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Projects in the business ecosystem: The case of Short Sea Shipping and Logistics

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ABSTRACT

This article develops a conceptual framework to analyze the governance of projects within a business ecosystem. The framework is applied to the case of a vessel delivery project in the short sea shipping business ecosystem, which is a cargo and logistics infrastructure service at sea. We develop a model that identifies contentious lock-ins among the workflows, and show how they can be resolved by governance that can increase performance of the sea logistics infrastructure. The model shows the interdependence of the short sea shipping business ecosystem and the vessel project, and it shows how performance is enhanced by their integration.

KEYWORDS

Ecosystem, Workflow, Project, Ship, Infrastructure

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Introduction

Project research has found that it is important to understand how the project is embedded in its surrounding context (Engwall, 2003). There are numerous ways to define the context of a project, such as an industry, a company, an alliance, or a value chain, to name a few. In this article, we propose to define the project context as a business ecosystem. The business ecosystem is a new kind of conceptualization of business boundaries based on ecological and lifecycle perspectives, and that is not confined to boundaries of corporate ownership structure, industry, technology, institutions etc. Instead, *business ecosystems are defined as systems of workflows that contribute toward a common system-level business goal*. The growing interest in business ecosystems is motivated by the substantial value created by businesses, such as Amazon, Airbnb, and Uber that disrupt traditional industries by re-organizing business across traditional boundaries to create new systems. We find this novel way of thinking about business especially relevant for infrastructure service delivery, because it generally cuts across societal and business boundaries over the infrastructure's lifecycle.

The business ecosystem constitutes a context for the project by that its workflows are coordinated with those of the business ecosystem. The business ecosystem is thus dependent on the project to contribute to business ecosystem performance, and the coordination of the workflows of the project and the business ecosystem need to be governed to achieve this goal. In other words, the delivery model for the project must be aligned with those workflows for the project to improve the performance of the ecosystem.

The purpose of this paper is to develop a governance framework for projects within a business ecosystem.

Previous research has identified that projects are important for learning and innovation in "project ecologies" (Boland Jr., Lyytinen, & Yoo, 2007; Grabher, 2004; Davies, Maculay, Debarro, & Thurston, 2014), but no studies have dealt with the governance issue. As we shall show, governance becomes a key issue when improving performance for project delivery by coordinating workflows in an ecosystem. In a similar vein, Davies et al. (2014) argue that innovation ecosystem performance is increased when ideas in one project are combined with those of other projects.

Even though projects are transitory organizations (Lundin & Söderholm, 1995), they can achieve development of the longer lasting business ecosystem. Business ecosystem development, however, is often impeded by a number of lock-ins (Sydow, Schreyögg, & Koch, 2009), and these can be resolved by project governance. Governing projects may thus be an important tool for business ecosystem development. Examples are the rise of service-led project scopes such as public-private partnerships or integrated solutions (Leiringer & Bröchner, 2010) and collaborative project delivery arrangements (Lahdenperä, 2012; Walker & Lloyd-Walker, 2015). Existing research addresses the governance issue, but does not explicitly consider it from a workflow perspective. For instance, research on delivery models focuses the relationships of the owner, designer, and builder. Business ecosystems are broader and at the system level, where not only design, build, and operations workflows are interdependent, but also various other workflows that occur in the business ecosystem before, during, and after the project. Since the project is embedded in the business ecosystem via workflows, we focus on how these workflows can be governed. The rationale is that business ecosystem level efficiencies can be obtained if project workflows can be designed to unlock lock-ins in the current ecosystem architecture.

Business ecosystems research has not developed a clear conceptualization of the governance of business ecosystems (cf. Gulati, Puranam, & Tushman, 2012). As we define business ecosystems to be workflows that are interconnected over the lifecycle of the business ecosystem in pursuit of commercial ends, it follows that business ecosystem governance focuses on the workflows. We define workflows as interdependent activities performed by actors that use interdependent resources (Crowston, 1997). The governance problem is that workflows may not necessarily be easily coordinated within a business ecosystem because of such reasons as that resources may be scarce, actors may have conflicting sub goals, certain workflows may be uneconomical, and/or due to the institutionalized structure of production in the ecosystem (Cacciatori & Jacobides, 2005; Jacobides & Winter, 2005).

The governance of workflows was discussed already by Thompson (1967), and subsequent research has identified different governance mechanisms for different kinds of interdependence in workflows (Levitt 2015; Tsvetkova et al., 2016). Business ecosystems contain many workflows, and any project is linked to the workflows in its business ecosystem. The links can be direct if workflows are within the project, or if they transcend project boundaries, but the project will also depend on workflows that are indirectly related to it, because all workflows in the business ecosystem contribute towards system efficiency. The governance of a project is essentially accomplished by a governance of workflows in the project, and the interfaces between those workflows and workflows in the surrounding ecosystem. The success of the project is dependent on its ability to integrate into the business ecosystems workflows, and enhance system level efficiency. A project usually contains multiple workflows of different kinds. So, while the different kinds of workflows require different kinds of governance mechanisms, the overall governance of the project needs to address combinations of different kinds of workflows. To the best of our knowledge, this has not been investigated before this article.

The paper is structured so that it starts with a discussion of a project in a business ecosystem, followed by a discussion of the governance of project, after which we analyze the array of governance tools that can be used in project governance. The methods section describes the clinical research method we use, which is a form of abductive method that starts by that the practitioners identify problems, and then scholars and practitioners work together to resolve them by using theory and analysis of empirical observation. Finally, we illustrate our framework in a case from the seaborne transportation industry and conclude by explicating how our framework contributes to the development of new delivery models.

Business ecosystem and workflow analysis in projects

What is a business ecosystem?

Collaboration and cooperation across industries and between companies is increasingly seen as a way to achieve enhanced capabilities, meaning that a company derives its capabilities through its business ecosystem. Two major characteristics of business ecosystems withstand: Firstly, there is a system-level business goal, usually of performance or efficiency (Adner, 2006; Gulati et al., 2012). Secondly, achieving the system-level goal hinges upon the idea of a system of interdependent firms whose performance depends on the actions of their collaborators (Adner & Kapoor, 2010; Moore, 1993), meaning that firms are parts of a system of interdependent workflows, often spanning conventional organizational and industrial boundaries (Tsvetkova et al., 2016). Business ecosystems become competitive by organizing workflows in the ecosystem for increased value creation (Thomas, Autio, & Gann, 2014) and remain viable as long as they are not outcompeted by other business ecosystems.

