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企業資源規劃系統封閉型態的形塑 與演化之個案研究

A Case Study of the Shaping and Evolution of ERP Closures

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摘要

本研究闡述一個建置及使用企業資源規劃系統超過十年的大型組織個案。採用科技的社會形塑觀點，研究體現於企業資源規劃系統的全域結構與區域結構之間的衝突互動。本個案研究發現，企業資源規劃系統的封閉與穩定化是暫時性的。穩定與顛覆是不停的在循環，它顯示在建置與使用大型企業資訊系統時，所謂的「共識型封閉」絕不是如同過去研究所說的那麼簡單。在達成共識之前，會出現不同類型的封閉型態以暫時結束區域結構與全域結構之間的衝突互動。區域結構傾向於主導使用者早期如何從事企業資源規劃系統的運用，而組織在後期轉向企業資源規劃系統的標準結構。於個案中顯示，結構制定與選用兩種技術使用行為同時存在，並隨著時間而有不同程度的顯著性。藉由科技的社會形塑觀點，同時包含行動者衝突互動與脈絡影響，本研究結果能更深入了解暫時性的穩定封閉是如何及何時被打破、改變而再次達到另一個穩定封閉的過程。

關鍵詞：企業資源規劃系統之封閉型態、科技的社會形塑、穩定、顛覆

Abstract

This study reports a case study of a large organization which has implemented and used enterprise resource planning systems (ERP) for more than 10 years. Adopting the view of social shaping of technology (SST) to study the dialectical interplay between the global structures embodied in the ERP and the local structures, the case study finds that the ERP closure is provisional. There is a cycle of stabilization and destabilization. It shows that closure by consensus in the implementation and use of large scale, enterprise-wide information systems is by no means as simple as previous researchers suggested. Our results demonstrate that before reaching a consensus, different types of closure can emerge to temporarily

end the dialectical interplay between the local structures and the global structures. While local practices tend to dominate how users engage with the ERP initially, the organization turns to the standard inscriptions later. Both the behaviors of structure enactment and appropriations are found and have different levels of salience over time. This study provides a better understanding of how, why and when the provisional closure is opened, changed, and re-closed over time from the SST perspective including both actor interplay and contextual influence.

Keywords: ERP Closure, Social Shaping of Technology, Stabilization, Destabilization

1. INTRODUCTION

The relationship between information technology (IT), especially such large scale enterprise systems as Enterprise resource planning (ERP), and social organizations has long been of interest to IS scholars (Orlikowski, 2000). One reason for this lasting interest may be due to the potential of IT in transforming organizations (Henderson & Venkatraman, 1993; Zammuto et al., 2007; Besson & Rowel, 2012). Recently, the prevailing thoughts on this issue tend to shift from a static and deterministic view, i.e., technology shapes organizations, to a dynamic and non-deterministic view (Barley, 1986; Boudreau & Robey, 2005). Underpinning the shift are social theories such as Orlikowski's (2000) practice lens, organizational learning (Robey et al., 2000), and the social shaping of technology (SST) (Williams & Edge, 1996). These social perspectives focus on the nature of technology itself, and how and what forces influence the dynamic interplay between technology and organizations. During ERP implementation, reconciliation of the structural differences and conflicts between ERP and social organizations, though critical, are difficult and costly. Consequently, it is important to understand how to end the controversies occurred during implementation and stabilize the ERP

to make it work (Wagner & Newell, 2006).

One way to make ERP work is to align the software with adopting organizations. The traditional wisdom suggests the adopters treat ERP as a black-boxed closure and adhere to its standards (i.e., a vanilla approach, which implements the package without any modification) (Glass, 1998). Widespread discourses, consultancy, and main stream academic opinions are combined to create a rhetoric closure that portrays the vanilla approach (Davenport, 1998; Glass, 1998; Sumner, 2000; Soh & Sia, 2005). By closure, we mean the end of controversies among various social groups and the stabilization of the ERP technology (Pinch & Bijker, 1984). Organizations are strongly encouraged to modify their structural arrangements to align with the structures inscribed within ERP. Since different social groups tend to define problems and thereby come up with solutions differently, giving rise to quite different artifacts, i.e. interpretative flexibility for solving their problems. As such, ERP closure involves the “disappearance” of problems of social groups as well as the stabilization of the ERP. However, recent ERP studies grounded in social theories questioned the rigidity of the ERP closure (Pozzebon, 2001). These studies have illustrated that the opportunities to open the ERP closure could be occurred at both macro and micro levels (Pozzebon et al., 2006). For example, at the macro level, ERP vendors may cooperate with the leading companies of a specific sector to develop or revise their ERP systems for a better fit with the demands of those companies (Pozzebon, 2001). Soh & Sia (2005) proposed an approach to select, identify, and resolve the misalignments between ERP and adopting organizations. Another window of opportunities for shaping the software is the customization during implementation (Clausen & Koch, 1999). Empirical evidence continues to suggest that even though the same technologies are made available everywhere, local contingencies continue to be the barriers of cultural convergence (see e.g., Davison, 2002; Dery et al., 2006; Elbanna, 2006; Sia & Soh, 2007). As such, one may observe that the bi-directional indeterminism between the global and the local is reflected on the consequent ERP artifacts (Williams, 1997b).

Despite it is well-recognized that an ERP closure is not permanently closed (Wagner & Newell, 2006), studies nevertheless tend to focus on one single phase

of ERP development or implementation, thereby overlooking the gradual alignment and harmonization of organizational practices during ERP implementation, use and maintenance (Williams & Pollock, 2012). With limited research on the evolution of ERP closure, this paper seeks to contribute to the ERP literature by examining the following question: In what ways does ERP closure evolve over time? Although our specific focus is on ERP systems, our results should nevertheless provide insights into the evolution of technological closure in other contexts.

We report a case study of a large business organization which has implemented and used ERP for more than 10 years. With a focus on how ERP closure evolves over time, this study employs the view of social shaping of technology (SST) as the theory base for interpreting the case. The rest of the paper is organized as follows. We first develop the theoretical background for the study, and then explain the research method. We then analyze the case by identifying patterns of social processes that lead to different types of ERP closures. Finally, the implications of the case study are discussed.

2. THEORETICAL FOUNDATIONS

2.1 Shaping and Evolution of ERP

A main stream of ERP studies is process research that seeks to explain ERP implementation outcomes by examining sequences of events over time (Robey et al., 2002). A popular analytic tool in process research is stage models (see e.g. Markus & Tanis, 2000; Baki & Cakar, 2005; Wei et al., 2005), which typically assume the stages follow a necessary sequence such as a life cycle. The assumption of a life cycle model is that ERP systems will follow a development path, moving from a given point of departure toward a subsequent end. Recently, researchers have stressed the importance of ERP post-implementation stage and conducting research over a longer period (Saeed et al., 2010; Williams & Pollock, 2012; Rose & Schlichter, 2013). Factors driving organizational benefits from ERP may vary

from project to project and the important success factors are likely to change over time. Consequently, multi-sites, multi-projects, and multi--timeframes and settings should be the more suitable contexts for studying large-scale enterprise systems and help demonstrate the evolution complexity of the systems (Seddon et al., 2010; Williams & Pollock, 2012; Rose & Schlichter, 2013). However, because not all ERP projects necessarily progress through the same lifecycle stages, Robey et al. (2002) therefore suggests that other theoretical mechanisms should be considered.

Within the stream of process research, the view of SST holds an anti-linear perspective (Lie & Sorensen, 1996; Williams, 1997b). The view denies a clear cut of design, implementation, and use because linear models imply that developers design and produce technology actively, while users are passive receipts of the technology. The concepts of “innofusion” (Fleck, 1993) and “consumption as production” (Lie & Sorensen, 1996) describe the facts that innovation is not limited to design and development but also emerge during their diffusion. As a result, the answer to the inquiry of “*how technology comes to be*” (Latour, 1987) involves at least two sets of shaping dynamics, with one “traditional” design and development dynamic at the sites of technology production and the other re-embedding dynamic at the sites of technology consumption (Orlikowski & Iacono, 2001; Sorensen, 2002). What SST researchers posit is how an ERP system evolves need not follow a predefined path. The direction and form of an ERP system are shaped by a range of political, economic, and social conditions; i.e., it is patterned by the context within which it is developed and used.

Pozzebon (2001) and Pozzebon et al. (2006) identify a multi-level framework denoting contextual and individual spaces and occasions for shaping and reshaping ERP. In other words, the windows of opportunity (Tyre & Orlikowski, 1994) to shape ERP seem to locate at multiple levels. ERP studies tend to focus on “interpretative flexibility,” “closure,” and how a range of contextual forces interacting to influence the ERP technology, its interpretations, and the rhetorical closure over it. For example, Wilson & Howcroft (2002)’s work demonstrates the social nature of information system failure by employing concepts of interpretative flexibility, stabilization, irreversibility, and translation. Yeow & Sia (2008) address the sources of diverse interpretations among reference social groups, and how a

consensus about localized best practices emerges over time through coalitions building, rhetoric, negotiations, and re-inscription. Alvarez (2008) illustrates that the rhetoric, ideologies, and demonstration provided by intermediaries such as ERP vendors and champions strongly shape users' interpretations of the technology. Swan et al. (1999) and Light & Wagner (2006) distinguish between the rhetoric portrayed by ERP vendors and the ERP realities. The rhetoric such as best practice may be detrimental to ERP adopters in terms of implementation and use because it limits their deliberate considerations about what they need, and what the package actually offers. However, ERP parameter configuration alone is not enough to cope with the requirements emerged from user contexts, and customizations are necessary and thereby inevitable (see e.g., Liang & Xue, 2004).

2.2 Closure Mechanisms of ERP

Central to the concepts of consensus, closure, and stabilization is the idea that an agreement over the meanings of a technology among relevant social groups leads to the end of controversies and makes the technology stable. Some ERP studies based on SST seek to extend, clarify, and even challenge the concepts and have illustrated that there may be mechanisms other than consensus that can create a stable socio-technical order. For example, Wagner & Newell (2006) propose that consensus is only one of the mechanisms by which directions of development might be settled. Pozzebon et al. (2006) examine five types of social interactions that can lead to a closure: through loss of interest, through force (coercive), through sound argument, through compromise, and through consensus. Willis & Chiasson (2007) expand the research of closure into a linguistic and discursive level to show how linguistic hegemony, such as best practices, can be a new way to achieve a closure coercively. Similarly, Shepherd et al. (2009) also show how the capabilities of ERP systems and their organizational effects are constructed through language. In sum, in addition to Pinch & Bijker's (1984) original idea that a closure is the result of "consensus" among relevant social groups, there may be other means that can lead to a closure (Russell & Williams, 2002).

