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# ERP implementation Success, Innovation, and Social Networks: Linking the Tertius iungens Approach to Performance

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## ABSTRACT

ERP system deployments can result in improvements in firm performance through automation, informational, and transformational effects. Nevertheless many implementations are not successful. Employing a social network approach this study investigates the role of the IT unit in exchanging and combining knowledge focusing on the planning phase. Drawing on prior research dealing with social capital and network position this paper investigates the network position of the IT unit using the approaches of tertius gaudens (the third who enjoys) and of tertius iungens (the third who joins) to improve our understanding of why ERP implementations succeed or fail. The model is tested employing a case study in a manufacturing firm of the aerospace industry. It is shown that a tertius iungens orientation may improve the probability of successfully implementing an ERP system.

## Keywords

ERP implementation, tertius iungens, tertius gaudens.

## INTRODUCTION

Past studies indicate that ERP system deployments can result in improvements in firm performance through automation, informational, and transformational effects (Mooney, Gurbaxani and Kraemer, 1996). While ERP implementations are quite common among firms (in particular medium to large firms) with only few exceptions, successful implementations are far rarer (Gattiker and Goodhue, 2005). This is not only due to technical problems but often due to insufficient achievements in terms of reaping business benefits. The latter can be attributed in parts to missing complementary organizational measures and the tendency to handle ERP implementation as a pure technical project.

For example, Pereira (1999) reported the strong complementarity of business process structures, human capital, and the implementation of an ERP system. He points out that in order to take full advantage of an ERP system, a firm has to decide which processes foster a competitive advantage, how to adapt these processes, and how to train the people. Both IS and those business resources must be aligned. The importance of complementarity is also emphasized in a study of computerization (Brynjolfsson and Hitt, 2003). They found that investments in organizational capital complementary to IT may be up to ten times larger than IT investments and take time to unfold their benefits. In the context of ERP usage it was found that due to the experience acquired by the operation of the system, benefits arising from the system's use grow over time (Gattiker and Goodhue, 2005). A survey by CIO Magazine suggests that the majority of firms start to reap benefits from the systems starting from the second year after implementation (Gattiker and Goodhue, 2005).

Thus a combination of IT resources and organizational resources in a way that can achieve those complementarities is important for reaping benefits from an ERP implementation because superior access to and integration of a range of specialized knowledge resources to produce goods and services is the basis for achieving competitive advantages (Grant, 1996). Theory dealing with social networks suggests that network position of an actor such as the IT unit influences both the influx of new knowledge (e.g. knowledge about ways of implementing an ERP) and the integration of different knowledge domains (e.g. the combination of IT and business knowledge to create an IT-enabled business process) (e.g. Burt, 1992; Granovetter, 1973, 1985; Hansen and Kautz, 2005). Nevertheless, there is a need for more research into the effect of network position on performance (Tsai, 2001).

Therefore we formulate following research question:

- **How is the network position of the IT unit connected to successful ERP implementation?**

Drawing on prior research dealing with social capital and network position (e.g. Burt, 1992; Nahapiet and Ghoshal, 1998; Obstfeld, 2005; Tsai, 2001) this paper investigates the network position of the IT unit using the approaches of *tertius gaudens* (the third who enjoys) and of *tertius iungens* (the third who joins) to improve our understanding of why ERP implementations succeed or fail. The model is tested employing a case study in a manufacturing firm of the aerospace industry.

The remainder of the paper is structured as follows: Section 2 deals with the theoretical foundation and is followed by section 3 explaining method and data. Section 4 presents the case and section 5 the study results. Key findings, limitations and future research are summarized and critically discussed within the concluding section 6.

## THEORETICAL FOUNDATION

Social networks can be analyzed by investigating the “behavioral orientation toward connecting people in their social network by either introducing disconnected individuals or facilitating new coordination between connected individuals” (Obstfeld, 2005, p. 100). The first approach is termed *tertius gaudens* and deals with the benefits accruing to a broker from connecting separated networks; the second approach is termed *tertius iungens* and is engaged in densifying social networks.

Thus *tertius iungens* emphasizes the closeness of relationships and focuses on building strong ties to facilitate knowledge flows and knowledge integration which lead to cost-effective operations. On the other hand, *tertius gaudens* deals with bridging structural holes (Burt, 1992) that “provide actors with information benefits in terms of access, timing, and referrals” (Bell and Zaheer, 2007, p. 963) thus focusing more on what Granovetter (1973) calls weak ties.

