factors form an important part for the study. These axes will later be used to match the profiles of scenario's. Each scenario consists of criteria that are distributed along the dimensions the same way as the success factors are. This way, for each profile of a scenario, the corresponding success factors can be retrieved. This works for every scenario combination.

Scenario's were generated using the three same dimensions and using three corresponding 'main criteria', with each 3 options. This resulted in 27 scenario's that were evaluated on their likeliness and how realistic they are. A shortlist of 15 scenario's was made and presented to a panel of Equans employees.

During the panel the scenario's were classified using an Impact/Effort matrix and the scenario's were placed in one of the following four categories: 'Quick Win', 'Major Project', 'Incremental', 'Rethink'. Two scenario's of 'Quick Win' and 'Major Project' were selected as most desirable and likely to be implemented by Equans. From these scenario's, 3D profiles were made as an example on how to use the combined success factor model, and the success factors were shown that needed to be focused on if Equans wants to implement the chosen scenarios during the panel. The analytical framework can also be used as a tool by technical service providers to examine more cases and identify more success factors.

5.2. Scientific contribution

To describe and identify the scientific contribution of this project, the initial motivation for this thesis will be revisited. The motivation for this thesis project is to help technical service providers that are active in energy transition of the industrial sector to implement service oriented business models. With these business models, TSPs want to achieve recurring revenues to close the gap between the value that they deliver to the customer and what the customers actually pay the TSPs for. However, such implementations of service business models at the scale these TSPs operate in are not yet done before.

For this research, knowledge gaps were identified in literature. Firstly, the implementation of service oriented business models are not yet conceptualized in literature nor analyzed in case studies. This gap is rather large and will be contributed to in multiple ways, which will be described. Secondly, challenges for the implementation of PSSs as mentioned in section 2.6 by Baines et al. (2009), will be addressed which are integrated product-service design, organisational strategy and organisational transformation. Thirdly, Meier et al. (2010) indicated that the impact of a PSS on recurring revenue should be addressed.

5.2.1. Absence in literature

The first gap that was mentioned was the absence of literature that describes the implementation of PSSs by technical service providers that are active in the industrial sectors' energy transition. This research contributed to this gap in multiple ways.

- Analytical framework
- Case study at Equans

Analytical framework

The analytical framework that is developed during this project addresses the gap that the implementation of service oriented business models in the industrial sector are not yet conceptualized in literature. The analytical framework is constructed by combining existing literature on PSS classification and adding steps to analyze literature on how PSSs are implemented in other markets and sector than that of TSPs. This framework marks the first conceptualization model of the implementation of Product Service System business models for the industrial sector in literature. It enables the user to construct a scope and goals for a company, identify suitable case studies from other markets and sectors, extract success factors for PSS implementation from these case studies, generate different PSS scenario compositions, and subsequently identify success factors for specific PSS scenarios. All in a structured manner that follows from literature. With this tool, other TSPs can start to create strategies for their own PSS business model implementations by creating a clear scope conform to their wishes and goals and finally, identify success factors that should be focuses on or incorporated into their strategy, based on real life case studies from literature.

Another way the analytical framework contributes to literature is the wide applicability of the framework. Besides the application for TSPs, as described above in this section, this analytical framework can be applied in other contexts where companies want to implement PSS business models. The core of the framework is not specifically designed to solely analyze cases for the industrial sector. Companies that are active in other sectors or other markets can also use this framework to structurally analyze PSS implementations and identify success factors that fit their own scope. See the adjusted analytical framework below that can be used by essentially any other company. See section A.4 for the adjusted analytical framework for general use and the described steps. This version of the analytical framework is a contribution to literature because it enables other companies to strategize for a PSS business model implementation with a method that is structured, consistent, and backed by theories from literature. Even though other PSS business model design methods exist in literature, this framework can help in the analysis of PSS implementation.

Lastly, the analytical framework contributed to literature by the success factors that have been identified for a PSS implementation as a TSP. When TSPs want to implement a service oriented business model that has not been implemented in the way they intend to do, best practices and success factors are a valuable contributor to creating a strategy towards as PSS implementation. The success factors that have been identified are the result of a study conducted by a renowned TSP in the industry: Equans. Therefore the success factors that are identified can be seen as general success factors which can be used as a general guideline for other TSPs to use. Even though it has been conducted at a single company, the success factors cover many aspects of a PSS business model implementation. Other TSPs can select parts of the scope that is processed in this research that they also want to reach. This way this case study can also be of value to other TSPs in general that want to implement PSSs business models. The presentation of success factors that can be used by TSPs that are active in the energy transition of the industrial sector is the first in literature.

Case study at Equans
This research also contributed to scientific literature in the sense that it is the first study that is conducted at a TSP on the topic of PSS business model implementation. This addresses the research gap that is described at the start of this section. By contributing to the gap with this first case study, other TSPs are able to use this as a reference for their own PSS implementation journey. Ideally, this first case study marks the start of other new case studies on this topic.

5.2.2. Known PSS implementation challenges
Second gap that had to be addressed according to Baines et al. (2009) are integrated product-service design, organisational strategy and organisational transformation. In this section it will be discussed how this project contributes to this gap.