Thus, we can see technological development as a closure process during

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which the form of an artifact becomes stabilized as a consensus is established by relevant social groups over what the technology is; what it can and cannot do, and so forth (McLoughlin, 1999). As such, the development of a technology becomes a process in which a number of alternative design options exist due to different meanings are attached by relevant social groups to the technology under design (Pinch & Bijker, 1984). When a closure is achieved among relevant social groups with competing interpretations of the available options, a particular design becomes taken for granted as the essence of the technology (Russell & Williams, 2002). Nevertheless, the same artifact can mean different things to the different social groups of users. Such interpretative flexibility represents the scope for the attribution by different groups of different meanings to an artifact, according to their different backgrounds, purposes, and commitments (Russell & Williams, 2002). It is then important to analyze how interpretative flexibility is reduced, controversies are terminated, and the technology becomes stabilized as these represent how a closure occurs. According to Pinch & Bijker (1984), a closure in technology involves the stabilization of an artifact and the disappearance of problems (p. 426). The key point is whether the relevant social groups see their problems as solved. This can happen in two ways (Bijker, 1995). First, controversies can be terminated through rhetorical closure. In rhetorical closure, the relevant social groups see the problem as resolved (whether it actually is or not). Bijker (1995) calls this *knock-down argument* (p. 86) that ends the controversies among relevant social groups. The second way is through problem redefinition; a closure is achieved “by redefining the key problem with respect to which the artifact should have the meaning of a solution” (p. 46).

To achieve a closure, the development of a technology then involves the building of alliances between various actors. It is critical to analyze the actions and strategies of network builders who create and maintain the network through translating the interests of heterogeneous actors and enrolling allies (both people and technologies). The term heterogeneous actors denotes that there is a range of things that need to be aligned, including work routines, incentive structures, training, technical modules, and organizational roles (Monteiro, 2000). The formation of new socio-technical relationships involves the alignment of an

initially diverse set of actors and interests into the new relationships and networks. A technology is conceived when a relative stable network of aligned interests is created and maintained (Howcroft et al., 2004). The results of the translation process are subsequently inscribed into the technology (Holmstrom & Stalder, 2001). As a result, inscribed in the technology is a form of congealed social relationship which just happens to take a material form (McLoughlin, 1999). Embodied in the technology are the structures and social relationships (the practice, assumptions, beliefs, language and other factors involved in its design and development) that have consequences for subsequent deployment (Howcroft et al., 2004).

As a result, ERP implementation and use involves a process of blending the global and local structures (Giddens, 1990; Sorensen, 2002). A range of options, social forces, and negotiations emerge during the process of embedding the global solutions into the application settings, making the reconciliation of structural differences and conflicts critical (Soh et al., 2000; Soh et al., 2003; Wei et al., 2005; Orlikowski & Yates, 2006; Wang et al., 2006). In the process, there are dialectics between the global and the local (Lie & Sorensen, 1996; Sorensen, 2002; Wagner & Newell, 2004; Silva & Fulk, 2012). By dialectical interplays, colliding forces or contradictory values compete with each other for domination or control (Van De Ven & Poole, 1995). Moreover, closure and stabilization have been found to be relative and temporary: conflicts and controversies can reopen and new changes can arise (Russell & Williams, 2002). The continuous battle between competing social groups who attribute different meanings to a technology makes stabilization and closure essentially provisional (Pozzebon et al., 2006) and sometimes leads to technological drifts (Ciborra & Hanseth, 2000). For example, key actors may allow a certain degree of technology customizations to satisfy the specific requirements of potential users. Thus, the influence of inscription on subsequent use is by no means deterministic. The interests of actors may also shift; newly enrolled actors may pose new problems as they interact with others in the network.

While previous studies employing SST have established a base for capturing more fine-grained influences surrounding ERP implementation, we still only have limited understanding of the factors that may affect the evolution of ERP in

organizations. With many and possibly radical technological and organizational changes involved, study of the ERP use in organizations should span extended time frames including initiation, procurement, implementation, use, maintenance, and subsequent review as a complete adoption cycle. Most studies however focus only on implementation and therefore are limited in assessing longer-term outcomes of innovation episodes (Williams & Pollock, 2012). A better understanding of the evolution of ERP closures can be developed by addressing the socio-technical relations over time and space, as the approach taken by this study.

2.3 Theoretical Framework

Based on the SST, this study attempts to understand the processes through which various ERP closure are achieved and opened. To attain such an objective, an integrated SST approach that opens a technology black box from “both inside and outside” is adopted (McLoughlin, 1999). In fact, the SST view insists that the black box of technology should be opened up for social analysis (Bijker & Law, 1992). One can open the black box and get inside to follow actors as they engage in the shaping of technology (Latour, 1987). This approach is labeled by McLoughlin (1999) as *inside the black box*, which starts from technology and works outward to show the social content of a particular technological development (p. 89). The other approach, labeled as *outside the black box* (McLoughlin, 1999), starts from social contexts and works inward to show how broader socio-economic factors shape the origins and development of technology. Consistent with the traditional classification of *micro* versus *macro* SST studies (Mackay & Gillespie, 1992), this distinction is particular useful in providing an overall picture of the SST because the SST has been seen as fruitful on examining the *content* of technology and offers an exploration of particular *processes* and *contexts* that frame the technological innovation (Howcroft et al., 2004). While inside the black box is the more local-oriented approach (Howcroft et al., 2004), which focuses on the interpretations, actions and strategies of actors involved, outside the black box is the approach of social shaping characterized by meta-narratives (Howcroft et al., 2004). For example, Howcroft & Light (2010) investigate how the different

perceptions of technological problems and solutions from relevant social groups shape the packaged software selection process and understand the influences of power in this context. Pozzebon & Pinsonneault (2012) combine both the possession and practice views to understand how the interplay between power and knowledge influence ERP projects. Dhillon et al. (2011) evaluate the relationships between individual intentions and organizational power during ERP implementation.

Overall, the SST offers the following analytical advantages: (1) it stresses the controversies, tensions, and contradictions rose in the dialectical confrontation between the local practices and the global solutions (Williams, 1997a); (2) the recent SST developments tend to blend the once distinct strands of the SST, allowing an integrated perspective that considers both the actor interplays and contextual influence as a whole; and (3) the SST holds a non-deterministic position to the dialectical interplay, emphasizing that there are choices in the technology implementation and use (Clausen & Koch, 1999). By adopting the SST as the conceptual and theoretical foundation, this study analyzes the dialectical interplays between the global solutions (ERP) and the local practices with three essential elements of the SST: actors, processes, and contexts. The research framework is depicted in Figure 1. The global structures refer to a set of practices, assumptions, values, and rules, reflecting the requirements of this social context and the vendor's choices at the design stage (Wang et al., 2006). In the same vein, the local structures refer to a set of practices, assumptions, values, and rules, reflecting the ERP adopter's business beliefs about how things ought to be done. A dialectical interplay emerges as the global structures confront with the local ones. As a result, the research focus is on the contradictions, controversies, and tensions emerged from the dialectical interplay. The outcomes of the dialectical interplay include a new socio-technical order and the resulting ERP closure.

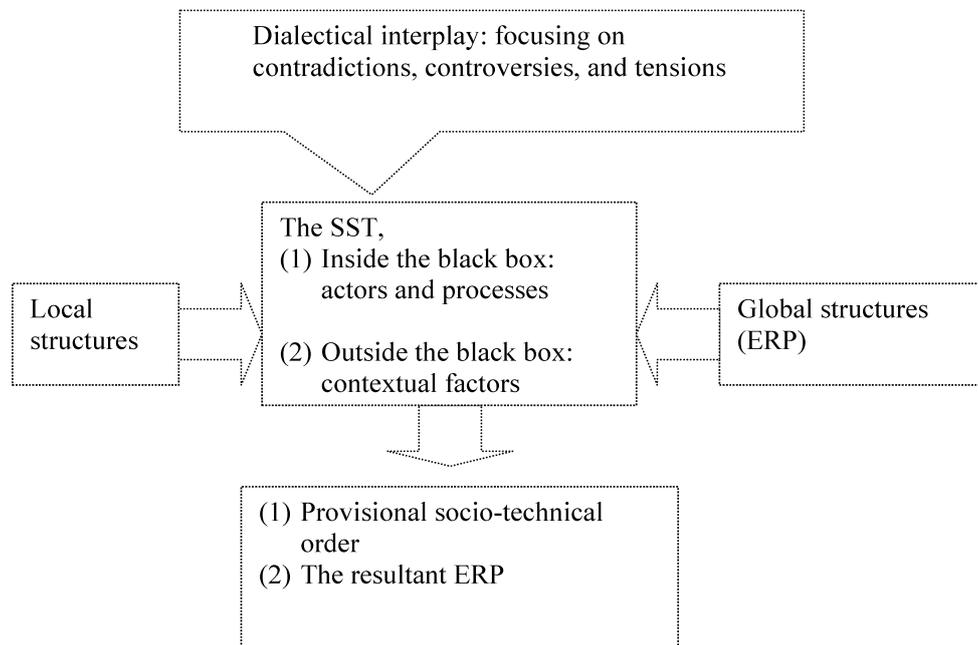


Figure 1 The Research Framework

Data source: this research

3. RESEARCH METHOD

3.1 Research Design and Case Selection

As the research purpose is to explore the dialectical interplay between the global solution (ERP) and the local structures for understanding the evolution of ERP closure, this study conducted an in-depth case study with the interpretive approach since interpretive research can help IS researchers understand human thoughts and actions in social and organizational contexts (Klein & Myers, 1999). Interpretive research attempts to understand phenomena through accessing the meanings that participants assigned to them (Orlikowski & Baroudi, 1991). Also, it does not predefine dependent and independent variables, but focuses on the complexity of human sense making as the situation emerges (Klein & Myers,

1999). To reconsider the relationship between structure enactment and structure appropriations from the SST perspective over an extended period of time, the research has been characteristically built on the basis of interpretive case study with detailed qualitative analysis (Russell & Williams, 2002).

The site selection is based on the purpose of this study. First, because the dialectical view of SST focuses on the relationship between the global solutions (the SAP-ERP in this case) and the local practices, the case should be able to demonstrate the negotiating process and neither just accept the vanilla approach nor perform customization too extensively. Second, for studying the evolution of ERP by including the important times and spaces, we need to find a company that had adopted ERP with a complete cycle. Also, it should not be a single site implementation. Consequently, the study was carried out in a large multinational company (ChipFoundry - a pseudonym), which first purchased SAP-ERP in 1998.

