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A STRATEGIC IMPROVISATION MODEL: A CASE STUDY OF HEALTHCARE INFORMATION SYSTEMS DESIGN

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Abstract

Pressured by the speed of technological advances, the need for change and improvisation has hit the healthcare industry. Now society demands that healthcare providers offer better patient care through the creative use of information technologies. In turn, healthcare management asserts pressure on IS/IT practitioners to expand the boundaries for innovative IS design strategies. Research on healthcare information systems (HIS) improvisation remains relatively underdeveloped. To fill this gap, from the perspective of a case study, we use both organizational improvisation and bricolage theoretical lenses to examine how strategic improvisation might give rise to superior HIS design. Theoretically, we proposed an inductively-derived conceptual model of improvisation that explains how strategic improvisation contributes to the formation of superior HIS that offer value added and quality patient-centric healthcare delivery. Professionally, this study contributes three key insights for IS improvisation in the healthcare industry with application to wider information systems development.

Keywords: Improvisation, Healthcare Information System Design, Information Systems Development, Case study.

1 INTRODUCTION

Operating in the highly competitive knowledge society, organizations are challenged to shape the future of their industries through innovative changes (Lawson and Samson, 2001). Looking at the modern business landscape of increased time-to-market pressures, regulatory changes and rapid-evolving customer demands (Overby, et al., 2006), contemporary management scholars have shifted their research interest from the rapid and continual innovation (Eisenhardt and Martin, 2000) to the exploration of improvisation study (Moorman and Miner, 1998), the key area of new development in the innovation field (Poolton and Ismail, 2000). Improvisation was especially proposed to be effective in complex and dynamic contexts (Ash, Berg and Coiera, 2004) for the study of the design and implementation activities (Moorman and Miner, 1998) that is crucial to be competitive (Crossan 1997).

Information systems development is now key to healthcare organizations meeting the challenge to improvise their Healthcare Information Systems (HIS) to enable high-quality, efficient patient-centred services (Mechanic, 2010; Wickramasinghe et al, 2007; Wickramasinghe, 2009). To improvise, 'involves the reworking of pre-composed materials and designs in relation to unanticipated ideas conceived, shaped, and transformed under the special conditions of performance, thereby adding unique features to every creation' (Weick, 1998, p. 554). Generally research on improvisation remains relatively underdeveloped (Vendelo, 2009; Cunha, Rego and Kamoche, 2009). This is especially the situation in regard to the formation of HIS design (Heeks, 2006). Hence, the research question under consideration in this study is to understand how strategic improvisation contributes to the formation of superior HIS design. Specifically, we attempt to fill this present void in the literature by examining improvisation theory and bricolage literature to understand the recombination and transformation of existing resources. This in turn positions a new approach to information systems development.

Our first step is to review the literature of IS improvisation and bricolage to establish how strategic improvisation might give rise to superior HIS design. We then introduce the research methodology and case study before discussing the research findings. Finally, we conclude with contributions to theory on HIS design-improvisation and provides insights on how to improvise HIS design (Aktas, Ulengin, Sahin, 2007) for practitioners both in this area and in wider information systems development.

2 THEORETICAL BACKGROUND

2.1 Information Systems Improvisation

Recognizing the potential of transforming societal health-and-wellness quality, the study of HIS design and improvisation research has slowly gained interest among researchers (Bansler and Havn, 2010; Heeks, 2006; Lau et al, 1999).