Integrated product-service design
Baines et al. (2009) stated that the design is a challenge because services are often hard to define in comparison with products and hence should be addressed. With the analytical framework, PSSs can be clearly analyzed, defined and designed. The combination of analyzing, defining and creating PSS configurations and implementations helps the integrated product-service design. Additionally, it the process can be custom and tailored because the companies' unique profile can be incorporated in the framework.

Organizational strategy
It is also stated in the paper from Baines et al. (2009) that it is difficult to define a clear strategy that is necessary to support the customers. Again, for this gap the analytical framework provides structure. As described throughout this project, the framework can help companies define strategies concerning the PSS implementation by identifying success factors for such an implementation. This feature thereby contributes to the need of addressing the organizational strategy defining of PSS business models.

Organizational structure
Lastly, Baines et al. (2009) mentioned that the configuration of the organizational structure should be addressed because the organizational structure of a PSS company differs from that of a traditional product firm. While this project does not specifically covers the organizational structure, it does address success factors that are related to the organizational structure of a company and should, in some cases, be focused on for a PSS business model implementation. Besides the success factors, users of the analytical framework can identify points of focus regarding the organizational structure themselves based on results that the framework yields.

5.2.3. Recurring revenue
As introduced in section 2.6, Meier et al. (2010) mentions that the influence of industrial PSS on recurring revenue has to be researched. Throughout this report it has been indicated that PSS business models can indeed influence a companies' ability to generate recurring revenue. The generated scenario's, case studies and panel feedback suggest that it is possible to generate recurring revenue by implementing a PSS business model. Specifically a use- or result-oriented PSS business model that are a part off long term agreements by the client. If such long term contracts are established, companies can create recurring revenue as long as the client uses the service or product, or as long as Equans can guarantee the agreed upon result. It has to be noted that the success of a result-oriented contract is the direct responsibility of the TSP. By shedding a light on this topic, this report has contributed to this scientific gap that was introduced by Meier et al. (2010).

5.3. Value for Equans

Besides scientific value, this project is also of value for Equans. First of all, this project identified the landscape of Product Service Systems to the company, a business model that it is not familiar with. The servitization and PSS elaborations can help Equans explore their options regarding the strategy that Equans has to develop to implement a PSS business model.

Secondly, during this project, the goals and scope of Equans were methodologically identified and constructed into a profile that is applicable and processable in a framework that is supported by literature and their own insights. This method of identifying their scope can help Equans to improve their journey towards a new business model, away from cost+ and lump sum.

Thirdly, this project academically identified success factors that Equans can focus on during the implementation of a PSS business model. The success factors cover many different types of PSS configurations, so success factors are presented for a scenario of their preference and fit to the company. These success factors can help Equans realize a new business model implementation, while keeping their scope in mind: recurring revenue, value based pricing, added value, positive cash flow and client lock-in.

A fourth way this project is of great value for Equans is the creation of the analytical tool, which can be seen in Figure 5.1. The true value of this tool is that it enables Equans to structurally create a strategy for a PSS implementation. This is done by structurally identifying the scope and the goals, selecting accurate case studies to conduct, creating real life scenario's, and finally extract fitting success factors for the implementation. This figure is an adjusted version of the analytical framework that is used throughout this thesis.

The difference between the analytical framework (Figure 2.3) and the analytical tool for Equans (Figure 5.1) is that the interview questions for the Equans interviews are removed from the framework, and that a reflection of the Equans 3D profile is added. The analytical tool will be further explained for the use of Equans.

Equans can use the tool to create the most accurate and up to date 3D profile of their scope according to the three dimensions of the model: Value Capture, Value Delivery and Value Creation. These are Step 1 and 2 in the analytical tool. Next, potential case studies can be evaluated using this tool by creating a 3D profile of the servitization systems that are discussed in the targeted paper (Step 3). This profile must be compared to the 3D profile of Equans to determine if the paper is suitable to use for the scope of Equans (Step 4). If the profiles match, the paper can be used to conduct a case study. If identified, success factors for the discussed servitization business models must also be placed onto one or more dimensions, to create a classified overview of the found success factors in a 3D profile manner (Step 5).

Following the success factor identification, scenario's must be constructed. For this step, the scenario framework and table (Figure 3.7, Table 3.10) must be used (Step 6). The user is free to add or change criteria of that make up a scenario, as long as it fits the dimensions that it represents, as long as it is used consistently and structured. The chosen probable scenario's must then be compared to the complete success factor overview to identify the corresponding success factors for these scenario's individually (Step 7).

