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ORGANIZING IN THE CONTEXT OF GLOBAL PROJECT-BASED FIRM – THE CASE OF SALES-OPERATIONS INTERFACE

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Dr. Raymond E. Levitt is the Kumagai Professor of Engineering at Stanford University. He is a co-founder and previous Associate Director/Director of Stanford's Center for Integrated Facility Engineering as well as the founder and Director of Stanford's Collaboratory for Research on Global Projects. His research interests center around organization design, institutional theory, and governance of public-private partnerships. He has published roughly 200 articles, books, and research papers.

Research highlights:

- We address integration of the sales and operations interface in global project-based firms.
- We elaborate the information processing model for this integration in the context of global project based firm.
- We provide empirical illustrations for this integration by presenting data from three case projects.
- We conclude that integration of these functions in the firm's organization is managed differently depending on the project phase.
- We conclude that the differing use of integration mechanisms across project phases is associated with contextual variables.

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Abstract

In this paper we study the cross-functional integration of project sales and project operations – two crucial functions when conducting business in global project-based firms. In particular we address contextual factors that are associated with integration needs among project sales and operations functions across project phases and report on how integration is managed across phases in three global projects with different contextual conditions. Using Galbraith's (1973) and Tushman & Nadler's (1978) model of the organization as an information processing system as our theoretical lens, we develop a set of propositions drawn from the general arguments of the theory and illustrated by these observations. The proposed theory underlying these propositions begins to explain how the contextual variables drive the use of different cross-functional integration mechanisms for sales and operations across project phases in global project-based firms. Subsequent research focusing on these and other key functions that require integration in different project phases can begin to validate and further elaborate this contingent framework for cross-functional integration in global project-based firms.

Keywords: Project sales and marketing, organizational integration, global projects, project-based firm, integration mechanisms, information processing

1. Introduction

The relative frequency of projects as a way of doing business has increased significantly (Cooper & Budd, 2007; Orr, Scott, Levitt, Artto, & Kujala, 2011; Shenhar & Dvir, 1996). Projects are the principal business vehicles for capital intensive industries, such as construction, pulp and paper, real estate, as well as oil and petroleum industries (Davies & Hobday, 2005; Shenhar & Dvir, 1996; Whitley, 2006). Such “projects as products” are distinguished from other types of products by their larger complexity and customization to individual customer specifications and a highly customized and longer sales process (Cooper & Budd, 2007; Cova & Salle, 2005; Hayes & Wheelwright, 1984; PMI, 2008). These projects are also different from internal projects in that they must be actively marketed and sold to external customers (Skaates & Tikkanen, 2003). The global nature of such projects, which bring together and integrate resources from multiple organizational units of firms and geographies is a relatively new, but highly pervasive, organizational phenomenon (Artto, Davies, Kujala, & Prencipe, 2011; Holstius, 2010; Orr et al., 2011, p. 17).

Recent research describes fundamental new forms of organizing firms in general (Greenwood & Miller, 2010). The nature of organizing has also changed for projects (Orr et al., 2011). Taken together this means that “project-based firms”, referring to firms conducting business mainly by projects (Hobday, 2000; Whitley, 2006), face new challenges in designing their organizations. These significant changes call for deeper investigation of the organization of global project-based firms.

Recent research suggests that organizations are becoming increasingly sensitive to a specific organizational design aspect: the necessity for integrating across internal functional units, such as sales and operations (Cooper & Budd, 2007; Cova & Salle, 2005; O’Leary-Kelly & Flores, 2002). Integration of sales and operations functions within a global project-based firm is important for

several reasons. First, sales plays a role at the boundary of the organization, linking demands of the environment and internal operational capabilities of the organization to develop offerings and value creation, requiring mutual understanding between sales and operations functions (Plouffe & Barclay, 2007; Ruekert & Walker, 1987; Shapiro, 1977). Simultaneously the nature of project business requires that the organization is highly flexible due to the complexity and uniqueness of many projects (Cooper & Budd, 2007; Cova, Ghauri, & Salle, 2002; Hadjikhani, 1996). Second, the functional instability is further increased as the needs that projects pose for the organization of the project-based firm are also subject to change – not just across projects, but even from one project phase to another (Adler, 1995; Morgan, Levitt, & Malek, 2008; Morris, 1982; Terwiesch, Loch, & Meyer, 2002). And finally, the global nature of projects increases the organizational challenges of project-based firms. The organizational units (e.g., sales and operations functions) are frequently globally dispersed and the organizational interface to be integrated changes from one project to another, implying that the establishment of common interpersonal practices and informal communication, and the accumulation of tacit knowledge within the organization, are difficult (Carroll, Gromley, Bilardo, Burton, & Woodman, 2006; Orr et al., 2011). All these factors make it clear that cross-functional integration is important in global project-based firms. As integration also poses significant costs to the organization, it requires detailed examination. This leads to the research question addressed in this paper: “Which contextual factors create integration needs and how is integration managed across the interface between project sales and operations functions in different phases of global projects within a global project-based firm?”

In order to address the research question, we build our research on the view of the organization as an information processing system (Galbraith, 1973, 1977; Levitt et al., 1999; Nadler & Tushman, 1997; Tushman & Nadler, 1978). Although the arguments of the information processing model have been widely applied by scholars in different fields (e.g., Jarvenpaa & Ives, 1993; Levitt et al.,

1999; Nobel & Birkinshaw, 1998; Trautmann, Turkulainen, Hartmann, & Bals, 2009), they have not been elaborated in the context of integration of sales and operations functions in a global project-based firm. Following this stream of research, we define integration as sharing and processing of information between different functional units (Galbraith, 1973, 1977; Levitt et al., 1999; Nadler & Tushman, 1997; Tushman & Nadler, 1978). We develop a model of cross-functional integration between sales and operations in global projects that draws on theoretical arguments about how context shapes cross-functional integration needs between these two functions; and it uses observations from three projects to illustrate and elaborate the propositions.