Technically, improvisation is referred to as a situational, embodied and temporal process (Oliver, 2009) that shifts the emphasis to incorporate the social, cultural and embodied context (Burner, 1993) that is iterative and cyclical (Oliver, 2009). More specifically, the fundamental structure of improvisation can be further divided into (1) a social structure concerning to behavioural norms, communication, and teamwork skills, and (2) a technical structure pertaining to task-related expertise, creativity and knowledge required for improvisation (Crossan et al., 2005; Kamoche et al., 2003; Tan et al., 2010). The process of improvisation typically occurs between the conception and execution of ideas, with a specific purpose to enable a suitable and successful final outcome (Cunha, et al., 1999). In particular, improvisation is viewed as 'a situated performance where thinking and action emerge simultaneously at the spur of the moment' (Ciborra, 1999, p. 78). Often 'time' and 'people' play a crucial element for change (Vendelo, 2009; Kamoche et al, 2003; Vera and Crossan, 2005) and

therefore in improvisation. This means that ‘people’ tend to improvise by intuition (Crossan and Sorrenti, 1997) with the use of ‘resources’ at hand (bricolage) (Baker and Nelson, 2005) especially when they do not have ‘time’ to plan (Baker and Nelson, 2005; Kamoche, et al., 2003). In particular, improvisation is the solution to the shortcomings faced by an organization that is adapting to a rapidly-changing environment and needs to solve complex, unstructured problems in cases of high time pressure (Augier, et al., 2001).

This paper aims to search for empirical evidence to advance knowledge in this area, addressing the lack of empirical validation in understanding the improvisation process (Tan et al., 2010). In particular we aim to unpack the relationship between the conception and execution of ideas (Silva and Hirschheim, 2007).

Expanding on Vendelo’s (2009) improvisation concept of ‘time’ and ‘people’, we propose to conceptualize improvisation with a construct of “resource-time-effort”. This concept is drawn from the resource-based view literature to suggest how resources might be managed within the context of healthcare. We believe this is an appropriate approach especially given that few previous studies have specifically addressed these aspects (Sirmon, et al., 2007).

In this study, improvisation is defined as an iterative process to transform ideas by the incorporation of the hospital’s social and technical context (Crossan et al., 2005; Kamoche et al., 2003; Tan et al., 2010) to continue experimentation and treat mistakes as learning (Kamoche et al., 2003). The support of ‘resource-time-effort’ as valuable features in the design of IS is conceptualized in IS design improvisation as presented in Figure 1 below.

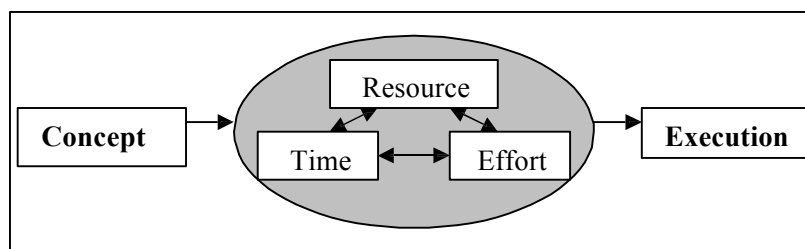


Figure 1. Conceptualization of IS design improvisation

Drawing from organizational improvisation theory literature, we conceptualized improvisation as fitting three main criteria, based on the “resource-time-effort” perspective. First, improvisation entails spontaneous, free-form and situational-based (Crossan, et al. 2005) responses through ‘timely’ planning and execution to urgent challenges. Next, improvisation relates to explorations and exploitation of ‘resources’ such as organizational experience and knowledge (Cunha et al, 2009) and makes sense of those challenges in providing prompt decisions under uncertainty (Brown and Eisenhardt 1995; Vera and Crossan 2005). The third criterion is that improvisation tends to involve an ‘effort’ in making decisions that are rarely replicated, they deviate from standard practices and are tailored to a specific context (Baker and Nelson 2005).

In addition, to ameliorate the lack of empirical evidence supporting the success of any improvisational effort (Vera and Rossan, 2005), this study explores the lessons and activities practised in the case study. It also enables the derivation of an IS design improvisation model for practitioners. For deeper understanding, bricolage literature is used to recognize where resource-seeking occurs (Levi-Strauss, 1966).

