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Abstract

This paper examines the additional insights that can be gained from applying multiple theoretical lenses to the interaction of users and technology. Researchers have stated the value of applying multiple lenses but generally these arguments have remained conceptual. The paper describes the implementation of an electronic document management system and the consequent user interactions over time that we call the process of technology appropriation. Four theoretical lenses are applied to the case study both individually and in combination. The additional lenses provide insights that were not available with the use of a single lens. The contribution of this paper is to demonstrate empirically ways in which a multi-lens approach can add value to information systems research.

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ADDITIONAL INSIGHTS FROM APPLYING MULTIPLE THEORETICAL LENSES: TECHNOLOGY APPROPRIATION BY INDIVIDUALS

Abstract

This paper examines the additional insights that can be gained from applying multiple theoretical lenses to the interaction of users and technology. Researchers have stated the value of applying multiple lenses but generally these arguments have remained conceptual. The paper describes the implementation of an electronic document management system and the consequent user interactions over time that we call the process of technology appropriation. Four theoretical lenses are applied to the case study both individually and in combination. The additional lenses provide insights that were not available with the use of a single lens. The contribution of this paper is to demonstrate empirically ways in which a multi-lens approach can add value to information systems research.

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Introduction

We build on the concept of triangulation (Jick 1979) where complementary research methods provide a convergent and more accurate picture of a phenomenon. More generally, a richer and more complete picture can be gained when researchers employ multiple research methods and multiple informants. Extending this to include multiple theoretical lenses has the potential to

further deepen our understanding: while any one theoretical lens brings some forces, variables or concepts to the fore, it also necessarily obscures others. No researcher can capture the infinite detail of reality. We select lenses that allow examination of some details to the exclusion of others: “Theory acts as a lens through which we focus and magnify certain things, while filtering out other things presumed to be noise” (Truex, Holmstrom and Keil 2006:800). Thus, using multiple theoretical lenses that foreground different details has the possibility of adding greater understanding of a phenomenon. On the other hand, it may threaten parsimony, epistemological purity and clarity of perceptions.

Van de Ven and Poole (1995) argue that both combining theoretical lenses and juxtaposing them have benefits for researchers. However, such an approach is not commonly used in information systems (IS) research. In this paper we apply Van de Ven and Poole’s four ‘theories of change’ in a case study investigating how users appropriated an information system. The introduction of a new information system into an organizational context is an example of organisational change and so is well-suited for studying use of these four theoretical lenses. We seek to identify whether any additional understanding is derived from the application of multiple theories of change when studying technology appropriation and so our research question is ‘*In what ways does application of multiple theoretical lenses contribute additional insights to understanding of technology appropriation?*’

The paper outlines arguments supporting use of multiple theoretical lenses and provides examples where multiple lenses have been applied by IS researchers. It details the four theories of change presented by Van de Ven and Poole (1995), analyses the key characteristics of each theory and hallmarks of their application. It also introduces the concept of technology appropriation that was used in this research. The paper then presents a qualitative case study of

the appropriation of an IS within Defence. The case is analysed using the four theories of change and the additional insights from applying multiple lenses are presented. The findings are discussed and implications for IS research are analysed.

Background

1. Why multiple motors?

Theory plays a central role in IS research. Theory is a ‘web of meaning’ (Neuman 1991: 33) about a phenomenon. Here we are interested in theory of the middle range (Merton 1968:39) that involves some abstraction but is still closely linked to empirical observations. Theory “guides the process of making sense of complicated and often contradictory real-world phenomena” (Truex et al. 2006:800). In acting as a lens, theory can blind us: just as it influences what we see, it also influences what we do not see (Weick 1985). The value of combining theories in a study has long been advocated in the social sciences but has rarely been applied in IS research.

There are two ways to apply multiple theoretical lenses in research (Okhuysen & Bonardi 2011; Van de Ven and Poole 1995). The first and more common approach is to combine lenses. The second is to apply multiple lenses separately. Okhuysen & Bonardi (2011) argue that combining lenses provides value when tackling complex, real-world problems or where there are ‘isolated silos of knowledge’ that obstruct richer or more complete understanding. However, they note challenges in combining theories arising from differences in the phenomena studied by each theory and compatibility of their underlying assumptions. These concerns are echoed by Truex et al. (2006) in their discussion of adaptation of non-IS theories to our field. Applying theories from our reference disciplines raises concerns including the fit with the phenomenon of interest and issues of epistemology, ontology and methodology that underpin the theory. One risk of

adapting theory (Truex et al. 2006:799) is “the temptation to adapt and use the bits of a theory that seem applicable to the task at hand without having understood and considered the limits and problems that may be associated with that theory.”