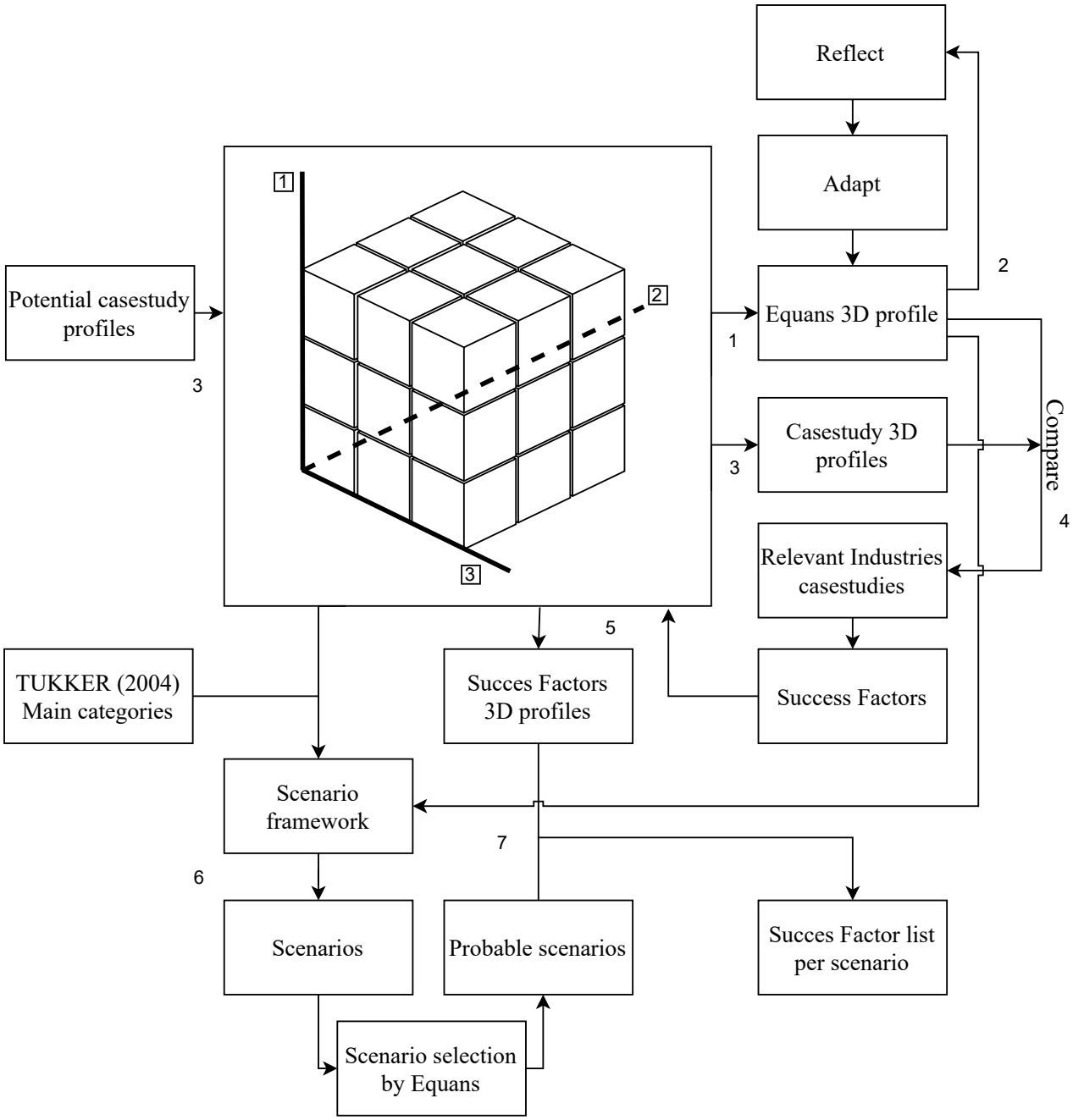

Figure 5.1: Case study and success factor identification analytical tool

5.4. Research reflection

In this section, a reflection on the whole research project is given per subject. Scenario generation, the panel with employees, and the success factors will be discussed.

Scenario generation

The scenario's were generated using the scenario framework that was introduced in subsection 3.6.1. The criteria that were used in this framework are supported by literature and interviews. However, the generation of the scenario's was done in a manner that reduced to total amount of scenario's that could be generated; the scenario's were generated using the combinations of the three 'main criteria', resulting in 27 unique combinations. The remaining three scenario's, however, were chosen by the context the scenario's portrayed. While this can be a good way of creating realistic and useful scenario's, it is also subjected to judgement and interpretation of the context of the 'main criteria'. It is not a bulletproof way of generating all scenario's because many scenario's are still not considered. However, the criteria were filled in with literary, interview and experience insights.

Panel with Equans employees

During the panel, the participants were asked to classify the shortlist of employees that was presented to them. This procedure requires the participants to objectively assess each scenario and evaluate the level of effort the scenario would take and the level of impact it would have on the company if the scenario was indeed implemented. However, once the scenario's were presented the participants would look at the scenario and judge it on whether they would implement it or not, on why a scenario would not be possible at this moment in the company or why they do or do not like the scenario. The participants struggled with assessing the scenario's objectively. This could be solved, to a certain extend, by steering the conversation and reminding them of the goal of the panel.

