EMERGENCE AND CONSEQUENCES OF DRIFT IN ORGANIZATIONAL INFORMATION SYSTEMS

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Abstract

The increasing ubiquity of information systems in organizations has been accompanied by a rise in users adopting technology that is not officially mandated (often known as shadow IT). This study examines the emergence and consequences of such locally-driven but centrally-unintended adaptations of an organization's collection of IT assets. This phenomenon, referred to as "IS portfolio drift, can be costly: the expenditure on developing, purchasing and supporting the officially-mandated applications is squandered, while additional funds are needed to maintain the shadow systems. Decision quality could be reduced, because of uncertainty over data provenance. However, portfolio drift can also be beneficial: it reflects employees' innovativeness in adapting to environmental change or in using emerging technologies to enhance their performance. I use a practice theory perspective to highlight how portfolio drift is an ongoing, macro-level outcome of the micro-level actions of various agents. The process of governing an IS portfolio is influenced by the relative allocation of power in an organization, how this allocation came to be, and how it changes. Ten case studies are used to delineate a process theory of portfolio drift, and explain the situated practices that steer the portfolio-in-use to meet the goals of the agents involved.

Keywords: portfolio management, drift, shadow systems, governance

1 INTRODUCTION

Information systems (IS) portfolios change when new systems are installed or existing systems are retired. This happens because of changes in the environment or in technology (e.g. Liu et al. 2008; Avison et al. 1998), or because managers and/or users find that the systems provided for their work do not meet their requirements, and begin searching for better applications or devices. Users may also work around burdensome systems. Central IT departments are often not aware of the user-initiated adoption of new systems or workarounds (Behrens 2009), as they are usually decided on and supported locally. Such changes to an IS portfolio can lead to higher support costs, security risks, and data fragmentation (McAfee 2006), as well as being knowledge-inefficient (Snook 2000). On the other hand, they are also considered a necessary part of "process democratization (Hill et al. 2006), which holds that users should be able to make use of emerging technologies to support their work, and as resources for innovation (Behrens 2009).

This study examines this phenomenon, which I term 'portfolio drift', and how organizations have responded to it. The concept of portfolio drift is based on Ciborra (2000) and Snook (2000), and refers to changes in IS portfolios that are locally-initiated and centrally-unintended. Although studies on IS governance have identified mechanisms to help organizations obtain greater value from their IT investments (e.g. Agarwal & Sambamurthy 2002; Sambamurthy & Zmud 1999; Schwarz & Hirschheim 2003; Weill 2004), a gap exists in terms of connecting these mechanisms with the micro-level actions of users and organizational sub-units. In particular, the focus on business-IT alignment does not take into account the influence of intra-organizational issues, such as differences in the level of power across business units, the history of IT use, and the symbolic role of IT. Alongside this, the greater malleability of technology and the increased ability of users to modify their technological environment mean that the agency theory perspective that guides most IS management advice is less useful for depicting the reality facing IS managers. In response, this study proposes the use of a practice lens (e.g. Bourdieu 1977; de Certeau 1984) to examine why portfolio drift occurs and how organizations handle it.

2 CONCEPTUALIZING DRIFT

Ciborra (2000) considered drift to be the deviation of IS systems from their planned purpose because of resistance, learning-by-doing, sabotage, coalition shifts, or serendipity. Examples of drift in information systems include changes in project objectives and configuration (Elbanna 2007), and changes in power differentials within organizations (Ignatiadis & Nandhakumar 2007). While drift has mainly been explored in the context of individual IS projects, I extend it to examine the modifications of an IS portfolio. I define portfolio drift (Figure 1) as occurring when an organization's IS portfolio is modified, either in terms of systems with different capabilities from the existing systems being used or existing systems being re-configured[1]. IS portfolios drift when users introduce shadow systems[2], or work-around or stop using the existing systems in a portfolio.

1 This study focuses on the software components of an IS portfolio. Hardware is usually more deeply embedded in work processes and thus, more difficult to work around.

[2] Shadow systems are IT purchases that lie outside the formal IT procurement plan, and are thus unknown to and unapproved by an organization's formal corporate IT department (McAfee, 2006). The use of shadow systems may lead to positive or negative consequences- the different outcomes may materialize at different levels of an organization and at different points in time.