3.2 Data Collection and Analysis

The interview of various key personnel was chosen as the primary data collection method. Among others, both open-ended and semi-structured interviews were used to collect data from 18 members of ChipFoundry. Open-ended interviews allowed interviewees to speak freely on what they thought and felt about the ERP implementation and use, controversies and interactions among IT, users, local practices, and the SAP-ERP. Semi-structured interviews involved asking questions from a pre-planned protocol (Yin, 2003). However, it was noteworthy that interviews were not limited to the questions listed. Questions were flexibly added during interviews in order to clarify and enrich empirical evidence.

As for the solicitation of interviewees, the SST suggested that social actors should not be predefined by researchers but to “ask the actors themselves” (McLoughlin, 1999). Consequently, a snowball sampling approach was adopted to solicit interviewees. Through contact with the IT deputy director Asali, access to the ERP department of ChipFoundry was granted. The first interview was then held with the ERP department head. Through the reference of the ERP department head, interviews were allowed to three senior ERP managers knowledgeable and

responsible for the SAP-ERP implementation and maintenance. With the help of the ERP managers, key users and two central planning managers were identified. As Table 1 shows, interviews were held with different roles at different levels (e.g., directors, department heads, managers, assistant managers, and users) and functions (e.g., accounting, central planning, operation support, and IT). The informants from IT include deputy director, ERP department head, ERP managers, and e-business department head. The informants from ERP user departments include (1) accounting director, managers, and administrator; (2) assistant managers of import/export, bonded management, and purchase management; (3) managers of central planning. Totally 26 interviews were held, with an average duration of 1.2 hours. The seniority of the interviewees working for ChipFoundry was 12.5 years on average, allowing the trace of who were involved and how the SAP-ERP was implemented, rolled out overseas, and used under what circumstances.

Adopting both views of “inside and outside the black box” (see Figure 1), this thesis compiled an interview protocol focusing on both actors’ interplay and contextual influence (McLoughlin, 1999). All interviews were taped and transcribed to preserve details of language use (Davidson, 2002). As Darke et al. (1998) suggest that data should be collected in various ways, a review of documentary evidence provided by ChipFoundry was also used to help contextualize and verify the interview responses. Such sources included proposals, evaluation reports, meeting minutes, and review materials. The data analysis took place in two steps: narrative analysis, to recreate the history line of ERP adoption and to identify SST elements including actors, contextual factors, etc.; and visual mapping to visually represent the global/local negotiation based on the research framework. After each interview, a preliminary analysis was carried out to select critical moments and to reconstruct the chain of events. The visual mapping was used to represent both inside and outside the blackbox factors and processes that focus on the contradictions, controversies, and tensions between the global and local structures.

Table 1 Interviews, Interviewees, and Interviewees' Seniority in ChipFoundry

Division	Position	Name (pseudonym)	Number	Interviews	Seniority (years)
IT	Deputy director	Asali	1	2	10
	ERP department head	Tom	1	1	12.5
	ERP manager	Joan and Angela	2	Joan (1), Angela (3)	Joan (12), Angela (19)
	ERP technical manager	Susan	1	3	19.5
	E-business department head	Joseph	1	1	13
Accounting	Director	Lam	1	1	13
	Manager	Amy	1	1	5
	Audit manager	Gina	1	2	10
	Assistant manager	Isabella	1	2	11
	Principal administrator	Lila	1	1	5
Operation support	Import/export assistant manager	Mia	1	1	10
	Bonded management assistant manager	Emily	1	1	17
	Purchase assistant manager	Paul	1	1	11
	Purchase manager	Kennedy	1	1	15
Central planning	Manager	Kim and Jack	2	Kim (2), Jack (1)	Kim (15), Jack (11)
Human resource	Principal administrator	Michelle	1	1	17
			Total: 18	Total: 26 Duration: 1.2 (hr)	Average: 12.5

Data source: this research

4. RESULTS

ChipFoundry was originally founded in 1980 as Taiwan’s first semiconductor integrated device manufacturer (IDM). In January 2008, when the field work began, ChipFoundry had over 13,000 employees worldwide and subsidiaries in Taiwan, Japan, Singapore, Holland, and the United States. ChipFoundry began the transformation into a pure-play wafer foundry in the middle of 1995. Its position as the foundry industry technology leader had been a major contributing factor to its rapid growth. ChipFoundry now is one of the world-leading semiconductor foundries specializing in contract manufacturing of customer designed integrated circuits (IC) for high performance semiconductor applications.

In 1998, the SAP-ERP was chosen as one of ChipFoundry’s enterprise applications. ChipFoundry employed an incremental implementation approach with four tactics: implementing one or two sites at a time, forming core teams, hiring consultants, and limiting the number of modules implemented. Aiew of the SAP modules implemented is given in Table 2.

Table 2 A Global View of SAP Modules Implemented

	Taiwan	Singapore	Japan	USA	Holland
SAP	FI	FI	FI	FI	FI
Modules	CO	CO	CO	CO	CO
	MM	MM	MM		
Note: FI (finance), CO (control), MM (material management)					

Data source: this research

The deployment of ERP in ChipFoundry was a dynamic process characterized by temporal stability and change for over 10 years. Different social actors internal or external to the organization, technologies, and contextual factors interacted to establish and re-establish temporal socio-technical orders that shaped the ERP. This analysis highlighted four episodes. The episodes were identified chronologically by critical events that entailed a new round of dialectical interplay between the local structures and the global technology (ERP). Transition to a new episode was evident in changes in the ERP closure. Table 3 provides a summary of all the key

events in the episodes.

Table 3 Key Events in the Four Episodes of ChipFoundry ERP Evolution

Episode 1	Purchase without implementation	Key actors	Closure	Contextual shaping
E1	Ricky was recruited			
E2	Purchased the SAP-ERP	Ricky (CFO)		Economic prosperity; mimic isomorphism
E3	Ricky quitted			
E4	In-house development of sales order management	Various	Closure by loss of interest	
Episode 2	Financial accounting focused implementation			
E5	Five companies consolidation			
E6	<ul style="list-style-type: none"> ■ Gin (accounting director) proposed to implement SAP FI CO. ■ Bela, Bob and Alex were enrolled 	Gin, Bela, Bob, and Alex (four directors)		Five companies consolidation
E7	Setup the ERP core team			
E8	Consultant on-site			
E9	Module selection	The ERP core team and external consultants		
E10	Enrolling users by allowing local structure reproduction	The ERP core team, external consultants, and users, the SAP-ERP, legacy systems		Strong user-orientation
E11	System go-live	The ERP core team, external consultants, and users	Closure by Compromise	

Data source: this research

Table 3 Key Events in the Four Episodes of ChipFoundry ERP Evolution (Continued)

Episode 3 International rollout			
E12	Lam (accounting director) proposed to rollout internationally	Lam, Bela, Bob, and Chi (four directors)	
E13	Dis-embedding and re-embedding	The ERP core team, ERP consultants, users	<ul style="list-style-type: none"> ■ Corporation's centralization on financial accounting ■ Subsidiary's local regulations and norms
E14	Rollout successfully	The ERP core team, ERP consultants, users	Closure by force
Episode 4 Closure reverse			
E15	Reflection on efficiency burdens	Accounting directors, users, ERP staffs	
E16	SAP's threat		
E17	Setup a team for assuring standards were followed	Accounting directors, principal users, ERP staffs	
E18	SAP upgrade	ERP consultants, SAP, users, ERP staffs	Closure by Vendor's threat consensus
E19	SAP module extension	Accounting, ERP department	Closure by Economic depression consensus

Data source: this research

4.1 Episode One: The Purchase of SAP-ERP without Implementation (1998 - 2000)

At least two actor-networks competed with each other in this period. The first one was formed by Ricky. In the December of 1997, Ricky, the former CFO of SemiconFoundry (a pseudonym), was recruited by ChipFoundry for his outstanding achievement in SemiconFoundry, the major rival of ChipFoundry in the world market. Ricky was distinguished not only for his finance management performance, but also for his successful achievement of implementing the SAP-ERP in SemiconFoundry. The major competitor of ChipFoundry adopted the SAP-ERP in 1996, and finished the implementation of selected modules (FI, CO, MM) in January, 1998.

Ricky soon decided to introduce the SAP-ERP in ChipFoundry, with an even stronger intention to implement all the core modules. A suite purchase of the SAP-ERP took place in the March of 1998, when most of the information systems of ChipFoundry had been developed in-house. The initial decision to adopt the SAP-ERP seemed to reflect Ricky's ambition to reproduce his previous success at SemiconFoundry. As noted by the purchase assistant manager, Paul, who was a core team member of the SAP-ERP implementation in year 2000:

The decision of purchasing the SAP-ERP was made by the former CFO Ricky, who was recruited from our major rival, SemiconFoundry. You knew that SemiconFoundry adopted and implemented the same technology as well (Paul, assistant purchase manager).

However, the SAP-ERP actor-network seemed reversible because the technology was not seen as indispensable (Callon, 1986). The consensus to deploy the SAP-ERP suite was weak because the decision to purchase the SAP-ERP was made mainly by the CFO, Ricky. The rationale to purchase the SAP-ERP, i.e., what the enterprise technology was and what it could do, remained unknown to other relevant social groups. As noted by the three senior ERP managers (i.e. Susan, Angela, and Joan) regarding the purchase decision of SAP-ERP, all of them mentioned that the decision was made somewhere out of the ERP department. There was no discourse held to seek common goals about the SAP-ERP

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deployment in their department at all. Social negotiations needed to reach a closure on deploying the SAP-ERP were far less than needed at least in, for example, two key social groups: IT division and operation support division. Senior managers in these two divisions were simply told that the company had bought the SAP-ERP software and license. As Susan put:

Well, I did not see any implementation plan and roadmap here. We just knew that the large package was purchased. No formal evaluation, introduction, or even demonstrations were held for the ERP department (Susan, the senior ERP technical manager).

When analyzing from a broader contextual view, economic conditions and how the organization positioned information technologies were influential to the blind buying of the SAP-ERP in 1998 (Lacity & Hirschheim, 1993). In the industry of foundry business, two Taiwan-based rivals (ChipFoundry and SemiconFoundry) dominated the worldwide market and competed with each other in every aspect of the business operations and market performance. Under the competing pressure and economic prosperity due to the knowledge economy and de-integration of semiconductor industry, very often, IT projects in ChipFoundry were initiated under the conditions of (1) plenty of finance and human resource support; and (2) new information technologies and their implementations were seen as innovation, and thus, were encouraged and enjoyed high autonomy in project accomplishment. As Tom, the department head of ERP, put:

What we sought was not a solution to problems, but a bandwagon. We bought so many expensive, fashionable IT platforms and tools for IT projects in the booming period (Tom, the ERP department head).