Based on the above discussion, we define a business ecosystem as a system of workflows that contribute to a common system-level business goal. The definition implies a bottom-up perspective, with micro-level workflows, and the business ecosystem boundary is determined by how these workflows contribute to a macro-level business ecosystem goal.

Workflow Analysis in Projects

Since business ecosystems are systems of workflows, it seems logical that workflow analysis would be key to the governance of business ecosystems. Research shows that workflows can be effectively governed in projects where the design and structure of the project is organized in such a way that it suits the characteristics of the workflow in the project (Crowston, 1997; Eppinger, 1991; Malone & Crowston, 1994; Sosa, Eppinger, & Rowles, 2004). Business ecosystems can contain many projects, and they may vary in length of time over the lifecycle of the business ecosystem.

Following Thompson (1967) and Levitt (1995), we identify four kinds of workflows in a business ecosystem:

- Pooled workflows where the work task can be done independently of other work tasks.
- Sequential workflows, where one work task has to be completed for the next to be able to start.
- Reciprocal-compatible workflows where several work tasks need to be done concurrently and integratively, and where the goals of the actors involved are compatible.
- Reciprocal-contentious workflows, where several work tasks need to be done concurrently and integratively, and where one or more subgoals of the actors involved are contentious.

In a business ecosystem, there may be multiple workflows of these four kinds at any point in time. They are bound together in that they contribute to the system-level business goal, which means that they can, but need not, be linked together at a specific point in time. The relationship between a business ecosystem, a project, and types of workflows is schematically depicted in Figure 1.

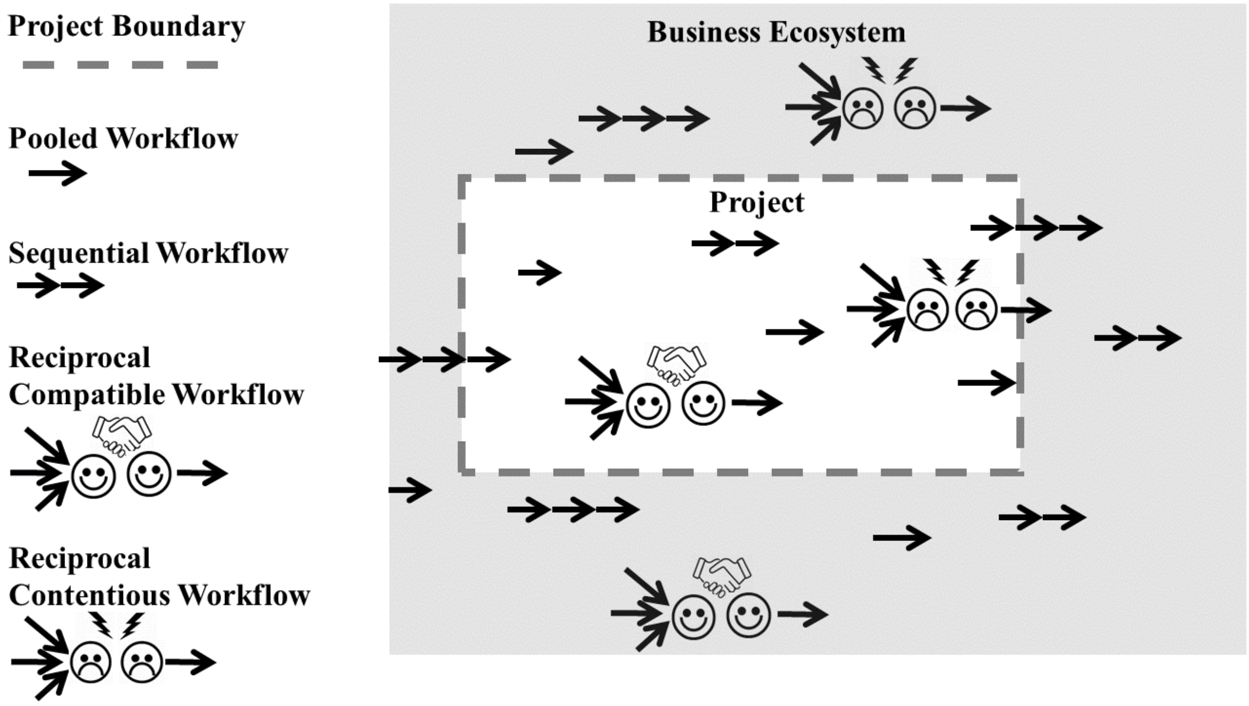

Figure 1. A project in a business ecosystem.

The workflows within and around the project can be governed with the aim to improve efficiency and create value within and around the project. The challenges for the governance of projects are that they are temporary, discontinuous organizations set up by a project owner (cf. Hadjikhani, 1996; Lundin & Söderholm, 1995) in a business ecosystem. In such settings, projects can act as “temporary administrative frameworks” where authoritative communication in an otherwise vertically disintegrated industry can unfold (Brusoni, 2005). For a project, such authority serves to coordinate workflows in a business ecosystem.

Analysis of all workflows in a project is probably overwhelming, so we rely on a heuristic that has been applied in the design structure matrix (Eppinger 1991). The heuristic analyzes and improves the efficiency of one of the most costly workflows, but does not claim to be able to identify the most optimally costly workflow. The reason for this caveat is that the system is complex, and also that it is dynamic over its lifecycle, meaning that which workflow is the most optimally costly one may change in an unpredictable manner. The logic of the heuristic is pragmatic, and it claims that analyzing and improving one of the most costly workflows will improve the overall efficiency in the project and in the ecosystem. A similar heuristic has been applied using a design structure matrix with positive results (Eppinger, 1991). The heuristic for most costly workflow is based on the cost of coordination, and is as follows:

1. Contentious-reciprocal interdependent workflows
2. Compatible-reciprocal interdependent workflows
3. Sequential interdependent workflows
4. Pooled interdependent workflows

The heuristic means that contentious-reciprocal interdependent workflows are addressed first, followed by those that are compatible-reciprocal, and then followed by reciprocal, and lastly that pooled interdependent workflows are treated. For each of these workflow types, there is an array of governance tools to choose from when improving coordination. To explicitly show how this can be done, the following section outlines the relationship between workflow interdependencies, cost, and governance tools.