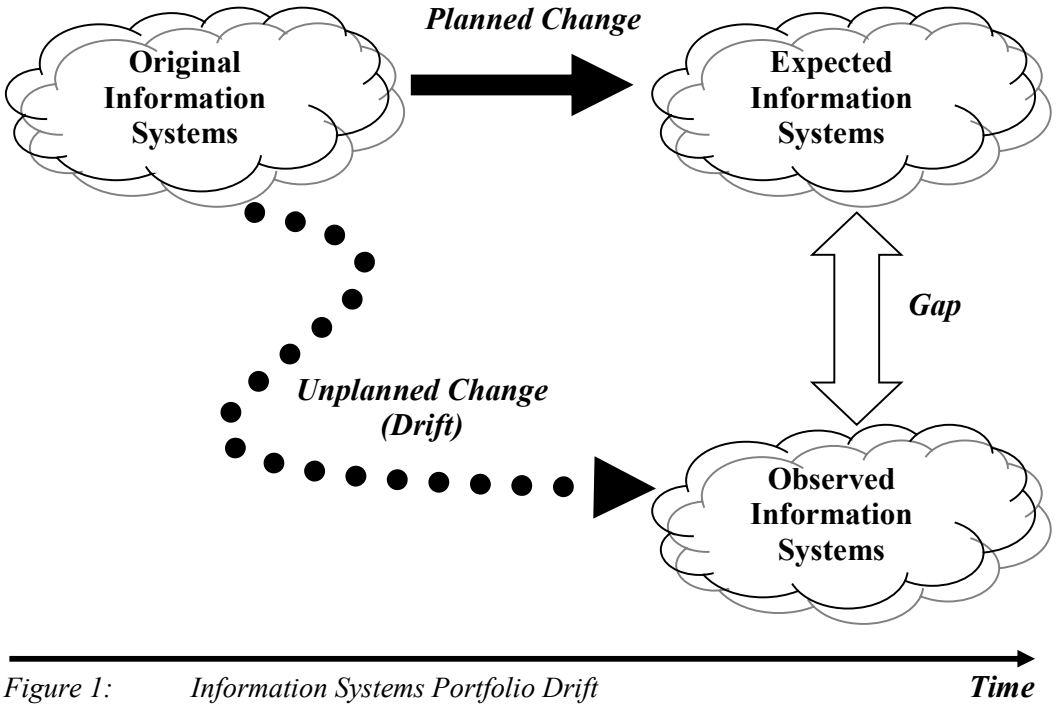

Figure 1: Information Systems Portfolio Drift

2.1 Why Portfolios Drift

While the dominant thread in IS research (e.g. Sambamurthy & Zmud 2000; Schwarz and Hirschheim 2003) is to limit users' scope for action while privileging managers' intentions, macro-level phenomena are now understood to be created and recreated through the micro-level actions of firm members (Orlikowski 2002; Schultze & Orlikowski 2004). Allowing users a greater role in IT management shifts IS research away from determinism toward voluntarism, emphasizing the agency of users (Leonardi & Barley 2008). This is consistent with Lamb and Kling's (2003) critique that most IS research relied on a "thinly socialized concept of the user.

Users affect IS portfolios in at least three different ways: they affect the adoption rate of technologies, they can introduce new technologies as substitutes for the current ones, and they can introduce new technologies to complement current ones. Users today are more familiar with IT and thus able to introduce new technologies into their work environments to complement or substitute what they have been provided with. Many innovations, such as such as USB thumb drives and online chat, were first used by individuals, before organizations adopted them. They are examples of the evolution of IS portfolios from the bottom up, propelled not by managerial mandate but individual choice. Understanding these processes would help remove the sense of '*deux et machina*' often found in studies of IT adoption.

While organizations may invest in various types of IT, merely purchasing something does not guarantee its use. Users can respond to new technologies in different ways: from positive resistance, acquiescence, apathy, negative resistance, to avoidance (Ferneley & Sobreprez 2006; Lapointe & Rivard 2005; Standing, Sims & Love 2009). One way resistance is manifested is in workarounds (cf. Gasser 1986; Koopman & Hoffman 2003). Workarounds are situated practices that rely upon the interpretive flexibility of work rules and are negotiated by social actors (Azad & King 2008) to achieve their goals. They are an example of *'portfolio drift'*. The experiences and abilities of users interact with the capabilities of information systems to produce an IS portfolio-in-use, which incorporates user-initiated workarounds and shadow systems. As workarounds are repeated over time, they can become institutionalized (Azad & King 2009) and difficult to remove from an organization's work processes. When users work around their

work information systems, the aggregate impact of their individual actions is a shift in their organization's IS portfolio.

2.2 How Portfolio Drift Occurs

Individuals are provided portfolios of various types of IT to carry out their work, simultaneously learning about them and appropriating different features. Individuals also introduce into this interaction knowledge, skills and experiences derived from using other technologies. They decide what IT to use for their tasks based on the fit of the tools, the ease of using them, organizational norms, and other factors. This may cause the enacted portfolio (the portfolio-in-use) to diverge from the intended portfolio.

A useful viewpoint to understand these changes is sociomateriality, which posits that the social and technical aspects of a system are entangled, not ontologically separate (Orlikowski 2010). For example, sociomateriality researchers would argue that instead of studying how collaborative practices are supported by IT, we should examine how integrating IT into the act of collaboration reconfigures it, and what this implies for control and responsibility. In this way, researchers can examine the interaction between materiality and voluntarism without privileging either human agency or technological materiality (Leonardi & Barley 2008).

Materiality refers to the impact of the physical attributes of technology on how it is used (Leonardi & Barley 2008). From a sociomateriality perspective, a key issue is: how do the attributes of the technologies and users influence the make-up of the IS portfolio? Another way of phrasing this question is: since portfolios are heterogeneous networks of actants (Law 1992; Latour 1996), how do they evolve over time? It is important to note that sociomateriality researchers leave out a key role when examining users' interaction with technologies: decision-makers. Churchman (1971) discussed how technology use is the result of an interaction between designers, users and decision-makers.

