2008

Adopting IT to Manage Compliance and Risks: An Institutional Perspective

Tom Butler
University College Cork, tbutler@afis.ucc.ie

Damien McGovern
Compliance and Risks Ltd., d.mcgovern@complianceandrisks.com

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Butler, Tom, Business Information Systems, University College Cork, Cork City, Ireland, tbutler@afis.ucc.ie

McGovern, Damien, CEO, Compliance and Risks Ltd., d.mcgovern@complianceandrisks.com

Abstract

Addressing the complexity of the growing number of regulatory instruments emanating from global institutional environments has prompted firms in the IT sector to adopt innovative information technologies to help manage compliance and related organizational risks. This paper first employs institutional theory to help explain how a range of exogenous regulative, normative and cultural cognitive factors are influencing IT manufacturers' adoption decisions on IT-based compliance solutions. The paper also draws on organizational theory to describe the endogenous institutional arrangements knowing organizations need to implement in order to address the challenges posed to them while operating in such environments. The findings of a case study on the adoption of what Napa Inc., a Fortune 500 IT manufacturer, considers to be the most innovative compliance management solution on the market, illustrates, that in order to be effective, such applications must support organizational sense making, decision taking and knowledge creation and management. Each of these activities are argued to be key characteristics of knowing organizations and collectively they underpin Loop III Learning, the absence of which results in suboptimal results for firms in dealing with compliance imperatives and addressing associated risks.

Keywords: Innovation, Adoption, Compliance, Institutional Theory, Knowledge Sharing

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1 INTRODUCTION

Business enterprises are under increasing institutional pressures in their organizational fields (DiMaggio and Powell 1983) to adopt 'green' strategies for their products and services (Murugesan 2007). Hence, regulative, normative and cultural cognitive/mimetic influences (Scott 2001) are said to be shaping the manner in which business enterprises are responding (see, for examples, Drahos and Braithwaite 2001)—this is termed institutional isomorphism. The European Union is, undoubtedly, the leader in proposing and drafting what is a raft of legal policy instruments that address environmental concerns; primary examples are the Restriction of Hazardous Substances (RoHS) Directive, the Waste Electrical and Electronic Equipment (WEEE) Directive, and, more recently the Registration, Evaluation and Authorisation of Chemicals (REACH) Regulation. While EU-based, these regulations have global implications for diverse industry sectors, particularly firms in the IT sector, as the growth of the high-technology products has increased the number and quantities of hazardous materials being put on the market (Hristev 2006; European Commission 2006). The key institutional pressure to comply with environmental regulations, are that companies face exclusion from major markets, stopped shipments, and product recalls (Aberdeen Group 2006). Non-government organizations (NGOs) and industry standards bodies are also bringing normative pressures to bear while customers, shareholders, competitors exert cultural cognitive/mimetic influences (Aberdeen Group 2006, Murugesan 2007). In an overall context, then, the consequences of IT manufacturing organizations in not addressing environmental issues are significant and include, for examples, a loss of revenue and potential damage to product brand image and corporate reputation (Aberdeen Group 2006, Greenemeier 2007).

Identifying and responding to normative and cultural cognitive influences involves strategic decisions (Aberdeen Group 2006, Murugesan 2007); in contrast, global regulatory environments are highly complex and organizations are facing enormous challenges in understanding compliance legislation and in making appropriate responses (Hristev 2006). Accordingly, information technology (IT) is being proposed as a key enabler to help companies manage environmental compliance imperatives and to minimize related risks; there is, however, a paucity of suitable IT-based systems in the marketplace to help organizations address what is a significant challenge (Kerrigan & Law 2003, Avila 2006). This study helps deepen the IS field's understanding of such issues by applying institutional theory in a study of the adoption of one such system—the Compliance-to-Product application—in the IT manufacturing sector. The objective of this study is, therefore, to explore how IS can support sense making, decision taking and knowledge creation and management in organizations faced with global regulatory compliance imperatives. The remainder of this paper is structured as follows: the next section applies institutional theory to illustrate the web of conditions and factors that are influencing organizations to adopt environmental compliance-based IT solutions. The third section describes this study's research approach, while the fourth presents the findings. The final section conducts a brief theoretical analysis and offers several conclusions.