Governance tools of use for workflow analysis in projects

The above-mentioned workflows are each coordinated in different ways, as shown in Table 1 (cf. Stinchcombe, 1990). Pooled workflows are coordinated primarily by standardization, either by specifying the required outputs and competence needed, or through the detailed work process. Sequential work tasks are coordinated primarily by hierarchical planning and scheduling of work tasks. Compatible-reciprocal workflows are coordinated primarily by mutual adjustment, where the involved actors organize themselves because their goals are compatible.

Contentious-reciprocal interdependence is negotiated by mutual adjustment and escalated in case of deadlocks, to be resolved by the project management, because one or more subgoals of the actors involved are contentious.

Because of the varying amount of effort needed to coordinate the four workflow types, the cost of coordination differs, ranging from the lowest for pooled workflow interdependence to the highest for contentious-reciprocal interdependence.

Table 1. Project governance framework

Type of workflow interdependence	Primary workflow coordination mechanism	Cost of coordination	Primary mode of project governance	Practical governance tools
Pooled	Standardization	Lowest	De-centralization	Authority system, incentive, pricing, standard operating procedures
Sequential	Planning and Scheduling	↕	Hierarchy	Pricing, incentive, authority, standard operating procedures
Compatible-reciprocal	Self-organized relationships and networks, information sharing facilitate mutual adjustment		Relationship and network governance	Network management, incentive, pricing
Contentious-reciprocal	Organized project to facilitate mutual adjustment based on project-level outcomes	Highest	Real or virtual hierarchy	Conflict resolution, authority system, network management

There are also primary modes of governance associated with each of the four workflow types. Pooled workflows can be governed by decentralization as long as delivery is made to specified standards. Sequential workflows need a hierarchy that sets, monitors, and adjusts the schedule.

Compatible-reciprocal workflows can be guided by self-governed relationships and networks. Contentious-reciprocal workflows need to be governed by a real or virtual hierarchy that specifies the relationships between the actors involved in mutual adjustment. The following section describes an array of practical governance tools for managing projects.

Governance tools to manage projects

Governance structures have traditionally been addressed from the point of view of formal safeguards, that is, contracts (Eccles, 1981; Stinchcombe, 1959; Williamson, 1979). Formal contracts represent obligations (Macneil, 1978), and a contract is often seen as the opposite of hierarchical control. In the specific case of projects, Cox and Thompson (1997) suggest that contractual terms cover typical market mechanisms: the relationship, risk allocation, division of responsibilities, and reimbursement mechanism. Stinchcombe (1990), however, noted early on that a contract also fulfills five governance functions predominantly associated with hierarchies: *1. authority system, 2. incentive system, 3. pricing system, 4. conflict resolution*, and *5. standard operating procedures*, and we add that governance is also about *6. network governance* (Smyth & Edkins, 2007; Smyth, Gustafsson, & Ganskau, 2010).

Stinchcombe (1990) referred to *authority system* as communication practices that distribute information, for instance in a construction project. Communication and information sharing lowers transaction costs (Dyer, 1997), creates effective and efficient knowledge-sharing routines (Dyer & Singh, 1998), and mitigates poor performance (Maznevski, 1994). Information communication can be increased by tools (Pietroforte, 1997) and is used in monitoring an agent's adherence to the principal's objectives (Evaristo, Scudder, Desouza, & Sato, 2004; Jensen & Meckling, 1976; Ouchi, 1979). Authority systems can be interpreted as administrative consistency and planning tools for collaboration (Lahdenperä, 2012), including both relationships and contracts (Poppo & Zenger, 2002). When knowledge or trust increases, the level of monitoring can be decreased in an authority system (Adler, 2001). The procurement process is crucial as it often sets the direction of the relationships. The form relationships take in the initial stages of cooperation is difficult to change later on (Doz, 1996; Olsen, Haugland, Karlsen, & Johan Husøy, 2005).

Incentives are one way to achieve commercial unity and mutually consistent objectives that are a prerequisite for collaborative governance arrangements, for example through shared financial risks and rewards (Lahdenperä, 2012). Incentives are associated with rewards for good performance (Stinchcombe, 1990). At a general level, risks are expected, directly or indirectly, to be assigned through contractual terms (Cox & Thompson, 1997). A couple studies report the successful management principles of the London Heathrow Terminal 5 project, where the owner accepted not assigning all risks to contractors, but decided to bear most of them itself (Brady, Davies, Gann, & Rush, 2008; Davies, Gann, & Douglas, 2009) using an incentive profit pool to reward all key participants for a successful project outcome. In a recent study, Brady and Davies (2014) illustrate how incentives were used in two successful mega projects (Heathrow Terminal 5 and the London Olympics).

Stinchcombe (1990) argued that “administered” rather than market-driven *pricing systems* could be another way to reach commercial unity. A concrete operationalization of such pricing systems are different forms of payment terms. For example, Turner and Simister (2001) used three standard forms of payment terms in their analysis: cost plus, remeasurement, and fixed price. Uber, AirBnB, and other recent business developments call for a fourth standard form: mediation payment. Turner and Simister (2001) argue that the different terms motivate contractors in different ways and that the choice of payment terms should be made according to the type of uncertainty in the project. More generally, the entire purchasing strategy may also have a significant impact on the buyer’s value creation potential, and should be aligned with the project marketing process of the seller to maximize value (Ahola, Laitinen, Kujala, & Wikström, 2008). In this regard, the pre-contractual phase of the procurement process is interesting because it involves decisions about project decomposition, the project delivery method, and supplier (or contractor) selection.

Costly market-based *conflict resolution* procedures are a major source of transaction inefficiencies. Stinchcombe (1990) proposed that contracts could provide mechanisms for avoiding costly disputes in courtrooms. Likewise, one important element of collaborative governance arrangements is the specification of conflict resolution procedures to improve the teamwork premises. Many industries—construction is a good example—have developed elaborate arbitration practices to negotiate changes to contracts because of factors that are not clearly stipulated in the contract.

Standard operational procedures aiming at process efficiency of all sorts can also be found in large projects, for example master schedules and standard documents (Stinchcombe, 1990). In an extensive comparison of various multi-party arrangements, Lahdenperä (2012) explicitly found that operational procedures are one cornerstone of collaborative governance arrangements.

