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IT-Related Organisational Change: An IS Theory of Reciprocal Change

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Abstract: Information Technology (IT) is indispensable to modern, competitive organisations and is instrumental in the many changes experienced by these organisations. The paper argues that IT-related organisational change follows a reciprocal, causal and cyclical pattern. The pattern begins with an organisation's social system causing changes to be made to its IT system, which reciprocates by causing changes to be made to the social system. These changes cycle ad infinitum. It is in this environment of IT-related organisational change that managers have to plan, organize, control, govern and lead their organisations toward their organisational goals. To do this effectively, they require theory for explaining and predicting these environments. Indeed, there are existing theories, models and frameworks that address various aspects of IT-related organisational change. However, based on an analysis of these, it was evident that none focuses explicitly on the reciprocal, causal and cyclical changes that occur as social systems and IT systems interact and has been operationalised and tested in various organisational contexts. This was the research problem. Thus, the objective of the paper was to propose such a theory for explaining and predicting IT-related organisational change. The paper is appropriately theoretical in nature and grounded in the academic literature. A framework from the academic literature, Weber's framework, was used to guide the development of the proposed theory. Weber's framework specifies the essential parts and qualities of an IS theory. The essential parts are constructs, associations, states and events and the essential qualities are importance, novelty, parsimony, level and falsifiability. For strategic and operational management, the proposed theory is parsimonious yet comprehensive enough to guide the planning, analysis, design, development and implementation of their IT-related organisational change. In addition, it promotes mitigation of undesirable and unintended consequences of IT-related organisational change. For researchers, the proposed theory provides a basis for explaining and predicting change within IS and provides direction for future research in the domain. In addition, the paper presents a process, based on the literature, for informing theory development and clarifying research constructs.

Keywords: change management, information systems (IS) theory, information technology (IT) change, IS theory of reciprocal change, IT-related organisational change, social system change

1. Introduction

Today, many forms of organisational change involve Information Technology (IT). Understanding how IT relates to organisational change has been a key research concern for many decades (Markus and Robey, 1988; Robey, Anderson, and Raymond, 2013). Given the pervasiveness of IT, it seems reasonable to suppose that IT-related organisational change has been experienced by the vast majority of strategic and operational management. These levels of management are required to plan, organize, control, govern and lead their organisations toward their organisational goals. Thus, theory for explaining and predicting these change environments is valuable.

This paper proposes an Information Systems (IS) theory of reciprocal change. The research problem addressed in the paper is the absence of an IS theory that focuses explicitly on the reciprocal, causal and cyclical changes that occur as social systems and IT systems interact and has been operationalised and tested in various organisational contexts. The objective of the paper is to propose such a theory for explaining and predicting IT-related organisational change (Gregor, 2006). This paper is appropriately theoretical in nature and grounded in the academic literature.

While the proposed theory stems directly from a view of socio-technical systems theory (Lee, 2004; Lee, 2010), the proposed theory makes its original contribution by extending this view into a set of constructs and relationships that can be operationalised and tested in various organisational contexts. This progresses the IS field with theory development, which is recognised as important (Gregor, 2006; Hassan, 2014; Hirschheim and Klein, 2012). In addition, it offers strategic and operational management the potential to obtain scientific evidence to support their IS decision-making.

The paper proceeds with three research questions, as follows:

- Do any of the prominent conceptions and theories of IT and organisational change focus explicitly on the reciprocal, causal and cyclical changes that occur as social systems and IT systems interact?

- Have any of these been operationalised and tested in various organisational contexts?
- What set of constructs and interrelationships enables the operationalisation and testing of the reciprocal, causal and cyclical changes that occur as social systems and IT systems interact?

The literature review follows this introduction and answers the first and second research questions. In the subsequent section, Weber's framework for informing theory development (Weber, 2012) is used to guide the development of the proposed theory. Weber's framework specifies the essential parts and qualities of an IS theory. The essential parts are constructs, associations, states and events and the essential qualities are importance, novelty, parsimony, level and falsifiability. The corresponding theory development section answers the third research question. Subsequently, the paper is concluded and future research directions are provided.

2. Literature review

Theorizing about change within organisations has been relevant well before the pervasiveness of computers and computing devices. During the mid-twentieth century, change was theorized as a three-step process. The first step involved unfreezing or creating a motivation to change, the second step concerned moving, changing or developing new responses and the third step referred to refreezing, stabilizing or the integration of the changes (Lewin, 1947). This conception had influence and application but, due to its time, did not include IT explicitly.