2 INSTITUTIONAL ISOMORPHISM IN THE HIGH-TECH SECTOR

Two complementary perspectives inform institutional theory in economics and sociology: the first is the institutional environments perspective, which focuses on the exogenous political, social, and legal influences that structure business activities, and the second is institutional arrangements perspective, which examines how business entities respond endogenously to exogenous influences and to compete in their chosen markets, manage their resources, and so on (Williamson 1998). Scott (2001, p. 33) defines "Institutions [as consisting] of cognitive, normative, and regulative structures and activities that provide stability and meaning to social behaviour. Institutions are transported by various carriers—cultures, structures and routines—and they operate at multiple levels of jurisdiction". Thus, DiMaggio and Powell (1983) argue that all organizations operate within an institutional framework defined by their organizational population and within a wider institutional environment—this they

term an 'organizational field'. According to DiMaggio and Powell (1983, p. 143), an 'organizational field' is comprised of "[t]hose organizations that, in the aggregate, constitute a recognized area of institutional life: [it consists of] key suppliers, resource and product consumers, regulatory agencies, and other organizations that produce similar services or products." DiMaggio and Powell argue that an 'organizational field' is shaped by coercive (regulative and legislative) influences from government departments, state-sponsored agencies, the judiciary, and so on, in addition to normative influences (from professional bodies and industry/trade standards bodies/associations, suppliers, consulting organizations, distributors, and so on) and mimetic forces (i.e.cultural-cognitive—Scott, 2001—from shareholders, non-government organizations (NGOs) and society-at-large). The model presented in Figure 1 integrates the institutional environments and arrangements perspectives using theory from DiMaggio and Powell (1983) and Choo (2006—see Section 2.2 below).

Figure 1 Institutional Environments and Organizational Arrangements (adapted from DiMaggio and Powell (1983) and Choo (2006)).

2.1 Institutional Environments: Coercive, Normative and Mimetic Influences

In the recent past, the European Union (EU) has played an increasing role in the regulation of environmental issues (Hristev 2006). The compliance apparatus that has evolved around EU Directives, and their transposition into the legislation of the EU's 27 member states, involves diverse enforcement and management regimes—diverse, because of the subtle differences in their implementation and enforcement by member states (Hristev 2006). The Restriction of Hazardous Substances Directive (RoHS) entered into force on February 13, 2003 in the European Union and, also, Norway, Lichtenstein and Iceland. With some notable, temporary 'use' exemptions aside, this directive severely restricts the amounts of 6 hazardous substances producers of Electronic and Electrical Equipment (EEE) can incorporate in products put onto the EU market since July 1, 2006. In 2007, Norway introduced 'Super' RoHS, which tripled the list of hazardous substances to 18—it is believed that the EU will follow suit in the coming years by identifying over 46 substances. The reason for such regulations is that hazardous substances cause environmental problems during the disposal and recycling of electrical and electronic equipment. Accordingly, a set of targeted substances are specified (e.g. lead and cadmium) and the levels above which they cannot be present in homogeneous materials, i.e. components that cannot be further mechanically disjointed, are detailed.