An effective area for combining theories is where the candidate theories focus on similar research areas but with incompatible assumptions about processes, causal relationships, mechanisms of change and other influences (Okhuysen & Bonardi 2011:9). Researchers may aim to develop more powerful or complete explanations than those derived from use of existing lenses. The challenge for researchers is to bridge the different perspectives so that a coherent and plausible explanation is constructed. This requires a thorough examination of the soundness and realism of each theory’s underlying assumptions and identification of common rather than incompatible areas. This may help researchers identify areas where additional explanations are needed. This is where combining lenses offers the greatest leverage. It is important to note that each contributing theory need not have equal weighting but “rather, that one will be in the foreground and will be enriched by the perspective provided by the other” (Okhuysen & Bonardi 2011:10)

A different approach is that of Van de Ven and Poole (1995) who present four ‘ideal type’ theories that they claim are the building blocks for explaining organizational change. They believe that the interplay between these theories is the basis of most more-complex theories of change. Like Okhuysen & Bonardi (2011), they observe the ‘compartmentalization’ of perspectives has produced isolated and impoverished lines of research. However, in addition to combining theories that is advocated by Okhuysen and Bonardi, they also see the value of applying multiple lenses separately. Juxtaposing or placing the different perspectives side by side then surfaces different “world views of social change” and may enable emergence of new

theories with “stronger and broader explanatory power” (Van de Ven & Poole 1995:511). Van de Ven and Poole argue that more comprehensive understanding of complex issues arises from the interplay between different perspectives because each perspective on its own can only offer a very partial view. Thus, they do not look to merely combine theories but to use them to provide ‘alternative pictures’ of the one phenomenon.

2. Theories of Change

In 1995, Van de Ven and Poole claimed that most research papers draw on at least one of four fundamental theories of social change in their description of change. They described these four theories - the life cycle, teleological, dialectical and evolutionary theories – and presented simplified outlines and analyses of each.

A lifecycle perspective explains change in terms of a sequence of phases through which a system passes. The progression through the phases is presumed to follow a certain immanent logic or sequence that is pre-programmed. Whilst the environment influences how the entity expresses itself, these are mediated by the immanent logic. Such an immanent or prescribed motor of change, called the generative mechanism of change by Van de Ven and Poole (1995), provides little clarification in explaining how and why the system changes.

A teleological perspective frames change as being driven by the purposeful pursuit of goals. The generative mechanism is the enactment of goals. Entities are seen to act as intentional agents working to fulfil their goals. These agents are presumed to be adaptive and creative in formulating and enacting their goals. Unlike lifecycle theories there is no prescribed sequence. Instead, there is “a repetitive sequence of goal formulation, implementation, evaluation, and modification of goals based on what was learned or intended by the entity” (p. 516).

Dialectical theories explain stability and change by reference to the tension that exists between opposing or contradictory forces, such as that between advocates of the status quo, the thesis, and those promoting change, the antithesis (Van de Ven & Poole 1995). The types of outcomes resulting from tensions can be understood in terms of maintenance (the thesis dominating the antithesis), substitution (of the thesis by the antithesis) or synthesis (an emergent result that differs from both the thesis and the antithesis). The generative mechanism or motor of change in dialectical theories is the tension or conflict that exists between opposing forces.

Evolutionary theory explains change as occurring through a continuous process of variation, selection and retention (Van de Ven & Poole 1995). The generative mechanism is competition between multiple entities. Variation comes about due to random or unpredictable changes or events. Selection occurs through competition for scarce resources in the environment. Retention refers to maintenance of an entity's form; it serves to counteract the “self-reinforcing loop between variations and selection” (p. 518). An evolutionary perspective captures the tension between change and inertia associated with the status quo.

These theories have unique process sequences and generative mechanisms to explain “how and why changes unfold” (511) that are described below. These apply to two different levels or units of analysis (single and multiple) and modes of change (pre-defined or emergent), thus leading to a typology of change processes as shown in Table 1.

Process sequences are the typical narrative patterns of change including the sequence in time (When), focal actors (Who) and context (Where).

Generative mechanisms or motors of change explain the process and reasons for change. More than one ‘motor’ may generate a process (i.e. change). Motors may operate at different levels: they might be nested, entangled or aggregated. They might also have different impacts on each

other: reinforcing, dampening or complex. Finally, motors may have a range of temporal relationships: succession (one motor displaces another), entrainment (external pacing factor causes coordination amongst motors) or cycle (alternating impacts of different motors).

Levels or the **unit of change** may be single and multiple. Although change occurs at many levels including the individual, group, organization and population, Van de Ven & Poole collapse these into two levels: within a single entity or the relationships between multiple entities.