The role of decision-makers is based on their ability to determine what users can use, because they possess some type of power. This is in keeping with practice theory, which focuses on the role of capital and power relationships, and helps clarify: which parties have agency, and whose goals are being targeted? This is worth knowing as it affects the technologies that will be available to users. Practice theory examines how micro-level social interactions have macro-level consequences (Bourdieu 1977; de Certeau 1984; Foucault 1980; Giddens 1984). Agents are autonomous enough to transform social structures, while being sufficiently conditioned to reproduce and incorporate them into their lived practice (Bourdieu 1977). At the same time, practices are guided and enabled by social 'fields' (Bourdieu 1990). As agents interact in these fields, they produce different kinds of capital (economic, cultural, social, and symbolic), and differential access to these creates a basis for power.

Since capital is unequally distributed across agents, they differ in their ability to achieve their competing goals, leading to drift in the IS portfolio. While the relevance of economic, cultural and social capital are clear in an IS management context, the role of symbolic capital is less so. In this context, symbolic capital refers to the ability to decide which components of an organization's IS portfolio are legitimate, as well as the authority to determine how these components should be obtained and managed. The dominant functional perspective of IS management asserts that IT managers possess this capital, but users do not (Liang et al. 2007; Newell et al. 2000). Over time, IS portfolios have become more modifiable because of more general-purpose applications, and widespread IT use. This has reduced the amount of symbolic capital managers possess. The ability to change an IS portfolio is also influenced by the material properties of the technologies being used. Users are better able to define the IT they use if the technology in question is easily circumvented or is fairly malleable. If it is well-embedded in their daily tasks, they will be less able to swap it with something else.

The evolution of an IS portfolio thus depends on the appropriation and re-creation of social and technological structures, the material properties of the technologies, and the balance of power between users and their managers. Managers and users do not have the same goals, because of their competing

interests, and both parties will seek to modify the portfolio following a logic of opposition (Robey & Boudreau 1999). The aim for each agent is for the portfolio to 'settle' at a position which maximizes on the dimensions (i.e. the goals) that are the most pertinent to them. This dynamism is also driven by the impact of the material characteristics of the IT: different types and levels of affordances influence the ease with which technologies can be governed and adopted. The difference between intended and unintended evolution is a measure of the drift of the portfolio, although the embedded nature of IT may make it difficult to identify whether and how much drift has occurred.

2.3 Consequences of Portfolio Drift

IT managers can choose to forego their portfolios' stability and adopt new IT innovations, or minimize changes so that their portfolios remain stable and easy to support. Those who choose the latter are driven by the realization that portfolio drift leads to portfolio fragmentation (the proliferation of redundant systems), wasted resources (the effort spent searching for shadow systems and developing workarounds, and the paid-for but unused official systems), and a misalignment between business and IS strategies. On the other hand, IT managers who tolerate drift may see the performance of their organization improving, because of the introduction of innovations by employees, who are more satisfied with the tools they use for their work. From the exploration/exploitation perspective, drift is closer to exploration, and could help in choosing mechanisms to achieve long-term reliability (Farjoun 2010). Limiting drift is consistent with exploitation as an organization's strategy.

3. RESEARCH METHODOLOGY

A case study methodology was chosen to investigate the research questions. A qualitative approach is appropriate because of the lack of prior research on portfolio drift and the need to understand the rich contexts within which IT adoption and modification decisions are made (Yin 2003). Given that the definition of portfolio drift (i.e. the use of workarounds and shadow systems) is fairly easily to identify, a descriptive approach was used for the case studies (Walsham 1993).

3.1 Data Collection

The data consists of ten case studies on organizational experiences with portfolio drift. These ten case studies are set in the business units of two large organizations. The two organizations were chosen so as to produce sufficient variation in the variables of greatest interest (Eisenhardt 1989), while controlling for other sources of differences. Both sites, EduExcel and EduSucceed, are large universities located in the US Midwest. While they were similar in terms of organizational attributes (e.g. size, number and variety of units, age, level of centralization), their IS portfolios differed substantially. EduExcel allows its sub-units more flexibility in choosing the applications they need, but was moving to an enterprise systems model. On the other hand, EduSucceed has been running its ERP system for about a decade. It was expected that the presence of an ERP system would minimize the amount of drift in EduSucceed relative to EduExcel.

To control for the diversity of the contexts, one business unit from each of these categories was selected for the study: colleges, administrative, facilities management, student services, and athletics. This enabled me to collect data from five business units from each university (a total of 10 cases) with theoretically different IS use needs. Two to four managers or supervisors from each business unit were interviewed. Within each business unit, interview subjects were chosen from various functions, such as finance, human resource management, IT management, and operations, so as to enhance the comparability of the data. In-depth, semi-structured and face-to-face interviews, lasting between one to two hours each, were conducted with 13 EduExcel employees and 14 EduSucceed employees. In addition, EduExcel's change management manager and EduSucceed's CIO were interviewed twice.

