Enterprise Systems Adoption and Implementation in Chinese SMEs: Exploring relationships between user firms and technology providers through ANT

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Abstract

Enterprise systems (ES) are a priority in China. The main literature on ES is dominated by survey-based research on large Western firms, which typically focus on the user firm only and on the before-and-after effects of implementation. Analyses using critical success factors and technology adoption theories feature widely. China-based research on ES although growing is relatively limited and is significantly influenced by Western-based approaches. In contrast, this research examines ES adoption and implementation in Chinese SMEs from a continuous, process perspective using four case studies. It argues that ES adoption and implementation is a complex process that involves multiple stakeholders, and exploring the interplay among them explains why and how an ES is adopted and implemented. Actor-network theory (ANT) informs the main analysis. Importantly, the unit of analysis (UOA) is the user-SME and the technology provider combined. The findings challenge the dominant user-centred adoption theories and the importance of the technology provider in the sociotechnical role.

Keywords
Enterprise systems; SMEs; case study; China; actor-network theory.

Introduction

The purpose of this paper is to report recent research into the adoption and implementation of ES by Chinese SMEs. China is distinctive in culture, organisational practices and institutional contexts, but it also exhibits scale. This combination is unique and provides the setting for the paper. Theoretically, the motivation for the research concerns the nature and workings of the relationship between the SME user and the technology provider. This relationship is especially important in SMEs where resources, technical and financial, are tightly constrained, and the dependency on the technology provider is high but under-reported (Liang & Xue 2004).

Practically, the motivation for the research is the unprecedented development of China. Now the second largest economy in the world, 99 percent of all firms in China are SMEs. The ICT industry is a pillar industry and viewed as essential for increasing productivity. The ES market reflects this and has seen extraordinary growth since 2014 of 14.25% p.a., which is twice that of mature economies (Technavio 2015). Much of this growth is in the SME sector reflecting both the size of this sector and its economic significance (MIIT 2016).

Despite the dual importance of the above, extant research, in both the West and China, remains under-contextualised (Liang et al. 2014). ES adoption research is predominately ‘user-firm and technology as artefact’ focused. There is an emphasis on input factors and outputs (Parker et al. 2015). In these situations,
the technology provider is treated as context. Twenty years ago, Tatnall & Gilding (1999) noted how the ideology of dualism is predominant in technology adoption research, which normally considers ‘the social’ as the context in which “innovation in Information Systems take place” (ibid. p.956). A situation that remains common today.

Like other technology adoptions, ES adoption requires an understanding of the interdependencies between the technical and the social (Leonardi et al. 2012). In this research actor-network theory (ANT) is employed to explore the user-firm and technology provider relationship at the micro-level. Two specific research questions arising from the above are addressed.

- Why and how do Chinese SMEs embark on the adoption and implementation of ES?
- What is the nature, and implications for the process, of the relationship between user-SMEs, technology providers and other parties?

Four cases have been completed. The unit of analysis (UOA) is symmetrical and consists of the user-SME and the ES technology provider as a single case. The remaining paper is divided into six parts. The literature review is on relevant ES research is presented, followed by the research methodology. Then, for reasons of paper length, one example case (Battery-Shell & GZsoft) is selected and analysed fully, whilst the other three cases are presented as summaries. An ANT cross-case analysis on all four cases follows. Key findings and contributions conclude the paper.

**Literature Review**

The ES literature is large and in many areas relatively mature, particularly in a western context with large firms and large technology providers. But, despite this attention, successful ES implementation remains problematic (Dwivedi et al. 2015). Process-based research with focused context is needed, and this is especially so in non-western contexts including developing and transitional economies such as China. The literature review is presented in two parts. First, studies relating to Chinese SMEs are examined after reviewing broad-based ES research on SMEs is discussed. Second, actor-network theory (ANT) – as the chosen interpretive frame – is studied.

