

IT systems deployment during standards adoption: a socio-technical approach

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Abstract

This research in progress paper explores the role of technological deployment within the framework of standards adoption. Set within the context of a business school seeking and obtaining an industry recognized quality assurance standard, four information systems were deployed within several months of each other to support disparate work processes related directly and indirectly to the standard adoption. Whereas the IT systems adoption gained traction during the initial stages of deployment, their usage during an eighteen month period reveals variations in how embedded processes were embraced by different types of users in letter and spirit, especially after the b-school was accredited. Using the notion of coupling levels, two of the systems appear tightly coupled following accreditation, whereas two show malignant coupling and benign coupling respectively. This inductive research attempts to explicate the inner details behind the noted variations. A detailed case study is developed based on usage data of the four IT systems, user interviews, documents analysis, and historical analysis. Initial results indicate IT systems play a role in supporting the management of power and accountability. This is then interrelated with the adoption or resistance to the IT system based standardization. The study contributes to a limited body of literature that explores relationships of power dynamics in organizations and information technology. Our work hopes to confirm and provide the basis for a socio-technical framework when studying social regulation in organizations using technology.

Keywords

Standards, Information technology systems, Coupling, Power, Socio-technical

INTRODUCTION

Standards and standards adoption have received considerable attention across a broad array of interdisciplinary literature. Standards can come in diverse forms ranging from container measurement to accounting and health-related baseline guidelines. Moreover, an increasing number of standard setting agencies are emerging through and across a wide range of fields (Durand and McGuire 2005). Accordingly, it is of little surprise that standards and standardization processes have received considerable attention in a diverse set of empirical settings using multiple theoretical lenses. Settings cover ICT in general (Hanseth et al. 2006; Lyytinen and King 2006), medicine (Braa et al. 2007), education (Cordier and Stablein 2013; Paradeise and Thoenig 2013), and quality practices (Guler et al. 2002; Viadiu et al. 2006), while the array of theoretical lenses employed include game theory (Axelrod et al. 1995), economics (David and Greenstein 1990; Garud and Kumaraswamy 1993; Katz and Shapiro 1985; Tassej 2000), complex systems (Braa et al. 2007), and sociology (Brunsson and Jacobsson, 2002; Brunsson et al. 2012).

In the traditional technology management field, studies usually associate the use of standards with efficiency gains, economies of scale and economies of scope (David and Greenstein 1990; Garud and Kumaraswamy 1993; Katz and Shapiro 1985; Tassej 2000). In a second approach however, scholars follow sociological insights to study the adoption and diffusion of standards as contested practices, following different motivations and interests of potential

standards adopters (Brunsson and Jacobsson 2002; Brunsson et al. 2012; McNulty and Ferlie 2004; Sandholtz 2012). These sociological approaches towards the study of standards adoption take an interest in the political, normative, and symbolic dimensions related to standardization (Brunsson and Jacobsson 2002; Sandholtz 2012; Timmermans and Epstein, 2010).

While significant inroads have been made in studying standards in each of these varying veins of enquiry, various streams of literature make little reference to each other (Botzem and Dobusch 2012). Paying scant attention to the work of scholars in other subgroups within the domain, or beyond, can hinder our ability to better understand standardization processes (cf. Timmermans and Epstein 2010). Moreover, although technology management is highly related to standardization processes, technology has been studied more as an outcome of the process rather than a medium through which standardization and regulation can happen (for some exceptions see Barley et al. (2011) and Ayyagari et al. (2011)). Following a more sociological approach, technology can be conceived as part of a plethora of social and technical mechanisms that can not only increase technological productivity but also control and regulate individuals' interactions (e.g. Barley 1986; Leonardi and Barley 2010; Timmermans and Epstein 2010). In this paper, technology is therefore understood not only in terms of its technical and tangible aspects, but also as occasions that trigger and/or reflect social dynamics, which in turn, modify or maintain an organization's social order (e.g. Barley 1986; Leonardi and Barley 2010; Orlikowski and Yates 1994). We put forward that these two gaps in the literature certainly deserve attention.

In this paper we focus on studying standards adoption in a business school which deployed four information technology (IT) systems in support of its efforts to obtain an industry recognised external accreditation. The IT systems are different software platforms and databases designated to manage all major functions of the organization (Dewett and Jones 2001). The adoption of the four IT systems, which represents adoption of embedded work processes required by external standards (hence standardization), is studied over an eighteen month period; this includes periods before and after accreditation. This detailed case study developed in a business school setting largely builds upon qualitative research and relies on theories of social dynamics as explanations for IT deployment and usage (e.g. Barley 1986; Brunsson and Jacobsson 2002; Orlikowski 2000; Sandholtz 2012).