2.2 Bricolage

Given that the concept of bricolage has been adopted by improvisational theorists (Innes and Booher 1999), it is useful to turn to it in order to develop a deeper understanding of improvisation. Bricolage serves to complement reasoning and fundamentally different collective creativity so as to introduce

new options and new combinations (Innes and Booher 1999) for appropriate designs to ensue. This approach complements the strengths of deploying modest resources to prevail over superior ones, such as from intellectual and financial perspectives (Garud and Karnoe 2003). This would prove especially useful in a hospital context where there is always competition for superior resources, which are normally allocated to the core business of medical services, laboratory and pharmacological research and equipment and hospital operations. In this environment, IT management must maximize modest resources to achieve optimal results. To do so, bricoleurs use resources with which they are familiar to address new tasks and challenges (Ferneley and Bell 2006). In information system development and design this then requires a combination of ‘bricolage materials’ (information technology hardware and software artefacts) and ‘network bricolage’, which allows bricoleurs to use pre-existing contacts and networks for strategic improvisation (Baker et al. 2003). Thus, by examining bricolage, not only do we facilitate a better understanding of the operationalization of the improvisation concept, but we also gain a deeper understanding of critical strategic aspects (Baker et al. 2003; Mintzberg 1994).

3 RESEARCH METHODOLOGY

Case study methodology is adopted in this study to unveil the ‘how’ question (Walsham 1995) that delves into the process of developing strategic IS improvisation. The process of unveiling strategic IS improvisation is complex and multi-faceted, inextricably connected to each specific organizational context (Pentland 1999) and comprising technological and complex human/social components (Tyrell 2002).

As we wanted to explore issues that are inextricably connected to a specific context, we believed a richer result would be achieved by studying hospital that has improvised two healthcare systems and won the industry award in the country. In this way we hoped to gain more insights pertaining to improvisation, irrespective of style of healthcare system, size, and (or) expenditure.

From our research questions, two conditions emerged to form the basis for case study selection. First, the case study hospital must aim to improve its workflows and HIS through the adoption of the Kaizen philosophy (Paul and Suresh, 2009) that involves incremental and continual improvement. This is achieved by constantly revising ideas to identify possible ‘waste’ in procedures that could be streamlined for further improvements. Such an execution has successfully introduced various new concepts by tapping into organisational experiences and knowledge capital (Cunha et al., 2009). Second, the process of improvising the information system development should ideally be enacted in the framework of theory construction and content enriching.

Research in a Singapore hospital (SH) was conducted over a period of six months with a total of 19 face-to-face interviews with staff recommended by the Director of Operations. Informants were nurses, IT specialists, doctors and top-management personnel with an average of three years working at SH. Most interviews were tape-recorded and transcribed, with photos and additional notes taken to provide more detail. Each interview session lasted between one-and-a-half and three hours. All informants were provided with an assurance of confidentiality and anonymity, especially when potentially sensitive information was sought (Walsham, 2006). Questions asked were exploratory in nature, open-ended and tailor-made to the role of the interviewee.

In case studies data analysis is “the heart of theory-building process” (Eisenhardt, 1989, p. 539). Data analysis was performed in conjunction with data collection from interviews in an iterative process that involved cycling between the empirical data, the theoretical lens and the relevant literature (Eisenhardt, 1989). Using the collected data, we identified an initial set of themes pertinent to construct improvisation, as identified in the literature. Each new finding was then verified to ensure that it was supported by at least two sources of data (Klein and Myers, 1999).

In turn, this set of themes (i.e. time, resource and effort) was used to form our improvisation theoretical lens. In order to ensure that the chain of evidence was at all times transparent, we provide

narratives, adding specific quotes from informants into the identified themes (Pratt, 2009). In this manner it is possible to establish a visual mapping strategy to organize the empirical data (Layngley, 1999). Then, the narratives and visual maps were compared with the theoretical lens and the relevant literature to further shape our emerging theoretical ideas. This data analysis process was continued until a state of theoretical saturation was reached; namely, when it became possible to comprehensively explain the findings of the case studies (Eisenhardt, 1989).

