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Lessons from Organizational Studies

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Managing and Governing Integrated Research Programmes: Lessons from Organizational Studies

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Abstract. To solve complex problems, researchers are increasingly working in large, integrated research programmes. Integration of projects within a single programme rather than supporting a range of individual, more autonomous projects, is supposed to lead to several benefits, including: creating and enhancing synergies amongst projects, improving collaboration and knowledge exchanges amongst researchers from different disciplines, realizing efficiency gains, and generating a higher return on investments in R&D. However, often these advantages are insufficiently realized in practice and large-scale integrated programs instead incur high overhead costs, frustrate researchers, and realize insufficient integration and collaboration. Why do integrated programmes sometimes fail to realize their lofty ambitions? In the present paper, we use the literature on governance, management studies, and organizational economics to analyse several key problems plaguing integrated programmes. We argue that these problems can be linked to the implementation of programme management systems and coordination mechanisms that are poorly aligned with the unique characteristics of integrated programmes. We develop guidelines for funding agencies and programme managers to implement systems and mechanisms that are a better fit for purpose and that enhance collaboration.

Keywords. integrated research programmes, complex problems, programme management challenges, governance, transdisciplinary collaboration

Introduction

Increasingly, funding bodies expect scientists to create large integrated research programmes that cover many different projects and involve many disciplines and stakeholders to solve complex societal problems, [e.g., 1, 2, 3]. The integrated programme layer is supposed to bring several benefits, including synergies amongst projects, efficiency-gains (e.g., avoidance of duplication), higher return on invested funds, and improved collaboration amongst researchers [4]. In addition, the sum is supposed to be greater than the individual parts. However, all too often, these advantages are not realized in practice. Collaboration between different disciplines is often difficult to achieve, while synergies between projects are hard to manage. Moreover, large-scale integrated programs incur high overhead costs, while they often fail to achieve the desired outcomes for stakeholders [5, 6]. Politics, power imbalances, communication problems, and hidden agendas form major hurdles.

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The question of how such problems can be overcome has been often posed in the transdisciplinary (TD) literature, as well as in the wider project management literature[7, 8]. It has, nonetheless, not been satisfactorily answered. We believe there are three main reasons for that.

Firstly, several of the problems mentioned in the previous paragraph can be linked to conflicts and disagreement between the programme participants. While the TD literature draws attention to such conflicts, it doesn't clearly lay out how they can be efficiently and effectively dealt with. In particular, the TD literature insufficiently consider the role competent governance structures and processes can play in preventing or mitigating such issues. However, this is important as these structures and processes can be critical to navigating the conflicts and disagreements that will inevitably arise[9].

Secondly, in the wide project management literature, *project management* approaches are often applied and extrapolated to the level of the *programme* (Lycett, et l., 2004). While components of dedicated project management approaches can be useful at the programme management level, additional coordination and collaboration problems arise at that level that are not well addressed by project management approaches and associated literature[2] (e.g., the Agile manifesto, PRINCE 2, PMBOK).

Thirdly, while a dedicated *programme management* literature has been in development for some time, a lot of work remains to be done in this field to adequately capture and study the messy nature of complex programmes [10]. For example, many studies in this field tend to adopt a single theoretical perspective. However, complex programmes involving multiple stakeholders tend to lead to a wide range of situations and problems that require a pluralty of theoreticical perspectives to make sense of.

In the present research paper, we aim to contribute to addressing the challenge of how to structure, manage and govern integrated research programmes, by using and adapting the literature on governance, business administration, and organizational economics to the research programme context. In this process, we analyze several key problems plaguing integrated programmes and present alternative approaches for dealing with them. The findings of our paper are especially relevant for TD programmes, because the potential for conflicts and coordination challenges to arise is especially high[3].

The remainder of this paper is organized as follows. In Section one, we give a brief overview of some of the problems affecting integrated programmes. In Section two, we argue that the literature on cooperative and corporate governance can help shed light on how productive outcomes can be realized by groups with heterogenous interests. In Section three, we discuss how Thompson's work on dependencies can inform programme participants on when collaboration across different projects within a programme is likely to be beneficial, and when it is likely to be harmful. In Section Four, we explain how insights from Transaction Cost Economics can be used to limit the administrative costs of managing complex, integrated programmes. Section Five concludes the paper.