3.2 Data Analysis

The first step in the analysis was to use the interviews to create a series of vignettes or short summaries of each business unit's experiences with their IT portfolio and how they managed changes. This helped to identify common themes in the narratives, locate power relations in the sites, and surface important distinctions between EduExcel and EduSucceed that were being continually produced and reproduced. Although the data is from five business units within each organization, the aim is to produce analytical generalizations (Yin 2003), where theoretical concepts and patterns are being generalized. The next step was to combine all comments about a particular aspect from each of the cases into a large spreadsheet. This helped to decontextualize the interviewees' comments from their original settings and place them in an alternative context (Tesch 1990). This was followed by an open-ended process of coding, where themes and patterns were generated by reading the vignettes and interviews (Glaser and Strauss 1967). Scenarios of drift that were common across the ten cases were extracted and summarized with various diagrams. Finally, these interpretations were described using the conceptual language provided previously.

4. RESULTS

IS portfolio drift is defined in this study as locally-driven but centrally-unintended adaptations of an organization's collection of IT assets. Thus, it comprises: a) workarounds of officially-mandated applications and b) the implementation of alternative 'shadow' systems. During the interviews, it was easier to identify examples of shadow IT than workarounds. This was for at least two reasons. First, the interviewees were managers, and did not carry out the routine transactions of their units. Workarounds are usually more familiar to the employees who carry out such transactions. Second, the managers had a greater awareness of the different systems that were present, both official and non-official, because they were usually involved in approving the purchase or development of these systems. In contrast, workarounds do not need to be approved by managers before users carry them out. Despite the lack of detail on workarounds, the existence of shadow systems is sufficient evidence that IS portfolios do drift.

EduSucceed had a considerable amount of drift in its IT portfolio. Although its decade-old ERP system was used by every business unit for their financial, HR or student services' needs, other aspects of its IT portfolio were less standardized. For example, many units had developed or purchased their own reporting applications to complement or supplement the one offered by Central IT. Other applications were deployed to support collaboration, customer interaction and performance assessment, since these functions were unavailable from the applications Central IT provided. Some local units installed their own systems even when systems with similar functionalities were offered by Central IT.

With EduExcel, in contrast, the challenge was in defining drift. Since there were very few central systems, there was in some sense no "original portfolio from which the five units in EduExcel had to drift away. Their IT portfolios consisted of various shadow systems that had been developed over time to deal with the lack of appropriate or useful central IT systems. There had also been little attempt by Central IT to manage the proliferation of local IT systems until the current ERP implementation project. However, a few business units were trying to consolidate their own portfolios, with some success.

4.1 Types of Portfolio Drift

Fourteen instances of portfolio drift were found across the ten business units, and after analyzing them using the framework developed in Section 2.2, three types of drift were surfaced. These categories are discussed below, followed by an example from the case studies.

i) Making a Truce

This type of drift is the result of a negotiated agreement to preserve the balance of power at many levels: between users and managers, between central and local units, and between IT and other functions. From a Bourdieuan perspective, the relative positions of different agents in a field are determined by the types and amounts of capital they hold. The different forms of capital are also both the weapons and objectives as agents struggle to dominate other agents in a field. While both the local and central units possess the means to develop new applications, which is a form of economic capital, only local units can pronounce which application provides the authoritative information they require. The latter ability is a form of cultural capital. Units rich in this field-specific capital of authoritativeness dominate their field. They excel at resisting efficiency-driven requests to use pre-existing applications. The dominated central unit cannot enforce a mandate to use pre-existing applications because declaring a system as being authoritative has consequences for the clients whom only the local units interact with. These clients could be the government, students, or the senior management of the local units. The resistance of the local units compels the central unit to deploy its financial resources to modify its portfolio. Although financial resources are also a form of economic capital, they play a limited role in this field. This is partly because the local units are fairly autonomous in how they manage their budget.

Thus, the attempts to fill a gap in the organization's IT portfolio play out in a series of offers and counter-offers between both parties (Figure 4). The negotiations as to which application fits conclude once a decision is arrived at, but can be re-visited by the local unit if the functionalities of the pre-existing applications change.

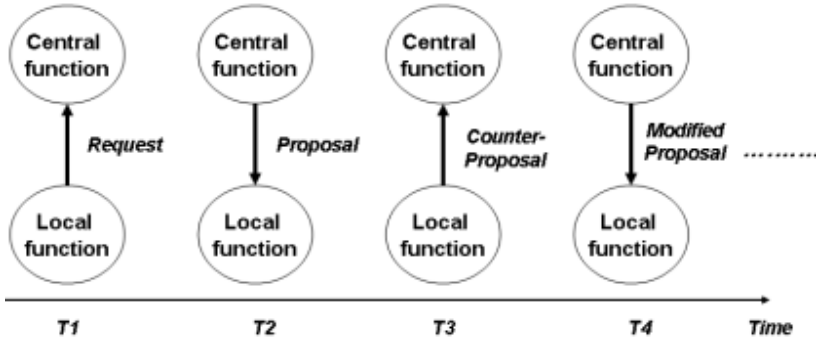

Figure 2: Drift Category 1- Making a Truce

Example- Course Checking Application: The various colleges in EduExcel required an application for students to determine which courses they needed for graduation, and for student advisors to check the students' programs of study. The university contracted with a Canadian software vendor to develop this application. However, it was inaccurate because the Canadian educational system was very different from the US system. This frustrated many advisors, even leading one college to develop its own application. This was not acceptable to EduExcel's Central Student Services unit and it attempted to stop it. The vehement feedback from users led to Central IT developing its own application for the same purpose. This new system meets the colleges' needs and is currently being rolled out. It is also linked to the original Canadian application, as the university wants to use that as an additional check.