The paper contributes to knowledge in several ways. First, a majority of prior research on cross-functional integration in the project context has focused on new product development (NPD) projects (e.g., Adler, 1995; Gerwin & Barrowman, 2002; Song & Montoya-Weiss, 2001; Song, Montoya-Weiss, & Schmidt, 1997; Song, Neeley, & Zhao, 1996) and looked at questions such as how to introduce customer requirements to new product designs and the subsequent integration between marketing and R&D (Kahn & McDonough, 1997; Souder, 1988; Souder, Sherman, & Davies-Cooper, 1998). Projects to deliver complex, highly customized products, on the other hand, have received relatively little attention (Cooper & Budd, 2007; Shenhar & Dvir, 1996) even though they are considered to pose quite different managerial challenges (Skaates & Tikkanen, 2003). We focus on the most critical organizational interface in that context, the project sales and project operations interface within a firm (Arenius, Artto, Lahti, & Meklin, 2002; Cooper & Budd, 2007).

Second, prior research on integration of sales and operations functions in the global context has focused on manufacturing businesses (Kahn & Mentzer, 1998; Kim, Park, & Prescott, 2003; Martinez & Jarillo, 1989), rather than project-based firms (Katsikeas, 2006; Orr et al., 2011).

Assessing project-based firms, however, is critical. First, due to the temporary nature of project

activities project-based firms require more managerial emphasis on integration (e.g., Cooper & Budd, 2007; Cova & Salle, 2005). And second, the contextual factors affecting integration needs and ways of managing integrating are not necessarily stable but can change, not just from project to project but even over the course of a single project (Adler, 1995; Morgan et al., 2008; Morris, 1982; Terwiesch et al., 2002). Therefore, integration of the functional interface between sales and operations requires special managerial attention in each individual project and potentially also in different sales and execution life cycle phases of the project.

2. Theoretical background

2.1 Organizing in the context of global project-based firms

In most project-based firms, project sales and project operations form separate functional units, which are assigned unique tasks (Cooper & Budd, 2007; Tikkanen, Kujala, & Artto, 2007). The *project sales unit* acts at the interface between the project-based firm and the customer. Its main responsibility is to create and maintain relationships with the customer (Cova et al., 2002). In the sales phase, after receiving a request for a quotation, the sales unit is assigned to complete tasks such as formulation of the quotation, carrying out negotiations and formulating the contract with the customer. It also controls the current and future flow of customers through its project sales activities (Cooper & Budd, 2007; Tikkanen et al., 2007). The *project operations unit* is the main unit responsible for delivering the project as agreed with the customer and defined in the contract. Specific tasks of the project operations unit include detailed project planning, procurement, execution, commissioning, and finally handing over the project to the customer. Figure 1 below illustrates the tasks of the project sales and project operations units as well as their interface. The width of the arrows in Figure 1 indicates the responsibility and participation in specific phases: accordingly, the sales unit has primary responsibility for the sales phase, and the operations unit has primary responsibility for the execution phase of a project. However, both units must participate in

both the project sales and execution phases in terms of defining the project scope and contract terms.

Figure 1. Integration of project sales and project operations functions in different project phases

One of the key challenges in managing the interface between functions is how to acquire the right information and then communicate it to the correct parties in other functions at the right time (Terwiesch et al., 2002). In the context of the sales and operations interface in a global project-based firm, this includes processing the information from the customer, and accumulating this knowledge and possible new data and combining it with technical information and information about operative capabilities into a quote. Then, if the project contract is won, the quote and contract information needs to be processed into specifications for the project operations unit and the end result is finally delivered and officially handed over to the customer. The project operations unit can also provide ideas about enhancements to the current project as well as additional products and services to the sales organization to negotiate with customers. Such information processing crosses several organizational boundaries – especially the boundary between project sales and project

operations functions. The temporary nature of projects makes the information processing vulnerable to misunderstandings and introduces information delivery barriers. These are maintained because of the uniqueness of projects and because in a global corporation the organizational units that jointly deliver projects change all the time. Hence, creating a common understanding and language as well as developing personal contacts is challenging. Subsequently, the importance of understanding how to better manage the interface with integration is increased.

Despite the importance of managing information processing across the functional units, prior research reports that traditional “over the wall” approaches are still found in many firms, in which the final sales agreement is handed to the operations unit for execution with little mutual discussion and iteration before the actual contract is finalized (Adler, 1995; Goold & Campbell, 2002). Such approaches, however, are likely to result in severe cost overruns due to unclear project specifications and consequent difficulties in the project execution phase. This can both significantly lower customer satisfaction and lead to lower performance of the project-based firm (Adler, 1995; Cooper & Budd, 2007) and eventually even lead to total destruction of the customer relationship (Tikkanen et al., 2007).

The integration challenge is further increased by global dispersion for two reasons. First, project-based firms oftentimes have hundreds of project sales units in various locations all around the world, whereas project operations units are in many cases centralized in only a few locations. Hence, the units responsible for individual projects change from one project to another. And second, the project sales unit is rarely located in the same location as the project operations unit, creating challenges in facilitating both formal and informal communication. Despite rapid advances and cost decreases in available communications technologies, geographical dispersion still makes

information processing between the units challenging (Orr & Scott, 2008; Ruuska, Artto, Eloranta, & Lehtonen, 2009; Van den Bulte & Moenaert, 1998).

2.2 Managing integration in the context of global project-based firms

We approach integration from the view of the organization as an information processing system. In order to increase the understanding of integration in the context of global projects, we build on the information processing model (Galbraith, 1973, 1977; Levitt et al., 1999; Nadler & Tushman, 1997; Tushman & Nadler, 1978). The fundamental idea of the model is that organizations have information processing needs that they manage using a requisite information processing capacity (Galbraith, 1973, 1977; Levitt et al., 1999; Nadler & Tushman, 1997; Tushman & Nadler, 1978). This builds on bounded rationality (March & Simon, 1958), which suggests that information is costly and hence, increasing information processing capacity excessively is undesirable. The model addresses organizations and integration in them at a very high level. Hence, the model needs contextualization and elaboration to provide understanding of integration in a global project-based firm. Below we explain the fundamental ideas of the model and take the first step in contextualizing the model.