Success factors

The success factors that were identified during the case studies will always be the success factors for that specific case. While they can guide and help other implementations of a PSS, they will never be a guarantee for future success. That is why success factors corresponding to a scenario always have to be used as an advice and not as a singe point of focus. History does not predict the future. Another important note is that the organisational structure of a company, in this case Equans, is a key factor in the implementation and focus of the presented success factors by the framework. Focusing on the success factors and implementing the scenario's can be a heavy resource demanding execution. The organisation is limited by its own capability to change and adapt new strategies.

Furthermore, the presented list of success factors only contain the factors of three cases. More factors could be identified if more case studies would have been conducted. However, due to time constraints, three case studies was the considered as supportive enough to create a meaningful list. Also, initially the plan was to conduct one case thoroughly as it was expected to contain enough information to finish the project with, however such in depth cases were not available in literature. Hence the decision was made to conduct three less in depth case studies to still be able to substantiate results in a way that is thorough.

5.5. Recommendations for future research

This research focused on identifying factors that influence a successful Product Service System implementation by a technical service provider that is active in the industrial transition. After this research, some recommendations for future research on the topic come to mind.

Future studies should focus on defining the dimensions that were used in the analytical framework more than the three categories now presented per dimension. This way, more clear decisions can be made on what point certain success factors or criteria have to be placed. This will create better defined 3D profiles and will improve the quality of the analytical tool.

Futhermore, more case studies have to be conducted to better identify what causes a PSS implementation to be successful. Ideally, studies must be conducted on how a company like Equans actually implements a PSS or similar servitization business model. This will potentially help introduce and convince the industrial sector that these systems are beneficial for the executing companies and the clients.

In following studies more scenario's have to be generated that fully capture all potential models. The whole PSS landscape cannot be defined by 14 scenario's. If more scenario's are made that include the possibilities better, strategies to implement these scenario's can be determined better. Also in future research, more technical service providers should be consulted than only one, to gain more insights on the current readiness of the TSP sector for the implementation of PSS scenario's. When organising panels with technical service providers, is has to be kept in mind that the participating companies will have a biased view on scenario's or solutions that will be presented to them, as this is what happened in this study. Emphisize the need for objectivity when presenting the participants with scenario's and solutions.

6
Conclusion

In this chapter, the thesis will be concluded. In section 6.1, the sub-research questions are answered followed by the main research question.

6.1. Answering the research questions

The main research question is as follows:

What factors influence a successful implementation of a PSS by technical service providers that are active in the energy transition in the industrial sector?

First, the sub-research questions will be answered. These will build up to eventually answer the main research question of the thesis.

Sub Research question 1: What are the characteristics of the energy transition in the industrial sector?

The characteristics can be divided in two main categories.

Industrial organisational characteristics

Literature has identified factors and characteristics of the energy transition in the industrial sector. More efforts are made to realize a shift in the energy resources of the sector. Promising alternatives of fossil fuels are biomass, nuclear energy, hydrogen, geothermal, and most off all electricity that is generated using renewable sources. The transition is characterized by the following barriers. First of all, fossil fuels are mainly used as a feedstock, making it hard to eliminate them. Especially when byproducts of fossil fuels are used as an energy resource in other industrial processes. Secondly, manufacturing processes are extremely efficiently linked through flows of mass and energy, making it difficult to independently alter processes in the production chain. The third barrier is the electric process equipment availability in industry, as well as a lack of technical expertise or capability to develop industrial process lines and/or process integration, and the heterogeneity of industrial sectors. Lastly, current active regulations and policies are favouring one fuel over another.

Economical characteristics

It is expected that the the demand for primary resources has grown by 40%-60% in 2050 compared to 2017. This is a result of globally rising Gross Domestic Product. Even if the heavy industry adopts low-carbon technologies, the increase in production will increase the GHG emissions from the heavy industry. Also, the most carbon-intensive chemical goods are produced manufactured in high volumes and low profit margin which discourages investments by incumbents to innovate. Additionally, electrification comes with high fuel switching capital costs and higher operating costs compared to fossil fuels. This is on top of high electricity network costs and capacity problems. The high electricity costs in turn result in low margins for high temperature operations, which are essential in the heavy industrial sector. All these factors result in the industrial sector being risk averse.

Sub Research question 2: What are the current problems and their causes for Equans that arise in the participation of the industrial energy transition?
One problem Equans has is high competition in the market they operate in for industrial energy transitions , every market participant is aiming for the same projects and results in underbidding the project. This, in turn, results in low profit margins. Another cause for low margins is another problem, which is incompetence of some project managers. Some project managers do not have the skills to extract everything out of a contract with the client, or are not capable of running the project to its full potential. This also contributes to the low profit margins Equans realizes on projects. Creating added value for customers is also a problem. Equans is not able to create a competitive advantage over their competition, stating that everyone can do the project that they realize. Equans has yet to find a way that creates an incentive for potential clients to choose for them. Equans is also not, or hardly able to generate long term recurring revenue streams. Almost all projects are a one time execution without further support or services for after the project has been built. Their business model is also a reason for that. Generally Equans uses a cost+, or lump sum business model which does not really allow for additional services to capture revenue over the long term. Besides the lack of recurring or long term revenue, the business models also does not lock-in their customers to secure their projects for longer periods of time.