**ES research on Chinese SMEs**

ES research is typically based on large firms in developed countries (Liang et al. 2007). Such research can be broadly categorised as ES adoption, ES implementation, and critical success factors (CSFs) (Esteves & Bohorquez 2007). While research on ES adoption is still underdeveloped, there are many research studies on ES implementation. The study of CSFs, however, remains the largest strand of research, addressing both adoption and implementation (Esteves & Bohorquez 2007). Two common traits are prominent: First, the analytical focus is on the company adopting the ES – the ‘user’ company (ibid.); Second, the dominance of survey-based methods and statistical analysis (Liang et al. 2014). Regarding ES research on SMEs in general, in the light of above traits, they are also identified as resource constrained (Malhotra & Temponi 2009) and externally dependent (Brown & Lockett 2004).

Research on ES in the China context is still underdeveloped, and heavily influenced by the dominant Western literature in terms of research approach and strategy (Liang et al. 2014). Many findings of SMEs discussed above are also applicable to Chinese SMEs, possibly to a greater extent (Xia et al. 2009). Despite the similarities, Chinese firms, in general, have passive attitudes towards ES innovation (Srivastava & Gips 2009) and are predominantly influenced by stronger hierarchical power (Ge & Voß 2009). Cultural studies are frequently emphasised (Martinsons et al. 2009) with insufficient understanding of the process of ES adoption and implementation (Liang & Xue 2004). Such phenomena arguably restrain contextual exploration, which can further impede ES research on Chinese SMEs (Liang & Xue 2004; Liang et al. 2014).

**Introducing ANT**

Part of Science and Technological Studies (STS), ANT is a conceptual framework, rather than a theory, for exploring sociotechnical processes. It is this latter quality that makes ANT a strong candidate for the focus of this paper into the reality of enterprise system technology adoption and uses in SMEs in China. Using Callon’s original framework (Callon 1986) (Table 1), this paper seeks to investigate adoption and implementation process through the relationship between the user firm and the technology provider.
Five strategies of enrolment are critical to network construction and demonstrated in Latour (1987): 1). Understand and cater to “other people's explicit interests”; 2). Convince people their “usual ways were cut off”; 3). Offer a “detour” or “shortcut”; 4). Displace or reshuffle interests and goals; 5). “Becoming indispensable”. In practice, they may be reflected in activities like negotiation between the needs of employees and the functionalities of ES, conducting software customisation, coordination by the person responsible, etc., and it is common for multiple strategies to be employed conjointly, as discussed in case analysis.

Research Method

A multiple case study approach is adopted in this study to address the needs of developing a richer and deeper understanding of ES adoption and implementation by Chinese SMEs, their relationship with the ES provider, and how both parties are influenced by the ICT policy context in which they operate. Such an approach can augment external validity, protect against observer bias (Barratt et al. 2011), aid triangulation, and improve generality (Yin 2009). We consider four cases, where each case consists of both user and provider perspectives. Four SME user companies (and two technology providers) were all situated in Shenzhen, Guangdong Province, China, and the four cases were built based on replication logic (Eisenhardt, 1989; Yin, 2009).

Semi-structured interviews were employed with the four user companies and two ES providers. Multiple interviews were conducted with the most relevant personnel from each firm (e.g. General Manager, Vice-General Manager, ES Consultant, etc.), and multiple interviewees per organization were included where possible. An inductive approach was employed, reflected in open-ended interview questions. Key interview questions were based on the process of translation (Callon 1986) presented in Table 1. For instance, these included the migration of focal issues, key agreements reached by involved parties, problem-solving strategy, etc. The study is retrospective in nature, covering recently completed implementations. The interviews were either audio-recorded and transcribed or hand-written notes were taken in Chinese that were later verified by the interviewees with their signatures. Documents were also collected from the organisations as appropriate, e.g. software brochures from the ES providers.

Example Case: Battery-Shell (user) and GZsoft (provider)

The example is organised into three parts. Part 1 provides the profiles of Battery Shell and GZsoft. Part 2 consists of ANT analysis in two stages: (i) identifying the networks and generic phases, and (ii) the ANT translation process. Part 3 provides the empirical accounts of the example case.

Profiles

Battery-Shell was established in 2002 and was a leading manufacturer that produces aluminium shells for lithium cell phone batteries in Shenzhen City, Guangdong Province, China. The company had poor knowledge of ES, but rapid growth put a severe strain on the company’s ‘traditional’ approach to management. As a result, a decision to explore the potential of an enterprise system (ERP) was taken.
The selected ES Provider – GZsoft was established in Guangzhou city, Guangdong province in 1992, and it is one of the domestic pioneers developing and providing ES solutions. However, ES products are surprisingly not the main focus of its business, since GZsoft is also a training and employability provider in the disability sector.