Mode of change relates to whether the process sequence is “prescribed a priori by either deterministic or probabilistic laws or whether the progression is constructed and emerges as the change process unfolds” (Van de Ven & Poole 1995:522). A prescribed mode involves a pre-specified direction or program; there may be variations on this but the theme is continuity and predictability. A constructive mode “generates unprecedented, novel forms that, in retrospect, are often discontinuous and unpredictable departures from the past.” The process is emergent over time and so is unpredictable and may result in discontinuity.

<p><i>Multiple Entities</i></p>	<p><i>Evolutionary</i></p> <p><u>Process sequence</u></p> <p>Repetitive sequence of variation, selection and retention</p> <p><u>Motors of change</u></p> <p>Population scarcity, environmental selection, Competition (population</p>	<p><i>Dialectical</i></p> <p><u>Process sequence</u></p> <p>Cycles of dialectical progression: synthesis is produced from resolution of thesis and antithesis</p> <p><u>Motors of change</u></p> <p>Pluralism (diversity), confrontation,</p>
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	level)	conflict
<i>Single Entity</i>	<p><i>Lifecycle</i></p> <p><u>Process sequence</u></p> <p>Necessary sequence of stages</p> <p><u>Motors of change</u></p> <p>Immanent program, regulation, compliant adaptation.</p>	<p><i>Teleology</i></p> <p><u>Process sequence</u></p> <p>Cycle of goal formulation, implementation, evaluation and modification</p> <p><u>Motors of change</u></p> <p>Purposeful enactment, social construction, consensus</p>
	<i>Prescribed Mode of Change</i>	<i>Constructive Mode of Change</i>

Table 1 Key characteristics of Van de Ven & Poole’s ‘ideal type’ theories

Indicators or cues to identify whether each theory has been applied are detailed in Table 2.

Theory	Indicators
<i>Lifecycle</i>	Single discrete entity, undergoes change but maintains its identity. It passes through stages distinguishable in form and function. A program, routine or rule exists that determines stages of development and progress through them.
<i>Teleology</i>	Individual/group acts as a single discrete identity, engages in reflexively monitored action goal and plan to attain it. Set of requirements to attain goal. No fixed order for actions and development path may change.

<i>Dialectical</i>	At least two entities that in conflict, tension or contradiction that give rise to attempts to resolve them or cope. The outcome is emergent or easing of tension.
<i>Evolutionary</i>	Population of entities in a common environment with limited resources. Random or planned variation leads to competition. Identifiable mechanisms exist for selection and retention of entities.

Table 2 Indicators for theories of change (adapted from Van de Ven & Poole 1995)

3. Interaction of People and Technology

IS research has a modest tradition of applying multiple lenses separately (Lapointe and Rivard 2007). Markus (1983, 1994) applied different theoretical models in her studies of user resistance and managers' choice of email. However, her research aim was to assess the power of the different models in explaining and predicting research outcomes (Markus 1983: 430; Markus 1994:502). Several IS researchers have juxtaposed theories to provide different perspectives of a phenomenon. In their study of IS implementation outcomes, Lapointe and Rivard (2007) apply three models at different levels of analysis to examine different phenomena: cognitive absorption is employed to examine individual use, a political variant of interaction theory is used to examine group resistance and the concept of organizational configurations is employed to study organization-level adoption. Having applied each model separately, they then combine them with the aim of providing greater understanding of IS implementation. However, this approach involves investigation of different, though related, phenomena (individual use, group resistance and organizational adoption). One study that applies alternate models to the one phenomenon is Baskerville & Pries-heje (2001) who applied three diffusion of innovation theories to a case

study of an internet company. Each theory surfaced different influences and strategies affecting the company's success. This study supports Van de Ven and Poole's claims that juxtaposing theories or models can provide different but complementary pictures of the one event.

Juxtaposing theories provides one way of “taking down the walls and building bridges” between opposing or competing perspectives (Okhuysen and Bonardi 2011). An IS area with multiple competing perspectives is organizational change associated with the interaction of people with a new technology.

The four fundamental theories of social change identified by Van de Ven and Poole are evident in IS research. A lifecycle perspective underpins the seminal model of systems development, the Waterfall or Systems Development Lifecycle (SDLC). It is also the basis of many IS implementation and diffusion models (Kwon & Zmud 1987; Leonard-Barton 1988; Rogers 1995). A lifecycle perspective facilitates generation of rich descriptions of the interaction between people and technology, as is the case with the Model of Technology Appropriation (MTA) (Carroll et al. 2002).

A teleological approach is evident in cognitive rational theories in IS, such as theories of acceptance and innovation diffusion. These theories assume that change is driven by the intentionality of users, with users' intentions being informed by their beliefs and attitudes toward the technology of interest (Davis 1989; Pfeffer 1982; Venkatesh et al. 2003).