The Waste Electrical and Electronic Equipment Directive (WEEE), which entered into force in the EU also on February 13 2003, aims to minimise the impact of EEE by increasing re-use and recycling and reducing the amount of equipment going to landfill. It seeks to achieve this by making producers responsible for financing the collection, treatment, and recovery of waste electrical equipment, and by obliging distributors to allow consumers to return their waste equipment free of charge (Hristev 2006). The implementation of WEEE and RoHS Directives resulted in highly complex legislation in member states which does not lend itself to easy comprehension, application, and integration into, for example, an IT organization's research, development, manufacturing and logistics processes (Pecht 2004). However, the task of maintaining compliance will become even more onerous for the IT and related sectors, as the new Registration, Evaluation and Authorisation of Chemicals (REACh) Regulation comes into force in June 2007. This EU-wide regulation obliges organizations to detail the potential hazards of chemicals in their products across the product life-cycle (Bush 2007). The trend toward increasing environmental regulations is not a European phenomenon, however. While the U.S. Environmental Protection Agency (EPA) has legislation covering hazardous substances across the whole range of manufacturing sectors, individual states, such as California, have been emulating the EU in adopting WEEE and RoHs-like legislation (Hristev 2006). It is notable, that outside the EU, Japan also has the most demanding laws; likewise, Korea, Australia, and Canada have introduced legislation similar to the RoHS and WEEE directives, while in China the China RoHS or the Methods for the Control of Pollution by Electronic Information Products Directive, came into force in March 1 2007.

As indicated, normative and cultural cognitive/mimetic exogenous influences also shape the response of business enterprises to concerns about their activities and products on the environment. For example, industry standards and professional bodies such as IEE and IEEE, customers, and supplier-relationships bring normative influences into play, while non-government organizations, customers, competitors bring cultural cognitive/mimetic influences to bear (see Avila 2006, Murugesan 2007). One recent example of cultural cognitive influences on IT manufacturing organizations comes from the non-government organization Greenpeace, which tests IT and electronic appliances for hazardous substances. In institutional terms, mimetic influences ensure that organizations will respond to 'green' strategies of competitors by emulating them in order to avoid being exposed by Greenpeace.

2.2 Institutional Arrangements: Sense Making, Knowledge Creation and Decision Making

Drawing on organizational theory and management and information science, Choo (2006) argues that his integrative theoretical model of the knowing organization transcends the limitations of traditional decision making models with their emphasis on rules, preferences and routines all of which results in single-loop learning (Argyris & Schön 1996)—Figure 2 outlines Choo's model. Drawing on industry case studies, and building on the empirical findings of Argyris and Schön, among others, Choo illustrates that organizations that focus on applying decision making routines (bounded as they are by organization-specific coercive, normative and mimetic forces) unquestioningly fail to detect and incorporate signals from the external environment and to better understand their activities. Thus, as Choo argues, they are limited to Loop I Learning.

Organizational sense making, which involves the application of beliefs, interpretations and enactments, is argued by Choo (2006, p. 310) to be vital as "we need to know 'what is going on and why' before we are able to decide 'what is to be done'. Making sensible interpretations is as critical as making the right moves." Choo illustrates that this is akin to Argyris and Schön's second loop learning, where sense making leads to changes in the organizations governing assumptions and beliefs. From the perspective of institutional theory, this would lead the organization to modify its internal regulative framework, with concomitant modifications to organization-specific normative (i.e. norms and beliefs within 'communities-of-practice') and mimetic (i.e. internal cultural-cognitive perceptions of the organization and its members, towards themselves, the 'organizational field' and society) influences. Returning to the broader institutional context, the complex regulatory environments and changing attitudes (in customers, stakeholders and competitors) described above require sophisticated sense making by IT manufacturing organizations. Thus, an organization needs to "adopt a greater openness toward information: they would need to view information from multiple perspectives; ask

new questions; try new sources; and be willing to reconsider beliefs and assumptions" (Choo 2006, p. 310). This requires the application of sense making to inform decision taking—this is Loop II Learning, according to Choo. In the context of the present study, this requires the support of IT, as Avila (2006) and others argue that information systems support is required by organizations to deal with the growing number of complex regulatory compliance imperatives.