4 CASE STUDY

4.1 Background of the Singapore Hospital (SH)

To support the government's newly-declared healthcare delivery standard, the Singapore Minister for Health challenged a Singapore hospital (SH) (anonymous) performing below-par to transform itself into a state-of-the-art hospital by improving its service and performance. Facing the odds of being one of the smallest hospitals, and consequent resource constraints, SH management took the challenge and engaged in an uphill struggle to improve. After only two years of intense activity SH was transformed and rejuvenated, becoming an iconic hospital, held in awe by the Singapore healthcare industry after being voted as the best patient service hospital in five consecutive years (2004-2009) (SH, 2009).

Phase I: Initiating HIS Improvisation

This phase of the project began with a self-motivated group consisting of the Operations Manager, nurses and doctors. After a week of serious discussions and in-depth study, they proposed to hospital senior management that change should target two problematic departments: the department of emergency (DE) and the bed management unit (BMU) and their proposal was accepted.

Under the supervision of the Director of Operations, a team in DE was tasked with mapping out a typical patient workflow. This was done by physically tracing patient movement from one 'station' to the next. The rationale for this was guided by the Kaizen concept of identifying possible 'waste' in procedures that could then be streamlined for improvement.

From studying the workflow, the recommendation for improvement was to assign a senior doctor (rather than a junior) to assess patient treatment and prioritise cases. Additionally, feedback from stakeholders mooted proposed the adoption of a new concept, a 'just-in-time' bed management system. This improvised concept allows wards to 'pull' patients to newly-available beds, as against to the traditional 'push' system of emergency departments.

To overcome the constraint of a shortage of human resources, SH used volunteers from the existing medical staff, in particular junior doctors and nurses from the pilot ward. Within a month, as one difficulty after another was handled, they managed to iron out all discrepancies successfully and finalize the key concepts of their ideal hassle-free and patient-centric systems.

However, to implement this ideal system the hospital was challenged for the second time, now with the lack of IT experts and information system development funds. The creative solution SH management adopted offered the proposed concept as a business case to polytechnic students. This tapped into their brainpower and provided a prototype study for them to attempt to solve. In parallel, SH advertised the project through the mass media, as a bait to attract IT solution providers to come forward with a prescription for the needed panacea.

Figure 2 below summarizes the SH effort, and the time spent in improvising with its limited resources, in its initiatives for HIS transformation and indicates a strong complement from network bricolage.