There are a few examples of use of a dialectic approach (Cho et al. 2007; Myers 1994; Robey & Boudreau 1999; Robey et al. 2002). Some IS researchers have drawn on theories in reference disciplines that employ a logic of contradiction. Giddens' structuration theory, for example, incorporates dialectic elements by identifying the possible tensions that exist between human agency and the structural properties of the contexts within which humans are embedded. The

synthesis from this tension is the process of mutual constitution of agency and structural properties. Similarly, critical theory surfaces the tensions between structure and agency.

IS studies have drawn on one or more aspects of evolutionary theory such as co-evolution (Fidock 2002; Kim & Kaplan 2006), and punctuated equilibrium (Lyytinen & Newman 2008; Sabherwal et al. 2001).

Technology Appropriation

The base theory applied in this research was Technology Appropriation (Carroll et al. 2002). Technology appropriation is the process through which “users adopt, adapt and integrate a technology into their everyday lives” (Carroll et al. 2002). It examines the interactions of individual users with technology. Our understanding of users’ appropriations of technology is expressed in the Model of Technology Appropriation (Carroll et al. 2002; Carroll 2004) that is shown in Figure 1.

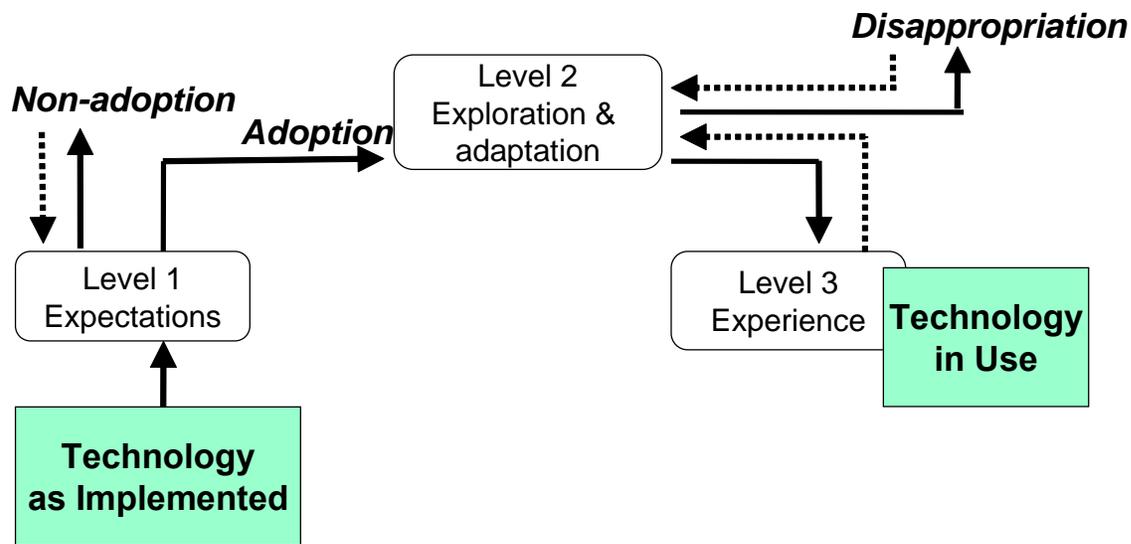


Figure 1 The MTA (adapted from Carroll 2004)

The model represents both the transformation of a technology and a user's evaluations of that technology over time. Thus the MTA expresses the change from a technology as it is provided for use (Technology as Implemented) into the technology as currently used (Technology in Use). As part of this transformation, users evaluate the technology at three levels and choose between outcomes of adoption or non-adoption and appropriation or disappropriation.

Level 1: An initial encounter with a new Technology as Implemented in a shop, sales presentation or training session leads to a filtering process where evaluation is made without any prolonged use of the technology. Users have expectations about the technology and how they will use it. Positive influences on this evaluation result in the decision to adopt the technology; this decision may include the selection of, purchase, or commitment to use a technology (Rogers 1995). Alternatively, users may be uninterested in the technology, resulting in non-adoption.

Level 2: Once adopted, a technology is subject to deeper evaluation that is only possible through use. At Level 2, users explore and experiment with the technology; this may involve adaptation of users' practices to the technology as well as adaptation of the technology itself. Alternatively, disappropriation occurs when, at some stage, users choose not to persist with the technology.

Level 3: Level 3 captures persistent use of a technology. The technology is integrated into users' practices – it is part of their everyday experience. The technology is stabilised, few further adaptations in its configuration occur and users' practices have converged on routine activities. Concepts such as infusion, stabilisation and routinisation capture the nature of use at this level. Changes may lead to re-evaluation of the technology (Level 2) and consequent disappropriation. Technology in Use may vary over time for an individual as multiple stabilisations are achieved (Mendoza, Stern & Carroll 2007); it will also vary for different users of a Technology as Implemented.