**ANT analysis**

**Identifying the networks and generic phases**

Based on the empirical data and the concept of network construction of ANT, four temporary networks in the process of ES adoption and implementation are identified: adoption, preparation, module implementation, and post-implementation. These temporary networks are described as generic phases for all four cases, and they provide the structure for the case analyses, discussed later. The process of translation (Callon 1986) is employed to pinpoint the key stages and milestones within the generic phases and provides a time-based process view of the interactions between the Battery-Shell and GZsoft (see Figure 1). This process view is *symmetrical* and captures in detail the dynamic relationship between user and provider.

![Figure 1: Process of ES adoption and implementation - generic phases (Battery-Shell & GZsoft)](image)

**ANT translation process**

A template for the analysis is presented in Table 2 with analytical instructions. The setting of the involved actants is continually changing during the process of ES adoption and implementation, and their level of engagement varies in different phases. By cycling the process of translation across the four generic phases (Table 2), each case is analysed through ANT with consideration of two key and different perspectives (user vs. vendor), as illustrated in empirical accounts.
ES adoption and implementation in Chinese SMEs

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Table 2: Template of ANT case analysis

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**Empirical accounts**

**Adoption**

The V-GM of Battery-Shell initiated the ES venture under a strong influence of his former company. However, the first problem lay in the construction of the network. Representing the board of shareholders as the spokesperson, the GM refused to initiate an ES project, claiming there were: 1) no apparent issues about corporate management at that moment; and 2) no immediate tangible benefits for ES implementation. Employees also showed no interest in cooperating due to limited understanding and unclear benefits. Thus, the V-GM had to weaken the network established by the shareholders and the employees.

To achieve that, the V-GM introduced the concept of standardisation learned from his former company, and such thought was quickly connected to business expansion and long-term development.

“...I used to work for a quoted manufacturing company at the management level for more than ten years...and I learned the potential of ES during the process. Battery-Shell is also a manufacturing company, but it has less complicated issues compared to my former company. Thus I am sure the problems can be solved by an ES. Adopting ES is the inevitable trend when a company becomes bigger and requires more standardised managerial solutions.” — V-GM of Battery-Shell

The V-GM, as the focal actor, quickly started to expand his network through two strategies: 1). Convincing the employees. With weakened association with the GM, it was increasingly difficult for the employees to retain their initial goals (e.g. continue employing their conventional working practice). The strong role of the V-GM made him indispensable to the employees, which forced them to accept the ES adoption, defined as the new problem; and 2). Creating a new group. Supervised by the V-GM, two more people, a procurement manager and IT administrator, were brought into the network to form the project team. The new actor-network shifted the corporate focus from conventional management to system management, which further supported the idea of ES adoption. Additionally, the V-GM consolidated his network by recruiting GZsoft to offer professional explanations on his behalf.

The influence of the GZsoft consultant cannot be undermined in terms of shaping the interests of the network. The lack of knowledge about the ES market, ES, and the ES providers diminished the V-GM’s capability of defining the common interests, which invited freedom for diversion and interpretation. The consultant took this opportunity, argued the attainability of the V-GM’s goals (e.g. to simulate the in-house ‘Production Coordination Table’), and introduced an alternative plan, as a detour: to firstly employ the entry-level ES package (named ‘Basic Pack’) with the promise of further extensions after the project.

“Regarding the requests of Battery-Shell, we suggested to the V-GM how to achieve the expected outcomes by conducting two sequential projects: the first project was designed to implement our ‘basic pack’ ES to construct a basis for the adoption of advanced modules; the completion of the first project was closely followed by a second one, which particularly focused on extended production management such as shop floor management, etc. We
had more advanced ES packages to manage these needs, such as the ‘standard pack’, ‘enterprise pack’, etc.” — Consultant of GZsoft

The proposition was eventually accepted by the V-GM with considerations about the limitation of firm size. Hence, the common interests were shifted again to the implementation of the ‘Basic Pack’.

