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Competing Market, Bureaucratic and Professional Work Logics in the Design and Implementation of IT on Professional Work : The Case of Medicine

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■ Abstract ■

There is growing evidence that professional work is changing as a result of the application of information technology (IT). However, the impact of information technology on professional work has produced mixed results. Our paper considers the source of these mixed results through a greater analytical attention paid to the nature of professional work. Defined as work involving expertise expressed through abstract and formalized knowledge as well as extensive working knowledge, the professional work logic assumes the greatest autonomy and discretion for workers in collectively controlling work characteristics-division of labor and its permanence, control over education, and control over new entrants and the monitoring and disciplining of existing members. The impact of IT on professional work will be difficult to control and predict without considering the assumptions and tensions within and across the three major types of work logics (Professional, Market and Bureaucratic). Using healthcare as an example, the paper provides various propositions for researching the initiation and effects of ICT design through these three work logics. These propositions illustrate the active role that IS researchers can take in researching an important economic and work-related topic, professional work, and in understanding how ICT affects work-related expertise.

Keyword : Professional Work, ICT Design and Implementation, Professional Logic, Market Logic, Bureaucratic Logic, Health Care.

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1. Introduction

There is growing evidence that professional work is changing as a result of the application of information technology (Evetts, 2014; Head, 2014). Professional work accounts for a significant share of world's GDP and the impact of that work is significant for the high-status professions in the healthcare industry. The healthcare's share of GNP in the U.S. alone has gone up from about 6% in 1970 to about 18% in 2009 ("OECD Health Data 2012-Frequently Requested Data" 2012). This astonishing rise in healthcare expenditure is considered to be crowding out investments in other areas of the economy including critical infrastructure (Young and Olsen, 2010). As a result, there has been a renewed push to decrease costs and to improve the quality of healthcare with the help of information technology (Anderson et al., 2006).

Over the last several decades, computer-based information systems (software) have been used to transform the way white-collar work is done. Specifically, the emergence of cheap, networked personal computers has allowed organizations to standardize many aspects of white-collar work across space and time by embedding and enforcing organizational routines via workflow software. The use of software has changed the way organizations and industries compete in a capitalist economy (Broadbent et al., 1999).

However, research on the impact of information technology on professional work-especially in the healthcare industry, one of the most information intensive industries-has produced mixed results (Diamond and Shirky, 2008; Walker, 2005). We believe that these mixed results can be attributed to the relative lack of attention paid to the nature of professional work in the healthcare industry. Professional work differs from other forms of paid work through its emphasis on expertise expressed both through the abstraction and the application of formalized knowledge. While professionals have managed to maintain relative autonomy and sovereignty given their specialized knowledge, their control over their work are being evaluated and questioned through IT-enabled systems.

In this paper, we ask how does professional work affect and how is it affected by IT? In asking the specific question, we address a more general question about the effect of IT on work-related expertise, control and discretion. Despite IS research on the design and implementation of IT in professional work, particularly in healthcare (Chiasson and Davidson, 2005), and other research on the nature of professional work (Freidson, 2001), research on the effects of IT on professional work is still relatively rare (Kohli and Kettinger, 2004). Related work on issues of legitimacy in computerized physician order entry (CPOE) (Kaganer et al., 2010), individual and group resistance behaviours in clinical information systems (Lapointe and Rivard 2005), studies of individual and group adoption and use of information systems with physicians (Heart et al., 2011; Venkatesh et al., 2011), and the politics of healthcare infrastructure integration (Sahay et al., 2009) touch upon these issues. Shaw and Stahl's (2011) work touches on professional knowledge and work in their proposed consideration of quality assurance systems during IT implementation with professionals, informed by Habermas' communicative action and notions from quality assurance that include worker knowledge and training. Davidson and

Chismar (2007) addresses how structural changes during CPOE implementation, including clinical standardization, increased work interdependency and cooperation across multidisciplinary departments. Kohli and Kettinger (2004) also show how "informating the clan" succeeds in the implementation of physician profiling systems related to standard costing, while an earlier attempt that didn't include professional workers failed. In these two related cases, the nature of professional work and knowledge and its relationship with IT are indirectly addressed.

In this paper, we highlight the research opportunities for IS research in studying the design, implementation and effects of IT on professional work-work considered to involve control, discretion and expertise. To do so, we consider the nature of work-including the knowledge required for work, the division of labor and the training of workers, and the organization and monitoring of work through three logics (Freidson, 2001) : the market, the bureaucratic and the professional logic. In particular, we consider key assumptions in each logic about the relative need for control and autonomy by workers over the nature of their work, and consider various implications for the design and implementation of the embedded IT artefact (Orlikowski and Iacono, 2001).

We consider the role of ICT design depending on the work logic-typically the bureaucratic or market logic. We then consider how these assumed logics in IS confront numerous unexpected effects when a third work logic-the professional logic-and its mixing with bureaucratic and market logics are considered.

We then explore a particular ICT-based movement in healthcare-standardization. We begin with the historical rise of the professional logic in healthcare, and subsequent challenges to it. We consider standardization as a response to it, and we consider the types of IT systems that have been introduced over the past decades that have made standardization possible. We consider the various forms of standardization, and its procedural form through evidence-based medicine.

We then explore how various assumptions through singular and mixed work logics towards standardization provide numerous propositions for researching the effects of IT on professional work. Our conclusion is that the design, implementation and effects of ICT on professional work can be better understood through a greater consideration of the professional logic and how it mixes with the other logics throughout. In either case, simple or complex mixing of the three logics provides numerous opportunities for empirical and theoretical research on how IT design and implementation influences and is influenced by professional work, which allows the active participation of IS researchers in an important economic and work-related area, and provides transferable insights about the effects of IT implementation on work and expertise.

2. The Nature of Professional Work

As a most basic starting point, work involves the application of various levels of mental and physical effort to bring about a valued output-i.e. a cooked meal, a software product. While wage labor-work performed in exchange for a salary-is the predominant focus of work today,

in the early stages of industrialization most workers looked down on it due to the loss of control it implied, and was also considered insidious by independent artisans who wanted to control their own competence (Vallas, 2011).

Originally seen as an activity done by those unfortunate to be bound to sweat and toil, the industrial revolution fundamentally changed how society views work, considering it now to be essential to a person's participation in civic life (Beck and Camiller, 2000). However, over the course of the last century, work has undergone a series of complex changes, including: the division of labor, the amount of discretion workers have in carrying out the work within work divisions, the requirements and methods for coordination across individuals in a division of labor, the controls and controllers of this division of labor and in the sanctioning of rewards and punishments, the allocation of rewards and profits from the collective output of the work, and the forms of technology used in supporting these changes (Volti, 2011). The result has been a sometimes dramatic increase in productivity, especially in the production of physical goods (Head, 2003). Many of these changes are inherent in the call for this special issue.