Organizations increase their *information processing capacity* by implementing integration mechanisms, which differ in their capacity to facilitate information processing (Burton, DeSanctis, & Obel, 2006; Galbraith, 1973; Lawrence & Lorsch, 1967; Martinez & Jarillo, 1989). The integration mechanisms can be divided into different categories. At the top level, integration mechanisms can be divided into vertical and lateral ones. Centralization of decision making and standardization of processes, implementation of rules and standards and plans are all vertical mechanisms. Lateral mechanisms, on the other hand, include encouraging communication across units by meetings, cross-functional teams, integrative departments, and liaison roles. And they

encourage informal and ad-hoc communication across organizational units by enhancing contacts across units by job rotation, events, co-location, and conferences. In addition, integration can also be managed to some degree with various types of information systems, but their role is more in complementing vertical and lateral mechanisms (Daft & Lengel, 1986; Ghoshal & Gratton, 2002).

Integration mechanisms pose costs to the organization; vertical mechanisms are less costly than lateral mechanisms. Simultaneously, however, vertical mechanisms also have lower capacity to facilitate information processing. Hence, when the needs for information processing are high, lateral mechanisms, such as various kinds of teams and liaison roles are needed. Due to these costs of integration, the use of integration mechanisms can be explained by the integration challenge that the organization is facing – in the terminology of information processing scholars, the *needs for information processing* (Galbraith, 1973, 1977; Tushman & Nadler, 1978). Organizations vary in terms of the information processing needs, which are suggested to arise from uncertainty of the organizational task (Galbraith, 1973, 1977; Tushman & Nadler, 1978). Prior research on organization design suggests that uncertainty can be divided into dimensions of (1) uniqueness, (2) ambiguity, (3) complexity, and (4) dispersion (e.g., Ghemawat, 2001; Morris, 1982; Orr et al., 2011; Perrow, 1967; Van de Ven, Delbecq, & Koenig, 1976). These are explained in Table 1.

Table 1. Factors affecting integration needs and their description in the context of global projects

Factor, definition and description	References
Uniqueness <i>Definition:</i> Variability, number of exceptions in decision making and fit; high uniqueness refers to situations in which exceptions, when encountered, involve different issues to be solved or different methods of completing the work. <i>Description:</i> In the context of global projects, uniqueness can be related to new content of the project, new customer relationships, new and different customer needs, a new context and location of the project, and variation in schedule. All of these increase the integration challenge and require information processing between project sales and project operations regarding, for example, customer requirements, operating environment, laws and regulations.	Adler (1995), Cooper & Budd (2007), Cova et al. (2002), Mandja & Veres (1998), Orr et al. (2011), Perrow (1967), Shenhar & Dvir (1996), Song et al. (1996)

Ambiguity

Definition: Nature of the search process; high ambiguity refers to a situation in which the tasks and problems are poorly defined and vague.

Description: In the context of global projects, ambiguity can be related to lack of ability of the customer to present clear requirements for the project, lack of understanding of customer's practices and requirements, lack of understanding of project objectives and lack of mutual understanding between sales and operations. Ambiguity makes both management of customer relationship and continuous learning difficult. Ambiguity creates information processing needs between project sales and project operations because the units need to make sure that the expectations and requirements set by the customer are understood, deliverable and described precisely enough and that the delivery by project operations responds to the customer's expectations. This may require developing several iterations of virtual (digital) or physical prototypes to be evaluated and critiqued by the customer's organization.

Adler (1995), Cova et al. (2002), Mandja & Veres (1998), Orr et al. (2011), Perrow (1967), Song et al. (1996)

Complexity

Definition: Number of variables in decision making; high complexity refers to situations in which the number of variables in decision making is high.

Description: In the context of global projects, complexity can be related both to the end-product and to the extent to which the project is a full delivery or part of a larger project. The greater the number of parts in the project, the higher the complexity; greater number of parts and subprojects means that there are more product interfaces that need to be in fit, requiring information exchange between project sales and project operations. Also the smaller the percentage of the project delivered by the focal firm, the more decisions need to be made about fit of the interfaces so that the part is deliverable and fits the overarching project, increasing the information processing requirements between sales and project operations and between project operations and others in the supply chain.

Cova et al. (2002), Levitt et al. (1999), Orr et al. (2011), Rivkin (2001), Ruuska et al. (2009), Shenhar & Dvir (1996)

Dispersion

Definition: Distribution of work across sites and locations; the higher the dispersion, the less likely the project parties have the same understanding of the project, are able to communicate and operate in similar ways and the more difficult it is to share knowledge and information due to time zone differences, lack of personal contacts and informal talks.

Description: In the context of a global project-based firm, there is dispersion because sales and operations units are rarely co-located, decreasing possibilities for direct communications and contact to develop a clear understanding of the counterpart's business context, creating lack of common language, lack of informal contacts and arenas for discussions, differences in time zones, and complexity of connecting individuals across sites, increasing the information processing needs between the units and thus creating challenges of integration.

Ghemawat (2001), Orr & Scott (2008), Orr et al. (2011), Ruuska et al. (2009)

Hence, taken to the context of this research, each factor (uniqueness, ambiguity, complexity, and dispersion) as described in Table 1 is expected to affect the information processing needs between project sales and project operations functions in a global project-based firm and hence, create integration challenge in that specific context (Daft & Lengel, 1986; Galbraith, 1973; Orr et al., 2011; Tushman & Nadler, 1978). According to the information processing model, the use of integration mechanisms can be explained by the extent of the integration challenge; there is an association between the contextual factors and the use of different integration mechanisms. How the contextual factors and specific integration mechanisms are related in the context of project sales and project operations interface in a global project-based firm, however, remains to be elaborated, which is the focus of this paper.