In its current stage, this paper reports significant variations in coupling levels of deployed IT systems within our organizational setting, i.e. degree of adoption arising from the relation between institutional exigencies and technical work (e.g. Fried et al. 2013; Sandholtz 2012). Further investigation into the underlying causes of variations between usages of these IT systems is currently underway. Initial results point out that the IT systems are tightly connected to social control (i.e. accountability, visibility), soft power dynamics (i.e., legitimacy, expertise, and reward structures) and passive resistance within the organization. These themes are elaborated further in the latter sections of the paper. We intend to develop this research further by expanding user interviews, archived document analysis and historical event analysis.

Although our results are preliminary and need further empirical examination, this research in its current form contributes to the limited body of literature that seeks to understand how IT systems affect and are affected in an organization when adopting standards. Our findings thus far point to social forces such as power dynamics, control of information and passive resistance as playing reflexive roles in organizational actors' interactions with technological systems. Further to this, our research to date also offers a contribution to the literature by guiding us towards a socio-technical conceptual framework for technology-supported social regulation in organizations.

THEORETICAL FOUNDATIONS

Our theoretical guidelines come from two research streams that have different emphasis but similar principles and assumptions. The first comes from studies on standards and standardization based on a sociological approach, while the second comes from studies on technology and IT systems. The former incorporates social contexts of managers and organizations in understanding IT adoption and diffusion. The key tenets of each are summarized below.

Scholars recognize that standards take different shapes and fulfil different purposes (Tassey 2000; Timmermans and Epstein 2010). For this paper we define standards as rule-like mechanisms aimed at achievement of an optimum degree of order in a given context (Brunsson et al. 2012). It is common that standards established by third-party organizations reach a considerable number of organizations (Brunsson et al. 2012; Rysman and Simcoe 2008). Standards can also be distinguished between process and outcome standards (Brunsson et al. 2012). Process standards regulate processes within and between organizations without determining any specific outcomes. In

contrast, outcome standards stipulate that adopters have to deliver a specific outcome (Werner and Katz 1976). For instance, the coffee sector witnessed a proliferation not only of process standards but also outcomes standards, which in theory facilitate direct relationships and a better flow of information (Giovannucci and Ponte 2005; Reinecke et al. 2012). In this paper we focus on process standards adoption.

Standards are commonly studied in parallel to frameworks of standardization processes, as phenomena which help regulate and calibrate social life by rendering the modern world compatible across cultures, geography and even time (Timmermans and Epstein 2010). As such, standards belong to mechanisms of social regulation (Botzem and Dobusch 2012; Brunsson and Jacobsson 2002; Sandholtz 2012). Based on theory provided by Brunsson and Jacobsson (2002), Sandholtz (2012) recently emphasized three different social regulation mechanisms: standards, directives, and norms (See Table 1). Standards reflect explicitly formulated and decided rules, which are formally and voluntarily adopted for the common use of many potential users. Directives on the other hand, tend to be mandatory, but like standards, directives tend to be explicitly stated and in most cases there is an identifiable author. Norms, or repeated patterns of social interaction, are voluntarily adopted, but it is more difficult to identify an author and they are not usually explicitly stated.

Table 1. Comparing different forms of social regulation

	Norms	Directives	Standards
Voluntarily adopted?	Yes	No	Yes
Explicitly stated?	No	Yes	Yes
Identifiable author?	No	Yes	Yes

Source: Sandholtz (2012)

Sandholtz (2012) further explained that the adoption of standards take certain pathways which ultimately determines the adoption and continued compliance even after the objectives of external accreditation are achieved. Standards can be translated into directives, norms, or both. If abstract external standards are enforced by top management teams (i.e. translated into directives) professionals normally show "cynical resistance" which result in "hypocritical implementation" especially once accreditation is achieved (Sandholtz 2012: 671). These are called decoupling situations. On the other hand, when internal experts initiate work-processes (norms) which later become directives complying to the standard's requirements, there is a "transparent implementation" and an "efficient accommodation" (Sandholtz 2012: 672), which leads to tight coupling with the standard. Fried et al. (2013) extended Sandholtz's insights and concluded that decoupling situations can also be seen as temporary solutions that allow actors to detach from reigning standardised practices and to test and develop innovative ideas under less formalised conditions. Following a process approach, Botzem and Dobusch (2012) demonstrated that the formation and subsequent diffusion of standards are shaped by the levels of legitimacy the actors possess as standards-setters.