ii) Co-creating the portfolio in use

This type of drift results from local units developing their own applications to resolve issues in their work processes. Such activities are not planned by either the management of the local or central units. The IT that emerges here is the result of user-driven, unplanned activities to make work less onerous. These technologies are usually fairly innovative and are, unlike the applications in the prior category, introduced with minimal interaction or negotiation with Central IT. This reflects the difference in the dispositions (habitus) between the local functional units and Central IT. The former were keen to adopt new technologies if they reduced their workload and if their functions were fairly resilient to technology

failures. In contrast, Central IT was focused on avoiding any disruption to the organizational IT portfolio and keeping it stable.

Besides the desire to make their work less burdensome, individual users also engaged in these activities when the material properties of the IT systems they are creating allowed them to do so. Since they were building new systems, there were no pre-existing systems embedded in the work processes. These new systems were often built using flexible platforms, such as Microsoft Access or Excel, making them more controllable and adaptable to the needs of local units.

Finally, as these innovations appeared over time, they gained credibility and respectability when other units began using them. This process made them more salient in the IT portfolios of the local units, bringing them to the attention of Central IT. Over time, the local units which introduced these innovations asked Central IT to take over their maintenance, because it had become too burdensome for them. This process was referred to as "offloading by one of the interviewees. While this type of drift is praiseworthy, because it benefits the broader organization, formal mechanisms are required to ensure that, as the innovations became more commonly-used, local units will be able to use them without being concerned about maintaining them.

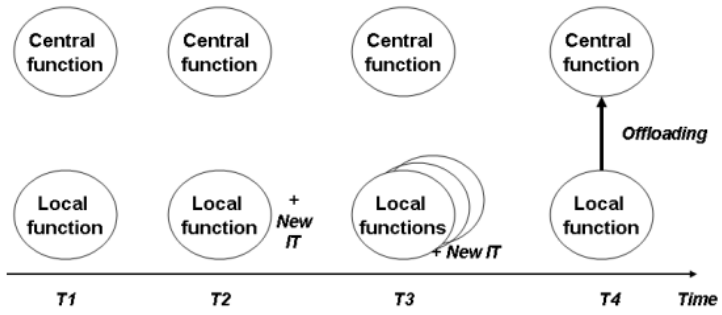

Figure 3: Drift Category 2- Co-creating the Portfolio-in-Use

Example- Scholarship Matching System: The College of Engineering at EduSucceed awards scholarships to students if they meet certain criteria. These criteria cover a range of attributes, such as academic achievement, income, community work, hometown, and degree major. Since the individuals who endowed the scholarships wanted to see the funds used to support the causes they had identified, matching students with scholarships was a very time-consuming process that used to take multiple weeks. A financial manager in the college developed an Access database that was linked to the Central Student Services database, and reduced the process to a single day. As other colleges began asking to use this application, Central IT took it over and maintained it.

iii) Going it alone (example: electronic time-clock)

The third type of drift refers to a situation where local units attempt to involve central units in developing applications, but central units do not reciprocate. This occurs even though the applications may be of use to other units. Here, a central challenge is uncovering the rationality underlying the actions of the different agents. Their reasoning may not be limited to economic logic, but instead may encompass a wide range of other functions and ends (Bourdieu & Wacquant 1984). Even though both the central and local units are part of a field, their struggle for dominance should not be viewed in the context of this interaction alone, but should instead be seen from the entire sequence of interactions. From that perspective, examples of drift from this category may be strategic moves made in response to or to prompt actions in other domains of interaction. For example, Central IT's refusal to cooperate with the Facilities Management unit in the example below could be traced to prior interactions where Facilities Management did not accede to Central IT's requests.

Agents have a sense of what the appropriate response should be when they make a particular move. When the response does not fit their understanding, they recognize that the other party has made a misstep of some sort. For example, local units expect Central IT to prefer the re-use of existing applications, not the development of duplicate ones. This understanding defers to Central IT the right to manage changes in an IT portfolio. When Central IT does not meet that expectation, local units adjust their perception of the structures that guide Central IT's actions. To achieve their goals, local units could then accept that they can operate under fewer constraints, or they can examine other moments of interaction to assess whether such a response is warranted or typical. The costs of going it alone include the long-term costs of maintaining an application, and the difficulties of moving to a shared application in the future. Moreover, there may be a more vehement response later by Central IT to a "going it alone strategy. What sources of capital would the local unit need to deploy then to maintain their position in the social space?