Thus, the SAP-ERP was purchased and licensed without deliberate evaluations and rollout planning.

However, Ricky quitted from ChipFoundry in the May of 1998, three months after the SAP-ERP purchase. The SAP-ERP suite was put in the drawer after Ricky's departure. Until year 2000, the SAP-ERP had virtually disappeared from ChipFoundry. It thus exerted no influence on the local practices at all. Rather, the

other competing actor-network consisted of users, business managers, IT managers and staffs, and homegrown applications that embodied local and cultural practices won out. A set of homegrown legacy systems written in SQL Fox Pro continued to support the business operations of ChipFoundry in a fragmented and dis-integrated manner. Also, a new homegrown sales order management (SOM), which was the counterpart of SAP SD (sales and distribution), was under construction from 1999 in a subsidiary of ChipFoundry about one year after the purchase of the SAP-ERP suite. The vision of SOM was to build a custom-made and flexible sales order management system that inscribed the foundry business models. The rhetoric foundry business models and custom-made with flexibility to change seemed to attract attention and obtain support effectively from diverse stakeholders in contrast to the global solutions in this period when autonomy was emphasized both in the subsidiaries and the IT division.

In sum, as illustrated in Figure 2, the first round of dialectical interplay began in year 1998 and was triggered by the purchase of the SAP-ERP. However, the airborne CFO failed to establish a stable alliance for implementing the SAP-ERP. He quitted suddenly after three months of the SAP-ERP purchase. As a result, the network was reversed. Homegrown applications and the local practices dominated in this episode. As for the social actors involved, Ricky seemed to be the only key network builder. The alignment of other relevant social groups such as the IT-ERP was poor since the senior managers interviewed felt that the decision to purchase and implement the SAP-ERP was made without the involvement of their departments. On the other hand, homegrown applications involved various network builders from relevant departments. Its discourse related to flexibility to change and foundry business model, therefore, dominated during this period.

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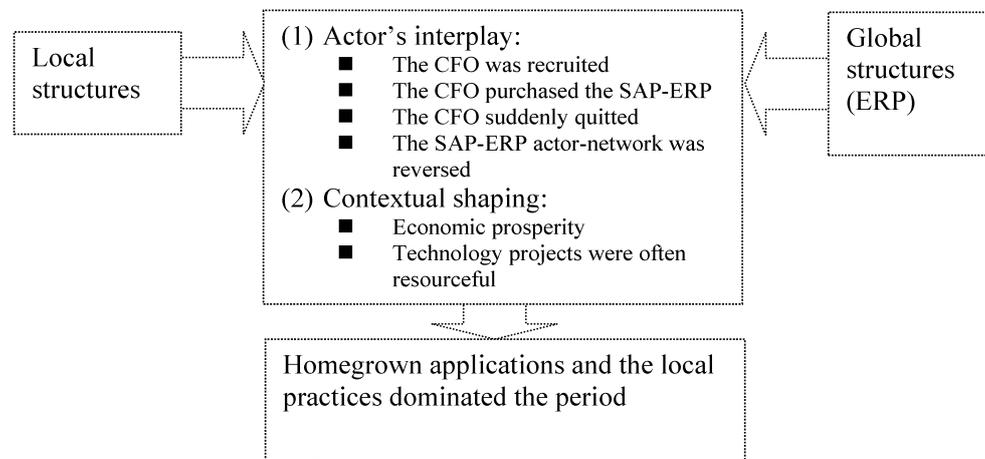


Figure 2 Episode One (1998-2000): The Domination of the Local Practices

Data source: this research

4.2. Episode Two: A Financial Accounting Focused Implementation (2000 - 2001)

4.2.1 The contextual change and the emergence of social alliance for the SAP-ERP

In January 2000, ChipFoundry intensified the competition with SemiconFoundry through a strategic move to increase the economies of scale of its wafer foundries. It completed the consolidation of five semiconductor manufacturing companies: three joint ventures and one acquisition. The number of employees worldwide suddenly rose from less than 3,000 to over 10,000. The consolidation also entailed significant organizational restructure. Several new corporate divisions were set up for merging and running the corresponding functions of merged companies. The once separated organizations and functions were unified. For example, all the CIM (computer integrated manufacturing) departments and the MIS departments of the merged companies all reported to Alex (the CIO, a newly created VP position).

The explosive growth in organizational scale brought about huge information processing requirements with which existed organizational processes and information systems could not cope. As a result of such contextual conditions, a

social alliance portraying the implementation of the SAP-ERP had emerged. The accounting director, Gin, raised the urgent need for the SAP-ERP. Four division directors (IT, central planning, accounting, operation support) soon formed the ERP implementation steering committee and decided to initiate the SAP-ERP implementation project in March 2000.

4.2.2 Stabilization processes

The alliance portraying the SAP-ERP implementation among the four corporation directors was stable and strong. In terms of actors' interplay, monetary resources and power (accounting director, Gin, as the project sponsor and a direct subordinate to the chairman), ambitions to do something and increase her visibility in the organization (IT Alex), division mission (central planning, Bela), and effective persuasion (operation support, Bob) all contributed to the alignment of the actor-network for the SAP-ERP implementation. As a result, the SAP-ERP was enrolled again to the newly formed actor-network. This time, the established closure of homegrown applications was destabilized. The social alliance of the four high level directors decided to "replace" the SQL Fox Pro legacy systems with the global technology (SAP-ERP) as soon as possible.

The stabilization process mainly comprised of three sub-processes: (1) a process of module selection that sought to define the project scope and to minimize the structural conflicts between the structures embodied in the SAP-ERP (the global) and ChipFoundry's local structures (the local); and (2) a dialectical implementation process that the global and the local competed with each other for domination; and (3) managerial support and the formation of ERP core team.

In seeking to "replace" the SQL Fox Pro-based legacy systems, one important tactic ChipFoundry employed was to narrow the destabilized portions of the established closure through SAP-ERP module selection. The four divisions performed a swift module selection for the SAP-ERP: SAP FI, CO, and MM modules were adopted. Accounting director, Gin as the sponsor of the project, made the project financial accounting focused: SAP FI and CO modules were included as requested by the accounting division. SAP MM was adopted due to (1) the consideration of operational interdependence; and (2) material management being one of the functions within the scope of operation support division (the

director Bob was in the alliance). SAP-ERP modules other than FI, CO, and MM were excluded because they were out of the business scope of the four aligned division directors. As put by a central planning manager (Kim): “*We dropped a module if we could not find solid business owners.*” Also, some modules within the business scope of the four functional divisions were excluded because they did not fit with the foundry business. For example, SAP PP (production planning) was strongly related to the central planning division. But it was considered not flexible enough for foundry production. ChipFoundry tended to adopt the modules that their extents of misalignment were acceptable. Misalignment problems led the social alliance to decide implementing only selected modules for avoiding unnecessary process changes and too many customizations. Modules that would induce too many contradictions, controversies and tensions were ruled out.

Another sub-process that contributed to the closure and stabilization was to obtain an agreement among and support from diverse users by allowing a certain level of reproduction of the local practices into the SAP-ERP. However, the degrees of reproduction seemed to be the results of the dialectical interplay between the embodied structures and the local practices under the context of the historical IT-User relationship in ChipFoundry. At the beginning of implementation, a two-week off-site intensive training was given to the ERP core team. However, the effectiveness of training provided by the SAP Taiwan was not satisfactory. After the initial training, SAP-ERP consultants were on site. It was the intensive co-work that the two parties (i.e., the SAP-ERP consultants and the client) began to improve the understanding of what the package could do, and how the company did their business. This co-work identified structure contradictions and differences between the package and the organization. The gap analysis revealed that the choices provided by standard software configuration alone were not enough to resolve the gaps. Three types of structural gaps were identified: (1) non-negotiable local contingencies such as regulations and taxation rules that the SAP-ERP did not have the corresponding design, and thus required customizations; (2) negotiable structures that had some overlapping between the global and the local; and (3) “socially” non-negotiable structures; i.e., any change to these embodied structures would induce extraordinary efforts and costs. Most gaps belonged to the negotiable type. With the strongly user-oriented culture, users’ voices were often louder than the IT division when engaging in negotiations for resolving the gaps. The

consultants were also lacked experiences in foundry industries since there were very few wafer foundry firms worldwide. As a result, in order to obtain agreement and support from diverse users (e.g., accounting, purchase, import/export, warehouse, and planning), ChipFoundry IT staffs and the SAP-ERP consultants allowed users to reproduce most of the local structures into the SAP-ERP through configurations, bolt-on, add-on, and extended reporting.

Managerial support remained as a key factor influencing ERP implementation success (see e.g. Ettlíe et al., 2005). The ERP steering committee, constituted by the four senior managers, served as an active cross-functional coordination mechanism. The committee played not only the symbolic role portraying the SAP-ERP implementation, but these managers did actively involve in shaping cross-functional operation flows. For example, the company used to have duplicated material masters for different functional departments. The members of the ERP steering committee redesigned the maintenance responsibility of the unified material master. Also, the formation of the SAP-ERP core team and the hiring of external SAP-ERP consultants both contributed to the SAP-ERP stabilization. The company staffed the core team with respected business and technology managers and principal staffs, thus providing needed business and technical expertise. Moreover, the team was free from their routine jobs and fully devoted to the SAP-ERP project. With resourceful support from senior management, SAP-ERP consultants were hired to be on site during the implementation period to co-work with the core team. The consultants had the generic knowledge of the global technology, whereas the business users had the knowledge of the local practices. These two types of knowledge were blended to result in the final ERP. While the external SAP-ERP consultants articulated and facilitated the understanding of the embodied solutions, the business personnel articulated the local practices. As mentioned earlier, the two parties worked to identify and resolve the gaps or structural conflicts between the package and the organization. The process of bridging the global solutions and the local practices actually unfolded as a series of negotiations back and forth. As Paul, one of the core team member, put:

To persuade colleagues was the most difficult mission. We identified and reconciled the conflicts through co-working with the consultants. However, when we brought the solutions back to the department, my colleagues often

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challenged the solutions or even raised new issues. We had to go back and forth; sometimes even escalated the issues to the ERP steering committee for the final resolution (Paul, assistant purchase manager, who was one member of the core team).