**Preparation**
With no experience of ES implementation, the V-GM had no knowledge to define the focal problems in this phase. To maintain the stability of the network, the consultant was empowered to control the project while the V-GM agreed to be responsible for managing any internal resistance. A temporary agreement was reached. The expertise assisted the consultant to become the focal actor, and additionally enabled him to define the new focal problems on information coding work. The introduced code rule created more possibilities for him to expand his influence by connecting with the employees and strengthening relationship established with other members of the project team.

However, misfits emerged in respect of the code rule, which obstructed the progress of the preparation work. Since the V-GM failed to respond to the emerging needs of employees, doubts gradually built up among them regarding the common interests he defined with the consultant.

“The code rule offered by GZsoft had certain limits for the code length. The length limit might have been suitable for other companies, however, it was not applicable to us. To completely reflect the meanings of our products in the coding, we needed to extend the maximum length. Initially, GZsoft was very confused about our requests, and refused to add more characters.” — Production coordinator of Battery-Shell

The competence of the consultant was challenged, and complaints emerged. Problems quickly developed as the needs for customisation, and the conflicts increased between the employees and the consultant. The network was facing collapse.

The private relationship between the IT administrator (a member of the project team) and the consultant played a crucial role in solving the disagreements and smoothing the way of the project. The negotiations he conducted introduced a new goal to the consultant — employee management. This made the consultant temporarily shift his objectives, which subsequently led to changes being made to the code rule. Additionally, hierarchical orders issued by the V-GM assisted the consultant to eliminate any resistance from the employees regarding the increased workload, and improved his bond with the consultant and stabilised the network.

**Module implementation**
Battery-Shell and GZsoft had different understandings about the problems that emerged at the stage of module implementation, which threatened the relationships established again. The employees of Battery-Shell focused on the misfits of the ES. Issues were reported in the procurement and stock departments regarding the ineffective functions offered by the implanted modules.

“According to the stock management module, a production plan would be generated based on the amount of the received order and the status of the stock. However, this approach was not applicable to our company. For instance, different customers usually had different quality requirements even for the same product, which constantly changed the status of the stock. The effects of oxidation could further decrease the accuracy of the stock information as this was changing all the time, it was arduous to use the module to produce a reliable production plan.” — Production coordinator of Battery-Shell

The consultant, on the other hand, considered that the problems were caused by the inherited working practice. Suggestions were made to modify the working practice in Battery-Shell, rather than customise the ES.

The V-GM never doubted the consultant’s expertise. However, while he maintained hierarchical pressure to ensure the involvement of the employees, the module implementation was discontinued, and negotiations had to be carried out to solve the employees’ problems. Customisation became the only option for the consultant if he wished to sustain his indispensability. With the good private relationship established with the consultant, the IT administrator acted as a mediator who reduced the employees’ complaints and accelerated the customisation process. The outcome of the customisation enabled the consultant to retain his position as a focal actor, which was further consolidated through training, parallel running and mock test.
Post-implementation
Since the employees had not mastered the modules implemented, Battery-Shell still had a strong dependency on the consultant. The distance support and maintenance service offered by the consultant decreased the possibility of ES malfunction, which sustained his association with key actants in Battery-Shell, especially with the V-GM who became the new focal actor. Such association offered the consultant the possibilities to negotiate with the V-GM about the follow-up project, which was initially agreed with.

Summarised Cases

Case highlights: Plasbox (user) & GZsoft (provider)
The GM of Plasbox attempted to act as a focal actor to redefine the company’s problems - adopt a new ES - to drive business reforms. However, it was failed due to resistance from a strong alliance formed by the legacy ES, the financial manager and the employees. To weaken their alliance, GM employed his strong position to recruit a new V-GM (signed as the new person responsible for the proposed ES project) to reshuffle the common goals. Also, the pre-existing strong relationship between the V-GM and the consultant was brought to Plasbox, directly led to the adoption of GZsoft ES.

The expertise of the consultant made him increasingly indispensable to the network, and his association with the V-GM and employees became stronger. However, implementation problems in the sales and marketing department emerged, which created tension between the consultant and the V-GM: the consultant intended to follow the routine, the V-GM, on the other hand, wanted to maximise the effect of empirical usage. This situation created more problems in the financial department (e.g. refusing to implement the financial module), and indirectly encouraged the employees to refer back to the previous working practice.