Important to many of these changes has been the effect on the nature of the work itself in terms of the knowledge required to perform it, control over the work and its coordination, and the forms of training and controls on labor-force entry (Freidson, 2001; Volti, 2011). The nature of the knowledge required to do work involves a mixture of knowledge types along a continuum from everyday knowledge to abstract and formal knowledge. Work requiring only everyday knowledge relies on knowledge that is commonly available to most people. Practical knowledge is a less common and specialized knowledge learned through practice in a particular work role. It is distinguished from everyday knowledge by the need for sometimes extensive experience.

Finally, formal knowledge is the more abstract and theoretical knowledge which needs to be learned in order to competently perform work. While this knowledge is to an extent codified and available for study by anyone, the growing complexity and volume of it and the need to practice its intelligible use in particular situations often requires years of study and practice in order to become a competent and capable worker.

Depending on the nature of the knowledge required for work, important implications arise for other dimensions of work including the extent of and permanence of the division of labor (specialization and its permanence), and questions about whom controls the division of labor and entry of workers (Freidson, 2001). Work requiring only everyday knowledge is prone to a division of labor that eventually renders it doable by anyone with little specialized training-the traditional approach Taylorism-resulting in small training requirements and control over work entry by other individuals besides the workers themselves (Crowley et al., 2010). Ignoring the tacit knowledge required for fast-food work, we would argue that such work involves mostly the everyday knowledge available to most people, and that control over the division of labor, training and the entry of workers is in the hands of other people besides the workers themselves (Ritzer, 2010). In many cases the control is by other specially trained managers who them-

selves are subject to the direct control of other senior managers, shareholders, or consumers.

Work requiring a higher degree of practical knowledge gained through experience requires on-the-job training with others mentors. As a result, it tends to be less prone to outside control over the division of labor, training and the entry of new workers because it takes time for an individual to develop the experience with other workers (Freidson, 2001). Often this knowledge is more transferable to other organizations beyond where it is learned, thus giving some power to the worker to dictate working conditions and the scope of work. However, the division of labor itself is often still dictated by others, and the performance of the work can still be controlled and monitored by others. For example, a forecaster in an organization may require a fair amount of on-the-job training and may become semi-skilled and valuable to an organization. Certainly, these skills may be transferable elsewhere. However, the actual scope and evaluation of performance of the worker are still often dictated by other high-level managers. In addition, while the working knowledge may be somewhat transferable to other organizations, the selection of people for the job is still controlled by other non-workers.

Work requiring a higher degree of formal knowledge gained through study and often tied to extensive practice (working knowledge) bestows on workers the greatest control over the nature of their work. Formal knowledge is abstract and theoretical, and may take many years of learning in order to become a proficient worker. Often the individuals who learn and practice such knowledge can apply this knowledge in many places, not just in the organization where it was first learned. In extreme cases, the workers may effectively control the nature of the division of labor-both the extent of specialization and its permanence-and may control the training, entry of new workers and the monitoring of their own members' performance. The result is a great degree of autonomy and discretion over the application of knowledge and its further development may be potentially free from external control by other managers and consumers-except at a very coarse-grained level.

Combining insights about the nature of the knowledge required for work, three ideal-typical logics about the control and organization of work are possible: the market, the bureaucratic and the professional logic (Freidson, 2001). An ideal type is an analytical construct, "formed by the one-sided accentuation of one or more points of view and by the synthesis of a great many diffuse, discrete, more or less present and occasionally absent concrete individual phenomena, which are arranged according to those one-sidedly emphasized viewpoints into a unified analytical construct" (Weber, 1997). Since no model is capable of completely representing concrete reality, the researcher can use the ideal types as an analytical construct to determine both similarities to and deviations from the phenomenon under investigation. Following Freidson (2001), we use these logics as three ideal-types to discuss the different logics for organizing and controlling work. We outline these logics in <Table 1>.

The market-based logic requires work that is fleeting and relatively unstable to meet these shifting consumer demands. As a result, the division of labor is shallow and changeable, preventing the development of any form of spe-

〈Table 1〉 Three Logics of Work and Their Assumptions about the Nature of and Worker Control over Work

	Market Logic	Bureaucratic Logic	Professional Logic
Knowledge	Everyday-common knowledge available to many people.	Working-learned on the job although guided by policies and procedures.	Formal-advanced theoretical and codified bodies of knowledge that need to be learned over long periods of time.
Division of labor-specialization	Low-everyday specializations that are fleeting and rarely develop into deep knowledge given changing market circumstances.	High-increasing specializations occurs in order to take advantage of increased efficiencies.	Medium-there are a number of specializations but not excessive given the design of discretionary work covering a broad enough domain of work to remain holistic.
Division of labor-permanence	Low-constantly shifting to carry out new roles in order to meet new market demand.	Moderate-relatively stable positions but change arises from the bureaucratic desire for greater efficiency.	High-stable divisions of labour set by the group and maintained over time to allow holistic work and to increase deep knowledge.
Training-formal education	Low training requirements-given everyday knowledge. Barriers to entry and exit are very low.	Medium training required within a narrow scope of work. Barriers to entry and exit are moderate.	High training requirements given the potentially large body of formal knowledge and the extensive practical training required. Barriers to entry and exit are very high and membership is controlled by other workers.
Control by Workers	Little control over the division of labor and training-dictates by the market prevent any amount of learning or control over individual entry.	Medium control over the division of labor and the knowledge developed in a role but performance evaluated by managerial oversight.	High the division of labor, knowledge production and application and the training and evaluation of members dictated by the workers themselves.

cialized-working knowledge because expertise has little time to develop before producers need to change to meet new consumer requirements. As a result, workers employ mostly everyday knowledge in order to move quickly toward and between various tasks, and the division of labor and its permanence is low given the need for agility. Given the emphasis on market demand and the requirements of everyday knowledge to meet this demand with numerous competitors, the division of labor specialization and permanence, and the need for training, are limited. Worker control over the work is very limited.

If this logic seems extreme to the reader it is because the ideal free-markets is rare, considered by some to be a fiction (Freidson, 2001). Galbraith (2007) provides a particular point of view on this-how in the 1980s, very little of the US economy (around 20% at most) could be classified as a traditional free market, given that the increasing complexity of the goods requiring advanced planning and coordination across typically a few producers-an inter-organizational bureaucracy. His conclusion was that the differences between the US and the then Soviet-Union were a matter of degree and not difference.

The bureaucratic logic is in many respects more representative of the large corporations studied by most management research. Arising out of Weber's response to Marx (Allen, 2004), the bureaucratic logic rests on the development in the extreme case, of working knowledge, but an increasing division of relatively stable divisions of labor that promotes increasing efficiency gains through it. In its extreme Taylori-

stic form, the knowledge employed at the work level may eventually be everyday knowledge, with any discretionary knowledge resting with higher level managers, with a moderately but constantly changing division of labour in order to realize increased efficiency, consistent with the objectives of many enterprise resource planning implementations and business process reengineering projects (Head, 2003). As a result, worker control over the division of labour is limited, and performance evaluation and training are primarily done by other managers and not co-workers. Even in the cases where a worker is more senior and has greater discretion, their division of labor, scope of work and evaluation are dictated by someone higher in the organization, and ultimately by consumers and shareholders.