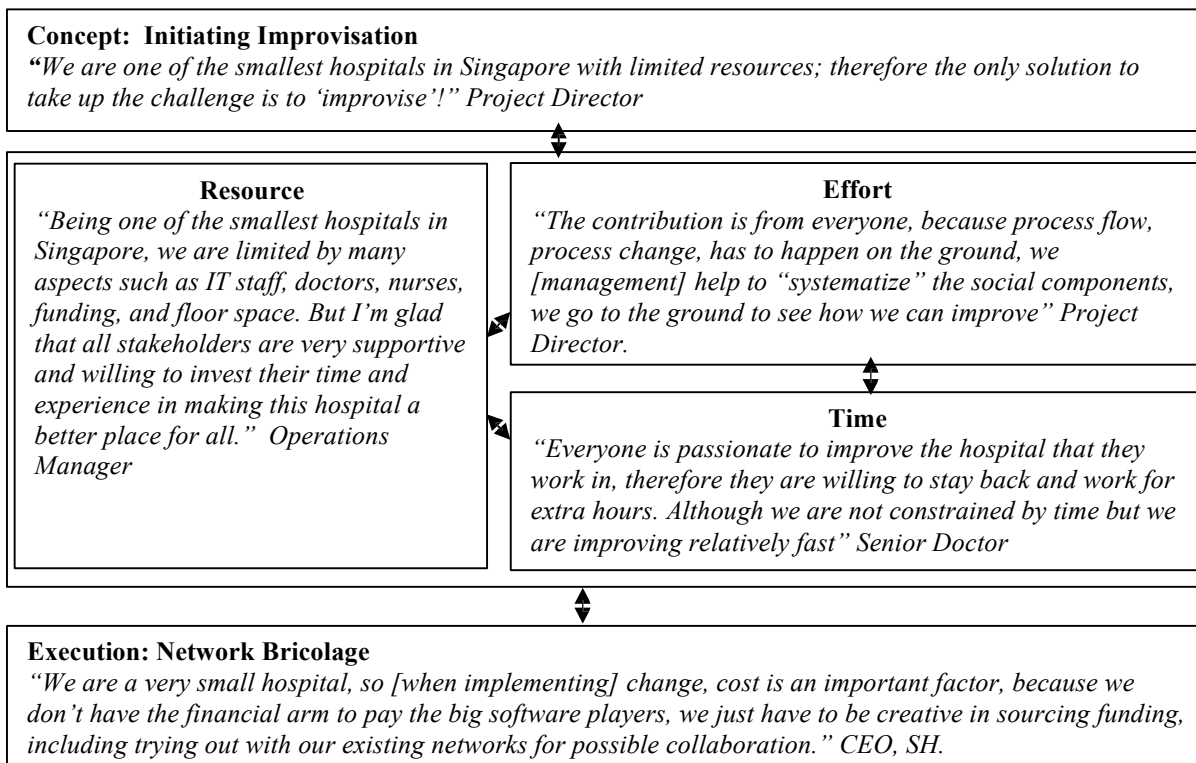


Figure 2. Conceptualization of IS development improvisation in the SH: Phase I

Phase II: Deploying the Healthcare Information Systems Improvisation

The media gamble was rewarded with a golden opportunity when both F Co. and C Co. (anonymous) came forward and formed a strategic partnership with SH. Combining their resources and expertise, F Co. fine-tuned the prototype which had been created by the polytechnic students and worked closely with the enthusiastic group of DE and staff to identify more substantial user requirements. With feedback from staff users, and wish-lists from patients, a Clinical system prototype was finally deployed.

Contemporaneously C Co. was exploring ways their service-oriented architecture and platforms could complement the hospital's existing infrastructure. Working closely with C Co., SH was challenged to improvise to ensure their existing infrastructures would support future technologies at minimal cost. After a feasibility study, SH eventually agreed to adopt the C Co. platform, integrating it with the existing bed-management and nurse-call systems.

The SH endeavour in improvising the HIS improvements was made possible by strong resource supports, a timely system requirement revision analysis, with the complement of structured bricolage that provided fundamental guidance and unified stakeholders. This phase is summarized in Figure 3.