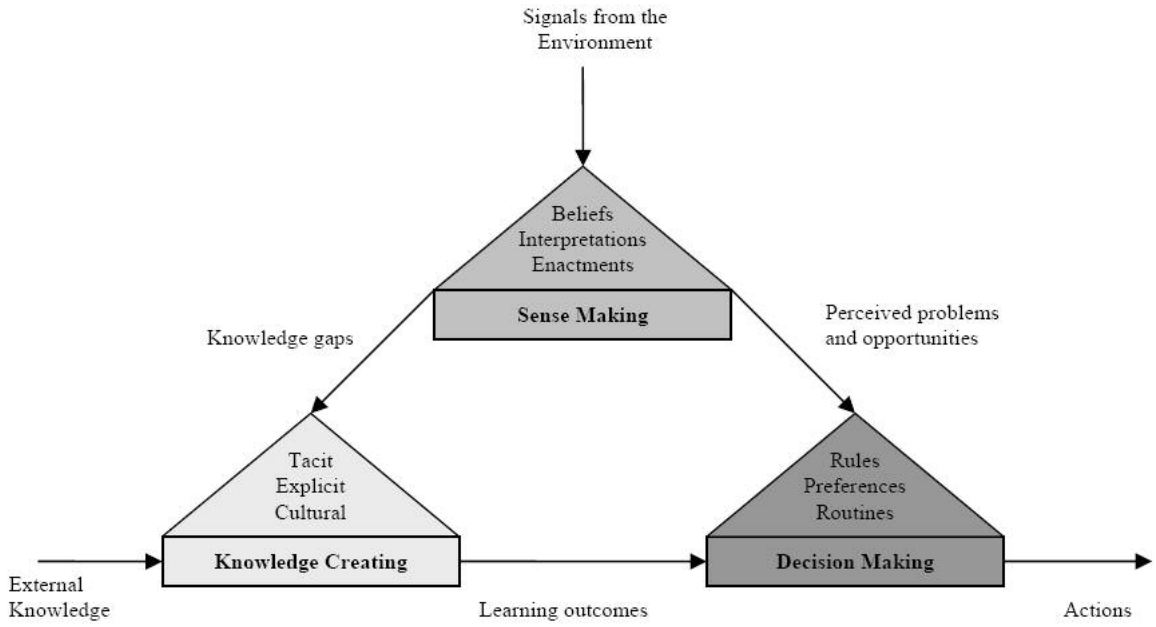

Figure 2 An Integrative Model of Sense Making, Decision Making and Knowledge Creation

As with Fransman (1998), Choo (2006) illustrates that firms need to recognize the importance of tacit and cultural knowledge in addition to the explicit knowledge (found in, for example, prescribed organizational routines), if they are to create enabling conditions and tools that foster knowledge creation, sharing and use—all of which underpin Loop III Learning. This has clear implications for IT manufacturing firms that need to integrate legal knowledge of compliance imperatives and the issues these create for product design specifications and knowledge of materials used in products produced by the firm (past, present and future) and product sub-components provided by suppliers, and so on. Such firms need to bridge knowledge gaps and make explicit learning outcomes, if they are to build on sense and decision making capabilities and engage in Loop III learning.

Drawing on Choo's theoretical model, and briefly stated, it is clear that an IS that supports organizational compliance with complex regulatory imperatives should enable sense making, decision making and knowledge creation if it is to be of use to adopting high-tech organizations.

2.3 The Role of IT in Enabling Institutional Arrangements Around Compliance

The costs of ensuring compliance for organizations are significant. In 2004, for example, meeting SOX requirements cost large U.S. firms over $5 billion, with $1 billion of this being spent on IT (Smith & McKeen 2006): likewise, the European Commission estimates that the cost of being in compliance with its new REACH legislation alone will be upwards of 5.2 billion ($7 billion) (European Commission 2006). Independent research reports that the cost of compliance with RoHS and WEEE is 2-3% of the cost of goods sold, a not insignificant amount given the size of the IT, electric and electronics industry (Spiegel 2005). However, while the cost of ensuring compliance are considerable, the costs of not being in compliance are even more significant, with companies facing the risk of exclusion from key markets, stopped shipments, product recalls, with a corresponding loss of revenue, and potentially disastrous consequences for brand image and/or corporate reputation (Aberdeen Group 2006, Avila 2006, Goosey 2007). In cases of a serious breach of compliance