The professional logic is less understood than the market or bureaucratic logic. It rests on the assumptions that experts and expertise can grow to such an extent that it is difficult for outsiders to control, monitor and dictate how the work should be conducted and evaluated (Ouchi, 1980). This logic rests on an increasingly formalized knowledge base, filled with abstract and theoretical knowledge requiring extensive learning, combined with extensive practice and working knowledge to become a competent worker. In the extreme case, the division of labor and training are almost exclusively controlled by the workers themselves as the people best able to figure out both the best division of that labor and those individuals capable of practicing it. These workers also have the discretion to shape the particular ends of their expertise, and not simply use their knowledge to satisfy the ends of other managers or consumers.

The division of labor in a professional logic is moderate to take advantage of some specialization but it maintains a scope to the work that is relatively broad in order to allow greater discretion and application of the knowledge to a wide variety of typically uncertain cases. As a result, the professional logic avoids the shallow division of labor in the market-based logic, and it avoids the increasingly narrow and the moderate change to the division in the bureaucratic logic.

Barriers to entry by untrained individuals are severe, resulting from the formal knowledge and practical training that is far removed from the everyday knowledge in a pure market-based logic, and the restricted practical knowledge required in the bureaucratic logic. Profession workers exercise control over domains of knowledge by creating a link between an occupation and its work-"jurisdiction"-by developing abstractions for the content of their work and developing formal training methods (Abbott, 1988). While professions can exercise control directly by emphasizing technique (e.g. crafts), prestige and power accrue to those professions that can successfully develop these elaborate abstractions of knowledge. Abbott (1988) argues that "only a knowledge system governed by abstractions can redefine its problems and tasks, defend them from interlopers and seize new problems". The professional logic provides the greatest control of the workers over the division of labour-specialization and permanence -and the greatest discretion in the application of their formal and practical knowledge to particular cases, largely free from outside monitoring and interventions by others-whether managers or markets. In extreme cases, a market shelter

allows only workers trained by other professional workers to carry out work. The argument is that the shelter to protect both consumers (i.e. danger) and the professionals themselves (i.e. to allow the development of specialized knowledge) from other competitors, and in some cases excludes direct competition amongst the professionals themselves. This provides legal protection for the workers to challenge and exclude any other untrained workers.

In addition to this expertise claim as manifested by the control over the division of labor, professional work also involves a moral claim (Freidson, 2001; Yeung and Woods, 2010). This moral claim rests on the idea that professionals can be trusted to develop and apply this expertise for public good through their discretion. This assumes a pronounced difficulty for other non-professionals to monitor and evaluate the work and further supports the market shelter argument.

3. Role of IT Depending on the Logic

The role of IT depends on the assumptions within the three logics. We outline these possibilities in <table 2> :

The implications for the design and implementation of IT vary across several dimensions including: decision making, communication-coordination and training-education-change. For market logics, systems are targeted at the decision making of competitive producers, looking to anticipate and develop product-services to meet changing consumer demand. For example, systems to collect and monitor consumer preferences, whether revealed through purchasing or directly through consumer surveys, would be important. Given the relatively small division of labor in a free market, only small systems are required for communication and coordination across individual producers, but the fluidity and

〈Table 2〉 The Role of IT Across the Three Work Logics

Roles of IT	Market	Bureaucratic	Professional
Decision making	To increase the delivery of information to small and numerous producers to inform decision making about products-services.	To increase the delivery of information to bureaucrats in monitoring and evaluating workers' performance and the overall division of labor. Worker decision making is supported where necessary to assist the discretionary use of working knowledge to particular cases as required.	To increase the capture and recording of information to assist individual and collection decision-making about the application of formalized and deep working knowledge to particular cases.
Communication-Coordination	Small division of labor so little need for coordination systems.	The development of IT to increase the coordination of activities across increasingly specialized divisions - built and developed for a specialized management team.	To increase the coordination of work across a moderate and relatively stable division of labor-built and developed by the workers themselves.
Training education-change	Systems for the quick application of everyday knowledge-IT-IS for routinized and rule-based transactions.	IT systems targeted at communicating work roles and assisting on-the-job training for the working knowledge required for specialized work roles.	IT systems targeted at the codification of formal knowledge and its dissemination. IT systems used to monitor and evaluate differences in process and outcomes amongst workers.

rapid change could involve IT to allow the quick formation and dissolution of producer-workers with other producers, and between producers and consumers. The role of systems for education and training would be limited to only systems that support the dynamic and shifting application of everyday knowledge, with a relatively simple division of labor to respond to market circumstances and heavy competition.

For the bureaucratic logic, systems become increasingly targeted towards decision making by specialized bureaucrats, for coordination-communication across an increasingly specialized division of labor, and for the training-education-change of workers and work roles. In terms of decision making, systems are targeted at informing bureaucrats about the performance of workers and for opportunities to change the division of labor in order to increase efficiency. Worker decision making is supported only where working knowledge is to be developed, within the constraints of the position and the work role set by upper managers. In the extreme Tayloristic case, the working knowledge required may resemble only the everyday knowledge found in the market logic, with worker discretion effectively eliminated. Communication and coordination systems are substantial because the increasingly specialized and shifting of the division of labor demands the development of systems to coordinate the individual results across specialized workers. Finally, IT systems are targeted at training and education to the degree required to develop workers' working knowledge to fulfil a particular role. Many of the systems involved here would be very similar to the traditional hierarchical structuring of information systems taught in introductory IS classes-transaction processing for managing the production and sale of products and services, management information systems to support a slightly greater degree of internal decision making over the lower-level work, decision support systems to support workers in charge of forecasting, and the executive information systems for upper level decision making about the overall direction of the organization.

For the professional logic, IT systems are targeted at assisting worker decision making toward a broader set of work scenarios, by increasing the capture and recording of individual and collective information to support individual or group work. The relatively permanent but moderate division of labor, as compared with the bureaucratic logic, would require information systems to coordinate and facilitate communication where the work is handed off to other workers. However, the relatively more holistic design of the work than in the other logics minimizes the need for hand off the work, and the coordination requirements for these hand offs would be less than in the other logics. Given the formalized nature of knowledge and the correspondingly deep expertise, IT systems targeted at capturing and disseminating formal knowledge, and the monitoring and evaluation of the individual and collective outcomes would be used by the workers, and not by other bureaucrats or consumers.

In ideal form, these three logics of work shape not only the types of information systems built, but the design, implementation and use logics that inform the resulting work practices around them. IT is thus both an enabler of work logics and shaped by it. We turn now to a specific example of an ICT-based movement to explore

and consider the work logics behind the design and effects of ICT in the standardization of professional work in health care. We aim to show how the design, implementation and effects of this particular ICT-based movement are shaped by singular and mixed forms of the three logics. We look to medicine as the exemplar of professional work because of its large percentage of the economy, and as a representative example of professional work generally and the interaction of ICT and work expertise more generally. We thus believe an examination of medicine has important implications not only for other professional work, but also on work expertise generally, viewed through the three work logics.