3. Data and methods

Our research design can best be described as theory elaboration (Bourgeois, 1979). In comparison to testing an existing theory (Popper, 1959) or developing and generating a new theory (Eisenhardt, 1989; Glaser & Strauss, 1967), the key idea of theory elaboration as applied in this paper is the interplay between theory and data to illustrate and elaborate a theory in a specific context (Siggelkow, 2007). This means that the information processing model provides the overall theoretical idea that is used as the basis of our empirical analysis. In this process we elaborate the information processing model in the context of the sales and operations interface in global project-based firms in order to enhance the understanding of how to manage integration in that specific context. We illustrate the general arguments of the information processing model with our empirical findings and elaborate the theory by providing *theoretical explanations* for the use of integration mechanisms in the context of the sales and operations interface in the global project-based firm. The outcome of the paper can therefore be classified as middle-range theory (Bourgeois, 1979; Layder,

1993) – theory that generalizes beyond a particular case but within a particular context or setting (Woodside, Liukko, & Vuori, 1999).

We collected empirical data to illustrate the theory following a single embedded unit case study design (Yin, 1990). We selected this case study research design for three reasons. First, case study approach supports the aim of elaborating the information processing model in the context of project sales and operations interface in a global project-based firm, which is an unexplored context; “interaction between a phenomenon and its context is best understood through in-depth case studies” (Dubois & Gadde, 2002, p. 554). Second, our research aims to understand how different contingencies are associated with differences in the use of integration mechanisms (Yin, 1990). And third, a single embedded unit case study allows us to control for the effect of company and company culture in the use of integration mechanisms on projects of that company (e.g., Ryu, Aydin, & Noh, 2008).

For the purposes of this research, we selected a global automation system supplier firm *Global Field Systems* company (GFS, a pseudonym) as a source of empirical data. GFS is specialized in projects related to automation and information management application networks and systems, field control technology, and life cycle performance services. Its main customers are in the pulp and paper sector as well as in power, energy, oil, and gas sectors. GFS is widely dispersed globally, employing around 3200 people in more than 50 countries, and serving customers in more than 100 countries across the world. GSF serves its customers through about 50 project sales units located in different regions of the world.

In its organization, it has a formal project operations function, which is responsible for project operations and execution. Most of the people and activities of the project operations function are

centralized in a unit in Finland, with a small number of other units in Europe, Americas and Asia. GFS simultaneously carries out multiple projects, which vary in size from 300,000 EUR to over 10 million EUR. We selected three projects for detailed analysis, named here as *Kappa*, *Gamma*, and *Theta*. The projects can be characterized as system projects using the terminology of Shenhar and Dvir (1996), meaning that they are each a collection of interactive elements and subsystems, jointly performing a wide range of independent functions. The single-firm focus allows for standardizing contextual factors, which increases the comparability of the case projects. Selecting cases of same type (Shenhar & Dvir, 1996) also permits comparative discussion related to the contextual factors that could affect the management of projects in different phases. To increase potential variance in the use of integration practices, the selected cases represent delivery projects in two distinct customer areas; pulp and paper industry, and energy and hydrocarbon industry. The selected projects are also highly geographically dispersed.

The aim of the paper is to provide empirical illustrations of the information processing model in the specific context as well as theoretical explanations for the empirical observations, thus elaborating the information processing model. The theoretical framework (information processing model) dictates the form of the required data (Layder, 1993). The data collection was carried out in three parts. The primary means of data collection was through in-depth interviews. In total 19 semi-structured interviews (45-90 minutes) were conducted, targeting informants in different organizational positions to get multiple perspectives on the topic. The informants were selected based on their organizational roles as well as their experience and in-depth knowledge related to the case projects. In each project, we conducted interviews with the following persons: project manager responsible for project operations, sales manager or sales person, quotation engineer, and project engineer. Additionally, we also interviewed the director (functional manager) of the project operations function, the directors of project sales units as well as engineering managers, who assign

project managers, quotation engineers, and project engineers to projects and thus have in-depth knowledge about the project sales and project operations interface (in total 8 informants).

Each interview was conducted by one or two researchers. All but one of the interviews were tape recorded and transcribed for analysis purposes. Detailed notes were also taken. The topics covered during the interviews focused on information regarding the projects, factors creating uncertainty for these two functions, division of roles in the projects, ways of integrating the functional units, and potential problems and challenges in the projects.

In addition, we analyzed the general guidelines developed in the company to carry out projects (i.e. the company's process model) to gain an understanding of how its projects are intended to be conducted. We also gathered archival documents, including project plans and reports, project process documentations, minutes of project meetings, and project presentations. Project plans and process documentation enhanced the understanding of what formal mechanisms are in place to manage the interface between sales and operations on a global scale. However, these documents were only used as secondary sources of information to prepare for interviews, and for cross-checking and complementing interview findings. Finally, a workshop was arranged with the project unit management team to discuss the findings and validate them.

The following two tables (Table 2 and Table 3) present the cases. Table 2 includes details about the case projects, including factors that affect the integration challenge along the four dimensions of *uniqueness*, *ambiguity*, *complexity*, and *dispersion*. Table 3 summarizes the use of integration mechanism in the two phases of the projects (project sales and project execution).