As illustrated in Figure 3, the second round of dialectical interplay was stimulated by the companies' consolidation and the establishment of a stable social alliance for implementing the SAP-ERP. The number of ChipFoundry's employees increased explosively from less than 3,000 to over 10,000 through consolidating the five semiconductor companies in year 2000. This contextual event induced the need of enterprise integration. As a result, the stable social alliance portraying the implementation of the SAP-ERP had emerged.

The resultant technological artifact was a hybrid ERP that blended the global and the local. The social actors involved in the interplay between the global and the local included the ERP core team, the ERP staffs, the ERP steering committee, the users of the four divisions, and the external ERP consultants. It was noteworthy that the technology mediation role played by the external consultants was consistent with prior studies (see e.g. Orlikowski et al., 1995; Pozzebon & Pinsonneault, 2005). They had the generic knowledge of the global technology, whereas the business users had the knowledge of the local practices. These two types of knowledge were blended to result in the final closure.

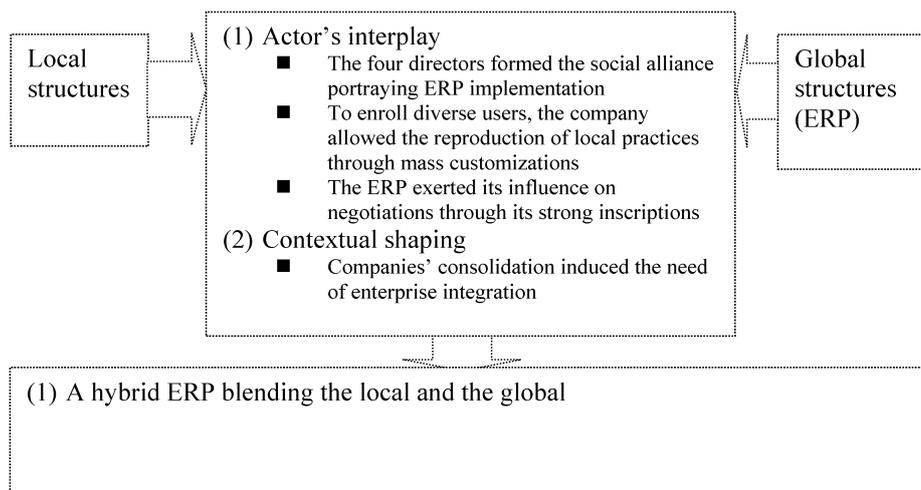


Figure 3 Episode Two (2000-2001): The Emergence of the Hybrid ERP

Data source: this research

4.3 Episode Three: Closure Derivation - An International Rollout (2003 - 2006)

The worldwide unification of accounting processes and platform consolidation began on year 2003. Lam, who was the former department head of accounting in ChipFoundry Japan, was appointed as the new accounting director of ChipFoundry in year 2003. The worldwide accounting process unification and platform consolidation was one portion of Lam's visions. Since all the accounting departments worldwide reported to Lam, the acceptance of the SAP-ERP closure was demanded. All overseas subsidiaries were the target sites including ChipFoundry Holland, ChipFoundry USA, ChipFoundry Singapore, and ChipFoundry Japan. Again, Lam enrolled the IT director (Chi, a new CIO), the central planning director (Bela), and the operation support director (Bob) to engage in the international rollout. While these senior managers again formed the ERP steering committee and the ERP core team, they did not employ any full-time external ERP consultant this time because they believed that the ERP core team and the ERP department of ChipFoundry had learned enough from previous implementation and operations. Instead, the consultant services were bought on an hourly basis.

The policy was to roll out the established SAP-ERP of ChipFoundry Taiwan to the overseas subsidiaries. Under this policy, local customization was discouraged because the established closure was seen as the ChipFoundry standard. However, the resultant overseas SAP-ERP was actually a derivation of the headquarters' SAP-ERP because of the contextual differences between ChipFoundry Taiwan and overseas subsidiaries. A gap analysis was again performed to see where the gaps located and focused the efforts on eliminating the gaps. As a result of the dialectical structure interplay, the degrees of derivations depended on four factors: (1) the business scopes of the overseas sites; (2) the non-negotiable local contingencies of the overseas sites; (3) customizations that were specific to ChipFoundry Taiwan; and (4) how many local employees were rotated and transferred from ChipFoundry Taiwan. The business scope of the subsidiaries largely determined which SAP-ERP modules were to be implemented. While all the subsidiaries implemented SAP FI and CO, those subsidiaries that did not have fabs excluded SAP MM since there was no material handling requirements. Furthermore, the non-negotiable local

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structures such as local regulations and taxation rules in the Holland and the USA subsidiaries were resolved by the built-in configurable options. Another lesson learned from the international rollout was that too many localized customizations could make a package difficult to be transferred from one site to another. The final factor influencing the extent of the derivation is related to the rotations of employees. In Singapore, the USA, and Holland, for example, most senior employees were transferred from Taiwan. The closure stabilization was easier because the employees were familiar with the structures of the headquarters.

In sum, the overseas SAP-ERP closure could be seen as derivations of the headquarters closure. Figure 4 illustrated how the social actors/forces interacted to produce the overseas SAP-ERP closure that actually was the derivation of the one in Taiwan.

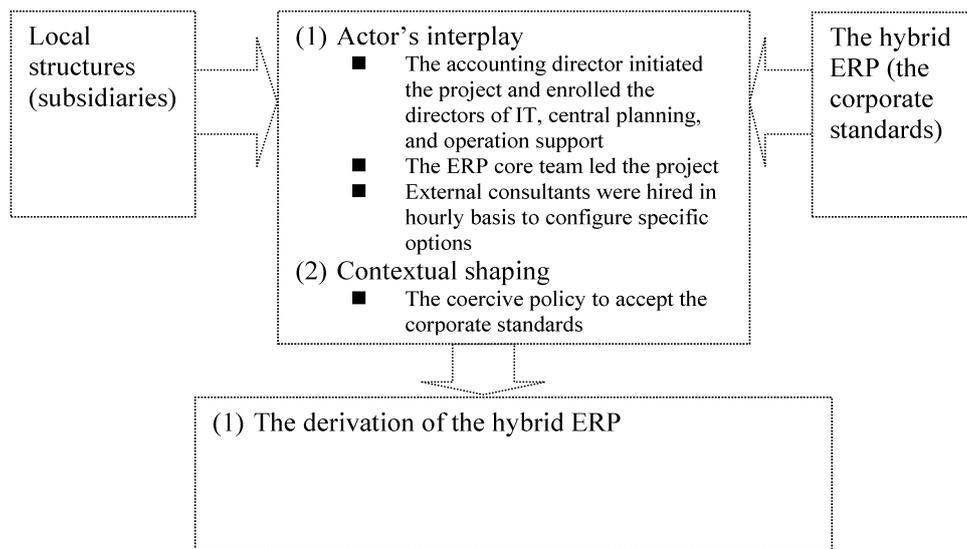


Figure 4 Episode Three (2003-2006): The Closure Derivation

Data source: this research

4.4 Episode Four: Closure Reversed (2007 - 2008)

Customizations can improve the fitness between the ERP and a company, but too many customizations often hinder process integration and data consistency, leading to efficiency burdens. Three sources of efficiency burdens were identified

in this episode. First, the strategy of porting the old systems that once contributed to obtain user agreement during the SAP-ERP implementation became one source of the efficiency loss. Another source of efficiency burdens was the ignorance of the SAP intended use (i.e., the designed intensions and patterns of use). For example, ChipFoundry tended to borrow candidate fields if it wanted to store some local information. Some of the borrowed fields appeared to be misused when the correct requirements that demanded the borrowed fields emerged. As a result, a group of functions and reports related to the misused fields could not be used when the organization needed them. The final reason that caused too many customizations was due to the unbalanced skills of the ERP staffs. They were good at customizing the package by writing the ABAP codes, but were poor at configuring the package. This influenced how users' requirements were fulfilled.

Because of the efficiency burdens caused by too many customizations, there was a significant mindset change in the technology use - from mass customization to embracing the standard. Meanwhile, ERP department also figured out that non-standard use created customization burdens, affected the system performance, and overloaded the ERP staffs. Coincident with the internal reflections, ChipFoundry was informed by the SAP Company that it would not sign the maintenance agreement (MA) with ChipFoundry in year 2008 if it remained with its current SAP-ERP version. ChipFoundry had decided to upgrade the current SAP-ERP and embrace the global standard. A series of activities had been carried by the ERP staffs and the users: (1) staffing; (2) knowledge acquisition; (3) stopping unnecessary customizations; (4) reviewing every add-on programs and custom reports; and (5) misuse recovery. The principle was to remove unnecessary customizations and to assure that new requirements are fulfilled by considering the standard structures first. In this way, both customizations and de-customizations worked toward a similar purpose: to reverse the choices previously made.

In sum, the fourth round of dialectical interplay was stimulated by both the internal reflections and the external threat from the SAP (see Figure 5) and could be characterized by (1) a reposition of the SAP-ERP caused by the lessons of efficiency burdens; (2) the SAP-ERP embodied structures had become the criteria to evaluate the rationality of new requirements; (3) The closure reverse could be seen as a global standard to replace the non-standard portions (e.g., add-ons and field misuses).