Literature on technology management shows strong connections to standardization processes, partly due to the role of technological expertise in the standard development process. In many cases, standards are a form of technical infrastructure that needs to be adopted by different actors within and/or across organizations. In cases of technological industries such as software developers, there has been a proliferation of standards and standardization processes to encourage interoperability, compatibility, and reliability. Scholars have therefore studied the standardization of technological industries in which the emphasis have been on switching costs, network effects, and path dependencies among other topics (David and Greenstein 1990; Garud and Kumaraswamy 1993; Katz and Shapiro 1985; Tassej 2000).

Technology, and more specifically IT systems, is also related to standardization because it offers the platform through which regulation can be achieved. However, literature on standardization is rather silent about the role that IT systems can play in standardization processes. To cast some light on the role IT systems can play on regulatory processes, we follow general guidelines under the umbrella of a social constructionist approach to technology (for a current review on the literature please refer to Leonardi and Barley (2010)). In brief, studies following this research stream agree that technologies in organizations are socially constructed instead of being predetermined by a set of guidelines in a social vacuum. Starting in the 1980s (e.g. Barley 1986) and progressing to present day, there are different mid-level approaches to a socially-driven understanding of how technology affects and is affected by organizations (Leonardi and Barley 2010).

In a recent review paper, Leonardi and Barley (2010) pointed out our major gaps in the literature on social construction of technology in organizations which revealed the necessity for a better understanding of power

dynamics and attention to the role of institutional level phenomena in shaping technological trajectories in organizations. For example, Leonardi and Barley (2010: 38) affirm: "...the question of how technology and power relations are entwined has not been substantively addressed by constructivist studies of technology and organizing". We therefore emphasize further understanding of soft power dynamics and technology in organizations. By soft power dynamics we mean different power sources (i.e. legitimacy, expertise, or reward) (e.g. French and Raven, 1959; Raven 1993) that people rely on when trying to influence or resist others influencing them.

Recent studies on standardization illustrate the importance of social dynamics in which actors' professional backgrounds, intentions, and power dynamics affect how the standardization unfolds. Moreover, these studies start breaking down the standardization process into different sub-processes in which symbolic resources such as legitimacy, experiences, and power positions of people involved in the standardization might affect the process. Yet these studies do not explicitly study how technology affects or is affected by the standardization process; a social construction approach to technology does provide theoretical guidelines that suggest the central role played by technology as a medium and an outcome of organizing standardization processes. Our study builds upon the aforementioned gaps in the two research streams discussed. More specifically, our overarching objectives are to uncover different social controls and soft power dynamics in the deployment of IT systems and how they support the adoption of standards in an organization.

RESEARCH METHODS, DATA AND RESULTS

Context and Background

Our case is set within a business school that was undertaking and subsequently obtained a widely sought and highly recognised quality assurance (process) standard. The b-school offers undergraduate and graduate programs in business administration. The faculty and student bodies represent a highly diverse group, with more than half of the respected student and faculty bodies being foreign nationals. Details such as location, student population and history are not provided for anonymity reasons; however, these are deemed to be irrelevant to the theoretical implications of the paper.

The school deployed four IT systems in support of the accreditation process. A summary of the systems, actors responsible for deployment, the key functions of the systems, and the key users are identified in Table 2. Although acquired, deployed and administered by different departments, all the systems were operationalized within six months of each other, indicating a sense of urgency related to the on-going accreditation. The earliest deployment was of the Decision Support System (DSS), which is used as the baseline month for comparing implementation timelines. The accreditation audit took place in Month 13.

Methods

This inductive research uses a detailed single case study, which has been developed iteratively by going back and forth between research design, data analysis and theoretical foundations. A single case study approach was employed as it is a tested method suitable to answer exploratory research (Eisenhardt 2007; Yin 1994). The inductive approach employed meant that as the research progressed, collected data either added clarity or required further inquiry. Theoretical underpinnings and subsequent data analysis were therefore refined throughout the process (for example see Bryman and Bell (2011)). Our case utilizes a number of approaches to data collection and analysis. Structure and usage logs of the four investigated information systems were used, while historical event analysis, user interviews, and document analysis also acted as sources of information.