Toward the end of the twentieth century, as IT pervaded organisations, theorizing about organisational change began to recognize IT. A notable perspective was the contingency view, which proposes that an organisation's structure is dependent on conditions relating to the organisation and its environment, such as competitors, organisational size, suppliers, industry type, labour type and customers (Robey, 1977). Thus, from a contingency viewpoint, the effect of IT on organisational change is dependent on or moderated by conditions relating to the organisation and its environment (Robey, 1977). This viewpoint tends to overlook IT as a direct causal variable.

Subsequently, theorizing about IT-related organisational change continued in various directions, such as the technological imperative, the organisational imperative and the emergent perspective (Markus and Robey, 1988). The technological imperative views IT as the primary driver of organisational change and is consistent with technological determinism. Although this view has certain merits, it has been difficult to support in organisational environments where social actors have discretion and often construct unintended but effective work routines (Orlikowski, 1996). In contrast, the organisational imperative disregards IT as the primary driver of organisational change (Markus and Robey, 1988) and views the actions and motives of managers and system designers as the primary drivers of organisational change. The organisational imperative is comparable to the conception of planned change, which refers to changes that are designed, directed and controlled by management. While the organisational imperative is well recognised, it has been regarded as unsuitable for modern organisational environments comprising frequent change, learning and self-organising (Orlikowski, 1996).

The emergent perspective differs from both the technological and organisational imperatives by excluding their causal arguments and viewing organisational change as the result of unpredictable interactions between IT and its organisational and human actors. Evidence demonstrates that the emergent perspective is applicable where organisational change is complex, uncertain, open-ended and unprecedented (Orlikowski and Hofman, 1997). The emergent perspective has also been modelled as an improvisational model that accommodates ongoing, unanticipated changes, requires no stable end-point and iterates among three categories of change, namely anticipated, emergent and opportunity-based changes (Orlikowski and Hofman, 1997). The improvisational model, in turn, has been integrated into a perspective called the situated change perspective, which considers change as ongoing and gradual where daily improvisations are enacted by organisational agents to produce change (Orlikowski, 1996).

Another prominent perspective of IT-related organisational change evinced in modern organisational contexts is the punctuated equilibrium perspective (Orlikowski, 1996). This perspective proposes long periods of organisational equilibrium or stability punctuated by rapid and radical changes. However, the proposition of long periods of organisational equilibrium or stability is challenged by modern organisational environments characterised by frequent change and inherent instability. Subsequently, an extended model was proposed called the punctuated socio-technical information system change (PISC) model (Lyytinen and Newman, 2008). In contrast to the punctuated equilibrium perspective, the PISC model incorporates theories of multi-level systems, socio-technical systems and process, and accounts for continuous incremental change in addition to

rapid and radical changes. Moreover, the PISC model expounds the processes involved in moving a socio-technical system from one state to another.

Another relevant conception is a theoretical framework based on practice theory and exposing inter-organizational information systems (IOIS) transformation and persistence (Reimers, Johnston, and Klein, 2014). The framework conceptualises IOIS as constellations of practices, where each practice comprises three dimensions, namely the ideational, normative and material dimensions. Notably, the framework was found to be more appropriate for studying IOIS evolution and long-term IS change than the PISC model and another applicable model, namely the colonial systems (CS) model, which is an evolutionary change model based on biological colonies. Specifically, it was found that the PISC model and the CS model could only partially explain the changes that were evident.

A theory that is particularly pertinent for IT-related organisational change is the adaptive structuration theory (AST) (DeSanctis and Poole, 1994). AST stems from Giddens' structuration theory, which was originally conceived is a general social science theory without IT as a central theme. Nevertheless, Giddens' structuration theory has been effective in noteworthy research involving IT. AST's particular formulation addresses the structures of IT and the structures of social action that emerge during their interaction with IT. Thus, AST aims to expose the complex relationships among IT and organisation that produce change. Furthermore, AST incorporates thinking from both the decision-making school, which emphasises technological determinism, and the institutional school, which emphasises the social construction of IT within encompassing institutional contexts.

IT-related organisational change has also been approached from the perspective of affordances, which can be defined as the potential uses of IT and related features as perceived by a user with specific goals (Seidel, Recker, and Vom Brocke, 2013). An example of this is a particular study where organisational change resulted from changes to informal advice networks, which occurred once IT users jointly realised the affordances offered by the IT (Leonardi, 2013b).

The aforementioned prominent conceptions and theories of IT and organisational change provide valuable insight into the phenomenon of IT-related organisational change. However, none focuses explicitly on the reciprocal, causal and cyclical changes that occur as social systems and IT systems interact even though many authors have alluded to IT-related organisational change as reciprocal, causal and circular (Cha and Cha, 2014; Leonardi, 2011; Leonardi, 2012; Lyytinen and Newman, 2008; Mcleod and Doolin, 2012; Orlikowski, 1996).