Sub Research question 3: What are the service and business models used in other relatable markets?
The relatable markets or sector from which the business models were researched are plant engineering companies, offshore industry, and the automotive sector. Plant engineering companies applied multiple types servitization business models: pay per part/use/unit, investment plus pay per part/use/unit for suppliers' operational costs. An elaborated description of the business models can be found in Figure 3.6. The business models from the offshore sector EPCI company are: (digital) service-oriented with customizability, cost+ for hours worked by mechanics on-site. In the automotive sector the business models switched from product- to use-oriented business models with many options of customization for specific needs. Additionally, the companies generated revenue through the offering of additional products with services. In section 3.5 the different business models are described in more detail.

Sub Research question 4: What are success factors that technical service provider should implement (in their organizational structure) to achieve a successful PSS implementation?
During the case studies success factors were identified concerning the implementation of Product Service Systems by technical service providers. These factors are displayed in Table 3.7, Table 3.8 and Table 3.9.

Now that all the sub-research questions are answered, the main research question can be answered on the next page.

What factors influence a successful implementation of a PSS by technical service providers that are active in the energy transition in the industrial sector?

Answering the main research question will happen in three parts, first the factors that characterize the industrial energy transition. Secondly, the problems and causes that consist within Equans. Thirdly, the success factors that were identified during the case studies on PSS implementation.

The main factors from the industrial energy transition that influence a successful PSS implementation are related to the way the current industrial sector is organized, and to the economics of the sector and the energy transition. The current organizational characteristics, described in the answer of SQ1, prevent the industrial sector from actively participating in, and executing the energy transition. The economic factors, also described in the answer of SQ1, point out that currently the cost of the energy transition is simply too high. Investments are held back because of this, resulting in delaying large energy transition projects in the industrial sector. These two main factors have a large influence on the implementation of PSS by technical service providers for executing the energy transition projects.

The factors in the case of Equans that influence an implementation of a PSS will be discussed in the following part. A successful implementation of a PSS business model is influenced by multiple factors, one of them is that many Equans employees are not willing to implement such a system because they do not see the value of it and have a risk averse mindset. Also potential client are risk averse in the adoption of a PSS. They want the trusted and known cost+ and lump sum models. Also, selling such services is hard because management is hardly ever reached when mechanics of Equans are trying to sell the service. The employees out in the field also work adversely because they, do not see the value or reason behind the service business model. They think that if the client needs service, they will call Equans and pay to fix it. Instead of the recurring revenue and long term binding of clients, and the possibilities such a business model offers to implement value based pricing.

In this final part the last factors that influence the implementation of a PSS are discussed. In the case studies, success factors were identified for a successful PSS implementation. These factors are displayed in section 3.5.

6.2. Recommendations for Equans

After this thesis project and its finding, recommendations for Equans are given.

If Equans wants to tackle their problems and achieve their goals, as defined in their scope profile, implementing a PSS would be a suitable method. It is shown in multiple cases that it can achieve the goals that were identified for and with Equans. A result oriented PSS is recommended since it allows for client lock-in, value based pricing, long term revenue security and value addition for the client. Starting a new business unit that focuses purely on the development and implementation of a PSS can greatly help, as is seen in the studies cases. This business unit is recommended to use the presented success factors and also use the analytical tool examine more potential case studies and identify more success factors than the one presented during this project. Parallel to using the analytical tool to identify more success factors, it is also recommended that Equans further refines and revise their 3D profile along the way to make sure the right factors are found for their goals and scope.

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A
Appendix

A.1. Search Queries initial literature review

Search words	Site	Year	Subject Area	Keywords	Article type	Search #	Results
Electrification Industrial Processes	ScienceDirect	-	Energy			1	17687
Electrification Industrial Processes Business Model	ScienceDirect	18-23	Business, Management and Accounting		Research Article	2	199
Electrification Industrial AND Processes AND Business AND Model AND	Scopus	-	Energy Business, Management and Accounting Engineering			3	6
Business AND Model AND innovation AND contractors	Scopus		Energy			4	10
Business AND Model AND Industrial AND innovation AND sustainable	Scopus	18-23	Energy Economics	Business Model Innovation	Article	5	15
Servitization AND Industrial AND Construction	Scopus	-			Article		13
Servitization AND Industrial AND Construction AND PSS	Scopus	-					2
technical AND service AND provider AND consultancy	Scopus	-	Engineering				9
technical AND service AND provider AND	Scopus	-	Energy	Service Provider	Article		4
technical W/1 service w/1 provider	Scopus	-		Energy	Article		5
technical W/1 service w/1 provider	Scopus	-		Business, Management and Accounting	Article		14
why AND PSS AND industry	Scopus	-					15
Business AND model AND development AND industrial AND challenges AND PSS	Scopus	-					18
Business AND model AND development AND industrial AND challenges AND PSS	Scopus	-	Energy				1

A.2. Scenarios

Scenario code	**111**	**112**	**113**	**121**
	1	2	3	4
Orientation	Result	Result	Result	Result
Contract term	Recurring	5y		Recurring
Product	Digital	Digital	Digital	Hybrid
Operations	Client	Equans + Client		Equans
Ownership	Equans	Equans + Client	Client	Equans
Financing	Equans (client lease)	Equans + Client		Equans (client lease)
Example	Software for building insights	Custom software		Customer pays for lower energy usage. Equans delivers using own sensors etc.
Decisions on criteria selection	recurring because result and software lease	5Y because shared ownership and shared financing.		Recurring because it's result-based without deep costs for the client.
x	Operations done by the client as they use it on their own for their insights	Operations are done together.		Operations by Equans because it's result-based.
x	Equans finance because they develop software. Client leases.	Shared financing because long-term revenue can be secured. Also opportunity for Equans.		Financing of sensors, software, etc., done by Equans because the client pays for the result. Equans owns the product.