We first began by learning about the structure of the standard itself in addition to functions and structures of the four IT systems. Mapping the relationships between the IT systems and embedded standardized work processes made it apparent that all systems were contributing largely to the accreditation process. Two systems (Workflow and Document Control System (WDCS) and DSS) were found to be deployed purely for accreditation purposes while Learning Management System (LMS) and Academics Information System (AIS) systems were deployed as a part of learning and student related business processes. In the case of the latter two systems however, the information they shared and supplied to other systems for accreditation makes them equally important for accreditation. Therefore, it is determined that these four systems are a fair representation of the standards requirements and corresponding adoption (please see Table 2).

Table 2: IT systems deployed by the B-school to (directly or indirectly) support the accreditation process

System	Key functions, Work processes of IT Systems	Standards Requirements	Deployed by	Key Users (in order)
WDCS Workflow and Document Control System	Task Monitoring Document Sharing Document Control Record of communications for audit trail of decisions	All	Chief Information Officer (CIO)	Faculty Staff Management
DSS Decision Support System	Automated reporting for standard compliance Learning Metrics Faculty Profile Faculty Performance	Mission Statement Faculty Qualifications Intellectual Contributions Continuous Improvement Management of Curricula UG Learning Goals Masters Learning Goals	Director Accreditation	Management Faculty Staff
LMS Learning Management System	Organizational repository, Classroom management, Course materials sharing, Assignments, Quizzes, Online and offline faculty-student communications	Student Mission Faculty Management and Support	Dean through CIO	Faculty Students
AIS Academics Information System	Business Processes: Admissions, Semesters and Academic Calendar, Course Registrations, Attendance and Leave, Grading and Transcripts, Finance and Accounting, Scholarships, etc.	Student Mission Student Admission Student Retention Staff Sufficiency Faculty Sufficiency Faculty Mgmt. and Support	Academics/ Administration Departments	Staff Students Faculty Management

Next, in order to explore the IT systems -hence standards- adoption, usage logs for first three IT systems were acquired from systems administrators. The data spanned around eighteen months beginning from the initial deployment. Detailed logs could not be captured for the fourth system (AIS). As a means to address the non-availability of logs, estimates for usage were developed by interviewing different types of users. Users were asked about frequencies of their queries under different situations including those before and after accreditation. Two important parameters were summarized; the number of queries per month for each system representing the general usage of the system, and the number of unique users making those queries during each month.

A chronology was then established by reviewing meeting minutes and organizational communications stemming from over 2000 pages of documents reviewed to date. The chronology identified two separate event types. The first event type can be best labelled as *deployment of IT systems* which records the information pertaining to the launching of IT systems. The second event type, named *social regulation*, includes directives issued for usage of IT systems and standards compliance as well as academic calendars. Putting the chronologies and usage data from previous steps together, we were able to establish our unit of analysis. We are utilizing the level of system activity as the unit of analysis which allows us to gauge the coupling levels for standards adoption within the pre and post accreditation periods.

Results

System activity levels clearly show a relationship between notable events and variations in response to those events (whether systems related or social regulation). For instance, a sharp rise is observable in the use of IT systems whenever a directive is issued or a compliance audit approaches. These dynamic patterns and their supporting data are illustrated within Figures 1 to 4. Each figure has a chart presenting the number of unique queries over time which presents a dynamic picture of the respective systems' usage.

It is evident from the dynamic patterns that LMS and AIS, and parts of the standards they support (Table 2), were adopted fully during pre and post-accreditation scenarios which would be considered *tight coupling*. DSS and