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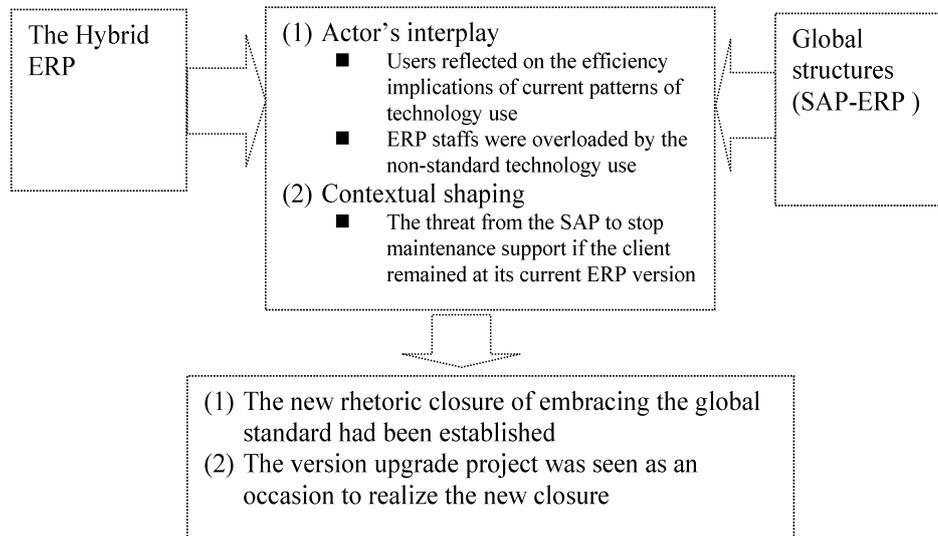


Figure 5 Episode Four (2007-2008): The Closure Reverse

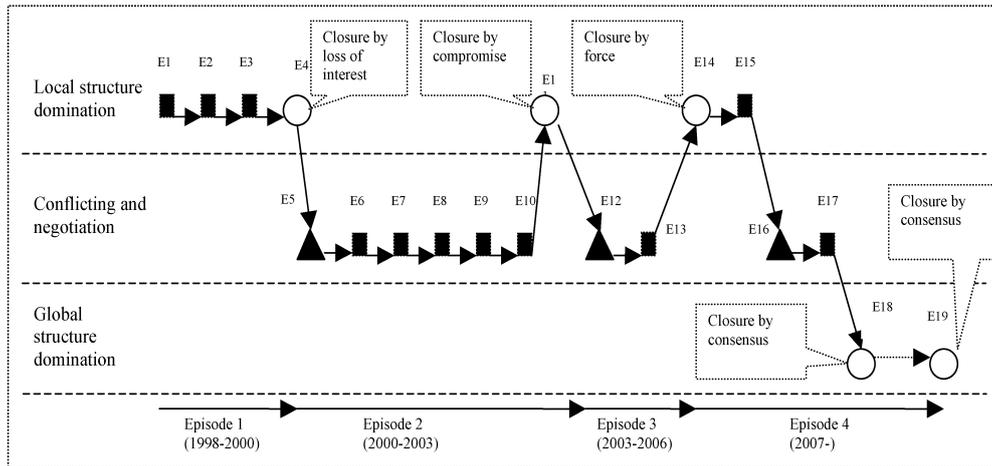
Data source: this research

5. ANALYSIS & DISCUSSION

5.1 The Evolution of ERP Closure

To what extent did the dialectics between the local structures and the global structures get settled? How would a prior closure re-open, change, and re-close (Sorensen, 2002)? To facilitate the discussion, a process model that identified the sequence of the events leading to the outcomes of our research interest was employed (Robey & Newman, 1996). Figure 6 maps the progression of the events involved through the four episodes of the ERP evolution. The horizontal axis in Figure 6 represents the temporal sequence, with the events to the left occurring before the events on the right. The periods between events are designated as one of three types of situations: local structure domination, conflicting and negotiation, or global structure domination. Local structure domination denotes that the organization tended to reproduce its local structures in the dialectical interplay. In

contrast, global structures domination denotes that the ERP embodied structures were largely accepted as the working standards. Conflicting and negotiation denotes the period that the established ERP closure had been challenged and destabilized.



■ Event ▲ Closure reopening event ○ Closure

Note: Please see Table 3 for a summary of the key events in the episodes.

Figure 6 Event Sequences and Closure Types of ChipFoundry ERP Evolution

Data source: this research

In ChipFoundry, four types of ERP closure were identified in temporal order: closure by loss of interest, closure by compromise, closure by force, closure by consensus (see Figure 6). Each closure was the socio-technical order resulting from the dialectical interplay between the local structures and the global structures. These dialectical interplays unfolded and settled through a recursive process of destabilization and stabilization. It was shown that there were multiple temporary convergences in ChipFoundry. In other words, a closure was provisional. It finally attained closure by consensus, but there presented many other types of closures before that.

In Episode 1, the SAP-ERP had been purchased without implementation for almost two years. Ricky, the former CFO, intended to reproduce his successful ERP implementation experience in SeminconFoundry but it turned out that his enthusiasm and expectations on the SAP-ERP were not organizational but

individual. After his sudden departure, three months after the SAP-ERP purchase, whether or not to implement the package was no longer an issue. The potential conflicts between the local structures and the global structures never happened. In other words, the first closure was attained through loss of interest on the SAP-ERP.

The second ERP closure was attained through compromise. Induced by the consolidations of five companies, the SAP-ERP was treated as a solution to enterprise integration. While the top management decided to replace the legacy systems with the SAP-ERP, they did not impose a vanilla approach to implementing the SAP-ERP. The modules selected for implementation essentially reflected the functional constitution of the social alliance supporting the SAP-ERP implementation. The stable social alliance constituted by the directors of the four corporate divisions largely determines the modules to be included or excluded. Modules outside the social alliance's business scope were excluded because implementing modules without solid business owners seemed impractical. Misalignments were then employed as another criterion for selecting those within-scope modules. This finding added insights into the misalignment studies (see e.g. Wei et al., 2005) by illustrating that in addition to considering the fit between the selected modules and the organization, the social alliance's influence also played an important role in module selection.

As top managers opened up space for negotiations about how the SAP-ERP should be integrated into routine practices, users, the ERP core team, and SAP consultants engaged in intensive negotiations to establish a new socio-technical order. Although SAP consultants did warn that changing the package to fit the organization would have detrimental effects. Due to the strong and long lasting user-orientation culture in ChipFoundry, one major strategy employed to enroll diverse users and obtain their support was to allow the mass reproduction of local structures in the technology. In so doing, controversies were effectively closed by the compromise among users, the ERP core team, and ERP consultants, and between the local structures and the global structures.

The third ERP closure was attained through force. Lam, as the new centralized director of finance accounting, launched the project to roll out the SAP-ERP globally. He imposed the solution to overseas subsidiaries. Changing the package to fit the subsidiaries' operation was discouraged and allowed only for local regulations. Subsidiaries had to follow the structures of headquarters that were

embedded in the package. The rollout project had been recognized as successfully in bringing about global consolidation in terms of operational and accounting practices.

The fourth closure was attained through consensus in interpretations regarding the SAP-ERP between the ERP department and users. Ironically, the once effective strategy to enlist user support by allowing the mass reproduction of local structures turned out to be the causes of “efficiency burdens” of users. As users’ daily operations increasingly relied on the SAP-ERP, they became unsatisfied with the low data availability, accuracy, information quality, and operational support caused by implementing limited modules, too many interfaces, and too many technological customizations. Deep reflections on whether the local structures were really superior to global structures in terms of overall integrated efficiency changed the interpretations of users regarding the SAP-ERP to be much more coherent with those of ERP staffs. Coincident with the external threat from the SAP to stop maintaining the system if ChipFoundry did not upgrade to a new version, the organization aimed to de-customize the established ERP closure in the SAP-ERP upgrade project.

The fifth ERP closure was rhetoric in nature and had not been fully realized yet. However, the consensus to implement more standard SAP modules was pretty evident both in the ERP department and the user groups. While users had requirements in rolling out forecasts, budget control, and consolidation statements, ERP department wanted to have a flexible tool to relieve them from creating so many extended reports. They all agreed that the SAP modules related to business intelligence were the solution to their problems.

The case study illustrated the provisional nature of closure because controversies and conflicts were not permanently closed, and might be closed temporarily by closure mechanisms other than consensus. In this case, closure by loss of interest, closure by compromise, closure by force, and closure by consensus formed successively temporal socio-technical orders. The recursive stabilization and destabilization cycles confirmed that an ERP closure was provisional (Kline & Pinch, 1999). It showed that “closure by consensus” in the implementation and use of large scale, enterprise-wide information systems is by no means as simple as Pinch and Bijker’s theory would suggest. Before reaching similar interpretations among relevant social groups regarding the SAP-ERP, different types of closure

emerged to end the dialectical interplay temporarily between the local and the global structures. It seemed that though lack of interpretational consensus, the penetration of the SAP-ERP in ChipFoundry increased incrementally from none (closure by loss of interest) to the headquarters (closure by compromise), and to include overseas subsidiaries (closure by force). When the presence of interpretational consensus, not only the role played by the embodied structures changed dramatically, but the number of adopted standard modules also increased. The ChipFoundry case showed that closure by consensus was not easy to attain although it was the major closure mechanism proposed by Pinch & Bijker (1987). As an ERP closure is provisional and unexpected in nature, understanding both the change in the contextual factors and the interplay among actors are necessary for addressing how and why the closure changes over time.

5.2 Theoretical Implications

The study has several implications for theories. First, the ERP literature contains few closure-related studies, with the process-based study particular scarce, especially the non-linear ones. Our study reveals that a consensus closure is possible, but the trip to the consensus closure may be long and unexpected because the social processes that establish a consensus closure are dynamic and cannot be planned. In making the ERP work for the organization, several temporal socio-technical orders are established and then shape and stabilize the ERP over time. It seems that the ERP technology stabilizes as a temporal socio-technical order emerges (see also Wagner & Newell, 2006; Elbanna, 2007). Consequently, in addition to reaching similar interpretations among relevant social groups regarding the ERP technology, interests, power, compromise, and the importance of the ERP for the organization over time all contribute to the formation of ERP closure.

The second contribution stems from the elaboration of how different social groups' interpretations to the ERP can change over time. Interpretive flexibility of relevant social groups may make the consensus closure difficult to achieve initially. However, the routinized use of ERP triggers user sensemaking regarding the technology and work processes and fosters reflective thinking, thus creating shared understanding between IT and users. Collective mind is an idiosyncratic capability, which enables users from different areas and with different types of expertise to

work together toward a common purpose (Saeed et al., 2010). When a consensus closure is achieved, both IT and users agree that it is needed to implement more standard modules with embodied global practices instead of customization. Interpretive flexibility can be defined not only for the different interpretations among social groups, but also for different interpretations of the same group over time.

The third contribution to the literature stems from the elaboration of how the ERP project scope is defined from the SST perspective. While the traditional wisdom of ERP and its module selection and implementation tends to emphasize the fit between the package and a adopting company from an institutional perspective (e.g. Sia & Soh, 2007), this study reveals that although a company has made a suite purchase of ERP, the actual possible choices for implementation are constrained by the social groups enrolled in the actor-network. Depending, in part, on the ability of network builders to create, maintain, and reinforce the strength of the actor-network, the study reveals a gradual expansion of ERP application scope, from deploying none to a few modules and finally forming the consensus to employ more modules. In this way, the study demonstrates the potential of the SST to enrich the misalignment literature.