The *tertius iungens* approach refers to building strong ties. “The strength of a tie is a (probably linear) combination of the amount of time, the emotional intensity, the intimacy (mutual confiding), and the reciprocal services which characterize the tie” (Granovetter, 1973, p. 1361). Correspondingly, a strong tie can be characterized as frequent and direct interaction that is reciprocal and path-dependent. Strong ties provide redundant information as over time the degree of connectedness increases, thus enhancing the probability that different actors are structurally equivalent and have access to similar information (Burt, 1992; Henderson and Venkatraman, 1993; Wasserman and Faust, 1994). Planning or technology committees have been proposed as a way of ensuring that the technical knowledge of the IT staff is optimally utilized to achieve the strategic objectives of the business units (Gordon and Gordon, 2000). Such committees are a possible way of fostering formal interaction in the first place and thereby developing shared domain knowledge over time. Levina and Vaast (2005) found that this is associated with the engagement of agents in a new joint field, through which agents develop a new interest (ability and inclination to participate in negotiating relationships between fields) and transform knowledge. The prerequisite is at least a peripheral understanding of each practice by the agent. To facilitate the integration of knowledge from other domains, what are called architectural patterns addressing the realization of business processes might be an appropriate means, because they promote the reuse of concepts, insights and knowledge and provide a medium for transferring knowledge from one domain to another (Aerts, Goossenaerts, Hammer and Wortmann, 2004).

In contrast, *tertius gaudens* deals with brokering benefits by spanning structural holes and expanding the knowledge network to more extended peers resulting in an exposure to new ideas (Granovetter, 1973; Hansen, 1999). The role of centrality in a structural holes network suggests that benefits accrue from superior access to information, ideas (Burt, 1992), learning and innovation (Tsai, 2001). Thus “distant and infrequent relationships (i.e., weak ties) are efficient for knowledge sharing because they provide access to novel information by bridging otherwise disconnected groups and individuals in an organization” (Hansen, 1999, p. 82). Spanning structural holes involves integrating and coordinating knowledge from many individuals from different disciplines and backgrounds, with varied experiences and expectations, located in different parts of the organization (Peppard and Ward, 2004). This not only involves the combination of different knowledge domains but also of different perspectives on the same knowledge domain.

## METHOD AND DATA

The methodology chosen for this research is a case study which is one form of empirical studies often employed in IS research investigating a phenomenon within its real-life context (Yin, 2003). To achieve the necessary rigor of a study, case studies have to be prepared and carried out thoroughly. In particular, the research question, the propositions and the unit of analysis have to be made explicit during design and preparation (Yin, 2003). The research question employed for the single case study presented in this paper is: How is the network position of the IT unit connected to successful ERP implementation? ‘How’ and ‘why’ questions are identified as appropriate for case studies (Yin, 2003).

For carrying out the case study, case and interview patterns were developed, discussed within the research community, and then tested with two IT managers and two managers of business units which were named as key informants. We developed one semi-structured questionnaire to capture contextual information, e.g about the business process, and one structured

questionnaire employing the indicators and coding schemes (see table 3) as proposed by Obstfeld (2005). After testing, the adapted documents were used for the actual case study interviews (Eisenhardt, 1989; Yin, 2003).

To ensure construct validity we used multiple sources of evidence by carrying-out interviews with key informants and by using observation during meetings. Interviewees included the senior manager of the job planning department, his deputy, and three employees, and from the IT department the senior manager, his deputy, and two specialists. Data were complemented by extensive reports, internal firm documentation, process documentation as contained in the quality management handbook, and academic literature.

The collected data were transcribed within three days of the interviews being completed. The interviewees validated the collected data directly after transcription. These interviews lasted between two and four hours each, and were accompanied by document collection, which mainly served to provide a profound overview of the company's and department's history, and current status.

To ensure internal validity, we used pattern matching (Yin, 2003). As highlighted in the following sections, collected citations were compared with theoretical propositions to indicate if these propositions could be supported or not.

External validity refers to the generalizability of findings. While logical generalizability is possible with case studies, statistical generalizability is not achievable. Nevertheless case studies can be used to reject propositions (Yin, 2003) as they are similar to experiments.