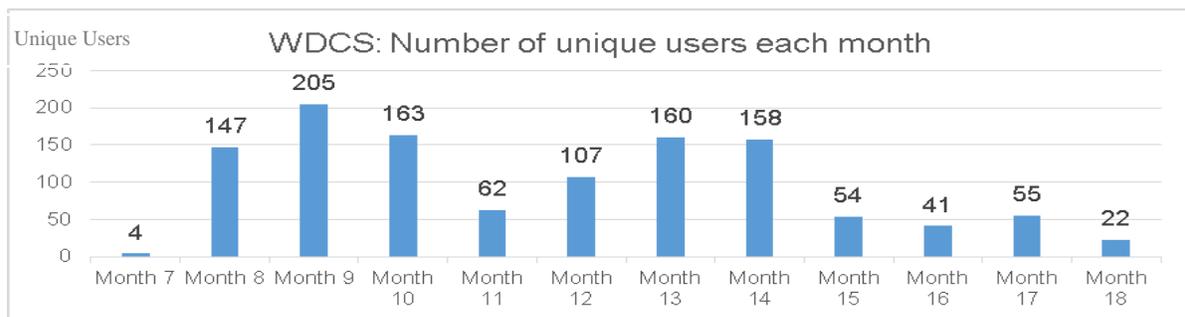
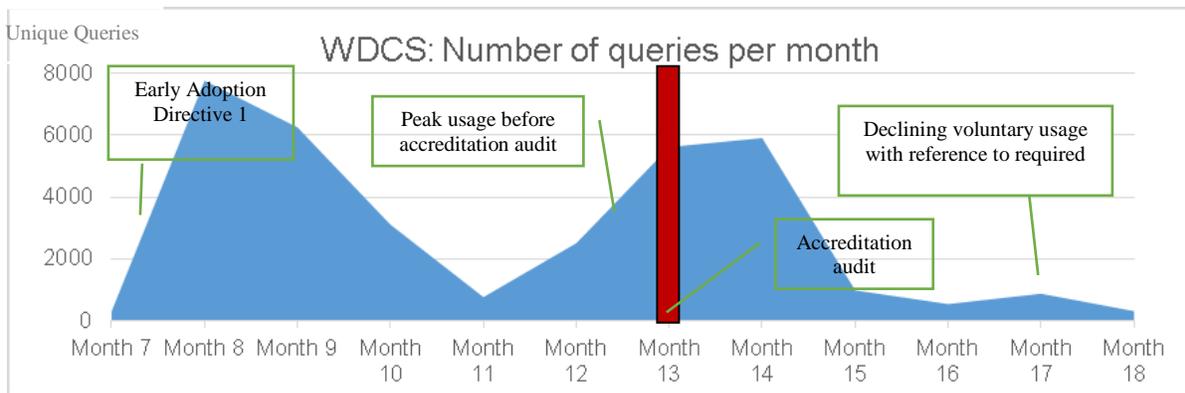


Figure 1: WDCS-Workflow and Document Control System (Source: System logs)

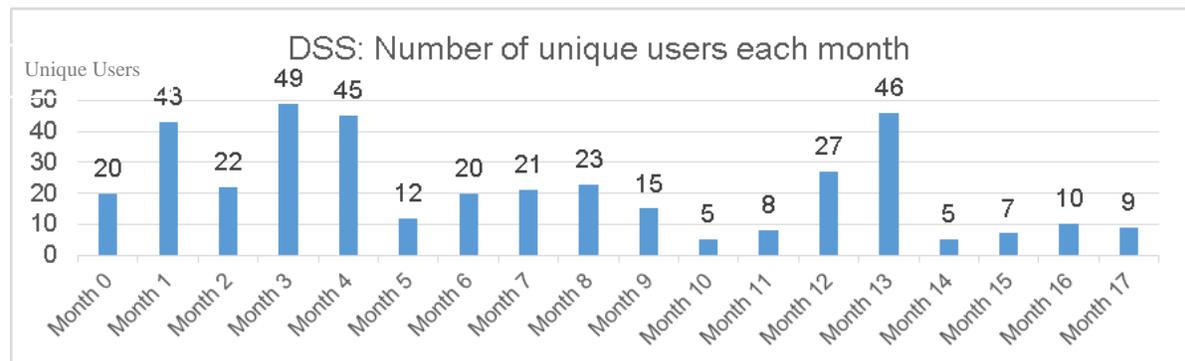
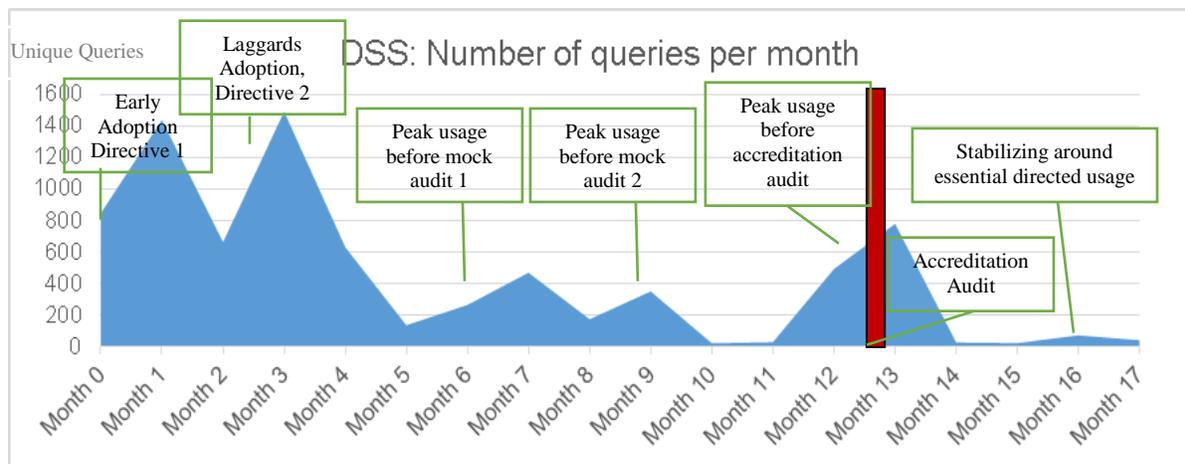