A specific type of "*standard operating procedure*" with implications for communication is found in the theory of modular designs that enable product development tasks to be carried out concurrently and autonomously through its standardized interfaces (Sanchez & Mahoney, 1996). Sanchez and Mahoney (1996) describe how standardized product interfaces create a well-defined "information structure" that specifies how the components of a product function together and consequently how the corresponding development processes and groups connect. This idea lies in the heart of the market-hierarchy contradiction. Sanchez and Mahoney (1996) explain this as the case when a well-defined information structure enables a kind of "embedded coordination without the need to continually exercise authority." Langlois (2003) called this phenomenon "the vanishing hand" of modularity. That is, as interfaces become fully standardized and specified, neither market nor hierarchy is needed to coordinate the transactions within an industry.

Hardly any single firm possesses all the capabilities needed to undertake a large project, meaning that collaborative *network governance* may be needed. Network governance can be organized in three primary ways: 1) networks led by a systems integrator, 2) networks that emerge from cooperation, and 3) networks regulated by institutions. These three forms of network governance can also be combined.

Networks led by a systems integrator is a governance form where authority for organizing the coordination of workflows in the network is escalated to a higher level in the network (Brusoni et al., 2001; Hobday et al., 2005). The system integrator will coordinate workflows in business ecosystems for overall system efficiency. This means that workflows in and around the project are vertically and horizontally coordinated over the lifecycle of the ecosystem, with ecosystem efficiency as the overall goal.

Networks that emerge from cooperation (Dyer, 1997; Powell, Koput, & Smith-Doerr, 1996) has been researched under a variety of labels such as cooperation (Dyer & Singh, 1998; Gulati & Singh, 1998) and network governance (Jones, Hesterly, & Borgatti, 1997). At the core of effective network collaboration in projects lies effective governance through formal and informal relational and contractual safeguards (Smyth & Edkins, 2007; Henisz et al., 2012; Smyth, Gustafsson, & Ganskau, 2010). For instance, complex projects tend to demand a culture of trust and mutual respect, and this must be reflected in the contract structure between the actors in the project network (Turner & Simister, 2001). Trust is also the basis for closer integration and information exchange between parties (Kirsilä, Hellström, & Wikström, 2007).

Non-business actors, public organizations, and other institutions define the normative, regulative, and cultural cognitive foundations for business ecosystems (Scott, 2012). An example is that regulators in Australia have changed the public private partnership regulations so that the infrastructure concessionaire should own a larger part of the lifecycle, and the regulators thereby effectively determine how the system should be integrated (Levitt and Eriksson, 2017). The overall purpose of their intervention is to safeguard the society's interest in the project. Governments as project participants may play diverse roles, but often hide behind the role of "the independent guardian of the public good" (Miller & Hobbs, 2005). Governments often set up their own governance frameworks for public projects (Williams, Klakegg, Magnussen, & Glasspool, 2010).

Method

The research method used in this article is clinical research, which originates from the tradition of action research, though clinical research focuses explicitly on solving problems that are relevant to the industry (Coget, 2009; Coghlan, 2000; Schein, 1993, 1995, 2008; Schön, 1995). In clinical research, the researchers help companies diagnose and solve problems in the practice. Thus, the main aims of a clinical inquiry include solving a clinical problem and triggering organizational change (Schein, 1995; Gustafsson & Tsvetkova, 2017). The main mechanism for clinical research is that business problems are solved in a collaborative process between research and practice, and that process allows for good access to data and constant validation of research results with the practitioners (Coghlan, 2011). The outcome of clinical research is not known beforehand, but rather the collaboration between researchers and practitioners usually results in an interesting outcome (Gustafsson & Tsvetkova, 2017).

In order to show how our analysis can be done, we selected a project case that we expected to contain the information suited for workflow analysis. Such case selection is labeled "paradigmatic" because the case is chosen so that it is helpful in establishing a school of thought (Flyvberg, 2006). The method chosen is also a case study since we focus on the project for the current clinical research to analyze the short sea logistics business ecosystem in the

Baltic Sea and, together with practitioners, develop solutions for increasing its efficiency and sustainability. The practitioners include two shipping companies, two key technology providers for vessels, a shipyard, and three cargo owners. A contract has been signed between a number of universities, industrial companies, and a financing research-oriented company that financed the project, and whose shareholders are a cluster of industrial companies. The contract stipulated the commitments, work, and conflict resolution in the project. Industrial companies did not provide monetary resources, but instead put the time used by staff as a commitment.

The clinical research focused on the development of business with industry actors and used meetings and documentation as tools to bring the business development process forward. Researchers used three kinds of meetings to drive the agenda forward together with the practitioners:

- Annual meetings are those in which participants discuss the achievements during the year and outline goals for the future. Annual positioning reports lay out future work and a common vision for the project participants.
- Monthly meetings are held to follow up on the previous month's work and to plan work for the month ahead. Input includes the minutes from the previous month's meetings and an agenda for discussions.
- Operative meetings are meetings with one or more corporations to address matters of operative importance. Operative meetings frequently happen on a weekly basis.

In addition to project meetings, there were a number of workshops and discussions that involved not only project participants, but also companies outside the project.

The actors and number of interactions with them are listed in Table 2.

Table 2. Major interaction with practice during the project

Actor type	Number of companies	Total number of individual interviews and discussions with researchers	Total number of participation in joint workshops
Companies working in the project	8	More than 150	More than 25
Cargo owners	7	13	12
Ship agencies	1	1	
Cargo brokers	2	2	
Ship pool operators	1	1	
Port management companies	12	12	1
Stevedoring companies	3	3	1
Ship operators	2	5	
Shipowners	2	5	
Technology (ship systems) providers	3	6	2
Policy-makers	5	10	1
Financiers	3	6	1
IT solutions providers	1	1	

Labor union for port workers	1	2	
Various marine associations	1	1	
Various marine experts	8	8	5
TOTAL	60	More than 226	More than 48

During the ecosystem project, the challenges related to the current short sea logistics ecosystem were identified. We used this framework for in-depth analysis of the focal short sea logistics case and refined it based on the findings of empirical analysis, as presented in the last chapter.