4. ICT-Based Movements : Logics Shaping the Design, Implementation and the Effects of Standardization in Medical Work

4.1 History

In the 1800s, the medical professionals in the U.S. practiced many different systems of healing-Allopathy, Homeopathy and Herbology among others. Each conceived of disease very differently. At that time, there were few regulations or laws controlling who could practice medicine and how it could be practiced. The majority of the individuals who practiced medicine lived in small communities, and were often illiterate and poor Starr (1982, 1996)). The subsequent 150 years since then saw an increase in the prestige of medical work, assisted by the establishment of professional organizations-the American Medical Association (AMA) in the U.S. for example -to champion its cause. The AMA took steps to erect closure by determining and controlling who was allowed to practice medicine, through the establishment of medical schools and the increasing the formal qualifications required to become a doctor (Light, 1991; Starr, 1982). In the case of the AMA, it also successfully lobbied the state governments in the U.S. in the late 19th century, to legally require medical workers to obtain a license sanctioned by the AMA to practice (Starr, 1982).

The efforts by AMA to increase qualifications had beneficial effects for doctors by creating a group of professionals who were competent in both the "science" and art of healing the body. The AMA's standardization of the practice of medicine (through standardized curriculum in medical schools) was informed by a desire to be seen as an empirical science (Starr, 1982). The first era of standardization was thus initiated and controlled by the doctors, focused mostly on standardizing the skills required for work via curriculum, tools and facilities such as hospitals, but not on the actual content of the doctors' work (Timmermans and Marc, 2003). This standardization enhanced the prestige of the medical profession and helped it gradually obtain market and work-related dominance over the domain of diseases and the human experiences of illnesses (Freidson, 1970).

4.2 Challenges

At the apex of the medical profession's dominance, with increasing autonomy and sove-

reignty over their work, various challenges have emerged to increase the possibilities for other non-professionals to intervene on medical work. One challenge is the escalating cost of healthcare. In most developed countries, spending on healthcare has been growing faster than income resulting in questions about future sustainability of status quo ("OECD Health Data 2012-Frequently Requested Data" 2012). The U.S. for example is already spending over 17% of GDP on healthcare. Hence, with the steady rise in the costs associated with the provision of medical care, a series of countervailing powers through various temporary and permanent alliances among government, insurance companies and employers, have emerged in an attempt to rein in the increased cost Light (1991, 2004).

Adding to this growing pressure are operational issues associated not only with higher cost but also the increasing prevalence of medical errors (Timmermans and Marc, 2003; Wennberg, 1984). With physicians in-charge of the division of labor, increasing morbidity and mortality associated with medical errors suggests that the coordination of medical work requires other participants besides the medical professional itself. Also, associated with cost and medical errors are the variations in the services and costs of treatment by professions, raising questions about the standardized medical training and practice, and issues concerning too much discretion. If standardized training is meant to produce workers who would act in similar ways, then these variations can only be explained through either required discretion or better medical outcomes. In many cases, medical variations are not supported by either discretion or outcomes (Timmermans and Marc, 2003).

4.3 Response

Against and arising from this backdrop, the past few decades have seen a continual struggle between doctors and many outside groups over the control of medical work. A crucial part of this struggle has been the push for a deeper standardization of work using IT (Berg, 1997). These have prompted broad responses through the use of IT, to the monitoring, evaluation and control of professional work, common across national contexts despite differences in terminology.

Timmermans and Epstein (2010) define standardization as a "process of constructing uniformities across time and space through the generation of agreed-upon rules". Work standardization can be classified into four categories (Timmermans and Marc, 2003; Timmermans and Epstein, 2010). Design standards attempt to create uniformity and mutual compatibility by setting out explicit structural specifications. An example of such a standard is the size of beds used in hospitals. Terminological standards ensure that the meaning of designated terms remain stable over space and time. For example, the medical profession uses standardized codes to describe patient diagnoses (International Classification of Diseases now in its tenth version : ICD-10).

Performance standards specify metrics for the desired outcome rather than how something should be done. For example, survival rate could be used to measure the performance of medical professions. The fourth type-procedural standards specifies the steps that need to be performed in a given work situation. Timmermans and Marc (2003) assert that procedural stan-

dards are contested vigorously and are the most difficult to achieve as they seek to prescribe the behavior of professionals. Software that codifies organizational routines is an excellent example of procedural standards.

Despite their separation analytically and practically, these standards are often intertwined (Timmermans and Marc, 2003). For example, in order to make meaningful comparison through a performance standard-survival rate-one needs to agree on the terminological standard, such as the definition of what constitutes as a survival rate. Thus, for the purposes of the subsequent discussion and analysis, we will draw upon them separately and together. Before doing so, we turn to the growing use of ICT that has allowed for standardization.

4.4 Terminological Standards : The Foundation

The basis for the standardization of medicine has come through the initial automation and transactional data which used terminological standards to increase the coordination of care across physicians, the submission of services and fee payments in Canada and the US, and the submission of patient registries for capitation payments and various patient outcomes in the UK (Tuohy, 1999). The governments in the U.S. and many of the OECD countries leveraged their position as leading public-option insurers for medical services by instituting new standardization procedures vis-à-vis terminology, thus requiring providers to use standardized codes for diagnoses and treatments. This information was provided to the government in a standard form (for example, Form UB-04 for Medicare in the U.S). Other large private insurers also followed the U.S. government form. As a consequence, hospitals began investing in information systems to automate the back-end of the care process in order to comply with these requirements and to ensure speedy reimbursements. These purpose of these initial electronic payment systems was to ease the burden of gathering the necessary data to get paid. In the case of Canada and the UK and evident in the US, the data pathways from physicians to payers became natural places to make new decisions arising from the data-to informate (Zuboff, 1988).

These transaction data presented new possibilities for non-professionals to increasingly shape professional work, including the changing of payment for work and the shaping of its delivery. One such possibility was the comparison of cost across physicians, and the setting of fixed payments per diagnosis, especially in fee-for-service settings like the US and Canada-although it was the US that has lead the way in this regard. Under various names-whether diagnostic-related groups (DRGs) or case-mix groupings (CMGs) (in Canada) or prospective payment or physician profiling systems (PPS), a medical diagnosis was used not only to compare the average costs for treatment across physicians but also to set a fixed payment-per-diagnosis. Essentially these systems did so by gathering and comparing the average and deviant total costs of care by hospitals and particular physicians, and the typical and atypical sets of procedures provided to a patient in a comparative group-often defined by an agreed set of diagnostic categories, adjusted for by severity and other co-morbidities (i.e. the presence of other conditions and diseases in addi-

tion to the primary one). Once patterns were revealed and increasingly possible through the capabilities of new ICTs, questions could be asked and answered about the variation, and actions taken to address both high cost and medical variation.

Laws were also changed to require hospitals to use uniform financial reporting methods to obtain additional data to be compared across the US (Mayes, 2007). As a result, the government and insurers now had access to a treasure trove of aggregated information from providers-diagnosis, test results, medical procedures, charge rates for various procedures as well as the cost to treat specific diagnoses.