Notwithstanding, a longstanding approach that considers both the social and IT aspects in relation to organisational change is the socio-technical approach. It was developed in the nineteen fifties and prescribed equal control to both technology and workers in the design of production environments (Mumford, 2006). It advocated that social systems and technical systems be jointly optimised for organisational effectiveness. In relation to modern organisational environments, socio-technical systems involve a recursive shaping between social systems and technical materiality (Leonardi, 2012). Specifically, social systems comprise roles, status, power (Leonardi, 2012), norms, polices, communication patterns (Leonardi, 2013a), division of labour, culture, reporting relationships, reward systems and business processes (Lee, 2010). Technical materiality (Leonardi, 2012) comprises an artefact's physical and/or digital arrangement of form that can exist identically at different locations and times (Leonardi, 2013a).

In particular, socio-technical systems theory views organisations as complex systems with two distinct yet interrelated sub-systems, namely the social and technical sub-systems (Davis, Challenger, Jayewardene, and Clegg, 2014). As the social and technical systems interact, what emerges is an IS, which is greater than the sum of its two parts (Lee, 2010). The theory indicates that for a change to be effective, equal consideration should be given to both sub-systems. Moreover, careful design of both parts is critical for IS success and just fixing one part of a problematic IS could result in a worse IS (Lee, 2010).

Socio-technical systems theory has been criticised by sociomateriality researchers for neglecting the material aspects of technology, however, socio-technical systems theory preserves the ontological distinctions between the material and social aspects and does not preclude the material aspects of technology (Robey et al, 2013). Notably, sociomateriality contrasts with socio-technical systems theory by viewing the social and technical sub-systems as an entangled unitary phenomenon (Leonardi, 2012). This view is suited to localised work practices,

while socio-technical systems theory is appropriate from the perspective of an entire organisation (Leonardi, 2012).

Importantly, socio-technical systems theory offers insight into the process where informational requirements are posed to an IT system by its corresponding social system, and organisational requirements are posed to a social system by its corresponding IT system (Lee, 2004). This process repeats ad infinitum (Lee, 2010). Thus, socio-technical systems theory describes the reciprocal, causal and cyclical changes that occur as social systems and IT systems interact, which answers the first research question in the positive. However, this process has not been operationalised and tested in various organisational contexts. Thus, the answer to the second research question is in the negative. Hence, the third research question, which is, what set of constructs and interrelationships enables the operationalisation and testing of the reciprocal, causal and cyclical changes that occur as social systems and IT systems interact? The next section answers this third research question.

3. Theory development

3.1 Definitions and the informing framework

IT is defined as the technological systems consisting of physical devices and associated software that are used to retrieve, transmit, process and store data (Watson, Boudreau, Chen, and Huber, 2008). In contrast, IS are the systems that emerge from the interaction between social systems, comprising an organisation's people and their related organisational structures (Lee, 2010; Leonardi, 2012; Leonardi, 2013a; Mumford, 2006) and IT, in support of organisational goals (Boell and Cecez-Kecmanovic, 2015; Lee, 2004; Watson, Boudreau, and Chen, 2010). Thus, the paper exhibits IS research as it investigates a phenomenon that occurs as social systems and IT systems interact.

Specifically, the proposed theory applies to organisational contexts, where an organisation is using or has used an IT system for a particular purpose. Within an organisation, its social system causes or initiates the first IT system change. This perpetuates unending cycles of reciprocal and causal change. Conceivably, an organisation can stop using IT systems completely, which would constitute a final IT system change and thereafter the proposed theory would not apply. However, between the first and final IT system changes, the theory is proposed to apply. Weber's framework informs the development of the proposed theory by specifying the parts of the proposed theory in the next section and the qualities of the proposed theory in the subsequent section.

3.2 The parts of the proposed theory

3.2.1 Constructs

Constructs are abstract concepts created for specific scientific or research purposes and are indispensable to most theories (MacKenzie, Podsakoff, and Podsakoff, 2011). Construct clarification is essential and it aims for robust and theoretically relevant constructs (Suddaby, 2010). It exposes what a construct conceptually represents and how that construct is similar and different to other constructs in its domain and related domains (MacKenzie et al, 2011). Thus, a construct's definition should avoid circularity, be expressed in clear, concise and positive terms, specify the general type of property that it represents and the entity to which it applies. In addition, it should have simultaneously sufficient and necessary key attributes that determine its exemplars, minimise multiple interpretations, be consistent with prior research and exhibit an appropriate balance between specificity and generality (Bagozzi, 2011; MacKenzie, 2003; MacKenzie et al, 2011; Suddaby, 2010).