The protocols as well as the results from the case study were cross-validated by the interviewees. This procedure is concordant with the literature in case study methodology (Dubé and Paré, 2003; Eisenhardt, 1989; Lee, 1989; Yin, 2003).

The following section describes the concrete case.

## THE CASE

### Case Setting

We conducted our case study in the aerospace industry and investigated the implementation of an ERP system intended to manage the primary business process of a manufacturer of airplane interiors (e.g. galleys, closets).

Characteristics	Data
Sector	Aerospace
Total assets	200 million €
Employees	1,000
Customers	150 airlines worldwide
Main aircraft producers delivered	Boeing and Airbus
Business characteristics	<ul style="list-style-type: none"> <li>a) End product is typically specific to the customer and to the aircraft for which it is designed.</li> <li>b) Cycle time and delivery performance is an overarching issue</li> <li>c) Growth rates of 25-30% per year</li> <li>d) Pressure for further industrialization of production with low process variance and overall innovation and integration</li> </ul>
Interviewees	Job planning: senior manager of the department, his deputy, and three employees, IT department: senior manager, his deputy, and two specialists

Table 1. Case data

### Process overview

The primary business process deals with the production of galleys. The sum of all galleys dedicated for one aircraft is called a ship set which ranges from about three galleys for single-aisle aircrafts such as Boeing B737 or Airbus A320 up to 21 galleys

for an Airbus A380. The business process evolves in two forms. One is dedicated for prototype ship sets involving heavy engineering work and another is dedicated to follow-on ship sets which are configurations already produced in the past and with, typically, low involvement of engineering.

In this paper we focus on the primary business process, dedicated to follow-on ship sets. This business process covers the activities of receiving an order at sales, job planning, production, and shipping. To support the business process several information systems are deployed. Although there was an ERP system introduced more than ten years ago, it was mainly used to report financial data externally but internally it was merely used as a “type writer”.

The IT support for the business process is both fragmented and poorly integrated. Among other problems, this is reflected in many process disruptions at interfaces between process steps due to a disconnect between IS and business process leading to isolated IS use in different process steps that are widely complemented by manual work.

This status of IT support for the business process together with the pressures on the business due to market requirements led to the decision to introduce an integrated ERP system to achieve predictable delivery performance and short cycle time.

The next section analyzes the ERP implementation process guided by the IT unit using the lens of *tertius gaudens* and *tertius iungens*.

## ANALYSIS AND RESULTS

### Results

Intra-organizational networks in which a specific unit plays a central role may have dense linkages to other units that are best suited for extensive knowledge transfer or sparse linkages that are best suited for achieving non-redundant knowledge.

In our case the IT unit plays a central role by delegation of authority to lead the ERP implementation process. The IT unit has intra-organizational linkages to several business unit, e.g. engineering department and job planning, and also inter-organizational linkages to IT consultants, providers of ERP solutions and peer organizations of other companies.

While the relationship between the IT and business units covers all phases from finding innovative ideas and design via implementation, usage, and adaptation to the disposal of an IT application, the IT planning process is often assumed to be crucial for forging alignment (Bassellier, Benbasat and Reich, 2003; Powell and Dent-Micallef, 1997). In the planning phase projects are started, developed and implemented in turn. Thus the planning phase involves both finding and implementing of innovative ideas. According to the theoretical foundation depicted in the previous section this should involve spanning structural holes as well as a connectionist approach to bring different stakeholders into close interaction.

According to the concept of structural holes, rare ties to other units beyond the focal unit provide superior access to information and opportunities to achieve innovations and to control the communication and information (Burt, 1992). Thus a network where the central player (here: IT unit) is tied to most or all other actors (here: business units and external organizations) but the other actors have only few ties among each other should provide the IT unit with unique resources, different thought worlds (Eisenhardt and Santos, 2002), and novel ideas. Therefore the IT unit should be able to manipulate or exploit these disconnected parties to come up with innovative ideas that would then be attributed to the IT unit.

In our case the ability to efficiently create accurate bills of materials (BOM), purchase orders and work plans out of CAD drawings to guide production is a business critical capability because it determines the supply of material to production and the flow of production steps. Inaccuracies will interrupt production until errors are resolved and thus immediately affect the production outcome.