Table 2. Case projects and context descriptions

	Kappa	Gamma	Theta
What	Steam cracker processes in an ethylene plant	Large hydrocarbon project: 50 valves	Large project consisting of bleaching plant and digester: 200 valves, level switches and analyzers
Delivery location	Iran	United Arab Emirates	India
Project part	1 MEUR	1.8 MEUR	1.8 MEUR
Customer	French main contractor	Italian main contractor	Internal customer (Finland and Sweden)
Responsible project units	French sales office, UK project operations unit	Italian sales office, Finnish project operations unit	Swedish sales office (the bleaching plant), Finnish sales office (the digester), Finnish project operations unit
Team in project sales	Sales manager and personnel from French sales office assisted by project operations unit staff from UK	Sales manager and personnel from Italian project sales unit assisted by a quotation engineer from Finnish project operations unit	Key Account Management sales group in Finland
Team in project operations	Project operations manager, project engineer, project assistants from UK project operations unit	Project operations manager, project engineer, project assistants from Finland project operations unit	Project operations manager, project engineer, project assistants from Finland project operations unit
Project characteristics	<i>Uniqueness:</i> No prior experience with the customer or location in Middle East, lot of changes emerging <i>Ambiguity:</i> Customer's objectives were clearly defined, detailed quotation was required <i>Complexity:</i> Scope of the project relatively simple, no real complex technical issues <i>Dispersion:</i> Rather significant dispersion between Finland and France and significant dispersion considering Middle East	<i>Uniqueness:</i> No prior experience with the customer but prior deliveries to United Arab Emirates <i>Ambiguity:</i> Relatively clear project compared to a typical project, detailed quotation required <i>Complexity:</i> Tight schedule and more demanding technology increased complexity <i>Dispersion:</i> Rather significant dispersion between Finland and Italy and significant considering UAE	<i>Uniqueness:</i> Customer part of the same corporation, plenty of prior experience, similarities with previous projects delivered to India <i>Ambiguity:</i> Relatively clear project but detailed quotation not required leading to vagueness in project definitions <i>Complexity:</i> Scope of the project relatively simple, no real complex technical issues <i>Dispersion:</i> Low dispersion between Finland and Sweden, significant dispersion considering India

Table 3. Use of integration mechanisms between project sales and project operations units in different project phases of three case projects

Integration mechanism	Kappa	Gamma	Theta
Project sales phase			
Vertical mechanisms	<p>Standard procedures for the sales process.</p> <p>Standard review of project details and status between project sales and operations to ensure quality and meeting customer specifications (in the end of sales phase).</p> <p>Formal hand-over of responsibility from sales to operations (project definition).</p>	<p>Standard procedures for the sales process.</p> <p>Standard review of project details and status between project sales and operations to ensure quality and meeting customer specifications (in the end of sales phase).</p> <p>Formal hand-over of responsibility from sales to operations (project definition).</p>	<p>Standard procedures for the sales process.</p> <p>Standard review of project details and status between project sales and operations to ensure quality and meeting customer specifications (in the end of sales phase).</p> <p>Formal hand-over of responsibility from sales to operations (project definition).</p>
Lateral formal mechanisms	<p>Quotation engineer in a <i>major role</i> as a liaison to transfer technical knowledge from operations to sales.</p> <p>Internal cross-functional meeting to share information mainly regarding the project details to project operations and technical capability to project sales.</p>	<p>Quotation engineer in a <i>minor role</i> as a liaison to transfer technical knowledge from operations to sales.</p> <p>Formal meetings between project operations manager and process engineer to discuss and negotiate the contract and process customer and technical information.</p> <p>Internal cross-functional teams to share information mainly regarding the project details to project operations and technical capability to project sales.</p>	<p>Quotation engineer in a <i>minor role</i> as a liaison to transfer technical knowledge from operations to sales.</p> <p>Project manager responsible for operations as a member of sales team to transfer technical information to sales prior to the actual sales agreement.</p> <p>Internal cross-functional meeting to share information mainly regarding the project details to project operations and technical capability to project sales.</p>

Lateral informal mechanisms	<p>Internal cross-functional kick-off meeting to create informal contacts between units.</p> <p><i>Some</i> informal meetings mainly to share information regarding the project details to project operations and technical capability to project sales.</p>	<p>Internal cross-functional kick-off meeting to create informal contacts between units.</p> <p><i>Major</i> emphasis on informal meetings mainly to share information regarding the project details to project operations and technical capability to project sales.</p>	<p>Internal cross-functional kick-off meeting to create informal contacts between units.</p>
Project execution phase			
Vertical mechanisms	<p>Standard procedures for the operations process.</p> <p>Formal kick off meeting to start the execution phase.</p>	<p>Standard procedures for the operations process.</p> <p>Formal kick off meeting to start the execution phase.</p>	<p>Standard procedures for the operations process.</p> <p>Formal kick off meeting to start the execution phase.</p>
Lateral formal mechanisms	<p>Sales persons in <i>minor roles</i> as liaison persons to share information about the customer requirements and needs to project operations.</p> <p><i>Some emphasis</i> on cross-functional technical teams and meetings to share information between functions.</p>	<p>Sales persons in <i>major roles</i> as liaison persons to share information about the customer requirements and needs to project operations.</p> <p><i>Major emphasis</i> on cross-functional technical teams and meetings to share information between functions.</p>	<p>Sales persons in <i>minor roles</i> as liaison persons to share information about the customer requirements and needs to project operations.</p> <p><i>Some emphasis</i> on cross-functional technical teams and meetings to share information between functions.</p>
Lateral informal mechanisms	<p><i>Some emphasis</i> on co-location to facilitate informal communication: project engineer and project manager co-located.</p>	<p><i>Major emphasis</i> on co-location to facilitate informal communication: project manager of operations, process engineer, and quotation engineer co-located.</p>	<p><i>Some emphasis</i> on co-location to facilitate informal communication: project engineer and project manager co-located.</p>

4. Development of propositions

In the following, we analyze our empirical data and illustrate the use of integration mechanisms to manage the project sales and project operations interface and the related contextual factors. We use the information processing model as our guiding theoretical lens and provide theoretical explanations for the use of integration mechanisms. These are then developed into theoretical propositions regarding how various contextual variables are associated with the use of integration mechanisms in the context of project sales and operations interface in a global project-based firm. The analysis of the integration mechanisms and contextual factors is carried out across the two major phases of the projects (the sales phase and the project execution phase). This allows us to reveal potential differences across the project phases (Adler, 1995; Morris, 1982; Orr et al., 2011).

According to the information processing model, vertical integration mechanisms are always used to some extent to manage the information processing needs (Galbraith, 1973; Nadler & Tushman, 1997; Tushman & Nadler, 1978). All of the projects followed rather formal and standardized project practices and formalized sales and execution processes. This ensured that certain critical information was processed across the functional units in different steps of the sales and execution phases of the projects and acted as a vertical integration mechanism between sales and operations functions. In the sales phase, all of the projects used a standard review of project specifications and status, and a formal hand-off from sales to operations. Both of these were implemented to ensure sharing of relevant information between sales and operations units at the end of the sales phase, when the project responsibility was handed over to project operations. The project execution phase started with a standard kick off meeting between the sales and operations units for the same reason.