Access to this data helped epidemiologists to document the variance in medical practices across the country (O'Connor et al., 1999; Welch et al., 1993; Wennberg, 1984). For instance in the US, Medicare patients with early-stage prostate cancer who lived in Louisiana were more likely to have their prostate glands removed than if they had similar conditions in Alabama (Timmermans and Marc, 2003; Wennberg, 1984). The evaluation of the empirical data made a persuasive case that most of these variations were not attributed to chance or discretion but to "inadequate medical knowledge, physician practice styles, patient preferences, over-reliance on inadequately verified diagnostic tools and inequities of the health care system in the U.S." (Timmermans and Marc, 2003). In addition, this data was also used to compare hospital efficiencies (Wennberg et al., 2004). Hence, terminological standards-required by the government as pre-condition for reimbursement of Medicare patients-helped pave the way for a more elaborate procedural and performance standards.

4.5 IT and IS basis for Standardization

Information systems have been used in many industries to standardize not only the data elements involved in the collection of data (terminological standards), but also to codify and enforce procedural standards through digital systems to control white-collar knowledge work (Head, 2003). Furthermore, they also facilitate the evaluation of knowledge work through performance standards.

Historically large medical institutions such as hospitals have used multiple computer-based information systems to collect and track data in both the clinical and administrative areas. Hospitals started using information systems in the 1970s, partly in response to the legal requirements to report standardized data, and to computerize their billing processes. This often entailed building systems to track the movement of patients within the hospital (Admission, Discharge, Transfer system), to track use and appropriateness of care (Utilization Management system-again driven by the need to be efficient vis-a-vis reimbursements) and to collect data needed to submit claims and monitor reimbursement status (Account Receivables system). The administrators utilized the rich information generated by the hospital workers-prior medical history, symptoms, diagnosis, test results, medical procedures etc.-to initiate processes to bill appropriate parties, generate population health statistics and track the performance of the hospital. Furthermore, hospitals used both internal and external data (for example, reimbursement rates released by the government for a specific procedure in Medicare in the U.S.) to generate management reports and benchmark their perfor-

mance.

Clinical systems have a direct bearing on the content of the medical care received by the patients. They deal with health-related information in diagnosing a patient and monitoring his or her care. The hospitals have not been very successful in fully realizing the potential of information systems in the clinical domain due to the relative difficulty (in contrast to administrative systems) in standardizing work processes that directly touch on the content of medical work. Electronic Medical Records (EMR) is the primary example of an information system in the clinical domain. Conceptually, EMR is supposed to handle all medical information about a patient and can serve as the main source of data for most of the information (both administrative and clinical) used in a hospital. However, in practice, the hospitals only use EMR to varying degrees, even when it is fully implemented. Hospitals believe that there is huge potential for cost savings, productivity gains and quality of care improvements across the entire healthcare system if they could use software to standardize the workflow in the clinical domain to the extent possible (Lenz et al., 2006; Sittig et al., 2008). Evidence Based Medicine (EBM) is one of the clearest examples of such attempts to first develop guidelines in the clinical domain and then to embed them in the workflow software logic.

4.6 Evidence Based Medicine (EBM) : Gold Standard for Procedural Standardization?

The most recent attempts have been made to standardize medical knowledge and its application through various names-clinical practice guidelines (Shaneyfelt and Centor, 2009) and evidence-based medicine (EBM) (Greenhalgh, 2010) being particular movements inside this broad area. Spurred on by the perceived benefits and availability of data through the capabilities of ICT, the purpose of EBM is to evaluate the effectiveness of medical practices and to issue guidelines deemed optimal-especially in those areas where individual decision making and training is claimed to be insufficient to see this bigger picture, and requires centralized standards to guide medical practice. This is especially considered to be the case for the many general practitioner who are considered to be unaware and untrained in particular medical specialties.

This process of gathering evidence to identify appropriate interventions to effectively treat patients through EBM attempts to follow “scientific” principles, and uses information technology extensively (Berg, 1997; Yeung and Woods, 2010). EBM has evolved much over the last 20 years and has attained enough legitimacy to pose a serious challenge, on the surface, to the autonomy and sovereignty of the doctors over their work, since these efforts appear to be the farthest in terms of dictating the content of doctors′ work. It also appears to be enthusiastically supported by other medical professionals such as Nurses and Paramedics-perhaps in an attempt to raise the legitimacy and prestige of their professions vis-a-vis physicians (Timmermans and Marc, 2003).

However, some critics of EBM ferociously argue that it converts their practice into “cookbook” medicine (Berg, 1997). They further contend that EBM completely eliminates the art and discretion consider essential to professional work, creating new problems and increasing the

uncertainties of practice instead of reducing them. While some of the criticisms question the scientific validity of the evidence (for example, results based on non-randomized trials), others attack the limitations of the scientific method (Berg, 1997).

While the profession of medicine still has strong control over the abstractions of medical expertise, supporters of the EBM movement including other institutions as well as members of its own profession, have resorted to using other abstractions from what are called other "scientific fields" such as Operations Management and Statistics to counter the critics, including the DRGs discussed earlier. They also advocate embedding the recommended guidelines as a procedural standard in the clinical information systems-constraining the discretion of medical work-where appropriate (Berg, 1997).

The proponents for the use of guidelines have also used information processing limitations of human mind as another important reason for the use of EBM (Berg, 1997). This line of reasoning is popular among the medical professionals, with the argument also pointing to the complexity of medical care and the need for increased patient safety. They cite research which shows problems with inappropriate medical care and medical errors in order to support the need for EBM (Gawande, 2010). They also emphasize the need for doctors to be engaged in this process.

5. Discussion

Our discussion focuses on how particular work logics inform the motivations for ICT design and implementation, and the final effects of standardization. These suggest various propositions for future IS research on professional work.

5.1 Singular Logics

In terms of singular work logics, the standardization and codification of professional work often prompts competing arguments for or against what is considered to be the deprofessionalization of medicine (Reed and Evans, 1987). Deprofessionalization is the loss of autonomy and control over work by the workers themselves-its decision making, the scope of work, the division of labor and permanence, the training and development of formal knowledge, and the control and monitoring of its members (Freidson, 2001). Deprofessionalization arguments rely on assumptions that standardization puts decision making about professional work increasingly into the hands of other non-professionals.

Through the bureaucratic logic, standardization through deprofessionalization can be viewed positively, as a method for addressing the problems of increasing medical cost, medical errors and variation. Bureaucratic logics would favour standardization in that it renders professional work visible, calculable and comparable allowing work practice and outcome variations to be exposed and eliminated for the benefit of patients and payers. It allows senior managers to measure cost and outcomes across workers performing similar work, and continues to restrict unnecessary discretion, and more clearly guides workers toward tighter quality and cost constraints. In this case, IT-enabled systems would use procedural standards to monitor the division of labor and to stabilize or change it based on performance standards in order to improve outcomes.