The governance models were designed and approved as the project continued, partly based on theoretical presuppositions described in this paper, and partly based on business viability. Thus, they were continuously tested and verified. A number of governance models proposed in this paper are already being implemented, while others are still being developed conceptually within the ongoing clinical inquiry.

Case analysis of a project in the short sea shipping and logistics business ecosystem

To illustrate and elaborate on our framework, we present an example of a project in the form of the construction of a cargo vessel for short sea shipping in the Baltic. Our analysis of the case offers an example of how system level lock-ins have an effect on the project, and how they can be resolved.

Short sea shipping refers to coastal shipping without crossing an ocean, including the movement of freight and passengers. Short sea logistics accounts for 40% of all freight in the European Union and 59% of all its sea freight (Eurostat 2017). The target is to increase the freight transported on ships as it is regarded as the most environmentally friendly logistics. Still, several studies show the deficiencies and potential for more sustainable freight (Eide, 2011; Gustafsson, 2015).

The current short sea logistics ecosystem in the Baltic Sea is characterized by a number of inefficiencies that make shipping - and consequently the operation of vessels - economically and environmentally challenging. Several lock-ins and even monopolies have been detected in the existing ecosystem (Gustafsson et al., 2014). The utilization rate of many ship types (e.g. bulker) is below 40% because of inefficient cargo space utilization, communication between actors, and the amount of idle time in ports (Eide, 2011; Johnson et al., 2014; Johnson & Styhre, 2015). The number of organizations involved in moving a consignment from producer to buyer has increased gradually and now ranges from 16 to 19, creating higher cost and fragmented information flow. Structural problems in queuing logic to the ports cause unnecessary energy consumption, as the ships often increase speed to reach earlier slots. Labor unions cause (Johnson & Styhre, 2015) idle time in the port. In 2015, the International Maritime Organisation (IMO) activated a new strict environmental regulation on the Baltic Sea and the English Channel: the sulphur directive. This directive imposes cost pressures on the industry, either in terms of using cleaner but more expensive fuels such as LNG or investments in cleaning technologies such as scrubbers.

The shipbuilding process is heavily biased toward a “low cost–oriented” logic, creating impediments for designing and delivering vessels that would be somewhat costlier to build, but would produce much greater benefits during operations over their lifecycle. Lack of communication between relevant parties entails that the ship cannot be optimally designed. Present structures focus on economizing the investment not considering market needs, operating profiles, available technologies, and future legislation. The transportation system forming the core of the business ecosystem includes the cargo owner, land transportation, ports, shipowner, and the end customer receiving the cargo. Included in the ecosystem are also ship brokers, technology providers, ship designers, ship yards, and authorities (Gustafsson, 2015).

Disruptive product and digital technologies such as autonomous ships and ports and digital open marketplaces will transform the project by impacting the future information and workflows, governance structures, and regulations in the overall ecosystem, which should be taken into consideration when planning new ships.

The specific project - the investment in short sea shipping vessels - is embedded in the ecosystem as illustrated in Figure 2. The vertical axis shows the lifecycle of a vessel, from planning to design, construction, and finally operations. The horizontal axis shows parts of the business ecosystem that have interconnected workflows. The vessel investment and development is the project. The workflows of a more permanent character in the ecosystem impacting the project are cargo owners, material flows, and existing port infrastructure. It is important for the relationships between actors in Figure 2 to have existing technologies, legislation, and regulations, the most important of which are environmental regulations. The various governance tools to connect the project workflows with the ecosystem and to govern the actual project is discussed in more detail below.

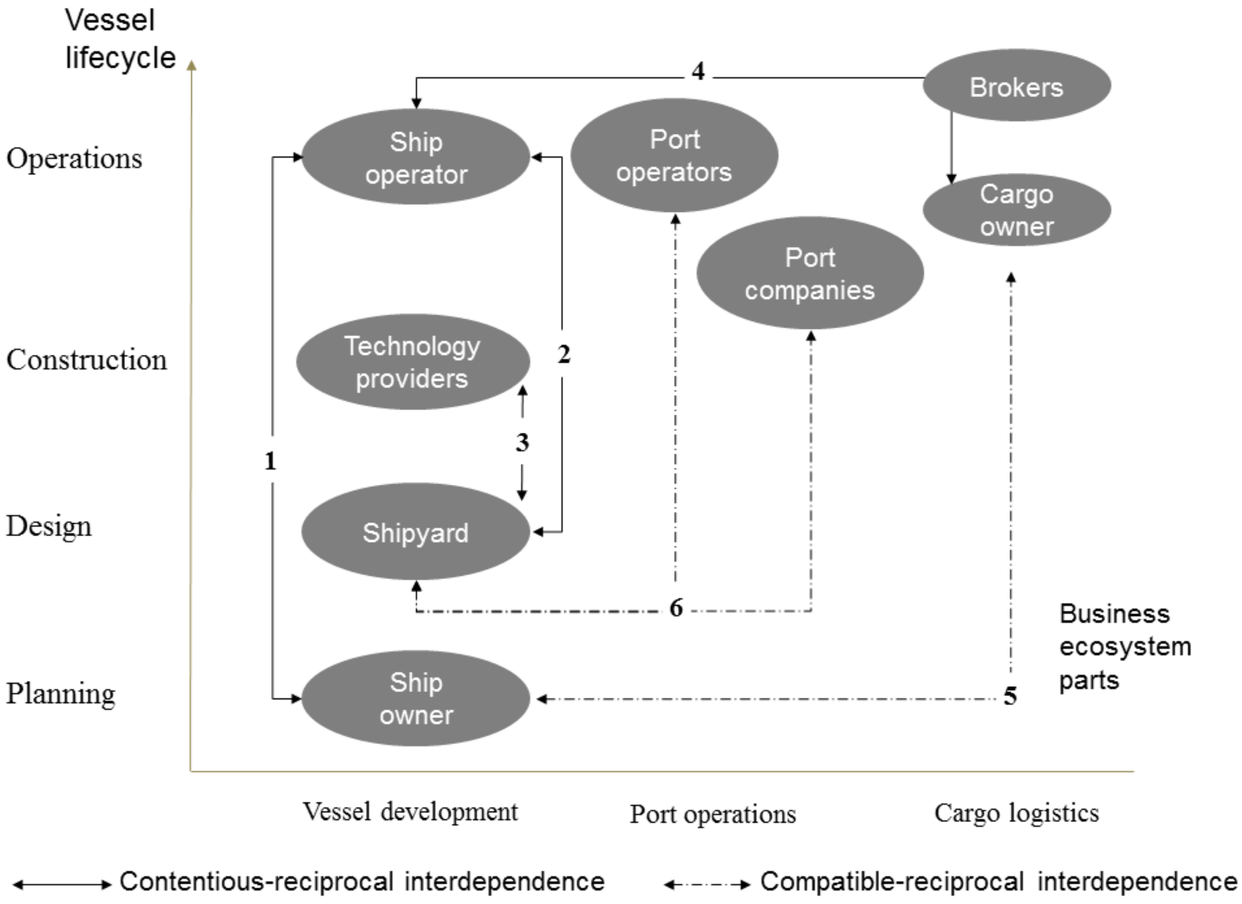

Figure 2. Vessel project.