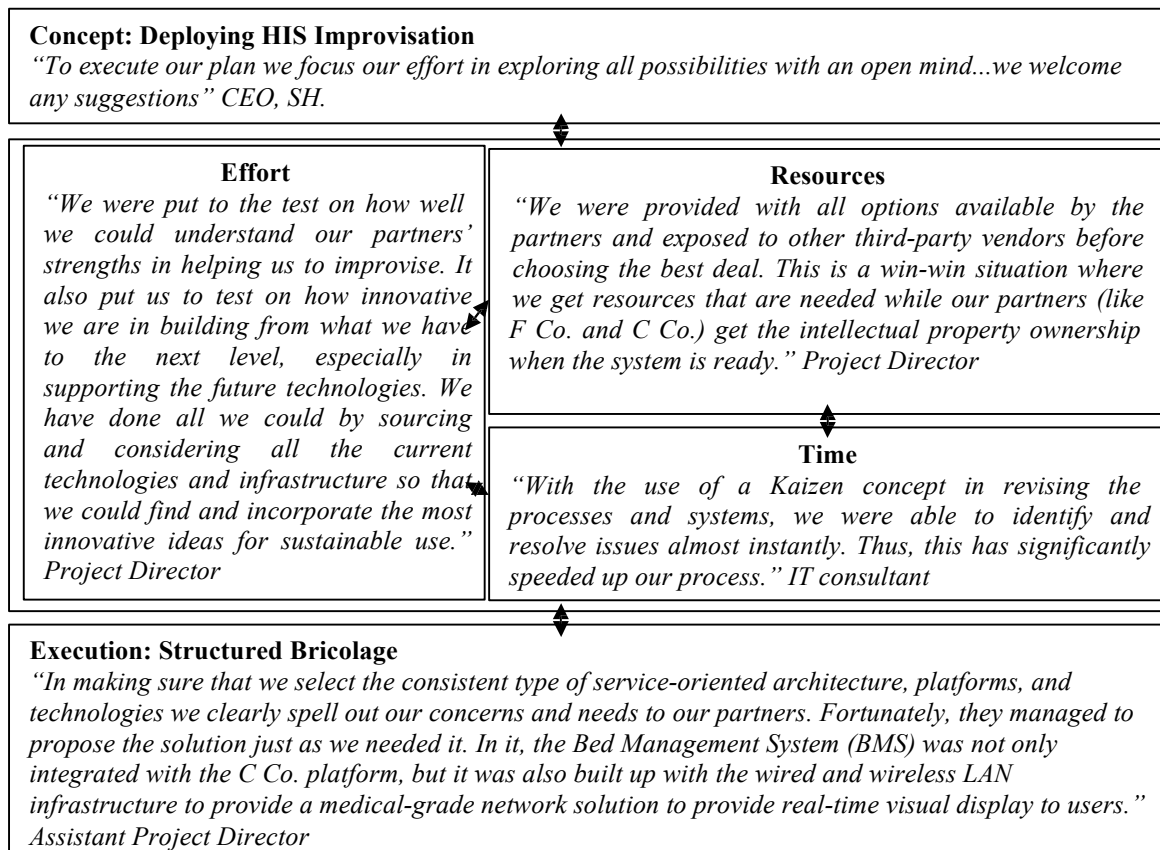


Figure 3. Conceptualization of IS development improvisation in the SH: Phase II

Phase III: Embracing the Improvised HIS Systems

A user training session of less than an hour was given prior to the deployment of the new Clinical system and Bed Management System (BMS). This was to the satisfaction of senior doctors and nurses because they had been previously involved, in Phase II, with the design, via Kaizen activities with the IT providers.

The Clinical system (all-in-one) database helped medical staff to handle patient priorities and allowed them to follow through cases that were processed, screened and categorized by senior doctors at the triage post. It also allowed doctors to attend to patients and prescribe medications on the spot, shortening the waiting and turnaround time for patients in DE. The fully integrated system meant patient information was online and computerized and there was no longer a need to provide the same basic information at every contact point. Not only was much effort saved from both the medical professionals' and patients' points of view, this transformation also successfully halved the average DE waiting time per patient from 40 to 20 minutes.

Nurses in the pilot ward displayed a strong willingness and commitment to adapt to the newly transformed ways of working. Of particular benefit to them was the BMS system that provides a real-time online visual display of available beds, facilitating the process of allocating patients to beds and significantly reducing communication problems between nurses from BMU and the pilot ward. Additionally the new system triggers an alert for housekeeping whenever there is an available bed ready for use. Hence, nurses can now spend their time servicing patients rather than searching for a housekeeper, updating the paperwork and phoning whenever a bed was ready. This 'just-in-time' approach significantly reduced (by 30 per cent) patient waiting time for beds.

The implementation of these two systems successfully transformed the hospital, providing simple solutions for patients and medical staff. Successful improvisation saw the use of resources, effort and

time for the SH information system development and consequent performance improvement. Institutional bricolage enabled a collective consensus which evolved from doctors and nurses in the process of transformation. This is summarized in Figure 4.