Table A.1: Scenario Table: 1 to 4

Scenario code	**122**	**123**	**131**	**132**
	5	6	7	8
Orientation	Result	Result	Result	Result
Contract term	5y		Recurring	
Product	Hybrid	Hybrid	Non Digital	Non Digital
Operations	Equans		Equans	
Ownership	Equans + Client	Client	Equans	Equans + Client
Financing	Equans + Client		Client	
Example	Lower downtime machinery of the client	Unlikely combination	Standby service in case of service need of the client	Unlikely combination
Decisions on criteria selection	5y because lower downtime needs to span over a longer period		Recurring because it's service-based and result-based	
	Equans operations because they take control of machinery		Operated by Equans because it uses only Equans mechanics	
	Financing is shared because Equans uses its own equipment. Client pays for the service		Client needs to pay for service	

Table A.2: Scenario Table: 5 to 8

Scenario code	**133**	**211**	**212**	**213**
	9	10	11	12
Orientation	Result	Use	Use	Use
Contract term	10Y	Recurring		5y
Product	Non Digital	Digital	Digital	Digital
Operations	Equans + Client	Client		Equans + Client
Ownership	Client	Equans	Equans + Client	Client
Financing	Client	Equans		Equans + Client
Example	More efficient production machine	Client uses test software that is paid per use	Use of insight system. Unlikely combination	Custom software. Long term commitment
Decisions on criteria selection	10Y because Equans gets paid for the result of the built machine. Needs guaranteed revenue	Recurring since it is user-based and software		5y because Equans also financed and it is use-oriented
	D2D: Client. In case of service: Equans	Operations by client because they use it		Operations done by both because Equans can assist
	Client finance because they want new factory part. And positive CF for Equans	Financing by Equans because they developed the software		Equans and Client both pay because it is custom ordered and Equans can secure long-term revenue

Table A.3: Scenario Table: 9 to 12

Scenario code	**221**	**222**	**223**	**231**
	13	14	15	16
Orientation	Use	Use	Use	Use
Contract term	Recurring	Recurring		
Product	Hybrid	Hybrid	Hybrid	Non Digital
Operations	Equans	Equans + Client		
Ownership	Equans	Equans + Client	Client	Equans
Financing	Equans + Client	Equans + Client		
Example	Emergency service of monitoring and service	Monitoring software + emergency service. Based on usage	Unlikely combinations	Leasing of equipment
Decisions on criteria selection	Recurring because it is membership based	Recurring because based on usage	Unlikely combinations	Requires Equans investment in tangible asset
	Operations done by Equans	Client operates monitoring software, Equans delivers emergency service if necessary		
	Equans pays for equipment and development and client for the use of the service and fixed fee for participating	Financing is both because Equans pays development and Client pays for usage and sensors		

Table A.4: Scenario Table: 13 to 16

Scenario code	**232**	**233**	**311**	**312**
	17	18	19	20
Orientation	Use	Use	Product	Product
Contract term	10Y	10Y	Recurring	
Product	Non Digital	Non Digital	Digital	Digital
Operations	Equans	Equans + Client	Equans + Client	
Ownership	Equans + Client	Client	Equans	Equans + Client
Financing	Equans + Client	Client	Client	
Example	Custom developed factory rig		Custom software developed for client on request. Equans keeps license rights	
Decisions on criteria selection	10Y because revenue needs to be secured after investment from Equans and since it is use based	Unlikely combinations	Recurring because Equans owns it and client paid for it. It is probable that client will keep it, resulting in recurring revenue	Product oriented is owned by buyer
	Can only be operated by Equans personnel. Lock-in		Both can operate	
	Both pay for development. Client pays for use	Client pays because it is a custom product and product oriented		

Table A.5: Scenario Table: 17 to 20

Scenario code	**313**	**321**	**322**	**323**
	21	22	23	24
Orientation	Product	Product	Product	Product
Contract term	5Y			recurring
Product	Digital	Hybrid	Hybrid	Hybrid
Operations	Client			Client
Ownership	Client	Equans	Equans + Client	Client
Financing	Client			Equans + Client
Example	Custom software. With support.			Client buys monitoring package with software, sensors and support if needed.
Decisions on criteria selection	5Y because that is the span Equans will support the software	Product oriented cannot be owned by company per definition	Product oriented cannot be owned by company per definition	recurring because client buys software and sensors once. Additional services are recurring
	Client operated since they use it			Client operates for own application
	Client pays because it is a custom project			Equans pays for software development. Client pays for package and services.