Figure 2: Decision Support System (Source: System logs)

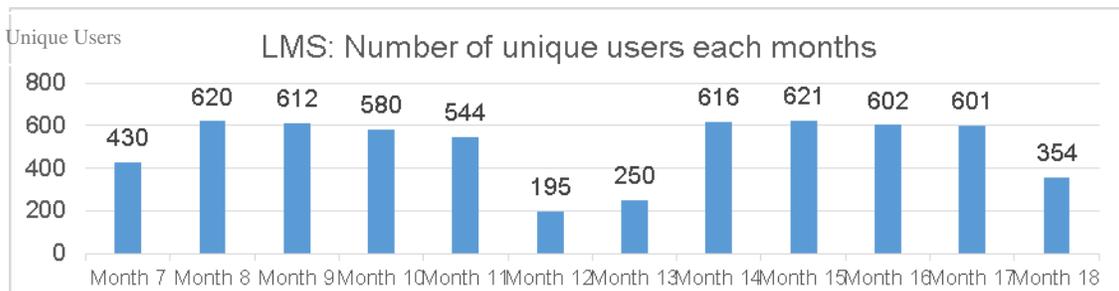
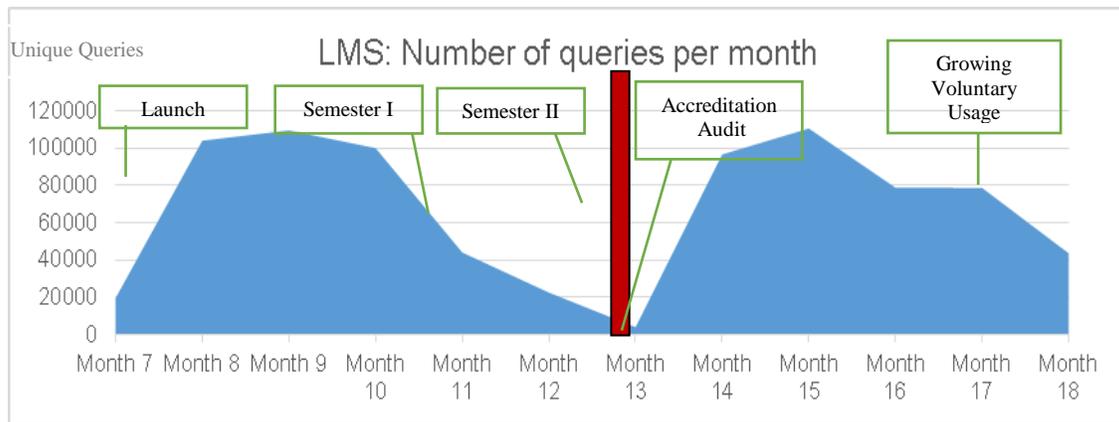


Figure 3: Learning Management System (LMS) (Source: System logs)