The outcomes of users' evaluations are conditional and may be reviewed; this is represented in Figure 1 by dotted arrows. The model can be populated with influences on a particular user cohort and their appropriation of one type of technology.

We believe that complementing the lifecycle perspective offered by the MTA with teleological, dialectic and evolutionary lenses offers the potential of providing greater understanding of an individual's appropriation of a technology than would be provided by drawing on only one theoretical perspective. Van de Ven & Poole 1995 (511) argue that the juxtaposition of these theories will develop new theory that "has stronger and broader explanatory power than the initial perspectives".

Research Design

Applying multiple theoretical lenses in the one research study may have methodological implications. Robey and Boudreau (1999) apply a logic of opposition in studying the role of IT in organizational outcomes. They believe that researchers need to employ research methods suited to their aims, so that opposing forces can be identified and examined over time. The theories they applied—organizational politics, culture and learning and institutional theory—all share common assumptions about reality. This is not always the case when applying multiple lenses. Markus (1994:509) noted that "The differing theoretical perspectives ... make differing and sometimes conflicting methodological demands." These include varying units of analysis (both the individual and the individual within an organization), hypothesis testing (surveys across hierarchical levels and large samples for statistical analysis) and inductive analysis (interviews). Applying methods drawn from different research paradigms surface concerns about the capacity to effectively reconcile competing paradigms that are argued to be incommensurable (Mingers 2004; Truex et al. 2006). Such a mixed-method research design differs from employing

complementary research methods underpinned by the one paradigm that is common in case study research (Yin 1995). Rather, each theoretical lens may require unique types of data that represent different ontologies and epistemologies.

While applying multiple theoretical lenses may provide richer explanations, they also threaten parsimony. A single lens that explains one aspect of a phenomenon may offer a bare amount of necessary detail. Multiple lenses foreground multiple aspects of a phenomenon that may result in complicated details that obscure clarity. We follow Weick (1979) who aims for theory that is “accurate, parsimonious, general, and useful.”

Examining individual’s appropriation of a system using the four perspectives presented by Van de Ven and Poole (1995) indicates a multi-method research design. A life cycle approach indicates qualitative data. These may draw on interviews, focus groups, observations, notes from meetings and conversations and historical recollections (Leonard-Barton 1988 ; Tyre & Orlikowski 1994). Such approaches typically provide rich descriptions of users’ appropriation activities. These descriptions often entail a processual or longitudinal aspect, where change in the phenomena of interest unfolds over time (Dey 1993). A teleological approach in IS research is evident in cognitive rational theories that assume that use is an outcome of users’ intentionality that is informed by their beliefs and attitudes. These theories employ statistical analysis of quantitative data to infer relationships between variables of interest. In quantitative research, use is largely conceptualised as the extent of use with little attention given to exploring or defining the use concept (Burton-Jones & Straub 2006). Dialectics requires qualitative data to enable conflicting forces to be identified and process data to study unfolding relationships between conflicting forces over time (Robey and Boudreau 1999). An evolutionary perspective requires data about populations that enables analysis of the processes of competition for scarce resources.

For this research, we constructed a multi-method research design that employed interviews, observation, questionnaires and document analysis.

We selected semi-structured interviews. We examined some aspects of the appropriation process via a pre-defined set of questions. However, the phenomenon of appropriation has emergent features and so the researcher introduced new questions to follow up on issues raised by interviewees. A form of semi-structured interviewing called the repertory grid is particularly useful for a dialectic perspective. We elicited participants' beliefs through presenting three pre-defined elements. For example, the researcher may select the elements 'car', 'train' and 'donkey'. The interviewee is then asked to consider how two of the elements are like each other but different from the third (Reger 1990). The interviewee produces bi-polar statements about the elements such as: car and donkey are alike because they only can carry a few people, whereas a train is different because it can carry many people. In this research the elements were: previous IM (information management) practices; IM using the new system; and ideal IM practices. Participants were asked to talk through and provide additional explanations for their bi-polar statements.

Observation as a detached observer (Adler & Adler 1994) provided access to participants' actions as well as their recollections of their actions gained through interviews.

Questionnaires were designed to collect both quantitative and qualitative data through use of rating scales and open and closed questions (Bryman 1989). Closed questions were chosen to collect demographic information and for forced choice responses, such as yes/no, while open-ended questions were included to elicit comments associated with particular rating scales.

Documents were analysed to identify historical circumstances leading to the acquisition of the system and evaluations of systems that pre-dated the current system. Also, in this research it was

important to position users' choices and actions in the context of the 'technology as implemented'. Evidence such as the system requirements documents was important in establishing the intentions of customers and designers.