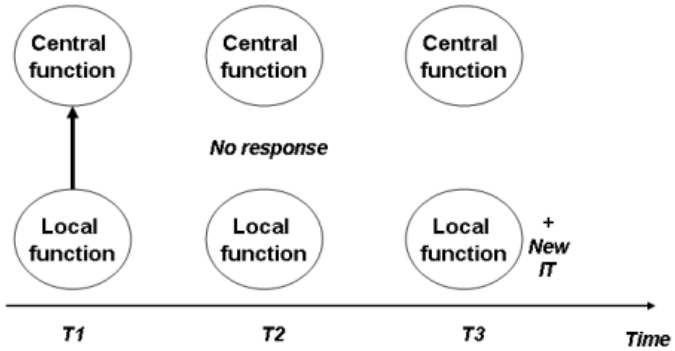

Figure 4: Drift Category 3- Going it Alone

Example: EduSucceed's Facilities Management (FM) department was interested in migrating from a paper timecard system to an electronic one. This would reduce data errors and increase accountability. Since Central IT had an electronic time-clock, the IT manager approached Central IT about using it, even though it lacked some of the features he wanted. He asked Central IT to provide him with a dump of the data so that he could insert it into FM's payroll system. Even though the software vendor agreed that this could be easily done and that other organizations had done so before, Central IT refused to set up the FTP server so that FM's IT manager could obtain the data. This pushed him to develop and deploy his own electronic time-clock. He was very frustrated and disappointed by the experience- for one thing, many locations across campus had both electronic time-clocks placed beside each other.

Table 1 below summarizes the structural, material and capital-specific features of the contexts in which the different types of drift occurred.

Patterns of Drift	Appropriation of Structures (Habitus)	Material Properties of Technologies	Balance of Power (Valuable Resources)
Making a Truce	a) Central IT: increase use of portfolio b) Local IT: help users provide accurate information to external clients- to be legitimate c) Local functions: distrust Central data	• Legacy systems (central IT portfolio) easily circumvented • Flexible and adaptable • Data portability • Shadow systems can be swapped with central systems easily- low switching costs	• *Economic capital*: a) developing IT- local and central units; b) budgets- autonomous • *Cultural capital*: declaring information to be authoritative- local units
Co-creating Portfolio-in-Use	a) Central IT: maintain a stable, relatively	• Innovative IT • Flexible and adaptable • No legacy systems, but shadow	• *Social capital*: a) Internal reputation- local IT department in step with IT

	unchanging portfolio b) Local IT: improve users' productivity	systems integrate central and local applications- become embedded- a necessary bridge- high switching costs	demands of employees and students b) External reputation- local units support other units on their own servers without charging them
Going it Alone	a) Central IT: demonstrate authority b) Local IT: meet requests of local users	• Legacy systems (central IT portfolio) easily circumvented • Highly-customized • Relatively expensive and difficult to move to central systems- high switching costs	• *Economic capital*: a) developing IT- local and central units; b) financial- autonomous budgets • *Cultural capital*: logic underlying the IT systems • *Social capital*: local IT's reputation within its unit

Table 1: Categories of Drift

5. DISCUSSION

All episodes of drift begin with a request for a new functionality, such as the ability to adjust time periods easily or show greater detail in financial reports, or the ability to communicate efficiently with employees who are not familiar with e-mail. IT departments in the local units see their role as meeting the needs of their users. Sometimes, they want to stay ahead of their users, so that they do not have a chance to complain. Thus, they are, or at least try to be, well-connected to their users. This is important to them because meeting their users' needs enhances their credibility and reputation within their units. In addition, providing their users with what they want also makes it easier for the IT department to manage its IT portfolio, since it knows exactly what systems are being used. Failing to satisfy users runs the risk of users purchasing their own applications, which often leads to paying more for systems that are difficult to maintain and integrate with the rest of the portfolio.

Since their budgets are independent of the Central IT unit, local IT units may or may not approach it when faced with the need to implement a new functionality. If they are aware that Central IT has a system with a similar feature, they may request it. However, if it is a new product or innovative functionality, they will go ahead by themselves. This is because they are aware of Central IT's reluctance to introduce new technology, as well as the slow speed at which it does so. The latter is understandable, given that it has to work with all of the units on campus to implement something. Moreover, if the central systems that are currently being used can be easily circumvented, it is more likely that local IT departments will acquire their own systems.

Central IT's response to a request from a local IT department depends on a few factors. For example: has the local department been cooperative in the past? how likely is it that the local department will install a shadow system, given its budget and IT skills? will this shadow system duplicate the existing functionalities of a system being managed by Central IT? what is the possibility of this system being used by more than one unit in the future? is the information provided by this new system required for internal consumption or for external parties? Besides these questions, Central IT also needs to assert its authority as the low-cost provider of essential, common systems for the organization. Thus, it has to ensure that its IT systems are being used by the local units to avoid inquiries over its budget and IT management skills. Central IT's replies to these and other questions leads to different trajectories being followed when a request for a new feature/system appears.

5.1 A Process Theory of Portfolio Drift

The examples from the case studies show that portfolio drift is not a simple linear causal process, but must be understood holistically. Process theories are useful for examining such phenomena. They are relevant here because portfolio drift is not a sequence of events or states that can be produced by manipulating certain causes; instead, the outcomes depend on a number of conditions that are necessary but not sufficient for the outcome to occur (Markus & Robey 1988). In other words, even if the conditions are present, the theorized outcome may not occur. The different outcomes are also viewed as being qualitatively different, not just different degrees of one particular dimension. Finally, process theories are useful because they retain empirical fidelity, while allowing some measure of generalizability. This enables the creation of predictive, testable theories, without having to decontextualize social phenomena.