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[2] An additional limitation of many project management approaches is that they tend to be mainly useful in the context of (individual) projects that deal with well-defined problems, where goals and timelines can be relatively easily and clearly established. They are less useful in situations where it is hard to specify these things, such as when dealing with complex, ill-defined problems. However, as is explained also further below, many integrated programmes are specifically set up to address such problems

[3] Compared to other integrated programme forms, such as interdiscplinary ones, TD programmes involve a wider set of stakeholders, with more diverse backgrounds, worldviews and interests.

1. Challenges in integrated programmes

Integrated research programs are often concerned with complex, multifaceted problems[1]. To address such problems, usually participants from a wide set of different fields of research or practice are needed. These participants are likely to have different ideas about what constitutes science and are likely to have established different ways of working. In particular, at least three problems are likely to emerge in such situations.

Firstly, there is the problem of agreeing upon a common goal or objective[11]. When researchers from different disciplines are given the task to jointly develop integrated programs, there often is a period in which collaboration seems impossible, and the participants cannot agree on anything other than very abstract objectives.

Secondly, without proper coordination, the various workstreams within a programme will not work in synch[12]. Managing dependencies is particularly challenging in this context, because researchers from different disciplines tend to find it hard to anticipate all cross-project linkages and are unlikely to have a good grasp of the degree of uncertainty surrounding the project plans undertaken by disciplines they are unfamiliar with.

Thirdly, there is the problem of how to manage and govern the programmes effectively and efficiently, more so as they increase in size and complexity. This is particularly challenging in the context of inter- and transdisciplinary programmes, where managers may lack the specific academic background to competently assess the value and performance of many of the projects.

2. Orchestration of collective action within integrated programmes: lessons from corporate and cooperative governance theory

As indicated above, participants in transdisciplinary programmes, find it difficult to agree upon goals, means, methods, etc. For this very reason, they require competent governance structures. What type of structure is needed depends on the characteristics of the coordination problem, and the context. Integrated research programmes have problems in common with at least three types of organizations: start-ups, investor-owned firms (IOFs), and cooperatives.

A research programme has some similarities to a start-up company in the sense that its structure, governance, ethics, norms, all still need to be built up by the time the programme starts. Of course, programmes are often embedded within organizations, so they do not start completely from scratch (unlike a start-up): existing organizational structure and policies offer guidance and put some boundaries in place. However, that can be a hindrance as much as it helps and can lead to messy, ambiguous, situations as often also many people from other organizations participate in large integrated programmes, bringing their own rules and norms. Furthermore, like IOFs, research programmes have to deal with the problem of how to ensure that the decisions made at the managerial level are in the best interest of the programme and its wider set of stakeholders (a failure to do so will lead to high agency costs). Finally, programmes are often partially "worker-controlled", in the sense that researchers on the "ground-floor" influence the direction of the overall programme. Like cooperatives, programmes thus

face the challenge of how to ensure that the democratic costs[4] that arise from such (partial) control are well-managed.

We will focus on just two of these three problems: how to deal with agency problems (a problem shared with IOFs) and how to manage democratic costs (a problem shared with cooperatives). To structure this discussion, we will use corporate and cooperative governance theory as a guidance.

2.1. Dealing with agency costs

Agency costs refer to the expenses a principle (e.g., a person, programme, organization), incurs when delegating decisions to a representative or agent (e.g., [13-15]. Examples of agency costs are the costs involved in hiring a stockbroker to manage an investment portfolio, or the costs shareholders incur when they hire a manager to run a company on their behalf. Agency costs include direct costs (e.g., broker's fee or the manager's salary), as well as opportunity costs (e.g., manager does not represent the principle's interest).

Much of the literature on corporate governance is concerned with limiting opportunity costs. Such costs can be limited by means of two mechanisms: (1), through incentive structures that align the interests of the principle and agent; and (2), through the implementation of mechanisms for monitoring agent behaviour and/or performance. In an IOF, the former can be achieved, for example, by including share packages in managerial remuneration. If appropriately structured, such packages can help ensure that managers act in the best interest of the shareholders. The latter can be achieved through external monitoring, as well as internal monitoring. In IOFs, external monitoring is done mainly through capital markets (as well as through accountants), which can exert pressure on under-performing managers by calling in loans or selling stocks. Internal monitoring is done primarily through the board of directors in IOFs, a control layer that usually has a clearly defined mandate and associated responsibility for defining ethical and professional standards, instigating audits, etc.