From the professional logic, deprofessionalization is viewed negatively because it prevents the necessary discretion and expertise from those best able to achieve the nuanced outcomes of care required in individual cases-the workers. Deprofessionalization is also viewed negatively because of a reduced ability for innovation in professional work towards alternative and greater health provision in the future.

This raises 3 propositions in <Table 3> :

In addition to the deprofessionalization aspect vis-á-vis the professional logic, the bureaucratic logic also assumes that non-professional outsiders are required to oversee healthcare work to handle the division of labor, its permanence, its training and control over the work on behalf of patients and consumers. In doing so, the bureaucratic logic thus counters the market logic by arguing against the consumers' ability to choose because of the tremendous uncertainty which can never be addressed through any level of consumer information. As a result, bureaucratic intermediaries are required to act on the patient's behalf. We thus conclude in <Table 4> :

In contrast, the market logic assumes consumers should be the primary decisions makers, and only information and information systems which deliver the price and outcome data required to inform consumer choice is needed. Given this, propositions 2a and b for controlling and standardizing practice through specialized bureaucrats is at odds with the market-based logic. In an extreme case, control over the work and its division of labour by bureaucrats or professional workers conspires against consumer interests since the best care and cost is unable to emerge from the innovation and variation in production possible in a free market.

Standardization is only supported if the unnecessary hoarding of knowledge by professionals is challenged by providing information about the best care and by identifying sub-optimal producers so that consumers and market-competitive forces can remove them. In both cases, the response is to build more ICT-based systems by developing terminological standards (for example, through standard forms

〈Table 3〉 Propositions from the Bureaucratic and Professional Logic about Deprofessionalization

Proposition 1a	Deprofessionalization is possible by making work visible, calculable and comparable to other non-professionals who will restrict and control medical work.
Proposition 1b	Deprofessionalization will reduce unnecessary variation in cost and practice, and reduce costs (positive bureaucratic logic).
Proposition 1c	Deprofessionalization will hurt the necessary discretion required by professionals to tailor the service to patient needs and for work-related innovation (negative professional logic).

〈Table 4〉 Bureaucratic Logic Propositions Countering the Market Logic

Proposition 2a	Professionals are technical experts who need to be monitored and evaluated by other bureaucratic experts in order to ensure their work supports consumer goals.
Proposition 2b	Standardization efforts by bureaucratic logic are there to protect consumers.

〈Table 5〉 Market Logic Propositions Countering the Bureaucratic and Professional Logics

Proposition 3a	Systems would be designed to encourage the use of terminological standards whenever appropriate to support the delivery of information to consumers and to facilitate comparison shopping.
Proposition 3b	Professional knowledge shared widely with consumers through standardization (procedural standards such as EBM as well as performance standards) will prevent the hoarding of knowledge that restricts and distorts market mechanisms.
Proposition 3c	Standardization through bureaucrats prevents consumer choice and the development of alternative providers and service-product variety.

〈Table 6〉 Propositions from the Professional Logic about Standardization through Professionalization

Proposition 4a	Control of standardization by professionals will preserve professional autonomy better than ceding control to non-professionals.
Proposition 4b	Prop 4b: Control of standardization by professionals will allow those most able and trained in medical work to shape and enforce it.

required for Medicare in the U.S.) and to use this standardized data to increase information provision to consumers in order to help them make better decisions. These systems by virtue of using terminological standards will also push organizations to decrease the hoarding of knowledge not only by professional workers but also by bureaucratic experts who otherwise might discourage comparison-shopping by consumers. We thus conclude in <Table 5> :

All of the propositions so far rest on a deprofessionalization assumption of professional work. However, standardization can be supported through the professional logic if it is shaped and determined by the professional workers themselves, and its development and enforcement through the training and the correction of member's work. In this case, the professional logic would respond to standardization as a part of professionalization through an increasing formalization of knowledge. Anything that assists with the process of finding best practices by professional workers but through the workers themselves would be seen as a part of the professional logic.

The professional logic assumes that an over-reliance on consumers and individual decision making results in poor and dangerous outcomes because market signals are too late and the information is too difficult for consumers to understand. It is only through trained and certified practitioners that health outcomes can be guaranteed. The market-logic could herald a return to the non-professional past of snake-oil salesman and bloodletting. In this case, <Table 6> highlights various propositions from the professional logic.

<Table 7> summarizes the overarching logic of the propositions. While table 7 highlights how these logics respond to and inform standardization independently, their mixing provides additional insights about the role of ICT design and implementation on work-which we explore in the next section.

〈Table 7〉 The Assuming Logic and Role of IT in Market, Bureaucratic and Professional Logics

	Market	Bureaucratic	Professional
Assuming logic	Well-informed clients and consumers can use information to make their own choices. Bureaucratic control is unnecessary and detrimental to individual choice, and professional autonomy conspires against consumer choice.	A group of skilled non-professionals, need to be responsible for representing clients (patient) interests. Unregulated consumer choice or professional discretion is problematic.	Standardization has been a part of medical work, and is best served by professional control and monitoring.
Role of IT	To increase the amount of information for visibility and comparability to increase consumer choice. Focus on terminological standards to facilitate comparison across organizations (reins in bureaucratic logic); Common terminology is a necessary condition to make sense of procedural and performance standards that individual organizations may have developed.	To increase the visibility and comparability of professional workers, and to reward-discipline on that basis. Focus on procedural and performance standards. Use of terminological standards are helpful in controlling professional logic (as long as market shelter is protected), but if taken too-far, may also result in evaluation of organizations by consumers.	To increase the ability of other professionals to see and learn from and self-regulate other professionals. Use of procedural and performance standards as suggested guidelines, but allow the preservation of discretion and autonomy in sensibly applying these guidelines.

5.2 Mixing

Freidson (2001) admits that the professional logic is an ideal, and that its realization in practice is complicated by how and where the professional logic mixes with the other market and bureaucratic logics. In many cases, the three logics sit uneasily with each other, but the argument may not be as much about which logic should prevail, but how the logics should be mixed in a particular contexts as Freidson (2001) suggests, "whether the virtues of each are suppressed by emphasis on the others and their vices excessively stimulated."

<Table 8> highlights a number of possibility prompting mixed work logics. Each will be drawn on in the following discussion by the code in the table.