The most demanding workflows are within the project as shown in Figure 2. The workflows between the project and the ecosystems are generally compatible-reciprocal. Moreover, the intensity of interaction between the project and the ecosystem is concentrated to the early and late phases of the project, even if the ambition is to interact and adapt during all phases of the investment. In the following section, a more detailed presentation of the most critical workflows within the ship investment project and the integrated flow between the project and the ecosystem is discussed.

The critical workflow interdependencies are displayed in Figure 2. Four are contentious-reciprocal, and two are compatible-reciprocal.

Contentious-reciprocal interdependencies

Our research revealed that the communication between the organizations responsible for building and owning the ships (shipowner) and the organization responsible for operating the ship (ship operator) fail to communicate when planning a new ship. Communication with the final customer, the freight owner, is also not well embedded during the planning and building phases. The shipowner makes the decision about key characteristics of the vessel during the design and planning phase, such as its size, tonnage, and suitability for certain cargos, while the ship operator is the one that operates (including staffing) the vessel during its operations phase (workflow interdependence 1 in Figure 2). Often the two actors are connected by a rather transactional time-charter party agreement, which allows a ship operator to charter and use the vessel for a certain price, and during a fixed period of time. In this situation, the information about actual operations is not communicated back to the shipowner, no “feedback for design” is generated, and thus the activity of defining future ship specifications is not well connected to vessel operation. Even in cases where shipowners operate their vessels themselves, the operations are often organized in separate divisions (i.e., according to a functional structure), resulting in the same kind of lack of communication.

Since the shipowners are not always involved in, nor do they directly benefit from, the operations of the vessel, there is low motivation for the shipowner to invest in more advanced (and potentially more expensive) technology that could lead to greater lifecycle benefits. Such benefits would include reduced fuel consumption, decreased costs of cargo, lower cleaning costs during operations, and timely vessel maintenance to reduce lost operating time from downtime. The shipowner, instead, focuses on minimizing the capital expenditure related to the vessel investment.

Currently, the contentious-reciprocal interdependence comes from shipowners and ship operators with diverging goals, impacting the cooperation around better ship design, construction, and operation. Moreover, the transactional time charter contract between shipowner and ship operator does not facilitate resolving the conflicting goals of actors.

Further vertical fragmentation along the vessel lifecycle is caused by the extremely low cost–oriented business model of a shipyard, which is a technical integrator and the major actor in designing the vessel. The shipyard strives to reuse existing designs and take bids for the lowest construction cost among a multitude of technology providers; the ship operator is not involved in the design process (workflow interdependence 2 in Figure 2). A related problem is the lack of a link between the technological knowledge of various technology providers and the design and planning process (workflow interdependence 3 in Figure 2). Due to the lowest cost–oriented bidding, there is no forum for proposing more advanced designs by technology providers, even if they have the requisite knowledge, and even if the technical solutions would lead to a lower cost and increased profits over the lifecycle.

In all these cases, the contentious-reciprocal interdependencies are currently governed as sequential through excluding the technology providers and ship operator from the decision-making during the vessel planning phase and exercising a highly structured and formalized bidding process. Thus, the need for mutual adjustment is ignored, and the potential for achieving the lifecycle benefits of vessel delivery and operation is overlooked. To increase the potential lifecycle performance of the vessel, there is a need to address, rather than avoid, the contentious nature of dependency between the activities of the named actors and move them into a concurrent co-design mode. There is also a need to escalate the decision-making to a higher level in the system so that a business ecosystem–level optimization perspective could be taken by a systems integrator. The systems integrator would need to resolve the contentious-reciprocal interdependencies by a combination of governance tools, such as authority system, incentives, pricing, and conflict resolution.

One solution is to create an alliance that virtually integrates the actors that are critical in the lifecycle performance of a vessel rather than integrating them legally through mergers and acquisitions. This could take place using forms of contracting that align the actors' interests and incentivizing them to invest their best knowledge and resources in (1) creating a vessel that would have the potential to achieve greater lifecycle performance and (2) ensuring that the vessel would operate in the intended manner. Such actors would include the ship operator, the yard, and the key technology providers. The alliance would be responsible for the design and construction of the vessel on the one hand, and for the operation and maintenance of the vessel on the other.

By sharing the profit generated during the lifecycle of the vessel operation, the alliance participants should be motivated in a number of new and more optimal ways, also considering the influence from the surrounding ecosystem. Technology providers are incentivized to adjust the capital expenditure for a vessel based on a value-driven rather than cost-driven logic, and to use their best knowledge to design and maintain the vessel in such a way that operations are not disrupted. Ship operators are incentivized to utilize their knowledge to provide input for the design of the vessel based on lifecycle operating costs given the current prices rather than being driven purely by minimizing the first cost. With this combined input, designers can simulate vessel construction and operations to help align the planning activities of a number of crucial actors within the alliance, as well as with potential consumers of logistics services.

Another contentious-reciprocal interdependence concerns vessel operation and the operations of cargo owners. Currently, cargo owners are reluctant to combine their bulk cargo shipments with others due to the assumed and real quality risks and prospective schedule delays (workflow interdependence 4 in Figure 2). Our research identified the potential of introducing new cargo handling technology to the vessel, which would address the conflicting interests of various cargo owners. The opportunity to safely separate different types of cargo and efficiently combine different cargos on different routes would resolve the contentious character of this interdependence and allow for increased vessel utilization while still delivering greater value to the end customers. A technical solution for this is a mega container (or containerization of bulk cargo in general), which is a larger container that can be used for bulk transportation. Currently, bulk is transported in the cargo area of the ship, and because it is expensive to clean the cargo area, the ship usually goes one way with bulk cargo, and then goes back empty to reload. Mega containers would make it possible to transport different kinds of bulk on the same ship and would even make it possible to transport regular containers and bulk on the same ship.