Compared to IOFs, elaborate incentive packages are almost always not an option in research programmes. Furthermore, scrutiny of researcher managers and programme leaders (i.e., the agents) through external monitoring by funding agencies is not nearly as continuous or as comprehensive as is the case with capital markets. By default, this implies that internal monitoring mechanisms of such agents and associated professional and ethical standards are, or at least should be, a key mechanism for reducing agency costs within research programmes. Unlike IOFs, such internal monitoring does not primarily need to be done in top-down fashion. A potential "governance" advantage that research programmes have over IOFs is that they can to a greater degree benefit from bottom-up monitoring, by the workers. Like cooperatives, which are further discussed below, the "workers" in a research programme have more of an incentive to monitor managerial performance than workers tend to have within IOFs. For cooperatives, this is because workers, like shareholders in IOFs, have a financial interest in the performance of their company. For researchers, this is because they tend to have a more active interest in the capital and other resources a company puts at their disposal than the average worker within an IOF. For example, without such resources, scientists may not be able to conduct their experiments, which are needed to achieve not only the goals of the programme, but also of their own academic career.

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[4] Both agency cost and democratic costs are specific types of transaction costs. A broader set of transaction costs is discussed in Section Four.

Research programmes could limit agency costs through a couple of steps. Firstly, by limiting the number of hierarchical layers within a programme to ensure responsibility for control and oversight does not become diluted, as is sometimes the case in research programmes. Fewer layers will not only support and enable more competent top-down monitoring, but it should also facilitate bottom-up monitoring, by researchers on the ground floor, as decision making becomes more transparent. Furthermore, programmes (or their external stakeholders) could attempt to actively support and leverage bottom-up monitoring, for example by ensuring that always some researchers from the "ground floor" are invited to meetings of the programme leadership. Such researchers could be selected on a rotating basis and could have a non-voting seat at these meetings. This should help ensure researchers on the ground floor that the formal procedures of the programme are followed in practice and that decisions are made that are in the best interest of the programme rather than on the whims of the programme manager.

2.2. Dealing with democratic costs

Democratic costs are the costs associated with collective decision-making processes within organizations [16]. This includes the costs of: (1), providing incentives to workers or members to participate in collective decision-making processes when that is required or expected to be beneficial; (2), the costs resulting from conflicts of interests between different groups of workers/members; and (3), the costs involved in managing such conflicts of interests [17]. Like agency costs, a distinction can be made between direct costs (e.g., time spent on meetings, general assemblies) and opportunity costs (delayed decisions, gridlock, etc.)[18]. Collective decision-making processes are part-and-parcel of transdisciplinary research programs. This is because the program must try to accommodate the needs and goals of numerous stakeholder (including researchers), which are typically misaligned, and with limited hierarchical authority.

Cooperatives are organizations in which collective decision-making processes play a key role. Hence, they are particularly prone to incurring high democratic costs. For this reason, the literature on cooperative governance has valuable insights into the types of mechanisms that can help to manage such costs. Pozzobon [18] and Pozzobon and Zylbersztajn [16] differentiate between various such mechanisms:

•   Implement effective and clear voting procedures to prevent gridlock and ensure timely decision making.

•   Limit a collective decision-making process to critical issues, given the high costs involved in mobilizing groups and encouraging participation.

•   Focus mobilization efforts on under-represented groups (such as certain science disciplines that are not well-represented in the decision-making process) rather than on encouraging mass participation.

•   Ensure proper representation at the board level of different groups of workers/members.

•   Related to the previous point, ensure that executive and control boards are neither too large (the decision-making process may stall) nor too small (certain groups are likely to be under-represented).

Most of the lessons can be adapted to a research programme context. For example, research programmes could implement clear voting procedures at each layer of a programme. This should help to prevent gridlocks and ensure that disputes can be quickly and efficiently addressed without unnecessary escalation. Furthermore, programme

managers could clearly convey to researchers in a programme when they have a vote on certain issues, and when merely their opinion is sought. This should help clarify to researchers on the ground floor what their role is and thus help prevent discontent that hampers the processes of realizing consensus.

3. Managing dependencies within a programme – lessons from Thompson

Within the context of an integrated research programme, dependencies occur when the overall programme cannot be unbundled into sub-tasks or projects that can be completed in an independent manner by different (groups of) researchers, but rather requires some form of cross-part coordination. Thompson [19], whose work in this space is foundational, distinguishes between three main types of dependencies:

• A pooled dependency occurs when different projects use the same shared or collective resource (e.g., a lab, the same experimental farm), but the researchers involved in each of the projects can otherwise work largely independently from each other. The coordination problems in such scenarios involve dealing with questions such as how access to the collective resource needs to be shared across different projects, how the resource needs to be maintained, etc.