Although the vertical mechanisms of standardized procedures and processes were important for managing integration between project sales and project operations units in both the sales and

execution phases, a variety of lateral mechanisms were also used to manage additional information processing needs in all case projects. According to the information processing model, lateral mechanisms are needed when the information processing needs are so significant that vertical mechanisms alone would lead to overloading the decision makers (Galbraith, 1973; Nadler & Tushman, 1997; Tushman & Nadler, 1978). For example in the project sales phase, centralization of decision making in the sales function could easily overload the senior sales personnel; because of bounded rationality (March & Simon, 1958), it is impossible for sales managers and personnel to gather and process all relevant sales as well as technical information for the quote. The interesting question then is: “Which contextual factors increase the integration challenge so that lateral mechanisms, which are more costly to the organization, are also used?” In the following, we provide theory-based arguments for the use of integration mechanisms we observed in these three projects.

The data suggests that a quotation engineer representing the operations unit was a critical integrative mechanism in all three case projects to manage the interface between project sales and project operations during the project sales phase. The quotation engineer was appointed as a liaison person to facilitate information processing from the operations function to the sales function during the project sales phase, but had no formal authority over project sales personnel. The information processed by the quotation engineer dealt primarily with technical and operational issues to ensure that the project quotation and contract designed to meet the customer’s needs were actually deliverable in technical terms. The role of the quotation engineer, however, differed between the case projects. In the Kappa case, the quotation engineer had a very significant integrative role. Even though he was involved only at the beginning of the project sales phase, he assisted in providing a complete initial quote. In the Gamma and Theta cases, the quotation engineer was involved from the beginning of the sales phase until the handover of the project responsibility to project

operations. Furthermore, in the Gamma and Theta cases, the quotation engineer only provided parts of the entire quote, providing technical support to the sales person.

In general the primary function of a liaison person is to communicate between organizational units without any formal authority (Morris, 1982). The use of a quotation engineer as a liaison person in the sales phase can be explained by the uniqueness of the projects. Uniqueness creates information processing needs between the project sales function and the project operations function, especially in the early stages of project (i.e. in the project sales phase). Information shared during this phase needs to be reviewed and discussed before commitments are made (Shenhar & Dvir, 1996). This is due to the fact that, unlike in selling standard products, the outcome of the project must be tailored to meet the technical specifications of the particular customer and the customer's operational and technical needs (Adler, 1995; Artto & Kujala, 2008; Cooper & Budd, 2007; Orr et al., 2011). The deliverables of the project are defined in the project sales phase based on the customer expectations and technical specifications, requirements, and restrictions. The unique nature of each customer's need potentially leads to unique technical aspects of each project – at least in the form of different combinations of standard components required to meet the customer's needs. To manage the uniqueness of the projects, the operations unit can provide its understanding of the challenges associated with providing the set of technical deliverables during the project sales phase. Therefore we propose:

Proposition 1: *A high level of uniqueness of project deliverables is associated with greater use of a liaison person, such as quotation engineer, as an integrative mechanism to manage the project sales and project operations interface during the project sales phase.*

Our findings also point to the use of cross-functional teams during the project sales phase, and subsequent reliance on group meetings and face-to-face discussions to integrate project sales and

project operations. These mechanisms were mentioned in all case projects as necessary activities to develop mutual understanding about underlying customer requirements and potential operational technical, time or cost constraints. Also, the overall project specifications were agreed with the customer through several meetings, in which both the sales team and project managers responsible for engineering and operations were involved, to ensure a fit between the customer requirements and the capabilities of the project-based firm.

In addition to these formal and informal meetings between the sales and operations units, in the Theta case, the project manager responsible for project operations was involved in the project team prior to the actual sales agreement was made. The project manager responsible for operations was appointed as soon as the opportunity to win the project contract was identified and he joined the sales team. The project manager was also part of the sales team in the customer negotiations. In the Kappa and Gamma cases, the project manager responsible for operations was not involved in the project sales team in the sales phase, but the project's technical and commercial details were discussed numerous times among the sales persons and project manager responsible for operations.

Various team structures, group meetings and direct contacts like the ones illustrated above increase mutual understanding related to the definition of the project task (Adler, 1995; Daft & Lengel, 1986; Daft, Lengel, & Trevino, 1987; Daft & Macintosh, 1981; Perrow, 1967). The use of such cross-functional teams and meetings can be explained through the inherent ambiguity of the projects. Ambiguity refers to situations in which tasks are poorly defined and it increases the difficulty of searching for acceptable solutions for a given task (Adler, 1995).

Ambiguity is higher in the project context where solutions are custom solutions as compared to delivery of standard products or services. For standard tasks, sales people can build new quotations

based on old quotations using scaling factors, location adjustment factors, price escalation indexes and so on, on their own. In contrast, organizational units engaged in delivering custom solutions (customized products and/or bundled services) might have “complete” information regarding the client’s high-level project requirements early during the sales phase. However, the detailed requirements and organizational delivery capabilities of the project-based firm are still ambiguous, so that sales people do not just lack information but do not even know what additional information might be needed; and identifying potential persons having the needed information is extremely challenging in a globally distributed, project-based firm with multiple operations units dispersed around the world.

Delivering custom solutions, therefore, requires that sales people have access to detailed technical knowledge about feasibility and manufacturability from operations. Due to the ambiguity, the search for information, however, is challenging and hence, developing mutual understanding with operations by joint discussions and negotiations is required. Ambiguity of the project generally decreases during the project lifecycle, decreasing the integration challenge and the related needs for information processing across functional units (Adler, 1995; Morris, 1982). Hence, information processing needs between sales and operation units due to ambiguity are at their highest at the beginning of the project – that is, during the project sales phase. Therefore, we propose:

Proposition 2: *A high level of ambiguity of the project is associated with greater use of managerial-level cross-functional teams and meetings as integration mechanisms to manage the project sales and project operations interface during the project sales phase.*

In the Gamma case, integration was also managed with formal meetings between the project manager responsible for operations and the project process engineer. The objective of these meetings was to review the final version of the quotation and to make sure that customer

requirements can be met with the available technical capabilities. This was seen as necessary despite the high competence of the quotation engineer and high quality of the quote. The changes made by the project manager responsible for operations and the project process engineer were not due to errors that have occurred earlier in the sales phase. Rather these changes were made because of continuously occurring changes in the solution specification requested by the customer. In addition, all cases used a formal project definition meeting at the end of the sales phase: during the project definition meeting, projects sales and project operations teams got together to discuss issues related to the fit between different parts of the projects.