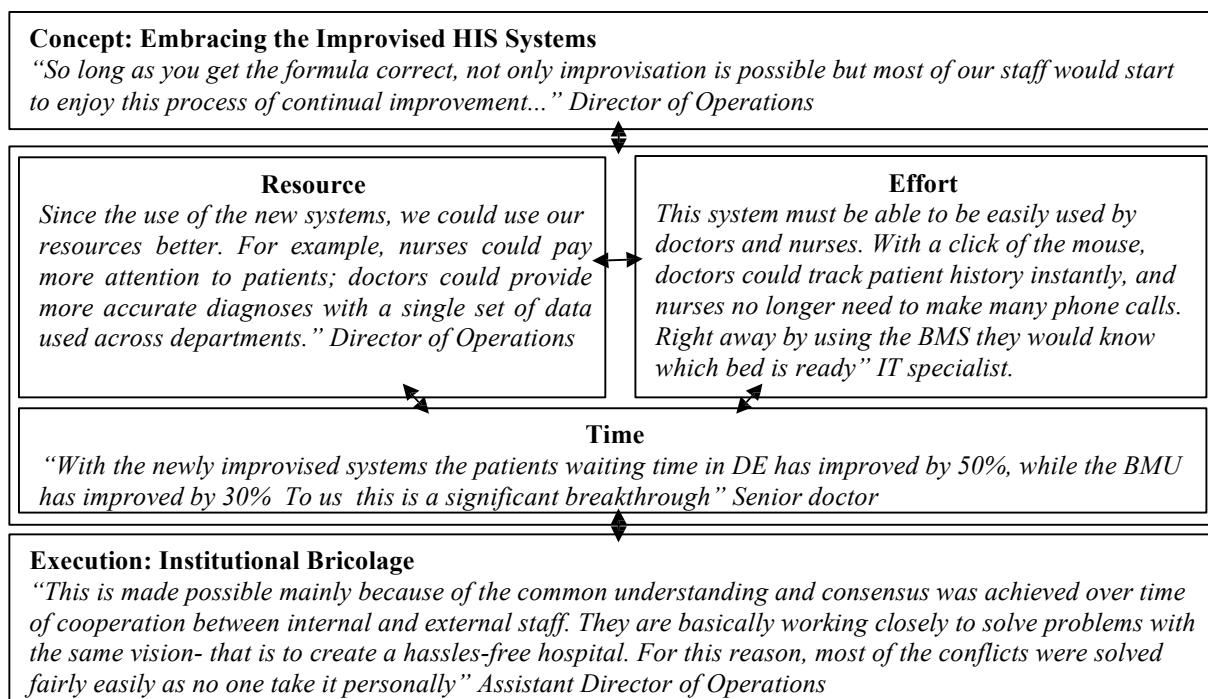


Figure 4. Conceptualization of IS development improvisation in the SH: Phase III

5 DISCUSSION

A conceptualization model of improvisation was inductively derived from the Singapore hospital case study. This conceptualization model suggests a shift in the emphasis of ‘resource-time-effort’ between the conception and execution of ideas (Cunha, et al., 1999), depending on the context (Burner, 1993). Given that the model is inductively derived from empirical data, the following discussion provides an explanation of how the existing literature corroborates our model and how the model enriches the existing conceptualization of improvisation for information system development, in particular for HIS.

Prior literature has suggested that the nature of improvisation is helping to develop a more appropriate view of the recovery process (Cunha, et al., 2009) with strong encouragement from the top management (Vera and Crossan, 2005) to improve service quality for patients. This is evident in this case study, where, in order to overcome the key challenge of the lack of resources, SH management successfully executed information system change by introducing network bricolage—the collective creativity initiating from volunteer networks (Baker et al., 2003) to improvise conceptual ideas by tapping into organizational experience and knowledge capital (Cunha et al. 2009). Together with the ‘time and effort’ invested by the team (led by the Director of Operations), bricolage successfully ironed out all discrepancies and finalized the key concepts of the ideal model for hassle-free and patient-centric systems.