However, this was quickly controlled. The consultant was eventually convinced to offer support and customisations to manage the newly emerged interests (including the finance department), which minimised their potential deviation. The V-GM occasionally exercised his hierarchical power to cut off employees’ dependency on the legacy ES (e.g. by issuing fines) to improve solidarity of actants. What is more, activities arranged by the consultant, such as mock test parallel running, greatly enhanced the stability and unity of the network.

Case highlights: TradeIT (user) & CHS (provider)
The GM of TradeIT was also the proprietor of the company. Although the employees’ strong dependency on the GM left them limited freedom to define alternative goals, it still had been difficult for the employees to modify or abandon their old working practice relating to the legacy ES. A new ES vendor - CHS was eventually introduced attempting to work on behalf of the GM to break the connections between the employees and the legacy ES, however, conflicts between the GM and CHS emerged due to the different approaches to defining the problems. The GM concerned the optimisation of company’s overall performance; CHS interested in matching the raised issues with its pre-designed ES packages.

Negotiating with the salesperson from CHS was the consequence of the GM’s balanced consideration about firm size and functionality. The pre-sales consultant managed the GM’s concerns through a flexible setting of module selection with a competitive price. The salesperson, pre-sales consultant, and the GM began to form a new network, and their association was consolidated by the conduct of the pre-sales investigation and delivery of the preliminary implementation plan followed.

The stability of the new network was quickly challenged due to a change of personnel in CHS and information loss associated. A new consultant was assigned to continue the work, however, changes (e.g. in implementation and training plans) had to be made by CHS to manage already irritated employees. The hierarchical pressure from the GM obstructed the employees’ association with the legacy ES, in the interim, the GM and the consultant worked together to solve their immediate difficulties.

More conflicts between the GM and the consultant emerged during module implementation in regard of system integration, which leads to more compromises from both parties: the consultant catered for the GM’s interests by reducing the implementation time; the GM assisted the consultant to convince the employees to follow the new working practice.
Case highlights: Track-Tech (user) & CHS (provider)

The V-GM of Track-Tech, a member of the board of shareholders, intended to initiate ES adoption, however, this is hampered by the resistance from both the board and the employees. The association between the board and the employees was weak, which invited space for negotiation and endowed the V-GM with great opportunities.

Not all the selection criteria proposed by the V-GM could be fulfilled since the influence of the ES vendor (e.g. reputation, expertise, etc.) was also important. The consultant, who represented CHS, persuaded the V-GM to focus on his key concerns of outsourcing management. This is quickly associated with an ES package – ‘Manufacturing Expert’, and even more benefits were promised. Thus, the initial goals set by the V-GM were reshuffled, in an implicit way, and a temporary alliance between the consultant and the V-GM was formed.

With his expertise, the consultant started to lead the construction of the network, through which to achieve his own goals – a successful implementation by following the routine. The V-GM simply employed his hierarchical power to weaken employees’ association with the previous working practice.

Conflicts also emerged between the consultant and the V-GM when implementation problems were identified in areas like authorisation management, changes in document formats, etc., which lead to the needs of customisation. The consultant had to compromise on some of the ES parameter settings, nevertheless, standardisation was greatly emphasised in the interim to improve conformity.

ANT Cross-case Analysis

Emerging from the detailed analysis of Battery Shell and GZsoft together with the other three summarised cases are two main themes: change in the power of control and emerging configuration. They are significant findings in this research and are discussed below.

Change in the power of control

The user company generally has better control during the ES adoption stage. The company is aware of the organisational problems and needs although they may be inaccurate depending on the case. On the other hand, the ES provider has the minimal power of control mainly due to the underdeveloped bond with the user company. This situation describes the nature of the association between heterogeneous actors.