Previous to the ERP implementation the situation was a fragmented process involving many manual steps. During the process of producing a prototype ship set the engineering department produced all necessary CAD drawings and the corresponding BOM that was complemented by production specifics through job planning. The BOM was entered mostly into the “old” ERP system. In a few other cases it was entered into Excel. Nevertheless lots of data were available in Word documents, Excel files, and in other data bases. This process did not allow for automatic data processing and scheduling of material and work. Therefore the job planning department had to deal with lots of paper work. The job planning task requires minimum of six months on-the-job-training to carry-out the basic tasks and at least two years to be able carrying-out the other tasks. Special BOM treatment requires even more expertise.

Thus a major task was to identify solutions to support the business process with an ERP solution to allow for an automated and integrated solution.

In the planning phase the IT unit strongly rests on

- IT consultants for technical ideas
- peers (IT units of other firms) for examples of business implementations (good practice) and to learn about Do's and Don'ts
- the engineering department for input regarding how to create a BOM satisfying regulation
- job planning for input regarding needed information and possible information sources
- the production and quality department for information required for carry-out work and for possible information sources
- the logistics department for information required for storage and retrieval of material and for the allocation of material to production steps
- the purchasing for information required for guiding and controlling the material flows to and from external suppliers

During the planning phase the network among these units and organizations was classified as sparse. Only the IT unit had ties to all parties relevant for finding an innovative solution, while other units were rather separated. Table 2 depicts the strength of ties (Granovetter, 1973) between the IT unit, the business units and external organizations as assessed by the IT unit at the beginning of the planning phase in a range from "strong", "somewhat strong", "somewhat weak", "weak", and "I prefer to avoid a contact" as proposed by Obstfeld (2005). The values depicted in the cells of table 2 represent the average assessments of all interviewees.

Units	IT unit	IT consultants	Peers	Engineering	Job planning	Production	Quality	Logistics	Purchasing
IT unit	-	Somewhat strong	Somewhat weak	Weak	Strong	Somewhat weak	Somewhat weak	Weak	Somewhat strong
IT consultants		-	N/A	Weak	Somewhat weak	N/A	N/A	N/A	Somewhat weak
Peers			-	N/A	N/A	N/A	N/A	N/A	N/A
Engineering				-	I prefer to avoid a contact	Somewhat weak	Weak	Weak	Weak
Job planning					-	Somewhat strong	Weak	Weak	Somewhat weak
Production						-	Somewhat weak	Weak	Weak
Quality							-	Weak	Somewhat weak
Logistics								-	Somewhat strong
Purchasing									-

**Table 2. Ties between units (initially)**

Given the network situation as depicted above the IT unit clearly is able to play a central role as an information broker and control the information flows within the network. The IT unit also is capable of accessing non-redundant information and achieving information benefits. Nevertheless in an effort to design a viable solution for the company the IT unit initiated the building-up of cross-functional teams to develop a solution backed by the business units. As a central measure an overall process map was designed to cover all major process steps including the data needed and provided by each step to avoid information gaps. The design of a single step that could be attributed to a specific department was then discussed within this specific unit and informed by knowledge acquired from other units or organizations. For example, how to build a work plan was informed by consultant and peer knowledge brought in by the IT unit who also introduced IT consultants in these meetings. Other tasks such as the standardization for the master data affected all units and therefore involved all stakeholders.

In all these steps the IT unit tried to foster collaboration among the stakeholders because it viewed collaboration as important to achieve a buy-in which was expected to increase both the influx of relevant information for the design and implementation phases as well as the willingness to proactively participate in these phases.

Employing indicators as proposed by Obstfeld (2005) we measure the extent of a tertius iungens, or tertius gaudens perspective, respectively. We used a 7-point Likert scale ranging from “fully agree” to “fully disagree” where values towards “fully disagree” represent a tertius gaudens perspective and values towards the opposite direction represent a tertius iungens perspective. The values depicted in the cells of table 3 represent the average assessments of all interviewees of the IT unit. The respective statements per cell are the statements of the senior IT manager. The following table 3 displays the results:

Indicator	IT unit
Introduce people to each other who might have a common strategic work interest	Somewhat agree “Depends on to whom I talk. In some case, in particular engineering and job planning, I strongly suggest to form a cross-functional team for working on BOM issues. In other cases it is waste of time”.
I will try to describe an issue in a way that will appeal to a diverse set of interests	Agree “Planning and then implementing an ERP system essentially affects all units having sometimes quite different interests. My job is to create a viable solution for the firm and thus I need to have the buy-in from the business units which I sometimes only can achieve when I consider the different requirements.”
I see opportunities for collaboration between people	Fully Agree “For example, when I talk to production guys and their needs I hear a lot of things which does not work just because information about the tracking status of material is missing. From this I can infer what other units such as purchasing, logistics, and job planning can do together with production to find a solution.”
I point out the common ground shared by people who have different perspectives on an issue	Agree “This is often a possibility to foster the willingness to find a common solution to a problem.”
I introduce two people when I think they might benefit from becoming acquainted	Somewhat agree “From time to time when I recognize that two people may benefit from exchanging ideas I pass contact data, but I do not check whether they really get in contact.”
I forge connections between different people dealing with a particular issue	Fully agree “It is very important to get different stakeholders at one table discussing different solutions to a challenge. I am very eager to get those people in touch if it is in the interest of the project task.”

**Table 3. Tertius iungens orientation**

What can be inferred from table 3 is an inclination to a tertius iungens approach of the IT unit which reflects the insight of the IT unit that large and complex projects need entire teams to learn to interact, develop routines and create their own culture of interworking to successfully develop and implement large and complex IT projects (Bharadwaj, 2000). Using cross-functional teams and work on process maps as a vehicle, accompanied by the effort of the IT unit to bring stakeholders together which was heavily backed by top management, a closer network was achieved which is reflected in table 4 depicting the result at the beginning of the implementation phase. The values depicted in the cells of table 4 represent the average assessments of all interviewees.

Units	IT unit	IT consultants	Peers	Engineering	Job planning	Production	Quality	Logistics	Purchasing
IT unit	-	Strong	Somewhat weak	Somewhat strong	Strong	Somewhat weak	Weak	Somewhat strong	Somewhat strong
IT consultants	-	-	N/A	Somewhat strong	Strong	Somewhat weak	Weak	Strong	Somewhat strong
Peers			-	N/A	weak	N/A	N/A	N/A	N/A
Engineering				-	Somewhat weak	Somewhat weak	Weak	Weak	Somewhat strong
Job planning					-	Somewhat strong	Weak	Somewhat weak	Somewhat strong
Production						-	Somewhat weak	Somewhat Weak	Weak
Quality							-	Somewhat Weak	Somewhat weak
Logistics								-	Somewhat strong
Purchasing									-

**Table 4. Ties between units**

Table 4 depicts a situation after a 7-month planning phase with stronger ties between IT unit and business units and external organizations and a denser network among the stakeholders in the project. Both provide for more efficient knowledge exchange and combination. The increase in tie strengths was used for commonly finding solutions to problems resulting from badly managed interdependencies between units and sub processes that weren't solvable within a single unit.

Overall the planning phase and the subsequent implementation were assessed as a success by the users of the new system. One business manager reported "Although (we) can think of a better solution, the implemented solution is appropriate". This is also reflected when looking on primary process performance data. Cycle time (measured as cycle time from the start to the end of the job planning activity) decreased from about 19 days to 8 days afterwards due to automation and IT-enabled process reorganization.

## CONCLUSION

Following a tertius iungens approach the IT unit was able to first reap benefits from a sparse network and then transformed this network into a denser one to allow for effective knowledge transfer and integration. Measurable business value could be created by a simultaneous change of IS and business practices through closer inter-working of previously weakly connected units.

According to social network theory the knowledge required to design and develop a complex system resides in different organizational units where strong ties provide the channels for the knowledge flow and increase the probability of sharing information while enhancing the development of a shared understanding (Ray, Barney and Muhanna, 2004; Tiwana, Bharadwaj and Sambamurthy, 2003). In this context, knowledge complexity is determined by the level of codification (fully documented, expressed in writing) and by dependence on other components. Within the depicted scenario, a greater number of strong ties provide an increased flow of knowledge. That is, the IT unit in charge of the ERP implementation project should foster denser network structures to get things implemented. Using the tertius iungens approach with the inclination to bring others together and join a common effort, the IT unit tried to achieve a higher closeness of the whole network consisting of IT unit, business units, IT consultants and peers.

Our study highlights the importance of a tertius iungens approach for successful ERP implementation. It also includes that an ERP implementation is not handled as a pure IT project but as a business project needing support from all stakeholders.



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