Table A.6: Scenario Table: 21 to 24

Scenario code	**331**	**332**	**333**
	25	26	27
Orientation	Product	Product	Product
Contract term			10Y
Product	Non Digital	Non Digital	Non Digital
Operations			Equans + Client
Ownership	Equans	Equans + Client	Client
Financing		Equans + Client	Client
Example			Factory rig + operations
Decisions on criteria selection	Product oriented cannot be owned by company per definition	Product oriented cannot be owned by company per definition	10Y because Equans secures long term service through lock-in
			Equans operates because they designed and built it
			Client pays because it is a custom order and design

Table A.7: Scenario Table: 25 to 27

A.3. Equans panel classification results

	1	2	3	4
A	0	0	2	0
B	4	4	0	4
C	0	0	2	0
D	0	0	0	0
Participant 1	b	b	c	b
Participant 2	b	b	a	b
Participant 3	b	b	a	b
Participant 4	b	b	c	b

Figure A.1: Results scenario classification 1 to 4

	5	6	7	8
A	0	0	0	2
B	0	0	0	0
C	1	0	0	0
D	3	0	0	2
Participant 1	d			d
Participant 2	c			a
Participant 3	d			d
Participant 4	d			a

Figure A.2: Results scenario classification 5 to 8

	9	10	11	12
A	4	4	0	0
B	0	0	0	4
C	0	0	0	0
D	0	0	4	0
Participant 1	a	a	d	b
Participant 2	a	a	d	b
Participant 3	a	a	d	b
Participant 4	a	a	d	b

Figure A.3: Results scenario classification 9 to 12

	13	14
A	4	0
B	0	4
C	0	0
D	0	0
Participant 1	a	b
Participant 2	a	b
Participant 3	a	b
Participant 4	a	b