The proposed theory comprises two measurable constructs, namely social system change (SSC) and IT system change (ITC). Both constructs contain the word "change", which refers to actions through which something becomes different in some way, such as in its form, nature, content or future course, with reference to a preceding point in time (*Dictionary.Com.* n.d.; *Oxford Dictionaries.* n.d.). Accordingly, the general type of property that both of these constructs refer to is an action. Notably, the people who perform the actions may or may not be part of the social system under consideration. This is acceptable since the proposed theory considers the SSC and ITC constructs independently from the individuals performing the changes.

The simultaneously sufficient and necessary key attributes that determine the exemplars of each construct follow. For SSC, they are an organisational social system that has used or is using an IT system for a particular purpose, had or has the means to cause change to the corresponding IT system and was or is experiencing

alteration to itself. For ITC, they are an IT system that was or is being used by a corresponding organisational social system for a particular purpose and was or is undergoing alteration. An exemplar is an organisational context where IT systems are used to achieve business goals, there have been IT system changes and there are consequently different work routines being implemented by users. The preceding clarification seeks to minimise multiple interpretations through clear definitions and specified characteristics. In addition, specificity is exhibited by the constructs through their definitions and stated characteristics and exemplar and generality is exhibited through the wide range of situations to which they may refer. Furthermore, the paper defines both of these constructs as unidimensional or reflective constructs where there are no sub-dimensions or conceptually distinguishable facets (Petter, Straub, and Rai, 2007).

3.2.2 Associations, states and events

The proposed theory specifies a particular sequence of events, as depicted in Figure 1 below. There can be an infinite amount of cycles, theoretically, and each cycle always begins with a social system that causes change to occur in its corresponding IT system, resulting in ITC, due to new informational requirements. Then, once change occurs in the IT system, it reciprocally causes change to occur in the social system, resulting in SSC, due to organisational requirements. Once change has occurred in the social system, the current cycle ends and another cycle can begin. An underlying assumption is that new informational requirements will arise in perpetuity. Of interest is whether any new informational requirements result from SSC itself. If so, then it could be further stated that SSC reciprocally causes ITC. Empirical data should be able to determine whether new informational requirements originate from a social system's external environment, internal environment, SSC or some combination of these.

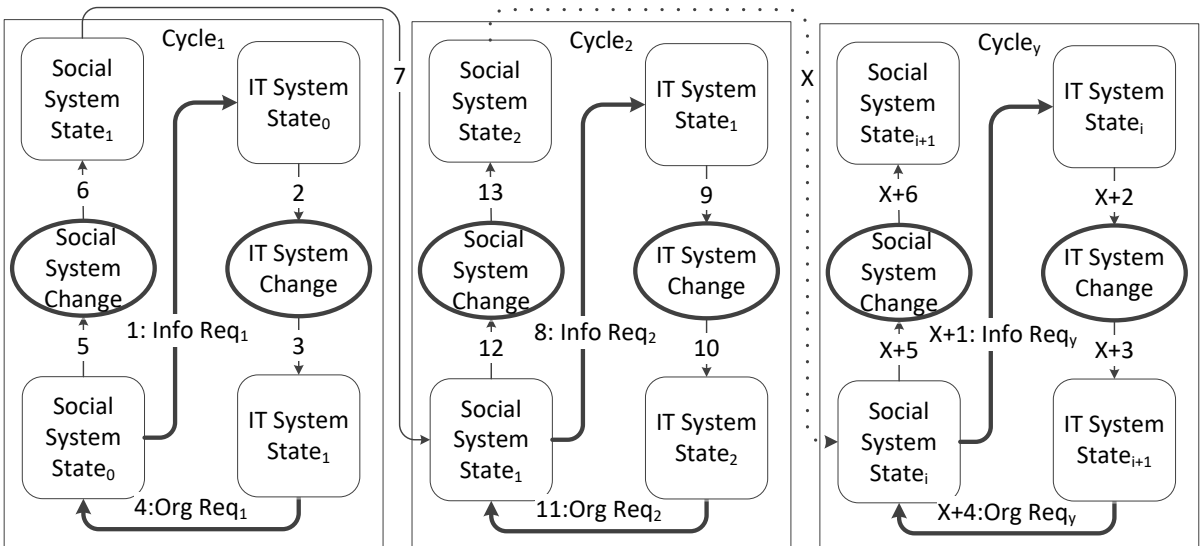

Figure 1: Proposed IS theory of reciprocal change

The associations depicted in Figure 1 represent direction of causality. Measurement indicators for each construct are expected to show that ITC causes SSC. Depending on the choice of indicators, this may be a positive or negative relationship, and may or may not be linear. Indicators for each construct should be dependent on the nature, characteristics and measurement requirements of the research scenario under consideration. For example, where a research scenario involves changes to a management information system, the potential indicators for measuring SSC and ITC could be those provided in Tables 1 and 2 below. Data could be gathered after many successive changes implemented on the IT system to obtain enough data points for statistical analyses.