• A sequential dependency occurs when one project's outputs (e.g., data generated through an experiment) forms an input for another project. To be able to manage this type of dependency, the "supplying" project needs to have a basic understanding of what type of data the "client" project needs, and what is expected by the client in terms of data integrity, validity, etc. However, while the supplying project needs to be able to have a working understanding of the "language" (e.g., concepts, methods) used by the client, they don't have to be fluent in this language as adaptations are relatively rare compared to projects with reciprocal dependencies.

• A reciprocal interdependency occurs when bi- or multilateral dependencies exist between projects. That is, when Project A not only receives inputs from project B, but also vice versa (i.e., project B also requires inputs from project A). This type of scenario arises when, for example, researchers from two project are jointly working on the development of different components of a model. In such cases, the ability of both projects to frequently adapt to each other's demands is key and researchers will need to be able to understand each other. Understanding each other is very important in such scenarios. This might not be easy when different disciplines are involved.

The frequency and complexity of the coordination mechanisms required to manage these dependencies is the lowest for pooled dependencies and the highest for reciprocal interdependencies [20, 21]. For **pooled dependencies**, basic planning, such as a schedule that allocates and divides lab-time amongst researchers may suffice. However, additional coordination mechanisms may be required if participants do not voluntarily comply with the rules that are set up to govern shared resources. When **sequential dependencies** exist between projects, generally additional coordination mechanisms, such as output standardization, are needed to manage the dependencies. When output standardization is not feasible, for example, because it is difficult to anticipate at the start of the research project what the results are going to be like, projects involving sequential dependencies may have to rely on process standardization. How **reciprocal interdependencies** should be managed tends to depend on the number of involved projects. When reciprocal interdependencies exist between just two projects, project leaders should focus on developing and cultivating strong lateral linkages between the projects. For example, by

arranging that some of the researchers are actively involved in both projects. When reciprocal interdependencies exists between more than two projects, such lateral linkages quickly become infeasible as the number of interdependent project increases. Under such circumstances, implementing a hierarchical structure will be a more efficient form for managing interdependencies, i.e., combining several previously independent projects under the management of a single unit.

As a first step, programme participants should at the start of the programme identify what types of dependences exist or are likely to arise between projects. Secondly, projects should then be grouped together into modules based on the types of dependencies that exist between them rather than purely based on the subject matter that is studied (e.g., the consumer, greenhouse gas emissions, etc.). It is beneficial to group projects together that are sequentially or reciprocally dependent on each other, as these types of projects require more frequent communication. Thirdly, coordination problems and mechanisms should be appropriately aligned to reduce coordination costs and limit the amount of meetings programme participants must attend. For example, projects that have only pooled dependencies with each other do not need to have "science" meetings and can limit their collaboration to achieving consensus on how administrative tasks, such as scheduling or budgeting, should be organized. This can help reduce meeting overload and a sense of "forced integration and collaboration" amongst researchers.

4. Determining programme boundaries and structure: lessons from Transaction Cost Economics

If integration always improves research outcomes, why not integrate all research projects within a single programme? This is the key question that TCE (Transaction Cost Economics) scholars would ask of proponents of integrated research programmes (see [22]). TCE scholars would argue that integration does not always improve research outcomes because of transaction costs[5].

"Transaction costs" refer to the resources that actors use up in the process of organizing and directing economic activity and other types of social interactions [23]; [22];[24]. In the context of an integrative research programme, these costs include the resources that are used to: search for suitable projects and competent researchers; coordinate tasks and work flows; develop collaborative norms and practices; incentivize actual collaboration; make adjustments to individual projects to make them fit into the whole; resolve disputes amongst participants; monitor and evaluate progress, etc.

From a TCE perspective, as programmes increases in size (in number of projects, involved researchers, etc.) the above-mentioned costs increase dramatically, at least without proper modularization of tasks and workflows. There are two main reasons. Firstly, it becomes harder for the management of the programme to form an accurate picture of the programme as programmes increase in size. Especially, it becomes more difficult to assess changes at lower levels in the programme in an accurate and timely manner, and thus to intervene successfully in running the programme (see [22]). Secondly, incentive intensity becomes diminished, and it becomes harder to create a performance-oriented culture (see [25]). This is for various reasons. For example, the stake each individual research has in the programme's success becomes smaller as the number of projects or researchers involved in the programme increases. Also, as the

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[5] In Section Two, we already discussed two types of transaction costs: agency costs and democratic costs.

programme's boundaries expand, fewer researchers deal directly with key external stakeholders, but mostly with each other which further diminishes incentive intensity (as many researchers don't have to directly justify their work to funders). The researchers become somewhat "locked-in" into dealing with each other, which can lead to a culture of complacency and forgiveness for under-performance (e.g., for budget over-runs) [22].