Coordination can be further facilitated by a new technology: an electronic marketplace for cargo transport. This solution would address the existing lack of efficient governance of the workflow interdependence between cargo owners and ship operators, which is currently bridged by cargo brokers in a somewhat opaque and non-optimal manner. Cargo owners are interested in lower freight rates and suitable delivery schedules, while the ship operator is interested in higher freight rates and high vessel utilization. Brokers, who act as intermediaries, exploit the opacity of information flow between cargo owners and ship operators and maintain a contentious-reciprocal interdependence by refusing to adapt new business practices in line with Uber. Removing brokers and letting cargo owners and ship operators interact directly via a marketplace would turn this dependency into a compatible-reciprocal one, since it resolves the conflict between parties through the introduction and use of an electronic marketplace for cargo that enables a more transparent information exchange and sets optimum freight rates. Also, more long-term contracts between cargo owners and ship operators can facilitate advanced logistics planning. By turning the interdependency into a compatible-reciprocal one, the system-level optimization of cargo flows and an efficient value chain can be achieved through a combination of pricing, conflict resolution, and network governance.

Compatible-reciprocal interdependencies

The next type of critical interdependencies analyzed are compatible-reciprocal ones. These include the interdependence between the vessel design and cargo transportation, as well as between vessel design and the design of port facilities and equipment in shipping operations. In both cases, there is a natural need for compatibility between the vessel and the cargo it is intended to transport, as well as for efficient vessel-port systems.

Cargo owners are the ultimate users of logistics services. Thus, the vessel operations need to be compatible with operations for cargo handling, including the type of cargo transported, transportation costs, frequency, and routes. Already during the dplanning phase, it is crucial to identify operating profiles in order to design a vessel that would show good performance during its lifecycle (workflow interdependence 5 in Figure 2). To do so, ship owners need to plan for cargo flow to be as efficient as possible, and then the ship owners need to task designers to make a ship that facilitates cargo flow. Although there are occasional informal discussions between shipowners and prospective end users (the cargo owners) there is no persistent dialogue between them, nor any one-time communication when the vessel is designed. Based on the findings, the dependency needs to be governed through early and extensive information exchange to enable the best fit of the vessel for the kinds of cargo to be transported. To achieve this, cargo owners can be incentivized to provide their input for vessel design in exchange for improved quality of transportation. As a result, the compatibility between cargo and vessels can be ensured, and the potential for system innovation is realized.

The other compatible-reciprocal interdependence is the dependence of vessel design on port operations and on port companies (workflow interdependence 6 in Figure 2). There is a direct technological link between the vessel and port facilities and equipment in terms of, for example, the size of vessels that are allowed to load or unload at a given port’s quay, the capacity of cargo handling facilities in the port, the compatibility of cargo handling systems on the vessel with those at the port for different kinds of cargo, etc.

Currently, the interdependence is governed as sequential. That is, port facilities and equipment are seen as a given and as a constraint for vessel design. Since such interdependence is compatible-reciprocal, there is a need for more proactive governance, which would enable coordination between the design of the vessel and the properties of equipment and facilities in relevant ports. This can be achieved by adjusting vessel design to fit the relevant characteristics of ports where it is likely to pick up or deliver cargo (the current, sequential governance approach), or by jointly designing vessel-port solutions. Mega containers are one of the solutions proposed within the present research project. They would potentially require a different cargo handling process in ports, but would ultimately create benefits for the port owners and operators through higher throughput in ports and through their improved quality of service. Although this requires a system-wide shift and investments, and although it naturally brings uncertainty, the attempt to achieve better technological alignment between vessels and ports can spur a more intensive information exchange and workflow alignment as well.

The interdependencies spanning the boundaries of other subsystems in the business ecosystem usually require the compatibility of those systems and open avenues for system innovation and network externalities. Proper governance tools for such compatible-reciprocal interdependencies should support extensive, transparent information sharing and thereby facilitate mutual adjustment for optimal outcomes at the ecosystem level. Governance tools that can be used are authority, incentive, and pricing systems, conflict resolution, and standard operating procedures.

Case analysis - Dynamic benefits of project governance

Short sea shipping vessel development can create dynamic benefits through workflow integration enabled by new governance schemes. Developments are currently underway, and these are discussed below. The most critical workflows and corresponding governance tools are listed in Table 3.

Table 3. Critical workflow interdependencies in the vessel development case

No.	Workflow inter-dependence	Lock-in	Unlock	Governance tools used to unlock
1.	Vessel planning – Vessel operations	Ship owners do not include ship operators in vessel planning.	Alliance	Authority system Incentive system Pricing Conflict resolution
2.	Vessel Design – Vessel operations	Shipyard use standard, low-cost designs rather than innovative solutions that would improve ship operation.	Alliance	Standard operating procedure Incentive system Pricing Conflict resolution
3.	Vessel design – Vessel construction	Shipyard use standard, low-cost designs rather than state-of-the-art technology that would improve ship operation.	Alliance	Standard operating procedure Incentive system Pricing Conflict resolution

4.	Vessel operation – Cargo logistics operation	Brokers mediate between ship operators and cargo owners, but the brokers are inefficient.	Open marketplace New technology	Pricing Conflict resolution Network governance
5.	Vessel planning – Cargo logistics operation	No collaboration between Ship owners and Cargo owners. Cargo logistics chain over vessel is not innovative.	Development fund to finance restructuring of cargo logistics chain	Authority system Incentive system Pricing Conflict resolution Standard operating procedure Network governance
6.	Vessel design – Port operations	Little collaboration between Shipyard, port operators and port companies. New port innovations incompatible with new vessels.	Escalation of decision to system integrator/ Pooling investments	Authority system Incentive system Pricing Conflict resolution Standard operating procedure