5.3 Practical Implications

This research has significant implications for firms that have adopted or are about to adopt an enterprise system in general and ERP in particular. First of all, the case suggests that taking a polarized approach (e.g. a vanilla approach versus customization strategy) in ERP implementation and use maybe impractical and problematic. A pure vanilla approach seems impractical because there are always local contingencies that the global technology cannot foresee or cope with in advance. In the same vein, taking a customization strategy seems problematic as well because in doing so one may create another big legacy system that reproduces the dis-integrated social structures and decreases the benefits of process and data integration brought about by the ERP. In other words, while managers should escape from the rhetoric or myth of “best practices,” they should also be cautious about the organizational implications of customizations or technological drifts.

Second, the resolution of misalignments does not necessarily contribute to

organizational efficiency. Rather, some of misalignments seem to stem from the requirements of operational convenience of powerful users. As the case suggests, a monolithic view of misalignments should be avoided. That is, seeing all the misalignments as detrimental and should be resolved may be problematic in terms of organizational efficiency, system quality, and the workloads of ERP staffs. Managers are suggested to pay attention to the nature of misalignments. Mechanisms and classification schemes should be setup to evaluate and classify the misalignments before beginning to resolve them.

Third, the study suggests that for a multinational corporation (MNC), too many customizations may add difficulty to the international ERP rollout. To make an organizational technology globally usable, managers should be aware of the cycle of embedding, dis-embedding, and re-embedding (Giddens, 1990; Sorensen, 2002). While the implementation and use of the SAP-ERP in Taiwan involves a dynamic of re-embedding, rolling out the SAP-ERP internationally is a process of dis-embedding and re-embedding. As a result, the efforts required to dis-embed the technology for an MNC's global use increase as the levels of local customization increase. The process of dis-embedding should not be neglected by the managers of MNC.

6. CONCLUSION

This case study based on the view social shaping of technology strives to better understand the ERP phenomenon by viewing the adoption, implementation, and use of the ERP as dialectical interplays between the local structures of the company and the global structures embodied in the ERP. The findings of this study suggest that the stability of an ERP closure is provisional. There is a cycle of stabilization and destabilization. Moreover, the awareness of problems is not enough to re-open the established closure, thus firms may need critical events to trigger the change. An integrated SST perspective that focuses not only on actors' interplays but also on contextual influences is necessary for a better understanding of how, why and when the provisional closure is opened, changed, and re-closed

over time. We also find that customizations exhibit both positive and negative effects on the ERP projects. On the one hand, customizations are the key to enroll and align diverse social interests, thus making the ERP go live. On the other hand, customizations are detrimental to the process and data integration of the ERP. As the users increasingly rely on the ERP, the issues of process and data integration come to the fore, turning the focus to global standards.

The historical evolution of the ERP could be understood as a long and unexpected process in which an organization pursues different aspects of “enterprise integration” including technical, operational, and social integration (Elbanna, 2007). However, this study reveals that it is difficult to attain these three types of integration at the same level at one time. The superior integration features of the ERP may be unable to be deployed without enrolling different social groups and enlisting their support. Besides, the different interpretations to the ERP among relevant stakeholders will lead to the compromises for the ERP to go live. However, the case company first uses compromise solution to attain social integration and then attempts to attain higher levels of technical and operational integrations. It reveals that firms may initially adopt a socially favorable but technically inefficient solution for implementing the ERP and then gradually develops into a more technically efficient solution. Previous compromises allowing local practice re-production result in many efficiency burdens and the users have deep reflection on this and eventually change their interpretations of the ERP. Awareness and interpretations change are necessary conditions to change, but firms still need some critical events to reopen the closures and negotiate for the new ones.

This study has several limitations. The first one is the challenge of generalizability caused by the adoption of in-depth analysis of a single case. However, the purpose of any SST study is not to pursue statistical generalization but analytical generalization. The point is to develop theoretical agendas and conceptual frameworks that transcend the individual case. Second, the retrospective nature of the study may result in incomplete or inaccurate data. Although numerous steps were taken to mitigate this concern, a longitudinal research design may be a better approach to avoid the retrospective bias.

REFERENCES

- Alvarez, R., 2008, "Examining Technology, Structure and Identity during an Enterprise System Implementation," **Information Systems Journal**, Vol. 18, No. 2, 203-224.
- Baki, B. and Cakar, K., 2005, "Determining the ERP Package Selecting Criteria: The Case of Turkish Manufacturing Companies," **Business Process Management Journal**, Vol. 11, No. 1, 75-86.
- Barley, S. R., 1986, "Technology as an Occasion for Structure: Evidence from Observations of Ct Scanners and the Social Order of Radiology Departments," **Administrative Science Quarterly**, Vol. 31, No. 1, 78-108.
- Besson, P. and Rowel, F., 2012, "Strategizing Information Systems-Enabled Organizational Transformation: A Transdisciplinary Review and New Directions," **Journal of Strategic Information Systems**, Vol. 21, No. 2, 103-124.
- Bijker, W. E., 1995, **Of Bicycles, Bakelites, and Bulbs: Toward a Theory of Sociotechnical Change**, 1st, Cambridge, MA: MIT Press.
- Bijker, W. E. and Law, J., 1992, **Shaping Technology/Building Society: Studies in Sociotechnical Change**, 1st, Cambridge, MA: MIT Press.
- Boudreau, M. C. and Robey, D., 2005, "Enacting Integrated Information Technology: A Human Agency Perspective," **Organization Science**, Vol. 16, No. 1, 3-18.
- Callon, M., 1986, "The Sociology of an Actor-Network: The Case of Electric Vehicle" in Callon, M., Law, J., and Rip, A. (eds.), **Mapping the Dynamics of Science and Technology: Sociology of Science in the Real World**, First Edition, London: Macmillan, 19-34.
- Ciborra, C. U. and Hanseth, O., 2000, "Introduction: From Control to Drift" in Ciborra, C. U. (ed.), **From Control to Drift: The Dynamics of Corporate Information Infrastructures**, First Edition, New York: Oxford University Press, 1-11.
- Clausen, C. and Koch, C., 1999, "The Role of Spaces and Occasions in the Transformation of Information Technologies-Lessons from the Social Shaping of IT Systems for Manufacturing in a Danish Context," **Technology Analysis & Strategic Management**, Vol. 11, No. 3, 463-482.
- Darke, P., Shanks, G., and Broadbent, M., 1998, "Successfully Completing Case Study Research: Combining Rigour, Relevance and Pragmatism," **Information Systems Journal**, Vol. 8, No. 4, 273-289.
- Davenport, T. H., 1998, "Putting the Enterprise into the Enterprise System," **Harvard Business Review**, Vol. 76, No. 4, 121-131.
- Davidson, E. J., 2002, "Technology Frames and Framing: A Socio-Cognitive Investigation of Requirements Determination," **MIS Quarterly**, Vol. 26, No. 4, 329-358.

- Davison, R., 2002, "Cultural Complications of ERP," **Communications of The ACM**, Vol. 45, No. 7, 109-111.
- Dery, K., Hall, R., and Wailes, N., 2006, "ERPs as 'Technologies-in-Practice' : Social Construction, Materiality and the Role of Organisational Factors," **New Technology, Work & Employment**, Vol. 21, No. 3, 229-241.
- Dhillon, G. S., Caldeira, M., and Wenger, M. R., 2011, "Intentionality and Power Interplay in IS Implementation: The Case of an Asset Management Firm," **Journal of Strategic Information Systems**, Vol. 20, No. 4, 438-448.
- Elbanna, A. R., 2006, "The Validity of the Improvisation Argument in the Implementation of Rigid Technology: The Case of ERP Systems," **Journal of Information Technology**, Vol. 21, No. 3, 165-175.
- Elbanna, A. R., 2007, "Implementing an Integrated System in a Socially Dis-Integrated Enterprise," **Information Technology & People**, Vol. 20, No. 2, 121-139.
- Ettlie, J. E., Perotti, V. J., Joseph, D. A., and Cotteleer, M. J., 2005, "Strategic Predictors of Successful Enterprise System Deployment," **International Journal of Operations & Production Management**, Vol. 25, No. 10, 953-972.
- Fleck, J., 1993, "Configurations: Crystallizing Contingency," **International Journal of Human Factors in Manufacturing**, Vol. 3, No. 1, 15-36.
- Giddens, A., 1990, **The Consequences of Modernity**, 1st, Cambridge, UK: Polity Press.
- Glass, R. L., 1998, "Enterprise Resource Planning-Breakthrough and/or Term Problem?" **The DATA BASE for Advances in Information Systems**, Vol. 29, No. 2, 13-16.
- Henderson, J. C. and Venkatraman, N., 1993, "Strategic Alignment: Leveraging Information Technology for Transforming Organizations," **IBM Systems Journal**, Vol. 32, No. 1, 4-16.
- Holmstrom, J. and Stalder, F., 2001, "Drifting Technologies and Multi-Purpose Networks: The Case of the Swedish Cashcard," **Information and Organization**, Vol. 11, No. 3, 187-206.
- Howcroft, D. and Light, B., 2010, "The Social Shaping of Packaged Software Selection," **Journal of the Association for Information Systems**, Vol. 11, No. 3, 122-148.
- Howcroft, D., Mitev, N., and Wilson, M., 2004, "What We May Learn from the Social Shaping of Technology Approach" in Mingers, J. and Willcocks, L. (eds.), **Social Theory and Philosophy for Information Systems**, First Edition, New York: John Wiley & Sons, 329-371.
- Klein, H. and Myers, M., 1999, "A Set of Principles for Conducting and Evaluating Interpretive Field Studies," **MIS Quarterly**, Vol. 23, No. 1, 67-93.
- Kline, R. and Pinch, T., 1999, "The Social Construction of Technology" in MacKenzie, D. and Wajcman, J. (eds.), **The Social Shaping of Technology**, Second Edition, Philadelphia, PA: Open University Press, 112-115.
- Lacity, M. C. and Hirschheim, R., 1993, "The Information Systems Outsourcing