Our observations from these three projects suggest that the nature of the teams and meetings used to manage the sales and operations interface changes over the course of projects. In the sales phase, and especially at the end of the sales phase, the teams involved managerial-level people (e.g., project managers) and the focus of the teams and meetings was on matching customer requirements vs. delivery capabilities of the firm. During the project execution phase, in contrast, the teams were more technical in nature, involving lower-level technical engineers. The discussion focused on technical interdependencies of the project solution, for which small changes in one part of the project might require significant compensating changes in other parts of the project.

The use of cross-functional teams with both managerial and technical focus can be explained by the complexity of the projects, which is partly related to the project scope. Complexity relates to the number and innovativeness of technical components, their degree of reciprocal interdependency (Levitt et al., 1999), and the number of parties involved in delivering the project. These create information processing needs during the project due to the higher number of interface coordination issues to be solved (Adler, 1995; Lawrence, 1981; Perrow, 1961). During the project sales phase, complexity requires managerial level people (e.g., project managers) to discuss high level customer

requirements and capabilities of the firm to fulfill them and to deliver the project efficiently and effectively. Also due to time pressures that are characteristics of most complex projects, project operations unit needs to have some preliminary understanding of the potential forthcoming task so they can be prepared and can allocate resources before the actual contract is won (Terwiesch et al., 2002). To achieve such information processing across the sales and operations interface, managerial level cross-functional meetings and teams are required. During the project execution phase, in contrast, the focus of managing the sales-operations interface is more on system integration issues. In this phase pooling together each group's understanding of even rather detailed technical data plays a much more significant role, requiring processing of technical information through cross-functional meetings and teams. This explains the change in the nature of the teams and meetings in this phase. Therefore, we propose:

Proposition 3a: *A high level of complexity of the project is associated with greater use of managerial-level cross-functional teams and meetings as integration mechanisms to manage the project sales and project operations interface during the project sales phase.*

Proposition 3b: *A high level of complexity of the project is associated with greater use of technical-level cross-functional teams and meetings as integration mechanisms to manage the project sales and project operations interface during the project execution phase.*

When further analyzing the project execution phase, our findings indicate the use of co-location as a way to integrate project sales and project operations functions. In the case of Gamma, the quotation engineer, project manager responsible for operations, and project process engineer were re-located to the same office for the project execution phase. In the Kappa and Theta cases, the project engineer and project manager responsible for operations were re-located in the same office.

In addition to co-location in the project execution phase, formal mechanisms, especially liaison persons with no formal authority were also used during the project execution phase. In particular, sales managers were assigned as liaison persons during the project execution phase, although they had somewhat different roles in the different cases. In the Kappa case, the project sales unit had a supportive role in commercial issues during the project execution phase, while the project manager responsible for operations took the main responsibility for managing the customer interface. The sales manager, however, acted as a liaison between project sales and project operations to facilitate information processing from project sales to the project manager responsible for operations. Also in the Theta case, the project sales unit was involved in the project execution phase in a supportive role, solving, for example, significant permitting issues, whereas the project manager responsible for operations had the primary responsibility for managing the customer interface. In the Theta case, the project sales manager also acted as a liaison between project sales and project operations. In the Gamma case, the project sales unit had a more active role. The company assigned people responsible for being the direct contact to the customer related to both commercial and technical issues. In this case, the sales manager also served as a liaison person to facilitate information processing regarding operational issues from project operations to project sales.

The use of co-location as a form of facilitating informal contacts and communication between the project sales and project operations in the project execution phase can be explained by dispersion of the functions (Ghemawat, 2001; Orr et al., 2011). Dispersion leads to challenges in information processing due to lack of personal contacts, lack of a forum for informal discussions, and potentially different time zones, which reduces the opportunities for having joint meetings, which can be facilitated by co-locating project sales and operations. In addition, dispersion also leads to lack of common “project identity” (Henisz, Levitt, & Scott, 2012). Co-locating the project sales and operations helps in creating an environment in which everyone feels like working for the same goal

rather than separately under their respective functions (Orr et al., 2011). Moreover, co-location facilitates social exchange, which builds trust and a sense of commonality among the project participants and, thereby, increases sharing of relevant knowledge and information in a timely manner.

The role of the sales manager as a liaison person in the project execution phase in the Gamma case can be explained by dispersion as well (Ghemawat, 2001; Orr & Scott, 2008; Ruuska et al., 2009); dispersion creates barriers between units, leading to a lack of understanding of customer requirements and delivery capabilities, and language barriers. All these increase the need for information processing between the project sales and project operations functions during the project execution phase. During the execution phase, dispersion creates information processing needs especially from the project sales function to the operations function. Such information exchange can be facilitated by assigning a liaison person from the sales function. Therefore, we propose:

Proposition 4a: *A high level of dispersion is associated with greater use of co-location as an integration mechanism to manage the project sales and project operations interface during the project execution phase.*

Proposition 4b: *A high level of dispersion is associated with greater use of liaison roles, such as sales manager, as integration mechanisms to manage the project sales and project operations interface during the project execution phase.*

5. Conclusions

Global projects are a rather new but pervasive phenomenon of today's business environment – yet they are relatively unexplored (Orr et al., 2011). In addition, the general way of organizing firms has changed, requiring fresh perspectives on the fundamentals of organization design (Greenwood & Miller, 2010; Orr et al., 2011). In this paper we have addressed management of global projects

and the challenge of organization design from the perspective of integration of project sales and project operations functions in a global project-based firm. By responding to the call for an interdisciplinary approach to studying the integration of sales and operations functions (e.g., Cooper & Budd, 2007), we have illustrated and elaborated the information processing model (Galbraith, 1973; Levitt et al., 1999; Nadler & Tushman, 1997; Tushman & Nadler, 1978) in the context of a global project-based firm.