The first example is provided by governance of the project by joint innovative activities between the cargo owner, shipowner, shipyard, technology providers, and third-party actors (government, consultants, NGOs). The governance effort involves the creation of an “innovation alliance” between all these actors before the vessel lifecycle investment decision has been made (workflow interdependencies 1, 2, and 3 in Table 2). The innovation alliance creates a compatible-reciprocal interdependence between workflows that were previously sequentially interdependent, or even not connected at all because of lock-ins. The innovation alliance fosters a collaborative environment where all the actors share proprietary information for the joint development of innovative vessels. The alliance can be governed by a combination of pricing, conflict resolution, authority, and incentive systems. One of the most important areas of governance is the relationship between the actors involved in the innovation alliance. This is a difficult task because one actor may share information that can be used for value creation by another. Governance tools are used to define the ownership of input and output of the innovation alliance, as well as the processes for collaboration in the alliance. The tools effectively govern the relationships within the project, and the relationships in between the project and the business ecosystem. The foremost goal of the alliance is value creation over the lifecycle of the vessel in the business ecosystem, and so a long-term perspective is central for all actors, but may not be in the interest of some. For instance, long-term investors are currently interested in investing in ships, and they may be very good shipowners because the current shipowners are reluctant to invest in long-term shipping business development.

Another example of a workflow integration is connecting the project with some of the major ports that it will utilize, and also to connect it with land transportation that utilizes the ports (workflow interdependencies 4 and 6 in Table 2). There are opportunities for efficiency improvements in the sequential interdependencies across vessel, port, and land transportation, for instance by increased information exchange, standardization, and by consideration of regulatory compliance across the different modes of transportation. Examples of opportunities are planned new investments in the port and land transportation spaces that can improve the performance of the new ships. New digital solutions based on real-time information of the flow of cargo at the different spaces can improve the overall performance of the ecosystem.

A third example of workflow integration is to make new types of financing structures where the ownership of parts of the infrastructure could be integrated so that one investor owns a larger part of the business ecosystem (workflow interdependence 5 in Table 2). The creation of a financial entity usually leads to a more careful consideration of the return on investment by the members of the entity, and so financing can be used as a governance tool in the project. There are currently financing initiatives for actors to own ships over construction and operation and maintenance, meaning that the workflows of those two lifecycle phases would be better integrated. These financing structures can be included into shipbuilding and ship operation alliances to find efficient forms of governance.

These new types of integration mechanisms create more demanding workflows in the project and its interaction with the ecosystem. With more costly workflows, the expectation is that the value created through these are higher and it also increases efficiency. Still, these demand new tools of integration where the authority systems, incentive schemes, and conflict resolution play an essential role. One example is a series of modular contracts that gradually bind the actors together and create more acceptable risk profiles.

Conclusions

This article argues that infrastructure service delivery can be performed better if infrastructure service delivery projects are considered in the context of their surrounding business ecosystem. Because business is increasingly integrated, and because this integration extends within and outside traditional business boundaries, there is a need to study projects and their delivery models in their context. This article develops a framework for the analysis of how a vessel development project is embedded in the context of a business ecosystem. The vessel is embedded in an ecosystem that does logistics business, and the business ecosystem extends beyond sea logistics, to also include port operations, as goods need to be loaded on and off a vessel efficiently. In other words, very central to the short sea shipping business ecosystem is the logistics infrastructure service that extends over sea and land, and the performance of the vessel delivery model depends on the way that it increases the performance of the short sea business ecosystem.

The case shows how workflows can be used to analyze project interdependencies and how greater system-level performance can be achieved by improving the workflows in and around the delivery project. The article presents a framework for determining which workflows to focus on for, and suggests that the most costly workflows should be focused first, because they can improve system-level benefits the most. For the vessel delivery project, increased business ecosystem benefits also increases the benefits of the vessel delivery project.

The article also presents a way to identify the most costly workflows, and argues that it can be done by the identification of what kind of interdependence there is in the workflow. Workflow interdependencies that contain contentious interdependencies cause lock-ins, that cannot normally be resolved without escalation of the contentious interdependence to some actor with authority and a system integrating goal. Workflow analysis is instrumental in identifying lock-ins that prevent increased system-wide value creation. The lock-ins can be unlocked with the help of the right set of governance tools, and this article shows how this can be done and how it leads to increased performance, innovation and value creation in the delivery model of the project and the system.

The interplay between the projects delivery model and the business ecosystem provides a great opportunity to find new ways to create value by capabilities such as innovation and system integration, and the workflow analysis and governance tools are important for that value creation. Thereby, the framework bears the potential to contribute to overcoming the long-lasting challenge of meeting (mega) project goals, but that is for future research to show.

This article analyses how primary governance mechanisms and tools and value creation: Pooled interdependence, Sequential workflow interdependence, Compatible-reciprocal workflow interdependence, and Contentious-reciprocal workflow interdependence

Governance tools can be used to help reorganize workflows so that they become less costly and create value in the business ecosystem. For instance, contentious-reciprocal workflows can be reorganized into compatible-reciprocal ones by creating a virtually integrated organization through an alliance that combines a fragmented network into a single “macrofirm” (Dioguardi, 1983). In doing so, the contentiousness is resolved by escalating the decision-making to a more macro level, and then letting the macro-level decision guide the more micro-level decision.

Future research can further study the boundary between projects and the business ecosystem thereby improving the delivery models of the projects. Another area of research is to study the relationship between the 4 kinds of workflow interdependencies with respect to how they may transition from one kind of interdependence to another over the lifecycle of the project. In such research, standardization, institutionalization, and modularization are interesting factors that may help understand and explain the dynamism of how workflow interdependence changes in projects.

In similar ways, workflows can be re-organized so that compatible-reciprocal interdependencies can be made sequential, and sequential ones can be made pooled. However, workflow reorganization should also consider the value created in the business ecosystem, and so the tradeoff between cost reduction and value creation in the business ecosystem should be the goal of workflow interdependence analysis for any project.

Managerial Implications

The framework that we have developed can be used for the analysis of which governance tools to use for the management of projects in business ecosystems to find the optimal delivery models. The greatest potential improvements in performance lie in effective governance of the most costly workflow coordination mechanisms. It is quite common that workflow interdependencies that are costly to coordinate remain uncoordinated, thus resulting in lock-ins that prevent efficient coordination and, for example, innovation. There are several governance tools that can be used separately or in combination to unlock lock-ins, and that will probably improve performance in the business ecosystem. Governance of projects can increase value creation, system integration capabilities, innovation, and the overall competitiveness of the business ecosystem.

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