A Case Study of the Shaping and Evolution of ERP Closures

- Bandwagon,” **Sloan Management Review**, Vol. 35, No. 1, 73-86.
- Latour, B., 1987, **Science in Action. How to Follow Engineers and Scientists through Society**, 1st, Cambridge, MA: Harvard University Press.
- Liang, H. and Xue, Y., 2004, “Coping with ERP-Related Contextual Issues in SMEs: A Vendor’s Perspective,” **Journal of Strategic Information Systems**, Vol. 13, No. 4, 399-415.
- Lie, M. and Sorensen, K. H., 1996, **Making Technology Our Own: Domesticating Technology into Everyday Life**, 1st, Oslo, NO: Scandinavian University Press.
- Light, B. and Wagner, E., 2006, “Integration in ERP Environments: Rhetoric, Realities and Organisational Possibilities,” **New Technology, Work & Employment**, Vol. 21, No. 3, 215-228.
- Mackay, H. and Gillespie, G., 1992, “Extending the Social Shaping of Technology Approach: Ideology and Appropriation,” **Social Studies of Science**, Vol. 22, No. 4, 685-716.
- Markus, M. L. and Tanis, C., 2000, “The Enterprise Systems Experience: From Adoption to Success” in Zmud, R. W. (ed.), **Framing the Domains of It Research: Glimpsing the Future through the Past**, First Edition, Cincinnati, OH: Pinnaflex Education Resources, 173-207.
- McLoughlin, I., 1999, **Creative Technological Change: The Shaping of Technology and Organisations**, 2nd, London: Routledge.
- Monteiro, E., 2000, “Actor-Network Theory and Information Infrastructure” in Ciborra, C. U. (ed.), **From Control to Drift: The Dynamics of Corporate Information Infrastructures**, First Edition, New York: Oxford University Press, 71-83.
- Orlikowski, W. J. and Baroudi, J. J., 1991, “Studying Information Technology in Organizations: Research Approaches and Assumptions,” **Information Systems Research**, Vol. 2, No. 1, 1-28.
- Orlikowski, W. J. and Iacono, C. S., 2001, “Research Commentary: Desperately Seeking the ‘IT’ in IT Research - a Call to Theorizing the IT Artifact,” **Information Systems Research**, Vol. 12, No. 2, 121-134.
- Orlikowski, W. J. and Yates, J., 2006, “ICT and Organizational Change,” **The Journal of Applied Behavioral Science**, Vol. 42, No. 1, 127-134.
- Orlikowski, W. J., 2000, “Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations,” **Organization Science**, Vol. 11, No. 4, 404-428.
- Orlikowski, W. J., Yates, J. A., Okamura, K., and Fujimoto, M., 1995, “Shaping Electronic Communication: The Metastructuring of Technology in the Context of Use,” **Organization Science**, Vol. 6, No. 4, 423-444.
- Pinch, T. J. and Bijker, W. E., 1984, “The Social Construction of Facts and Artefacts: or How the Sociology of Science and the Sociology of Technology Might Benefit Each

- Other,” **Social Studies of Science**, Vol. 14, No. 3, 399-441.
- Pinch, T. J. and Bijker, W. E., 1987, “The Social Construction of Facts and Artifacts: or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other” in Bijker, W. E., Hughes, T. P., and Pinch, T. J. (eds.), **The Social Construction of Technological Systems: New Directions in Sociology of History and Technology**, First Edition, Cambridge, MA: MIT Press, 17-50.
- Pozzebon, M., 2001, “Demystifying the Rhetorical Closure of ERP Packages. ”, **Proceedings of the 22nd International Conference on Information Systems Association for Information Systems**, New Orleans, USA.
- Pozzebon, M. and Pinsonneault, A., 2005, “Global-Local Negotiations for Implementing Configurable Packages: The Power of Initial Organizational Decisions,” **Journal of Strategic Information Systems**, Vol. 14, No. 2, 121-145.
- Pozzebon, M. and Pinsonneault, A., 2012, “The Dynamics of Client-Consultant Relationships: Exploring the Interplay of Power and Knowledge,” **Journal of Information Technology**, Vol. 27, No. 1, 35-56.
- Pozzebon, M., Titah, R., and Pinsonneault, A., 2006, “Combining Social Shaping of Technology and Communicative Action Theory for Understanding Rhetorical Closure in IT,” **Information Technology & People**, Vol. 19, No. 3, 244-271.
- Robey, D. and Newman, M., 1996, “Sequential Patterns in Information Systems Development: An Application of a Social Process Model,” **ACM Transaction on Information Systems**, Vol. 14, No. 1, 30-63.
- Robey, D., Boudreau, M. C., and Rose, G. M., 2000, “Information Technology and Organizational Learning: A Review and Assessment of Research,” **Accounting, Management and Information Technologies**, Vol. 10, No. 2, 125-155.
- Robey, D., Ross, J. W., and Boudreau, M. C., 2002, “Learning to Implement Enterprise Systems: An Exploratory Study of the Dialectics of Change,” **Journal of Management Information Systems**, Vol. 19, No. 1, 17-46.
- Rose, J. and Schlichter, B. R., 2013, “Decoupling, Re-engaging: Managing Trust Relationships in Implementation Projects,” **Information Systems Journal**, Vol. 23, No. 1, 5-33.
- Russell, S. and Williams, R., 2002, “Social Shaping of Technology: Frameworks, Findings and Implications for Policy with Glossary of Social Shaping Concepts” in Sorensen, K. H. and Williams, R. (eds.), **Shaping Technology, Guiding Policy: Concepts, Spaces and Tools**, First Edition, Northampton, MA: Edward Elgar, 37-132.
- Saeed, K. A., Abdinnour, S., Lengnick-Hall, M. L., and Lengnick-Hall, C. A., 2010, “Examining the Impact of Pre-Implementation Expectations on Post-Implementation Use of Enterprise Systems: A Longitudinal Study,” **Decision Sciences**, Vol. 41, No. 4, 659-688.
- Seddon, P. B., Calvert, C., and Yang, S., 2010, “A Multi-Project Model of Key Factors

A Case Study of the Shaping and Evolution of ERP Closures

- Affecting Organizational Benefits from Enterprise Systems,” **MIS Quarterly**, Vol. 34, No. 2, 305-328.
- Shepherd, C., Clegg, C., and Stride, C., 2009, “Opening the Black Box: A Multi-Method Analysis of an Enterprise Resource Planning Implementation,” **Journal of Information Technology**, Vol. 24, No. 1, 81-102.
- Sia, S. K. and Soh, C., 2007, “An Assessment of Package-Organisation Misalignment: Institutional and Ontological Structures,” **European Journal of Information Systems**, Vol. 16, No. 5, 568-583.
- Silva, L. and Fulk, H. K., 2012, “From Disruption to Struggles: Theorizing Power in ERP Implementation Projects,” **Information and Organization**, Vol. 22, No. 1, 227-251.
- Soh, C. and Sia, S. K., 2005, “The Challenges of Implementing ‘Vanilla’ Versions of Enterprise Systems,” **MIS Quarterly Executive**, Vol. 4, No. 3, 373-384.
- Soh, C., Kien, S. S., and Tay-Yap, J., 2000, “Cultural Fits and Misfits: Is ERP a Universal Solution?” **Communications of The ACM**, Vol. 43, No. 4, 47-51.
- Soh, C., Sia, S. K., Boh, W. F., and Tang, M., 2003, “Misalignments in ERP Implementation: A Dialectic Perspective,” **International Journal of Human-Computer Interaction**, Vol. 16, No. 1, 81-100.
- Sorensen, K. H., 2002, “Social Shaping on the Move? On the Policy Relevance of the Social Shaping of Technology Perspective” in Sorensen, K. H. and Williams, R. (eds.), **Shaping Technology, Guiding Policy: Concepts, Spaces and Tools**, First Edition, Northampton, MA: Edward Elgar, 19-35.
- Sumner, M., 2000, “Risk Factors in Enterprise-Wide/ERP Projects,” **Journal of Information Technology**, Vol. 15, No. 4, 317-327.
- Swan, J., Newell, S., and Robertson, M., 1999, “The Illusion of ‘Best Practice’ in Information Systems for Operations Management,” **European Journal of Information Systems**, Vol. 8, No. 4, 284-293.
- Tyre, M. J. and Orlikowski, W. J., 1994, “Windows of Opportunity: Temporal Patterns of Technological Adaptation in Organizations,” **Organization Science**, Vol. 5, No. 1, 98-118.
- Van De Ven, A. H. and Poole, M. S., 1995, “Explaining Development and Change in Organizations,” **Academy of Management Review**, Vol. 20, No. 3, 510-540.
- Wagner, E. L. and Newell, S., 2004, “‘Best’ for Whom?: The Tension between ‘Best Practice’ ERP Packages and Diverse Epistemic Cultures in a University Context,” **Journal of Strategic Information Systems**, Vol. 13, No. 4, 305-328.
- Wagner, E. L. and Newell, S., 2006, “Repairing ERP: Producing Social Order to Create a Working Information System,” **The Journal of Applied Behavioral Science**, Vol. 42, No. 1, 40-57.
- Wang, E. T. G., Klein, G., and Jiang, J. J., 2006, “ERP Misfit: Country of Origin and Organizational Factors,” **Journal of Management Information Systems**, Vol. 23,

- No. 1, 263-292.
- Wei, H. L., Wang, E. T. G., and Ju, P. H., 2005, "Understanding Misalignment and Cascading Change of ERP Implementation: A Stage View of Process Analysis," **European Journal of Information Systems**, Vol. 14, No. 4, 324-334.
- Williams, R. and Edge, D., 1996, "The Social Shaping of Technology," **Research Policy**, Vol. 25, No. 6, 865-899.
- Williams, R. and Pollock, N., 2012, "Moving Beyond the Single Site Implementation Study: How (and Why) We Should Study the Biography of Packaged Enterprise Solutions," **Information Systems Research**, Vol. 23, No. 1, 1-22.
- Williams, R., 1997a, "Universal Solutions or Local Contingencies? Tensions and Contradictions in the Mutual Shaping of Work Organizations" in McLoughlin, I. and Harris, M. (eds.), **Innovation, Organizational Change and Technology**, First Edition, London: International Business Press, 170-185.
- Williams, R., 1997b, "The Social Shaping of Information and Communications Technologies" in Kubicek, H., Williams, R., and Dutton, W. H. (eds.), **The Social Shaping of Information Superhighways**, First Edition, New York: St. Martin's Press, 299-338.
- Willis, R. and Chiasson, M., 2007, "Do the Ends Justify the Means?" **Information Technology & People**, Vol. 20, No. 3, 212-234.
- Wilson, M. and Howcroft, D., 2002, "Re-conceptualising Failure: Social Shaping Meets IS Research," **European Journal of Information Systems**, Vol. 11, No. 4, 236-250.
- Yeow, A. and Sia, S. K., 2008, "Negotiating 'Best Practices' in Package Software Implementation," **Information and Organization**, Vol. 18, No. 1, 1-28.
- Yin, R. K., 2003, **Case Study Research: Design and Methods**, 3rd, Thousand Oaks, CA: Sage Publications Inc.
- Zammuto, R. F., Griffith, T. L., Majchrzak, A., Dougherty, D. J., and Faraj, S., 2007, "Information Technology and the Changing Fabric of Organization," **Organization Science**, Vol. 18, No. 5, 749-762.

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