However, the situation can significantly change after the contract signing. Here a new association is formed. The contract becomes an actant, i.e. a legitimate source of action and the situation changes. The expertise and the experience enable the ES provider to quickly take control of the project, and therefore start to direct the development of the preparation work (e.g. through training, formalised procedures, etc.). It is common for the user companies to take the position of providing the required internal support, especially when they lack ES related experience (e.g. Track-Tech and Battery-Shell). This subsequently intensifies the dependency of the user company on the ES provider. ES provider normally starts to secede from the project once the selected ES modules are implemented, which limits the support offered and indirectly forces the user company to take control of the ES at the stage of post implementation. The change in the power of control forms the backbone of the ES adoption and implementation, and it additionally illustrates the continuous process of network formation and construction.

Emerging configuration

Unlike the static view depicted in the dominant ES literature, ES adoption and implementation is a dynamic process that involves frequent change. ES configurations are not fixed. Changes can be initiated by the user companies e.g. Battery-Shell changed the ES requirements but needed the acquiescence of GZsoft to action this. A temporary actor-network was formed and the contract was relaxed. Similarly, ES actors can initiate change, such as the change of personnel and implementation plan relating to the case of TradeIT and CHS. Such insight into the changing agenda between user and provider is characteristic of all four SMEs and is an important insight. It underlines the limitations of treating ES as an artefact devoid of its social context.
Conclusion and Contributions

ANT has proven to be an effective theory to disclose the changing relationships among actors and the resulting associations. Changes occur when associations are reconstituted, and actants lead to new actions. The ‘black box’, constituting the social and technical elements, was revealed in terms of the network of relationships. These insights at the micro-level have important implications for theory and practice, and address the original research questions. There are two main contributions to theory.

Coexistent of adoption and implementation

This research challenges the artificial boundary normally drawn between ES adoption and implementation, and indicates that they are coexistent during the process of ES adoption and implementation. None of the four cases exhibited a linear dependency. Progress was iterative and episodic.

ES adoption and implementation are commonly considered as separate phases to highlight the before-after impact of ES. In China 20 per cent of all papers in leading journals are on this theme (Liang et al. 2014). The empirical evidence in this work at a micro-level demonstrates that ES adoption is inextricably intertwined with implementation. They are two sides of the same coin, which resonates with Whittington’s (1996) the concept of ‘Strategy as Practice’ in the general strategy literature. In the context of the Chinese SMEs studied, this inter-relationship is at the heart of the construction of the actor-networks, which legitimate the changes.

This finding offers opens the ‘black box’ and provides strong evidence for the need to see ES adoption, and implementation is a complex process rather than a simple event. It legitimates the importance of process explanations for adoption and implementation of ES and the acceptance that it is a social process, beyond simple deterministic planning.

Issues of ES adoption at the firm level

Traditional approaches to explain adoption and implementation of technology are too limited in their applicability. Hillmer (2009) evaluated and compared a wide range of technology adoption theories and models, and subsequently indicated that “all models remain mostly one-sided and limited” (ibid. p.27).

Similar observations can also be identified in recent reviews (Momani & Jamous 2017). However, in practice, both SMEs and ES providers are in a relationship and have to make difficult or fuzzy decisions beyond the control of a single party, including policy influences. This research challenges the effectiveness of accepted adoption theories in the context of China SMEs. Dominant theories such as Diffusion of Innovation theory (Rogers 2003) and Technology Acceptance Models (TAM) (Davis 1989). They are not sufficiently comprehensive to explain ES adoption and implementation.

The implications for the theory are significant. It reinforces the importance of context observed by others (Liang et al. 2014; Xia et al. 2009). However, our findings demonstrate that any adoption approach that is user firm-centric and simplifies the analysis by omission, e.g. ignoring the interplay between users and providers is potentially flawed. The difficulties are greatest in the context of SMEs, and in transitional or developing economies, where the dependency on external stakeholders is huge and cannot be ignored. Although this research is China situated, the authors believe that this conclusion can be generalised beyond China. The similarities between SMEs in China and the West, in terms of the challenges faced, are greater than their differences.

Limitations

The main limitation is that the study is at the firm level and focused on the ‘user firm – technology provider’ relationship. Whilst the micro-level analysis is sensitive to wider institutional pressures via the behaviours and decisions of the firms (e.g. regulation) there is more research to be done. Replicating the research in another province would provide an opportunity to confirm the insights of this research but also to assess the impact of local regulation and policy.
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