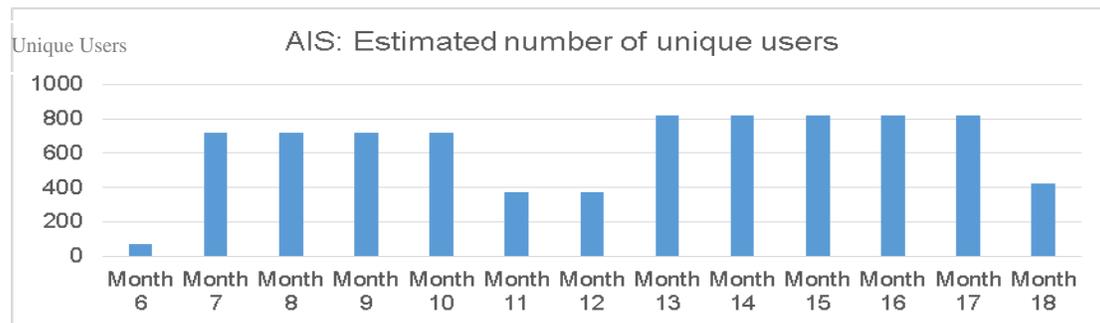
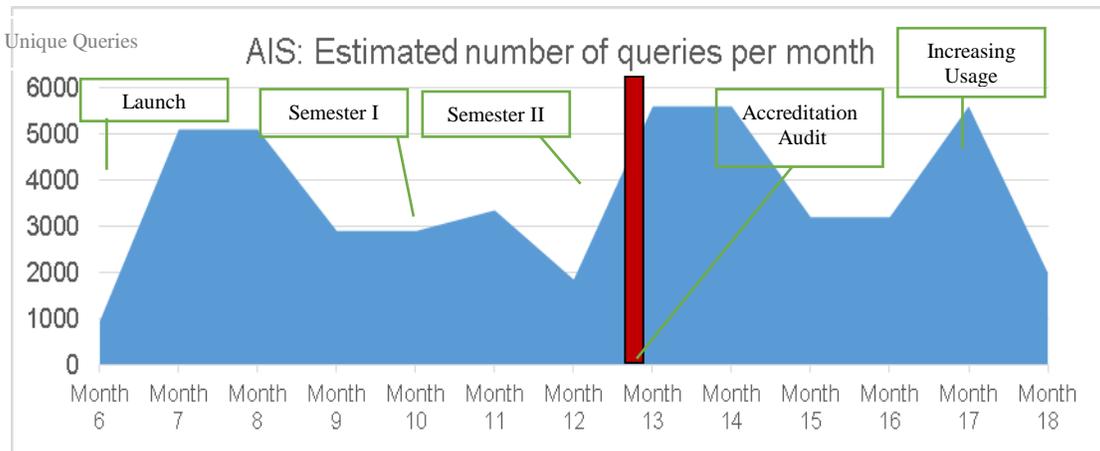


Figure 4: Students Academic and Information System (AIS)
 (Source: Estimates based on user interviews)

WDCS were heavily used prior to accreditation being granted. Their usage however dropped sharply post accreditation. In the case of WDCS, activity peaks and troughs mirror three events. These were directives from either senior managers, communications from the accreditation office, or key deliverable dates within the accreditation timeline. In the case of the key dates, these resulted in the viewing of reports and dashboards as well as frequent member data contributions enabling reporting to the external accreditation body. The sharp declines in activity beyond the achievement of accreditation can be best described as *malignant decoupling*. Once the accreditation was completed, most users did not return to the system except for minimal use concerning retrieval of forms and templates.

DSS, which was primarily deployed to support automated reporting of performance metrics for accreditation, shows characteristics of *benign decoupling* (Sandholtz 2012). Where both the individual and organisation activity levels were high prior to the accreditation audit, post accreditation activity levels and types of queries changed significantly. Individual user input declined slightly, while institutional input and output activity levels reduced to almost no activity. Additionally, individual activities were significantly delayed (occurred later and less frequently) when compared to pre-accreditation levels. Investigation of supporting documents (process documents) shows that DSS related activities should be embedded and recursive, irrespective of pre or post accreditation status.

Instead of detailed narratives which are still under development, a summary of the early findings is reported in Table 3.

Table 3. Coupling levels of IT systems at the b-school before and after accreditation
(“>” should be read as “followed by”)

IT System	Progress of social regulation in the context of technical work and soft power dynamics	Coupling Levels
WDCS Workflow and Document Control System	System built in-house to support documentation and need for tasks tracking for accreditation > Directives issued > Adoption of functions essential for compliance > Accreditation > Reduced usage or resistance based on “department affiliations” or “systems belonging to the department” or “no redundant work even under directives or rewards”	Malignant Decoupling (Low or no post-accreditation usage)
DSS Decision Support System	System assessed and acquired by the organization to support accreditation > Directives issued multiple times > Common usage for compliance by faculty and staff > Accreditation > Minimal usage for compliance and reporting personal (faculty) performance updates	Benign Decoupling (Only essential post-accreditation usage)
LMS Learning Management System	System assessed and acquired in line with organizational needs > Directives issued > Widely adopted > Accreditation > Excessive usage for professional obligations	Tight Coupling (High or increasing usage pre and post-accreditation)
AIS Administration and Academics Information System	System assessed and acquired for organizational needs > Directives issued > Accreditation > Excessive usage for organizational requirements and inputs to accreditation > Accreditation > Excessive and growing usage for organizational requirements and inputs to accreditation	Tight Coupling (High or increasing usage pre and post-accreditation)