Figure 5 illustrates a model of a process theory of portfolio drift. It is depicted as a decision tree, and the end-points consist of the three different types of portfolio drift and a decision not to drift (i.e. to use the centrally-provided, official system). The theory starts with the tension between the local and central IT units, based on the differences in their dispositions over the IS portfolio. While central IT wants to preserve its authority as the agent with the ability to define the IS portfolio, the local IT unit is focused on meeting the needs of its users, which may involve changing the portfolio. The first condition that affects the resolution of this tension is the level of switching costs: how painful is it for the local unit to stop using the centrally-provided system and switch to a new one it acquires or develops itself?

The subsequent decisions depend on the types of resources the agents possess, and the relative amount of each type of resource. If switching costs are low, but central IT possesses more economic capital than local IT, the theorized outcome is for the local unit to keep using the official systems. The same result is predicted if switching costs are high and social capital is irrelevant in that context. If both economic and cultural capital are relevant when switching costs are low, local IT should negotiate a truce with central IT. This is because, while the local unit may possess the necessary cultural capital to decide whether the data or the logic of the system are appropriate, the central unit may be able to develop a better system because of its economic capital, in terms of its development experience. When switching costs are high, the local unit can deploy its cultural and social capital to overcome this barrier. For example, it may draw on its social network to share the development costs, so that the switching costs are less of a burden. Alternatively, developing a costly system may be worth it if the local unit enhances its reputation with its clients and/or its peers.

The drift of an IS portfolio lead to a variety of consequences for the different parties who have a stake in it. Users, for whom drift of any of the three kinds is equivalent to their requests being answered, are more satisfied with the systems they use for their work. For example, the staff of the student services department of EduSucceed were overjoyed when the course checking report was modified to fit their requirements, because this meant they did not have to carry out any more manual workarounds. In EduExcel, the managers of the Facilities Management department were very pleased with the electronic time clock application, because it meant they could communicate better with their employees as well as increase their accountability. While drift may be beneficial for users and managers from the various functions, it often turns out to be an additional burden for IT managers. They will have to maintain systems that may not be well-integrated with the rest of their portfolio, or may not be well-understood within their organization because they are new in the market. If other units want to "piggy-back on the new applications, IT managers will face even higher maintenance costs. For example, EduExcel's IT manager was not pleased about maintaining the student course checking application, because they were difficult to set up and maintain, especially the latter because of the data issues. However, he had no choice but to do so, because they were very important for his department in its dealings with its corporate clientele.