Benefiting from the network bricolage execution strategy, the hospital progressed into the second phase of HIS design improvisation. In this phase, the main challenge was to understand and match multiple stakeholders’ resources in conceptualizing the improvisation idea that remained unique and tailored to the specific needs of the hospital. In ensuring success, SH management turned to execute structured bricolage as a guide to clarifying hospital aims and goals for decision-making processes.

Such execution speeded up the improvisation process, through the resource mix-and-match technique, to supplement the HIS design deployment progress.

HIS design improvisation was achieved in the last phase with an equal emphasis on the resource-time-effort principle. This final stage of improvisation was supplemented with the execution of institutional bricolage where based on the organization structure and behavior (Scott, 1995, Xu and Shenkar, 2002) different stakeholders eventually formed a close bond, fostering cooperation (Cleaver, 2003) to locate specific advantages for the organisation to achieve improvisation. As evident in the case study, in this phase, the application of the Clinical system and BMS systems not only improved patient waiting time but also better allocated human resources to provide better quality service to patients.

6 CONCLUSION

The purpose of this study was to enhance current understanding of information system development through conceptualizing, in this case a HIS, improvisation process model and bricolage. Using our Singapore case study, we found that HIS design improvisation, coupled with network, structure and institutional bricolage, can be formulated to source, maneuver and complement resources. The improvisation, or collective creativity, to design the IS development benefited from an equilibrium stage between ‘resource-time-effort’ (refer to figure 7). Inductively derived findings have addressed the lack of empirical validation for understanding the process of improvisation (Tan et al., 2010) and may serve as a foundation for future research.

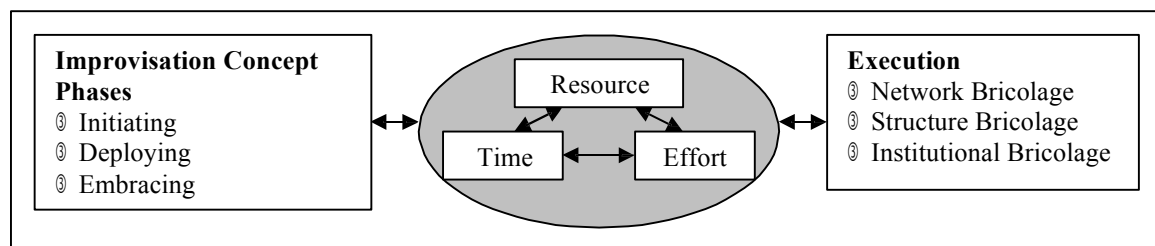


Figure 7. Conceptualization of IS development improvisation

The case study data provide insights for researchers and professionals in this area. Theoretically, this study has contributed to improvisation literature with rich empirical data linking the relationship between concepts and execution with a “resource-time-effort” principle for the conceptualization of an improvisation model. By doing so, we have also expanded the Vendelo (2009) improvisation concept. Furthermore, through improvising for the new HIS model, this study proposes and clarifies a series of structured activities and systematic processes. The outcome of HIS improvisation through the case study further validates the older literature claim of a shift in emphasis of the resource-time-effort principle which occurs between conception and execution of ideas (Cunha, et al., 1999), greatly dependent on context (Burner, 1993).

For professionals, this study contributes three key insights for IS development in the healthcare industry using improvisation. First, practitioners need to be open-minded and creative in achieving a network bricolage strategy for sourcing, manoeuvring and complementing available resources. Second, it is important to appropriately obtain a structure bricolage strategy for project governance. Last, it is critical to introduce an institutional bricolage strategy to harmonize working relationships and balance the use of resources to achieve creative improvisation.

From our case study data, it appears that HIS improvisation is an approach in the right direction for facilitating urgent and timely strategic information system development. It optimises design and implementation to realize the healthcare value proposition. Since this study remains at its infancy stage, and we recognize that this is a single case study thus we cannot make strong generalisations. Accordingly we strongly urge for more confirmatory research in this area.

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