〈Table 8〉 Key Issues Prompting Mixing Across the Professional, Bureaucratic and Market Work Logics

	Key Issues Prompting Logic Mixture
Professional	1) Which medical areas are best subject to professional control because of topic newness and uncertainty? (P1) 2) If cost is not a primary concern of professional workers, then who will be in-charge of the overall allocation of resources, especially as costs escalate? (P2) 3) Regardless of how much work remains under professional control, where do the logics work together in tempering each other? (P3)
Bureaucratic	1) How can medical variation be evaluated without the assistance of medical expertise to evaluate the outcomes? (H1) 2) How is the discretionary aspect of professional knowledge taken into account to handle client variation and future innovation? (H2) 3) Which areas are to be handled and governed by bureaucratic control because of market failure and which are to be left to market logics? (H3)
Market	1) Given the increasing complexity and diversity of medical treatments, where is consumer sovereignty difficult to achieve without the assistance of the other logics? (M1) 2) Why do most industrialized countries respond to healthcare (in particular) by creating bureaucratic and professional logics to handle market failures? (M2) 3) Why has the increasingly privatized approach to healthcare in the US lead to the highest costs? (M3)

The majority of the evidence suggests that despite design efforts by typically bureaucratic or market logics only, the professional logic shapes the outcomes of ICT-based movements. For example, there is evidence that the US-probably the furthest along amongst the developed countries towards a dominant emphasis on the market logic-in-fact produces the highest cost per person despite market claims and a large population (compared to the US and Canada) with the greatest possibilities for economies of scale (Evans and Brown, 1984; Kerr, 2013) (see M2 & M3). Although the evidence is messy and often politically fractious, this cost profile suggests that instead of increasing the certainty of information and consumer choice, an increasing number of market participants and product offerings in-fact overly complicates consumer choice (at least in part, due to difficulties in formulating terminological and performance standards), and in many cases through a collapse in markets, prevents some consumers from participating in healthcare at all (Mechanic, 2006). Canada and the UK, with relatively simple and government-funded only systems spend substantially less on healthcare cost as a percentage of GDP with the same or better health outcomes ("OECD Health Data 2012-Frequently Requested Data" 2012). The problems appear to stem for an inherent information asymmetry that face health care consumers (Evans and Brown, 1984) (see M1). This prompts proposition 6 :

The response to proposition 6 is often an increasing number of intermediaries between the patient and the medical worker, whether as regulated for-profit insurance companies, for-profit or not-for-profit healthcare organizations, or various governmental organizations (see H1). However, these intermediaries, particularly in the US, are still relying upon paying clients and so a mixed market-bureaucratic logic ensues (see H3). Even in Canada and the UK, taxpayers and government are increasingly exploring market logics but within various forms of bureaucratically organized controls (Pollock, 2006). And although the UK runs a national health service (NHS) which employs physicians, Canada uses a fee-for-service system similar to the US which prompts a form of market logic-although those fees are set with one buyer-the provincial governments (Ludwick and Doucette, 2009).

There are also numerous examples where despite various attempts otherwise, the professional logics mix with the others in tempering the effects of market and bureaucratic logics on their own. For example, the empirical evidence on standardization has in-fact helped or preserved professional groups autonomy, and market-based reforms targeted at increasing customer information for decision making has in-fact been used by professional groups in claiming overall success, and in increasing the monitoring and evaluation of their colleagues (c.f. Exworthy et al., 2010). This active interest and influences over monitoring and evaluation has been referred to as "soft autonomy" (Levay and Waks, 2009) (see P1).

〈Table 9〉 Problems with the Tacit Knowledge for a Health Care Market

Proposition 6	Problems with information provision and tacit knowledge prevent a pure market logic to control professional work.

Further, it is important for professionals to stay engaged with and partially in control of the procedural standardization attempts even if it means selectively reduced discretion (but decided by professionals) (see P3). Timmermans (2008) shows that there is in fact such a thing as too much market shelter by favourably comparing clinical professionals to forensic science professionals. He argues that by relying too much on market shelter and ignoring attempts at standardization, the forensics profession has put itself in a potentially vulnerable position, whereas clinical professionals have maintained control of their profession by selectively engaging with bureaucratic logics by maintaining their control even at the expense of reduced discretion. This further buttresses our argument about the need for appropriate balance in the mixing of the work logics (see P3).

It is also clear that when standardization systems are providing information to other bureaucratic managers and outside groups, its implementation ultimately depends on an accommodation of professional logics and professionals' responses to technology (see H2). For example, the outcomes of DRG and CMG categories rely on medical definitions by the medical professionals themselves at the outset, and that the diagnosis itself which is under physician's control still dictates what happens through standardization (Pongpirul, 2013). In this respect, discretionary control is maintained outside of the classification, although once classified this discretion may be reduced. Within a professional logic interested in providing best practice to patients through worker control, this is a good thing. In any case, it points to the still inherently tacit knowledge of professional groups that cannot be so easily captured by bureaucratic and market logics (see P1 and P2).

It's no surprise then that many of the physician profiling systems require an informating of the clan (Kohli and Kettinger, 2004) failing when they are imposed by administrators only. In the case of informating the clan, the physician leads and the physicians themselves are in charge of using the information and dealing with outliers. This leads to proposition 7 :

Similarly, the pure professional logic is never realized in any setting, and at some level is counter-balanced and mixed with the other logics in various ways-e.g. companies, insurance companies, government budget holders, etc. (see P2 and P3). Also, the continuing cost escalation, medical variations and errors suggest that numerous research questions remain about the nature of these anomalies and how they are to be addressed through some other mixture of the various work logics (see P2). This prompts proposition 8 :

〈Table 10〉 Dependence on Health Care workers for Standardization Efforts

Proposition 7	Standardization efforts depend on existing professional work activities regardless of the type of standards (for e.g. procedural and performance standards).

〈Table 11〉 Work Logic Boundaries

Proposition 8	At some point the professional logic ends and other logics begin in order to address any over-domination by the professional logic.

Despite this, we would argue that that the bureaucratic and market logics tend to be the primary ones in information systems design and implementation, most likely arising from their perceived success in other industries, such as manufacturing (see H1 & H2). However results in the service sector have been mixed. Head (2003) highlights the extent of the problems through employee disempowerment, even in those areas originally immune to semi-automation such as healthcare and customer service. Justifying its continuation are usually competitiveness and cost-cutting measures considered to be the driving motivation for many system development projects. And with a significant portion of an organisation's costs as employee wages, design approaches tend to treat employees as an expense that should be cut in order to achieve increased profits.

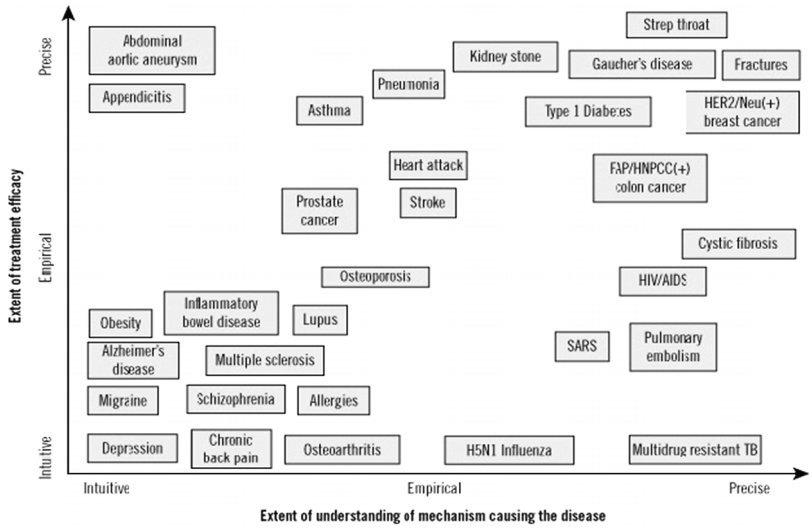
If Head is an indication, many of these attempts to implement information systems through primarily bureaucratic and market logics fail, particularly Enterprise Resource Planning within the service sector. Based on their own criteria of efficiency, Head (2003) reports that 92% of European respondents with ERP projects were dissatisfied with ERP implementation results. Only 8% had any improvements in organisational performance, 5% had improvements in productivity, 5% had streamlined processes, and only 13% were satisfied with improvements in information flows.