Our aim was to address the question of which contextual factors create integration needs and how firms manage the integration of the sales and operations interface in global project-based firms over the course of the projects. We approached this by using the information processing model as our starting point (Galbraith, 1973; Levitt et al., 1999; Nadler & Tushman, 1997; Tushman & Nadler, 1978). We provided empirical observations by presenting data from three case projects within a global project-based firm. We elaborated the model by providing a set of propositions that could explain the observed use of integration mechanisms in the context of our research. As our empirical illustrations indicate, the separation of project responsibilities into project sales and project operations functions creates a critical interface between those functions that needs to be managed.

Our key conclusions based on the elaboration of the information processing framework in the context of global project based firm are as follows. First, integration is managed differently depending on whether the project is in the sales or execution phase. Second, contextual factors can be analyzed to find out potential patters of selecting and using integration mechanisms in different business environments and situations. Moreover, contextual factors are associated with the use of integration mechanisms differently across project phases. Based on our empirical observations as well as elaboration of the information processing model from prior literature, we provided a theoretical framework to explore the use of integration mechanisms in the context of project sales

and operations integration in a global project-based firm. Based on observations from these illustrative cases, we have developed a set of propositions regarding how the use of specific integration mechanisms in different phases might be associated with individual contextual factors. These propositions must be further refined, validated, and generalized through future empirical research.

The paper contributes to the understanding of contemporary organization designs and, especially, to the management of cross-functional integration in a global project-based firm. The context of a global project-based firm allows us to uncover some interesting and important insights for research on cross-functional integration of sales and operations. Due to the temporary nature of projects, project-based firms require more managerial emphasis on integration (e.g., Cooper & Budd, 2007; Cova & Salle, 2005). We provide some empirical illustrations and elaboration of this claim and discuss contextual factors that affect the integration needs. We suggest that the management of cross-functional integration varies across project phases and we present propositions on which contextual factors describe this. This project-phase specificity is an important contribution. It is in line with the general conclusion made in the context of R&D-manufacturing integration in development projects (Adler, 1995; Terwiesch et al., 2002).

However, as our conclusions indicate, contextual factors in the context of global delivery projects (“projects as products”) are associated with the use of integration mechanisms in different ways than in the case of NPDs. For example, our data and the related theoretical discussion suggest that uniqueness is especially associated with the use of liaison roles in contrast to extensive use of cross-functional teams in the context of NPD projects (Adler, 1995). Also, whereas Adler (1995) suggests that in general ambiguity creates information processing needs especially in the later phases of the projects, we conclude that the need for information processing due to ambiguity is higher during the

early project phases, such as the global project's sales phase. This highlights the importance of looking at such projects differently than traditional NPDs as they clearly pose different managerial challenges (Skaates & Tikkanen, 2003).

The findings regarding the importance of various lateral integration mechanisms also contribute to the project management literature. The traditional approach to project management has emphasized the use of vertical mechanisms, such as standardization of processes and various management procedures to ensure a detailed project plan in the beginning of the project which is then to be followed throughout the project (Morris Crawford, Hodgson, Shepherd & Thomas, 2006). As our results indicate, such "Project Management 1.0" mechanisms are important but inadequate to manage the integration challenge fully. Projects delivering custom solutions in today's global environment need to be managed using highly flexible and agile "Project Management 2.0" approaches like the ones described in this paper to accommodate changes in scope, schedule and resources throughout the project (Levitt, 2011). And finally, the paper also contributes to the contingency theory of project management (Morris, 1982; Shenhar & Dvir, 1996) by providing empirical illustrations and detailed insight into how the specific contextual factors affect project management in different phases of the project.

The findings of the paper have implications for research on organization design in general, and for approaches used to achieve integration, more specifically. As Greenwood and Miller (2010, p. 78) recently stated, "we have neglected a vital challenge that should be a core, perhaps even *the* core, concern of organizational theory: understanding the management of collective effort through organization design". The conclusions made in this paper contribute to this discussion by indicating that, despite the importance of early research on organization design at the firm level (e.g., Lawrence & Lorsch, 1967; Mintzberg, 1983), research on organizational designs needs to be

conducted at a more detailed level – such as the project level – to fully understand the related managerial challenges. As our paper suggests, contextual factors associated with the integration needs and the mechanisms used to manage those needs vary not just across projects but even across the phases of a single project. A firm-level of analysis would overlook this conclusion.

This study has some key limitations. The empirical part of the study is illustrative in nature and based on three case studies within a single firm. It does support the study's aims and approach of illustrating general propositions and providing contextualized evidence to set the ground for elaborating an existing high level theory. Moreover, the results provide a way for more focused future empirical research. Overall, there are several interesting avenues for further research. Future research could engage in more data collection based on the propositions presented in this paper and address the phenomenon also in other project-based industries, such as ship building, air plane building, and film-making. This could serve to enhance the validity of the framework and potentially also reveal other factors affecting the integration challenge in the context of global project-based firms. Also project-based firms with more service-focused business models (Kujala, Artto, Aaltonen, & Turkulainen, 2010) could be included to address the potential effect of the service-focused nature on the management of the sales-operations interface. Very interesting, yet empirically rather challenging, would be to assess the use of integration mechanisms in project-based firms and their global projects from an institutional perspective. This would involve assessing whether the integration mechanisms are indeed implemented due to information processing needs versus whether their use is dependent on various institutional forces and institutionalized practices in firms. One way to empirically address the institutional perspective would be by closely observing the actual decision making processes in firms.¹ This kind of research design would employ

¹ The authors would like to thank one of the anonymous reviewers for pointing this out.

ethnographic methods, and it could provide interesting insights into how the decision making process regarding organization designs actually takes place.

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