The traditional literature relating to the adoption of standards would typically expect the processes developed as a part of standardization to break away once external accreditation is achieved. This is known as ceremonial compliance or decoupling (e.g. Meyer and Rowan 1977). Our research tentatively shows a continued usage of some systems, rather than a total decoupling which is closer to recent studies suggesting granular decoupling (Sandholtz 2012; Fried et al. 2013).

Progress

To date we have identified variations in activity levels of IT systems before and after accreditation. These have been observed primarily through the construct of decoupling. By imposing user activity level data upon an accreditation timeframe, three different types of coupling have emerged as an explanatory framework. This is considered a useful

start to contextualize decoupling, but as our literature review pointed out, deals with only one element amongst a recursive and complex social dynamic. Additional support to our developing construct has occurred through limited user interviews but with significant document analysis (meeting minutes, directives, organizational structure, and email communications between selected members). The documents have greatly complemented our understanding of the emerging themes from early user interviews. The six preliminary empirical interviews thus far have exhibited broad themes pertaining to structure, power and their reflexivity. They point at social exigencies as sources of variations in adoption of IT systems and decoupling of standards. Various themes that surfaced include: past experience or expertise, accountability by heads of departments, visibility of assignments and individual's or departmental progress to others, and reward systems. Beyond these emergent themes, we have stronger indications that power dynamics and control of information has played key a role in the variations of decoupling. For instance, regarding WDCS, one of the informants explicitly states the issue of distant power sources attempting to drive system usage:

“We cannot use [this system]. We belong to a different department and our department is required to use [another system] and it's hard to do redundant work even under directives or rewards.”

Another informant illustrates their belief towards the ineffectiveness of a top-down imposed directive, believing that imposed power constructs will not sustain:

“Yes, for the systems which are being used, most people would adopt the systems under strict directives, but only for the short term. It's not long term.”

We are in the midst of strengthening our empirical standing with additional user interviews of key members leading the school's accreditation initiative, faculty members, and key staff members involved in using IT systems and supporting accreditation. This additional engagement not only further expands the number of interviewees, but seeks greater levels of understanding towards post-accreditation contexts, individual's understanding of the IT systems and the reasons behind user adoption or resistance.

DISCUSSION AND FUTURE WORK

Though still in its early stages, this research finds variations in coupling levels; these represent pre and post-accreditation differences in the adoption of standard requirements. Where the traditional literature reports decoupling as the most common outcome after the adoption of standards, we have found preliminary evidence that would suggest tight coupling, benign and malignant decoupling. This in turn lends weight to the emerging social stream in technology and organizational studies which present counter examples to the traditional literature in the form of tight coupling and benign decoupling. Leveraging the cited literature, our early findings from this paper could be seen as a two-dimensional socio-technical framework which could be developed to explain the variations in adoption of standards and IT systems. Further theoretical and empirical work is needed to develop such a framework.

Whilst we seek a social explanation to our technology research question, other possible areas may also offer greater insights into the interactions between couplings. Our empirics brought to light the value of past experience, reward systems and pressures pertaining to transparency and visibility as part of social dynamics when adopting IT systems. Yet another source could be professional cultures (Hall 2005). Service organizations are more modular than manufacturing organizations. Especially in the context of schools and universities, there is a notion of academic freedom which might be a professional norm and a part of professional culture that differentiates academic departments and faculty members from other service departments and professionals. However, this also calls for further research.

We believe accepting technology as playing a role in social control and regulation offers considerable promise moving forward with this work. While that might not be a radically new idea, when it comes to the hints of power dynamics, and control of information found in our empirics, it offers the potential for a more robust explanation of drivers and inhibitors of longevity of systems beyond the life span of initial accreditation. In support of this goal, we have sought the use of a single case study as a means to play close attention to the contextual drivers that may also interplay between power and systems adoption. As (Barley 1986:105) concludes, 'identical technologies can occasion similar dynamics and yet lead to different structural outcomes'. Such interactions between technical and social dimensions can untangle the rather abstract idea of embeddedness and IT systems. Therefore we believe this

study has the potential to advance our understanding of different *integral* roles that IT systems play in society and more specifically in organizations.

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