Case Description

This study was undertaken within a Defence organisation. The MTA predicts that adaptations to technology and practices will occur over time and that patterns of appropriation across individuals are likely to be heterogeneous. Defence provides an extreme context that manifests strong structural and cultural imperatives to control use and thereby limit adaptations and variability in patterns of appropriation across individuals and over time. Defence is therefore well suited to examining the effectiveness of the MTA in explaining the process of technology appropriation in organisations. If evidence of heterogeneous and dynamic appropriations is found in such a constrained context then this would suggest that the MTA has utility in less constrained organisational contexts.

The electronic document management system (EDMS) was implemented into three sections of Defence. This was a pilot implementation, intended to reduce the risk of broader implementation. The Defence context meant that use was mandated, to the extent that 'use' can be mandated. EDMS was introduced to improve document and information management. Previous practice was individually-based with ad hoc processes. Documents were stored on individual desktop computers and disseminated in paper and electronic versions. Much information handled was sensitive. Document (paper-based and electronic) management was reaching crisis point where locating information, sharing it (i.e. to maintain corporate memory) and archiving documents (to comply with legislation) were problematic. EDMS was implemented to track accountability,

shift from individual to group storage (and so access) and to comply with legislative requirements.

No formal requirements process was undertaken. An existing records management system was enhanced to provide document management and a requirements document induced from the capabilities of the enhanced system. The new system necessitated major changes in business practices, including additional steps when creating and modifying documents that are core activities in the three sections. The need to input metadata for each document as well as new naming and storage conventions required a change in culture from individual to group focus and from decentralised to centralised information management.

Views of multiple stakeholder groups were sought. 134 were participants selected from across the three sites plus employees involved in managing or supporting the EDMS implementation. Users covered the main levels of the organisation and included civilian and Defence employees from Army, Navy and Air Force. They had been exposed to the system for between 1 and 16 months.

Data were collected at two time points: initial and follow up, with 13 people studied in both time points. Initial data collection involved 102 people of whom 80 provided their perceptions of EDMS and patterns of use (this was 32% of the user population). The follow up featured 45 people, of whom 34 providing information about EDMS (13% of the population).

Findings

The case findings will now be examined through the lens of each of the four mechanisms identified by Van de Ven & Poole (1995): lifecycle, teleology, dialectics and evolution. Illustrative examples are provided to illustrate the value of multiple perspectives.

Lifecycle

<i>Generative mechanism</i>	Immanent program, regulation, compliant adaptation. Known end-state
<i>Cues to identify</i>	Single discrete entity, undergoes change but maintains its identity. Passes through stages distinguishable in form and function. Program, routine/rule exists that determines stages of development and progress through them.

In the MTA, the unit of analysis is the individual user who encounters a new technology or system (Level 1). A user follows a series of phases with clear outcomes: the initial encounter results in a doption or not, further interaction between the user and technology results in persistent use or disappropriation.

Adoption of the EDMS system largely occurred because use was mandated. Users had little discretion over using at least some aspects of the system. The system was used by all respondents to store and manage MS Word documents. However, there were second-hand reports of non-adoption, with the executive staff in one section not using EDMS directly. Rather, they wrote changes on paper documents that subordinates scanned into EDMS.

In the MTA, adoption is followed by a period of exploration and adaptation (Level 2). Users adapt their practices to incorporate the technology and may also adapt the technology to meet their needs. All respondents to the follow-up questionnaire had adapted their practices. For example, use of EDMS to store or create MS Word documents involved new information management practices, as entry of metadata was required when creating a new document. These new practices were generally added to existing practices: 27 of 32 respondents employed all

available storage options, not just EDMS. At this phase, appropriation of EDMS was sometimes partial: there was limited use of core features. Workarounds were evident such as entering nonsense data into metadata field and storing documents on local PC hard disks. Other participants used EDMS for a wider range of document types and activities and so appropriated it more completely.

Adaptations to EDMS occurred at the organisational level. An in-house application was developed so that documents on EDMS could be shared with other parts of Defence (who were not part of the EDMS trial). Also, the EDMS vendor created an add-in so that email in the corporate email system could be transferred into EDMS. Adaptations to EDMS by individuals were not possible due to tight controls over this system, which is common Defence practice.

Over time, under the MTA, adaptations cease and use patterns stabilise. Users integrate a technology with their practices (Level 3) or dis-appropriate it. At an organisational level (from the viewpoint of the Information Manager), patterns of appropriation had stabilised with the use of EDMS by users described as being “*part of what they do every day*”, and reports of user acceptance and organisational dependence on the system.

Teleology

<i>Generative mechanism</i>	Purposeful enactment of goals, social construction, consensus.
<i>Cues to identify</i>	Individual/group acts as single discrete identity, engages in reflexively monitored action to socially construct, share and plan to attain the goal. Set of requirements to attain goal. No fixed order of actions and development path may change.