Figure A.4: Results scenario classification 13 and 14

A.4. Analytical framework for general use

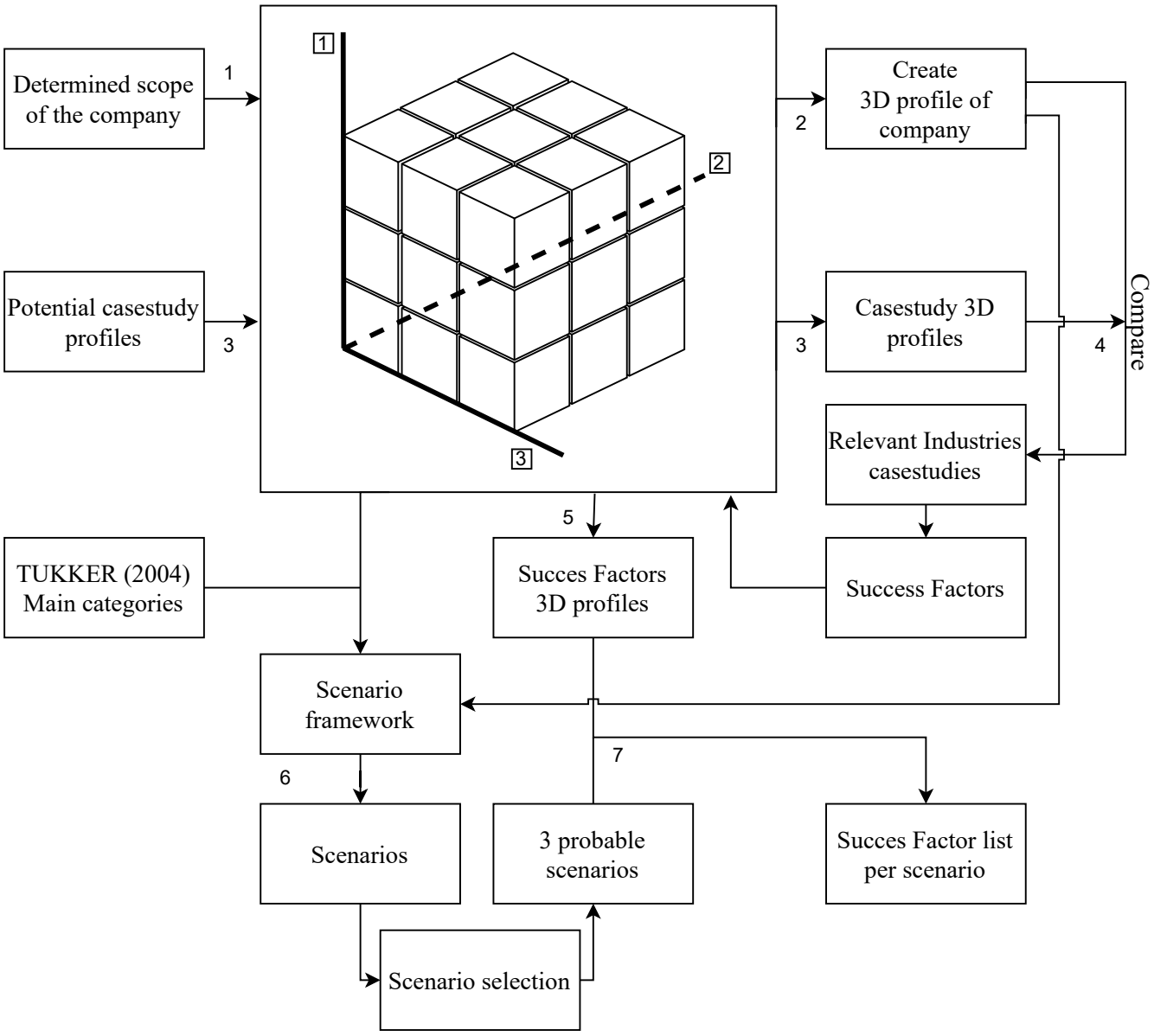

Figure A.5: General Analytical Framework

A.4.1. General Analytical Framework: Step description

Step 1

The user company has to determine their own goals to create a scope on what they want to achieve with a PSS business model implementation.

Step 2

The user has to categorize this scope on the three dimensions axis 'Value Capture', 'Value Delivery' and 'Value Creation' to create the 3D profile of the user company that will be used in Step 4 and Step 7.

Step 3

The user company has to select potential case study profiles and create initial 3D profiles of these potential case study profiles to be able to compare them to the company 3D profile.

Step 4
Compare the potential case study 3D profiles with the company 3D profile to see if the profiles match for 80% or more to ensure the case studies are suitable for use by the user company. If the match is over 80%, conduct the case studies and identify success factors for the PSS described in the case studies.

Step 5
Analyze the success factors and categorize them on the three dimensions.

Step 6
Generate scenario's using the scenario framework displayed in Figure A.6. Next, select the three most probable scenario's to narrow down the options.

Step 7
Compare the selected scenario's to the combined success factor list from the three dimensions and identify the corresponding success factors to those scenario's. The result is a list of success factors that should be focused on during the implementation of the PSSs from the selected scenario's.

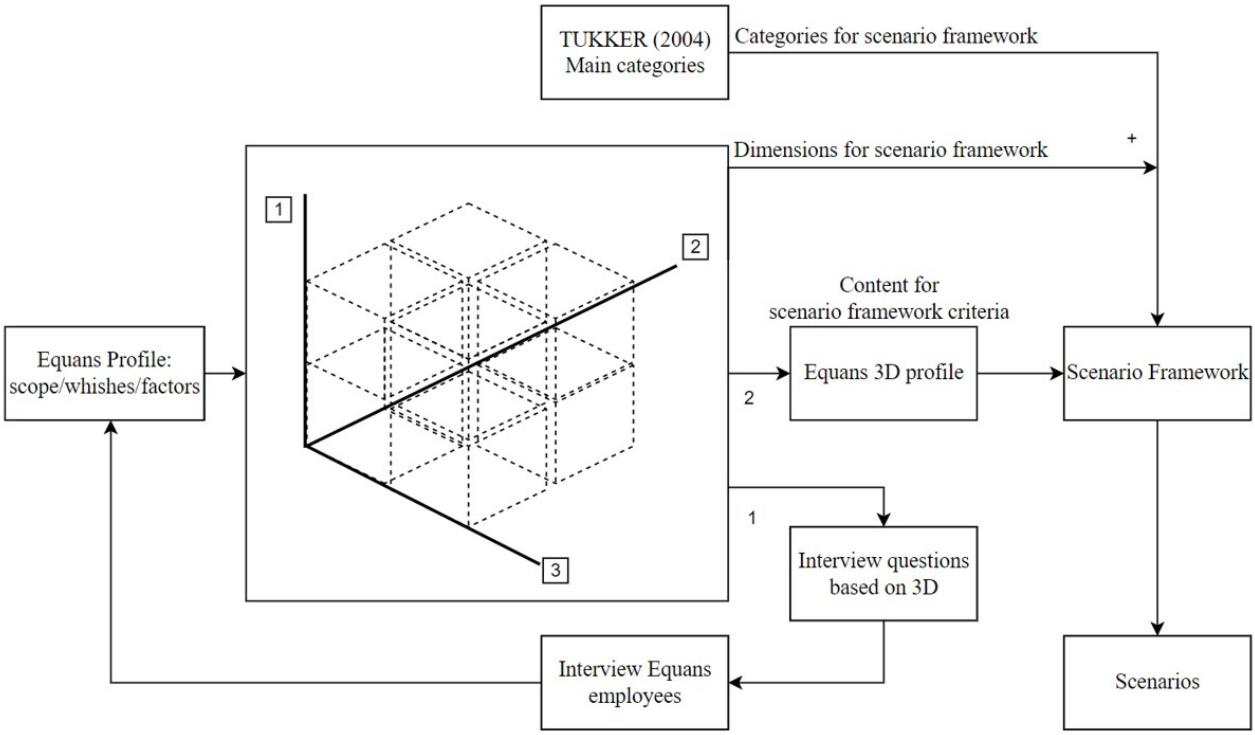

Figure A.6: Scenario framework