Table 2: Potential SSC construct indicators for the management information system scenario

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
My weekly reporting process is much quicker					

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
The process to identify exceptions is more accurate					
I report the information directly to the departmental manager as the system now verifies the information that my line manager had to manually verify					
The culture has become proactive now that the system warns about potentially problematic transactions					
I had to implement several workarounds to achieve my daily outcomes					
I may be reassigned because the system performs the processing that I used to do					

Table 3: Potential ITC construct indicators for the management information system scenario

	Quantity
The function points implemented per function type (outputs, inquiries, inputs, internal files and external interfaces)	
The use case points implemented	
The story points implemented	
The size of non-functional requirements implemented	
The size of functional requirements implemented	
The financial cost of changes implemented	

In addition, a state refers to a quantitative value representing a construct (Weber, 2012). Closely related to a state is an event, which refers to a construct that undergoes an alteration from a before state value to an after state value (Weber, 2012). Determining the complete space of states and events is beyond the scope of the paper, since these are dependent on the specific indicators selected for each research scenario.

3.3 The qualities of the proposed theory

The proposed theory is important for research and practice. For researchers, the proposed theory provides a basis for explaining and predicting the reciprocity of change within IS and it provides direction for future research in the domain. For strategic and operational management, being able to understand and anticipate how changes made to an IT system influence a corresponding social system enhances decision-making, resource allocation, planning, implementation and change management. Furthermore, such insight mitigates unintended and undesirable effects that IT system changes can have on an organisation's social system and performance. The proposed theory promotes the simultaneous design and management of IT system and social system changes.

The proposed theory is novel because it extends prior research (Lee, 2004; Lee, 2010) into a set of constructs and relationships that can be operationalised, tested and falsified in various organisational contexts. Such novelty facilitates new thinking about IT-related organisational change, new avenues of research and new ways of managing IS. The proposed theory is parsimonious, comprising two focal constructs and two associations. This has the benefit of limiting the conceivable state and event spaces, which promotes research precision and efficiency. For strategic and operational management, the proposed theory is parsimonious yet comprehensive enough to guide the planning, analysis, design, development and implementation of their IT-related organisational change. Furthermore, the proposed theory can be regarded as a macro-level theory as it is general enough to apply to many different contexts involving IT-related organisational change.

Importantly, scientific theories have to be falsifiable. This requires that a theory be specified precisely enough that empirical tests can be undertaken to falsify or fail the theory. Only if a theory survives and continues to explain new evidence can it be regarded as a useful theory. The ITC and SSC constructs provide a basis for researchers to develop indicators and test the proposed reciprocal and causal relationship from ITC to SSC. Thus, this section answers the third research question by presenting an original set of constructs and interrelationships, the proposed theory, that enables the operationalisation and testing of the reciprocal, causal and cyclical changes that occur as social systems and IT systems interact.

4. Conclusion

IT systems are unique artefacts (Robey et al, 2013). In particular, software comprises complexity, conformity, changeability and invisibility (Brooks, 1987). This warrants a unique IS theory, being the proposed theory, for

understanding the reciprocal, causal and cyclical changes that occur as social systems and their corresponding IT systems interact. The proposed theory provides the foundation for explaining and predicting how changes to IT systems impact organisational social systems, which include roles, communication patterns, division of labour, culture, reporting relationships and business processes. With knowledge about the impact of IT system changes, strategic and operational management can better plan, organize, control, govern and lead their organisations toward their organisational goals, and avoid unintended and undesirable consequences.

Nonetheless, the proposed theory requires empirical evidence and repeated attempts at falsification. To facilitate this, future research should proceed by identifying various organisational contexts and IT systems, develop applicable indicators for each, and test the proposed reciprocal and causal relationship from ITC to SSC. Future research may also provide answers to the following research questions:

- How are different types of IT system changes and different types of social system changes related?
- How are different types of IT system changes associated with different types of IT systems?
- How are different types of social system changes associated with different types of organisations?
- How are IT system changes that were not initiated by informational requirements from the corresponding social system related to changes in that social system?

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