The purposeful pursuit of goals by intentional agents operated in the EDMS case at the organisational and individual level, which provided a multilevel examination of teleology.

The implementation of EDMS was intentional with clear organizational goals. There was pressure from top levels of Defence and from the government to improve document and records management. Key stakeholders decided that a system should be acquired, piloted and implemented to achieve the goals of improved document and information management.

Once EDMS was implemented, individuals also engaged in intentional acts. Participants made active appropriation choices shaped by a variety of influences. Consistent with prior research, perceived usefulness and ease of use were significantly correlated with system use (Karahanna et al. 1999) as were support and training (Al-Gahtani & King 1999; Igarria et al. 1995), and competence (Clegg et al. 1997; Compeau et al. 1999; Henry & Stone 1997). System design, and business impacts (the extent to which EDMS had led to improvements in specific document and information management tasks) were also related significantly with system use.

Users' goals were intentionally adapted as a result of learning. For example, some users had experienced loss of documents they were working on and many users had been affected by the system being unavailable on occasion, preventing them from accessing certain documents. As a result, a number of users decided to minimise their use of the system, or actively work around it, in order to reduce the chances of losing work or having problems accessing documents in the future. Such an outcome is not part of the immanent logic of a lifecycle theory.

Dialectics

<i>Generative mechanism</i>	Pluralism (diversity), confrontation, conflict
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<i>Cues to identify</i>	At least two entities that are in tension, contradiction or conflict. These give rise to attempts to resolve or cope with the conflict. Outcome is emergent or easing of tension.
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The repertory grid analysis surfaced tensions related to the introduction of EDMS to users' existing portfolios of technologies and practices. Prior to EDMS, individuals had a range of IM practices using paper, e-mail and various network storage options. These prior practices and technologies were an important influence on users' evaluation of EDMS. Carroll (2008) uses the phrase "technology portfolios" to convey the use of a collection of complementary technologies. The existing portfolio of document and information management technologies represented the thesis. EDMS and new information management procedures represented the antithesis. Maintenance of the thesis was difficult since use of EDMS was mandated. Nevertheless, there was evidence of non-adoption and partial appropriations. Substitution of existing technologies and practices by EDMS and new IM practices was identified by examining the different storage options used. Four people had replaced storage of MS Word documents on network drives with storage on EDMS, indicating substitution. However, 27 of 32 respondents used all available storage options suggesting that substitution had not occurred for most users. Various syntheses were the most common outcome, with EDMS becoming part of users' portfolios of technologies and practices rather than replacing the existing technologies within their portfolios.

EDMS provided users with functionality designed for a variety of tasks. User perceptions of the value of this functionality, assessed using business impact, were generally quite positive. However, users were far less positive about system usability, with almost half of those providing comments raising concerns. From a dialectic perspective, system functionality represented the thesis and usability the antithesis. Outcomes from this conflict included users:

- effectively appropriating system functionality to support their work (dominance of functionality)
- minimising use of EDMS (dominance of usability concerns)
- employing core functions that were easier to use, such as document search and creation, and avoiding those that were more complex, such as collaborative document development. In the latter case, there were reports of personnel maintaining paper-based approaches.

A dialectical perspective highlights the importance of studying the introduction of a new system not just as a stand-alone resource, as depicted in the MTA, but also in relation to a user's existing portfolio of resources. It also shows that a Technology as Implemented is not always evaluated as a whole. It is composed of different functions and attributes that users may evaluate individually and so affecting whether and how the technology is appropriated.

Evolution

<i>Generative mechanism</i>	Population scarcity, environmental selection, competition (population level)
<i>Cues to identify</i>	Population of entities in common environment with limited resources. Random/planned variation leads to competition. Identifiable mechanisms exist for selection & retention of entities.

Evolution refers to population-level changes. Looking across the three sites over time, competition between the old and new led to persistence of some old technologies and practices in addition to the introduction of some new ones to reach a point of retention of this new portfolio.

An important influence on the appropriation choices of some individuals was the experience of losing documents. This was an unanticipated variation. People working in the HQs were in time-poor and so constrained in their capacity to incorporate new technologies and practices. Losing work introduced an additional time impost because of the need to rewrite documents. Consequences were reversion to technologies and practices that pre-dated EDMS, minimising use and workarounds to avoid EDMS.

Retention of existing technologies and practices was apparent not only for those who had lost work, but for all of those people who completed the follow-up questionnaire. All 32 respondents employed at least one other method of storage besides EDMS, with 27 employing paper, network drives (home drive, group drive and mail box) as well as EDMS.

Discussion

Juxtaposing theoretical lenses

Being a lifecycle model, the MTA explains change primarily in terms of a sequence of pre-determined phases. However, the MTA is limited in its ability to explain why this movement through the phases occurs. We aimed to increase its explanatory power by juxtaposing additional theories of change. Thus the lifecycle theory with its immanent progression and pre-determined outcomes has been augmented by three other theories of change outlined by Van de Ven and Poole (1995).