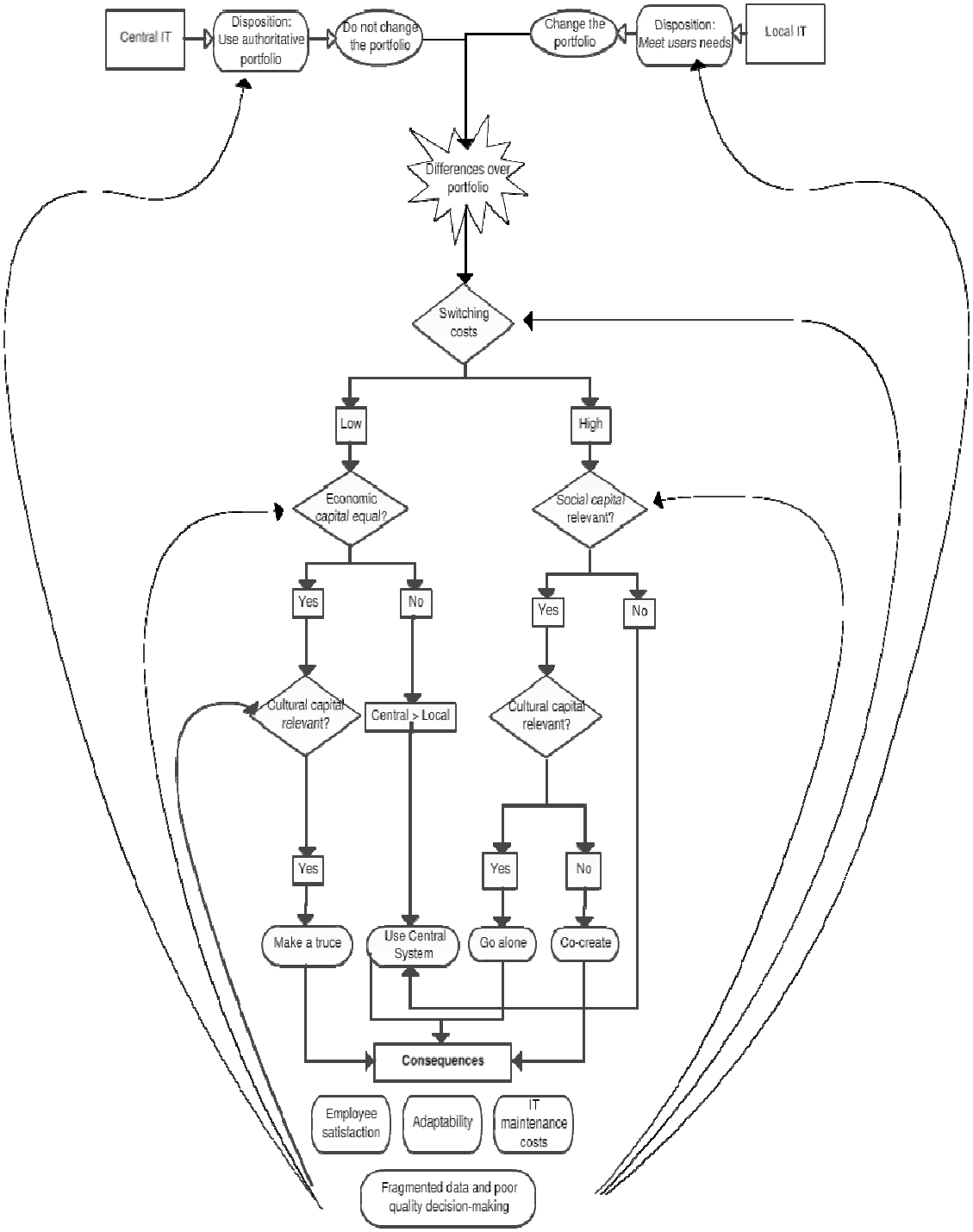

Figure 5: Process Theory of Portfolio Drift

Drift can affect the quality of decision-making if the data in the different systems cannot be integrated. So, for example, the International Students and Programs unit at EduExcel had to mandate the use of QuickBooks as the standard financial application because its Finance Manager was unable to consolidate his unit's budgets without falling back on manually computing them in Excel. Finally, when drift results in software being developed to fill gaps in an organization's portfolio, such as two databases not being

linked when a report requires data from both of them, the "gap-filling application will, by its presence, accentuate the gap and make it even more permanent. In other words, the shadow system's raison d'être as a workaround becomes obscured as it merges with the other legacy systems in an IT portfolio. Such developments make adaptability even more difficult, as the growth of legacy systems makes it harder to dislodge them to make way for new applications that handle multiple functions, such as ERP systems.

Apart from these immediate consequences, the type of portfolio drift that occurs, or does not occur, can reinforce or weaken the volume of resources possessed by the different agents. It also affects their disposition towards the IS portfolio: will they be more inclined in the future to support changes to it or to keep it as it is? The creation of new systems has an impact on the relative switching costs of the central systems. If the new local systems can exchange data easily with the central systems, and have similar interfaces and functionalities, then moving to central systems will be easier in the future. On the other hand, if the new systems do not have counterparts in the central portfolio, then users will find it difficult to leave them if they are asked to during rationalization projects. In turn, these changes in resources and dispositions influence future occurrences of portfolio drift.

To conclude, the mechanisms that explain the different patterns observed in the data are the material features of the technologies, the different forms of capital that are drawn upon, and the dispositions of the various agents. The structures that influence the relationships between the different agents in the field are constantly created and re-created. As drift takes place, the material attributes of the artifacts that are created influence future trajectories. Moreover, the success or failure of each episode of drift in meeting the needs of a local unit's users affects the resources the unit's IT department can deploy in the future, as it competes with Central IT to determine which IT artifacts are legitimate. Since "practice is inseparable from temporality (Bourdieu 1990), it is important to keep in mind the trajectories through which drift takes place. Although the agents may operate in seemingly-static structures, these structures are patterned, emergent phenomena, existing in the midst of many sources of constraints, both social and material (Dyke 1999; Zammuto et al 2007).

6. CONCLUSION

This study's main contribution is that portfolio drift is likely to be common. IS portfolios are constantly in flux because they are contested spaces for legitimacy and other resources. There are many deep and long-running interactions between the material attributes of the IT assets in a portfolio and the resources and preferences of users and managers from IT and non-IT units. The trajectory of these interactions is affected by the type of resource considered symbolically powerful in a certain context, and the inclinations of the agents involved. Thus, organizational IT adoption should not be seen as a one-off occurrence, but as a link in a chain of continuous interactions between individuals in the IT and functional departments, and the central and local units. In line with this, IS portfolios follow a logic more akin to dialectics than the teleology assumed in standard IT management descriptions (van de Ven and Poole 1995), where organizations move from a collection of disparate systems, to some form of enterprise application integration with middleware, and then the use of an integrated ERP system. This study's limitations include the difficulty of defining an "IS portfolio because of the generativity of IS portfolios and the ability of users to identify episodes of drift, mean that there are substantial opportunities for further research. Another limitation is that this study has been agnostic about the severity of the changes so that as many examples of unintended changes in IS portfolios could be included in the sample.

The current corporate IT environment is different. Employees are more IT-savvy and the roles of users and designers have blurred (Pollock 2005). "Artful work, based on knowledge and creativity, is becoming more important, and is more effective when workers are free to choose their own tools (Hill, et al. 2006). By adopting a practice-based perspective, this study addresses these changes and challenges conventional notions of the roles of the various agents in determining the legitimacy of an IS portfolio's components.

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