regulations, firms may be faced with hefty fines and/or criminal prosecutions as with SOX (Aberdeen Group 2006). Thus, regulative influences seem to be paramount in decisions to adopt IT-based solutions. Take, for example, that DuPont, Chevron and Johnson & Johnson have adopted compliance-as-a-service systems to manage their response to relatively straightforward environmental, health and safety legislation (Brodkin 2007).

Firms in the IT manufacturing sector seem to be less successful in adopting information systems to manage what are arguably more complex and wide-ranging exogenous regulatory influences. Kerrigan and Law (2003, p. 126) argue that an information system "if properly designed and developed, has the potential to mitigate and help solve many of these complicated issues." However, the Aberdeen Group (2006) found that nearly 80% of companies lack an integrated IS infrastructure to track, audit and manage issues around product compliance. Given the inherent complexity of legal regulations, national and international, it is argued that a piecemeal approach to the management of compliance and risk is no longer viable (Goosey 2007)—hence, practitioners and researchers argue that an enterprise-wide IT-based solution is required (Avila 2006). Such a system would permit firms to anticipate, plan, and track compliance initiatives, taking into account, existing and proposed regulations, and which would interface seamlessly with other organizational IS (Sammer 2005). Thus, Avila (2006) argues that an IS needs to be implemented that not only offers material compliance analysis capabilities, but can also account for rapidly changing environmental regulations across multiple markets and geographies, while enabling process change and reducing the costs of compliance. This study argues that dealing with complex regulative institutional environments involves viewing the firm as a repository of firm-specific knowledge, rather than the traditional view, which conceptualises firms' as a response to information-related problems (Fransman 1998). That is, in considering firms as engaging in Loop III Learning, as opposed to Loop I and II. Thus, Choo's (2006) integrative treatise follows Fransman in that it provides a comprehensive theoretical framework for understanding and explaining the arrangements firms make to transform them into knowing organizations through Loop III learning.

3 RESEARCH METHOD

A case study design was chosen for the study (Yin 2003). Two university researchers participated in this research, while four practitioners from the company played an active role as "co-researchers". The primary co-researcher was the Irish founder of Compliance and Risks Ltd., who was the inventor of the underlying compliance management method, while the secondary co-researchers included the Californian-based software team's project manager; a senior software engineer from C&R; and the company's Marketing and Sales Director. The majority (7) of the development team were headquartered in Northern California, with 2 being based in Europe. The company's Legal and Data Team were primarily European based; however, it did have a number of lawyers working out of US offices. The remaining participants included users of the pilot version of C2P at Napa Inc., a Fortune 500 company and household name in the industry, headquartered in Silicon Valley.

The data for the present study was gathered using semi-structured interviews and during numerous meetings and on-site visits in Europe and the US, spanning the period from August 2005 to August 2007: participant observation was also employed throughout (Yin 2003). It must be noted, however, that researchers had no access, at any time, to confidential client data, in accordance with C&R's non-disclosure and confidentiality obligations to its clients. Internet-based teleconferencing technologies were also employed to facilitate meetings, in addition to emails and instant messaging. The data was interpreted and analyzed on an ongoing basis and augmented by official company documentation, including Compliance and Risks' business plan, training manuals, technology architecture documentation, and so on.