ERP implementation in the service sector, with health care as one example, encounters a number of inherent problems without considering the professional work logic. The decomposition of jobs into smaller and smaller tasks with the expectation that they will be able to reproduce the whole is extremely difficult, especially in service sector industries, where a single and uniform set of service steps will rarely satisfy customer and producer needs (see H2). Despite material successes in the standardization of manufacturing, successful service often depends on employee discretion to tailor the delivery of a service. As a result, striving for cost-cutting and efficiency can impoverish the service. It can also have long-lasting and debilitating consequences on the learning processes especially for professionals (Head, 2003). As a result of the sole or even chief pursuit of efficiency, IS systems may often turn out to be sub-optimal even by the standards of efficiency. This prompts proposition 9 :

Given this starting point for considering mixed logics in ICT design and effect is to simply acknowledge the professional logic, and that any ICT-design and implementation depend on it. Once recognized, then the mixing and experimentation with all three logics-and the resulting ICT designs and implementations to support it-can be initiated. Christensen et al. (2000) highlights one possibility in comparing the certainty of cause and treatment in healthcare, with medical conditions that have both more certain cause and treatment requiring less formalized knowledge than those with greater uncertainty (see M1, H3, P3).

〈Table 12〉 Failure through only Market and Bureaucratic Logics

Proposition 9	The dominance of market or bureaucratic logics only without considering the professional work arguments will be prone to failure.



〈Figure 1〉 Medical Conditions Requiring More or Less Understanding of the Mechanisms of Disease and the Treatment Efficacy (adapted from Christensen, 2000)

From <Figure 1>, it is possible that the three logics mix where disease cause and treatment is increasingly known, thus increasing the possibilities of both market and bureaucratic logics, and where it isn't, thus increasing the possibilities for professional work-logic. ICT design and implementation plays an important role here if it assists in increasing the possibilities for a greater understanding about disease mechanisms and treatment options (c.f. the web system patientslikeme and patient-to-patient communication about medications and results).

Conversely, the introduction of new technologies and medicines in the market and in research laboratories could increase the need for physicians and other medical workers to explore and develop the nature and forms of treatments possible from these technologies. This would suggest a transition from more market-based systems which produce the treatments toward professional development of formalized and working knowledge.

6. Conclusion

A recent BBC report in the UK indicates that the surgeons who opt out of public reporting through the web site NHS (National Health Service) choices, on their mortality rates and whether it is within the expected range, will be named ("BBC News-'Danger of mis-representation' over surgeons' tables" 2013). The article also reports on issues related to problems with using the data for patient decision making because of numerous statistical issues which increase the reported mortality including: the variety of patients involved in different specialities, the team-based nature of more complicated surgeries, and the sometimes small number of cases collected for some surgeons during any particular reporting period.

This report about surgeons opting out of public reporting of their mortality rates ("BBC News-'Danger of mis-representation' over surgeons' tables" 2013), highlights the emergence

of the three work logics within this one example. The market logic is driving the project, by suggesting the disclosure of surgery rates will assist with patient choice. However, various bureaucratic logics suggest that patients will be unable to make informed decisions because of the expertise required to interpret the tables, and various professional logics suggest that the professionals themselves are using the tables to determine and evaluate the outcomes amongst themselves (Exworthy et al., 2010). These final results make sense through the analysis and mixing of the three work logics.

ICT thus plays a powerful role in shaping the present and future of professional work. However, the role ICT plays in changing professional work depends on a number of distinct logics about the nature and control of work which while initially contradictory, typically mix together in producing the final effects from and on work. In this paper, we have considered separately and together how these work logics posit particular differences in how the knowledge required for work shapes the targets of ICT design: the division of labor and its permanence, the training of workers and the controller of the work and the workers. Their reconciliation or lack of reconciliation during ICT design and IS realization needs to be explored and understood in order to address the mixed results of ICT design and implementation in professional work (Diamond and Shirky, 2008; Walker, 2005).

We explored how one particular and illustrative example of ICT-lead movement in healthcare illustrates how the logics would respond differently to standardization depending on how worker control over the work is increased or decreased through it. The market logic sees the disclosure and sharing of medical information through standardization as good for consumer choice, but sees the standardization of practice as a restriction on the diversity and expanded number of producers that would compete for consumers' choices. Standardization in the bureaucratic logic is a necessary and desirable outcome of the continual evaluation and control over an increasingly specialized division of labor that controls the sanctioning and reward of workers' performance. In the professional logic, standardization controlled by others is problematic, but good if it preserves and enhances the control and formalization of knowledge through the professional workers themselves.

There are a number of limitations with our approach. We have focused on medicine because of its economic and ideal dominance in professional work. However, its dominance may restrict its immediate applicability and transferability to other areas of professional work and work expertise in general. Future research and commentary will be necessary to transfer the insights from this paper to these other areas of work. We also use three ideal categories of work which while initially helpful for analytical purposes, may be seen as a series of straw-man arguments. We hope our mixed analysis of the logics within the paper helps to address this weakness, but our work will rely upon other research and commentary to assist in this transfer. We also have chosen to illustrate professional work through an argument and essay and not through a specific empirical example. While we believe it is important to step back and assess the theoretical and empirical domain in advance of more empirical work in order to ensure we have our various assumptions and

logics in order, we necessarily depend on future IS research to address the many propositions left unanswered in this paper.

Given these limitations, we have illustrated a number of important propositions for IS researchers to explore in understanding how ICT is shaped by and effects the nature of professional work. These propositions also illustrate how IS researchers can actively participate in an important economic and work-related set of areas in professional work, and how the findings from research in professional work can be transferable to other insights about the effect and role of ICT on work-related expertise

While singular work logics may often launch standardization projects, the effects on work often result from mixes with the professional logic, because the ultimate success or failure of any ICT project depends upon the incorporation of professional logics-e.g. standardization depends on the determination, entry and exit of professional practice and diagnostic categories; market-based initiatives to inform consumers often in-fact inform other professionals as much as consumers (Exworthy et al., 2010); attempts to informate the bureaucracy succeed only when they are controlled by and informate the clan (Kohli and Kettinger, 2004); and standardization efforts succeed through clinician control (Davidson and Chismar, 2007). In other words, where the logics are reconciled and considered, the outcomes are determined and success can be realistically and productively determined.

Finally, our own professional role as IS researchers require us to observe, understand, and shape the future of ICT design and implementation in professional work, as autonomous professionals (Somers, 2010). This will require us to move beyond only the market and bureaucratic logics which often inform and shape our work, toward the professional logic also.

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