The teleological perspective draws attention to the intentional pursuit of goals, both individual and organizational. It brought into relief the role of beliefs and attitudes in shaping intentions, choices and actions. It was particularly valuable in the earlier phases of the appropriation process, explaining why Technology as Implemented was selected and users' expectations of

usefulness, ease of use and business impacts. Failure of the EDMS to live up to these expectations led users to adapt their goals, resulting in partial appropriation, minimising use and workarounds due to system performance issues that were not highlighted by the lifecycle approach.

Nevertheless, there were influences for which a teleological perspective was unable to account: prior appropriations, discrepant events and habitual use. This is because these influences do not entail perceptions of a system. A teleological lens therefore appears more suited to understanding users' initial encounters with a particular technology and their adaptations to the technology (Levels 1 and 2 of the MTA). It is not as useful for understanding habitual patterns of use (Level 3).

Dialectic theories explain change by reference to the tension that exists between opposing or contradictory forces, such as that between advocates of the status quo, the thesis, and those promoting change, the antithesis. Maintenance, substitution or synthesis are the outcomes resulting from these tensions. A dialectic perspective was particularly valuable in surfacing the role of existing technologies in the appropriation of a new technology. EDMS was introduced to replace existing records and information management technologies and so lead to new practices: EDMS was the antithesis to the status quo or thesis. However, use of EDMS alongside of pre-existing paper and network based systems represented a synthesis between the old and the new. It also highlighted tensions arising from different perceptions of the attributes of the one technology, particularly its functionality and usability. This surfaces a finer-grained view of 'technology' in the MTA.

An additional extension to the process description of the MTA is the inclusion of prior appropriations as part of the wider context. At what point does the appropriation process begin?

It begins when the user encounters a technology for the first time such as in a product review, an advertisement or when observing another user interacting with it. However, users are not empty vessels. They bring with them certain experiences that shape how they make sense of the new technology, that influence what they believe will be possible to achieve using the technology. Where prior appropriations relate to experiences of similar technologies, they can be thought of as the interface between two processes of appropriations for similar technologies.

An evolutionary perspective explains population-level change as occurring through a continuous process of variation, selection and retention. Variation results from random or unpredictable changes or events such as reliability problems. Selection occurs through competition for scarce resources in the environment. Time and effort were important resources that affected selection. Retention refers to maintenance of an entity's form; which serves to counteract the impetus for change created by variation and selection. Inertial forces were apparent in the EDMS case through maintenance of pre-existing practices and technologies.

Combining lenses

Van de Ven and Poole (1995) argue that combining lenses – or more specifically, the motors associated with each lens – may occur in different ways. In this section, we combine the lenses temporally to assist in explaining the genesis or transitions between changes (Van de Ven & Poole 1995). The lifecycle theory is the primary motor of change in the MTA. Adding other theories as secondary motors can explain the transitions between phases, or Levels in the MTA, as represented in Figure 2.

productive in the EDMS case study. The evolutionary lens focuses on population level changes whereas the MTA is pitched at the individual level. Its primary value arose from highlighting the effects of random or unexpected variations.

Limitations

The scope of our paper necessarily involves limitations. Firstly, Van de Ven and Poole's discussion of the four 'ideal types' of theories is necessarily abbreviated. A few common aspects of each theory have been extracted. As a result, it excludes much of the richness of each theory and the nuances with which it can be applied. Secondly, in this paper we have selected illustrative examples to address the research question. Thus, each is simplified both in exposition of the perspective and its application to the EDMS case.

Conclusion

In this paper we posed the question: *'In what ways does application of multiple theoretical lenses contribute additional insights to understanding of technology appropriation?'* To address this question, we juxtaposed and then combined four lenses temporally.

Applying each lens separately allows us to gain a more complete view of a phenomenon, in this case, the appropriation of the EDMS. Each of four theories of change provides unique insights into the process of technology appropriation. Placing these insights side by side provided explanations for observations that could not be explained by any one lens.

We then combined the lenses temporally, a cross the process of technology appropriation to explain the genesis of transitions between changes in patterns of appropriation.

Van de Ven & Poole (1995:511) argue that juxtaposing different perspectives may provide the basis for new theories with "stronger and broader explanatory power." In this paper we

juxtaposed and then combined different theories to augment the Model of Technology Appropriation. We have illustrated ways in which different perspectives contributed additional insights to our understanding of technology appropriation. Other ways of combining lenses may lead to emergent outcomes rather than just aggregation as we have seen here. Further research to increase the explanatory power of the MTA will involve comparing and contrasting the value of these different lenses at different phases of the MTA.

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