Because of such problems, programme leaders should always question what the benefits are from integrating or maintaining a research project within a programme. To limit problems and costs, only project opportunities that meet certain criteria should be included within a programme[6]. Specifically, based on TCE, we argue that projects should only be integrated when a focal project's outputs are relevant to a programme's mission and at least one of the following conditions applies:

    a)   The project's desired outputs are unclear at the start of the programme and will need to be revised over the course of the programme, for example because of new research findings or because of changes in the larger environment in which the projects or programme are embedded;

    b)   Not only the outputs of the project team are important to the programme's success, but also the processes, methods, and ways of working the team uses need to be closely monitored and understood by programme participants;

    c)   Related to that, frequent interactions between the focal project and other members within the programme are critical to the project, other project(s) within the programme, or both;

    d)   The programme offers the project access to a unique set of tangible or intangible assets (IP, laboratory, etc.) that are critical to the success of the project and which the project cannot easily obtain elsewhere.

To emphasize, just because a project is relevant to a programme's mission does not mean that it should be included in an integrated programme. When none of the above-mentioned conditions applies (a to d), it can be beneficial for the project to acquire funding elsewhere to prevent undue interference by programme management. This can also be beneficial for the programme, as it will reduce the administrative burden on its managers. If such a project cannot find funding elsewhere, the programme leaders should consider funding the project but keeping it largely separated from the other projects in the programme. In such case though, the funding should be accompanied by a comprehensive project brief.

Conditions a to d can be applied not just to individual projects, but also to clusters of projects. Such clusters could be compartmentalized into modules (similar to what should be done for individual projects when none of the conditions a-d hold)[7]. The advantage of designing the programme in a modular fashion based on these criteria is that it helps to limit unnecessary transaction costs. A TCE-inspired modularization will stimulate researchers to collaborate with those projects with which they have synergies and will limit their exposure to information about projects where such synergies are lacking. This helps to reduce both information overload and administrative costs.

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[6] Programmes can be designed in a top-down fashion (e.g., as when programme leaders first design an objective for the overall programme, and then break the programme down into more sub-tasks) or a bottom-up fashion (e.g., as when programme leaders request researchers to submit project proposals, which are then subsequently grouped together). In the latter scenario, some or all of the projects will have predated the creation of the programme and programme leaders will therefore need some criteria for determining what projects to include in a programme. Furthermore, programme leaders may have to re-assess what projects to keep within a programme, for example because of budget changes.

[7] This approach can complement the modularization approach proposed in the previous section on Thompson's work.

5. Conclusion

Over the last couple of decades, there has been increased expectation from funding agencies that researchers create integrated research programmes. Doing so is supposed to bring several benefits, such as synergies, efficiency gains and increased collaboration between researchers. However, many integrated research programmes fail to realize these benefits. This is for various reasons, including difficulties with: (1), realizing consensus amongst a heterogenous group of participants; (2), managing dependencies across the programme; (3), designing appropriate programme structures and boundaries.

To be able to better deal with the first challenge, we have argued that programme participants and stakeholders can learn lessons from the literature on corporate and cooperative governance theory. An integrated research programme can be viewed as a temporary, hybrid-organizational form that shares characteristics and problems with start-ups, investor-owned firms more generally, and especially with cooperatives. A competent governance structure considers the unique properties of research programmes, as well as their similarities with other organizational forms, to reduce agency costs and democratic costs.

To deal with the second challenge, we have argued that programme participants and stakeholders can draw upon insights from Thompson's work on dependencies. The nature of the dependencies between the different components or projects within a programme influences the type of coordination problems that are likely to occur across projects. This, in turn, influences the type of functional support structures and methods that are suitable for realizing efficient and effective cross-project coordination. Coordination mechanisms that are well-aligned will help to synchronize workflows, enhance meaningful collaboration, while at the same time limiting the amount of time and effort that researchers spend on undertaking non-science activities.

To deal with the third challenge, we have argued that Williamson's TCE framework can help participants design programme boundaries and structures that prevent programmes from becoming "too large or complex" to manage competently and efficiently. To that end, programme managers should always question what the benefits are from including or maintaining a research project within a programme. In programmes that are already large and complex, tasks and workflows need to be properly modularized based on transaction cost economizing principles.

Further work could combine these insights with lessons from other organizational theories. Also, more case studies of how integrated programmes are governed are needed.

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