4 ENABLING THE KNOWING ORGANIZATION WITH COMPLIANCE-TO-PRODUCT (C2P)

This section describes the adoption by Napa Inc. of Compliance and Risks Ltd.'s Compliance Knowledge Management System (CKMS) based on the Compliance-to-Product (C2P) application. In 2005, Napa was experiencing significant and growing problems with the increasing number and diversity of environmental regulations across all of its key markets. It found that its internal compliance processes were not geared towards the management of what were a complex web of compliance imperatives and other signals from the external environment. Napa's Compliance Officer then opined, "[p]olicy imperatives are exponentially growing, in the environmental arena the policy is focusing increasingly on product issues (RoHS, Power management, labelling, packaging design) and has been steadily moving away from end-of-pipe policy typical of the 1980's and 1990's [Environmental Health and Safety] regulations. Added to this, unlike other policy areas, environmental policy is enforced at multiple levels adding regional, national and local level data points (e.g. Battery marking and recycling is enforced by European Commission, UK DEFRA and DTI, UK Regional Environment Agencies, Local authorities, City councils)". As indicated, such environment-oriented signals involved changes in customer preferences towards 'green' products; hence, going green also became a strategic business imperative for Napa Inc., as the threat of customers switching to substitute products posed a real danger. Napa was looking for an innovative technology that transcended the limited functionality of existing compliance applications, which had their origins in organizational document, risk, and product lifecycle management. Napa argued that such applications were deficient in several areas, in that they merely added compliance-related functionality to the base system and failed to incorporate global compliance knowledge management concepts, even though vendors were marketing them as enterprise-wide compliance systems.

External Regulatory Requirements Gathering Processes	*Enterprise Compliance and Knowledge Management Processes*	*Napa Inc. Compliance Activities Pre-implementation*
Track and monitor regulations	Assess and manage issues, risks and tasks	Track and Monitor
Create structured legal and compliance data	Communicate and collaborate	Assess Risk
Manage legal and compliance data	Implementation compliance	Raise awareness and communication
Assess and manage regulatory requirements	Report and audit	Implement compliance solutions

Table 1 External and Enterprise Compliance Processes Vs. Napa Inc. Compliance Activities

In mid-2005, Napa Inc. became aware of Compliance and Risks' nascent Compliance-to-Product application, which was then in the prototype stage. It was the first such application Napa had reviewed that was based on a conceptual design that incorporated External Regulatory Requirements Gathering Processes and Enterprise Compliance Processes. Table 1 illustrates these processes and sub-processes and compares them with Napa's compliance activities. What made the Compliance-to-Product particularly attractive to Napa, however, was that unlike competing applications, its compliance database would be populated with "[s]ource regulatory data [that] is delivered pre-formatted, structured and ready to use out of the box" (Compliance Officer). Napa had built its brand and reputation on innovative, easy-to-use, IT artefacts and its corporate culture was, therefore, disposed to adopt and use a novel compliance management application such as C2P. In order to enhance the application's usability, Napa decided to provide detailed requirements for the development of a working version to Compliance and Risks and to pilot test it. The following subsection describes the result of this collaboration and indicates the functions and features required of a Compliance Knowledge Management System if it is to be successfully adopted and used.

4.1 Adopting and Using Compliance-to-Product

In 2005, the year prior to that when Choo (2006) published his integrative theoretical model of the knowing organization, Compliance and Risks Ltd. articulated the high-level model of Compliance-to-Product shown in Figure 3 (placed side-by-side with Choo's) and detailed in Table 2 above. Table 2 groups the functions and features according to the three dimensions of C2P's high-level model. These resulted from the interplay of the 'situated practical knowledge' of C2P designers and requirements gathered from practitioners in Napa. The similarities between the two models are remarkable and will be the topic of discussion in the concluding section.

Sense Making of Global Regulations	
Features	Benefits
Knowledge Repository	This populated regulations database saves data entry, tracking and monitoring on behalf of client users.
Terms and definitions	Facilitates analysis and interpretation of legal and business terms.
Smart links	Shows the relationship between regulatory imperatives and requirements and their impact on a product or activity.
Structured data	Streamlines compliance processes by addressing compliance requirements, documenting related organizations, geographical areas, exceptions and the impacts of exemptions.
Frequent data updates	Client does not have to track and monitor new regulations.
Advisor commentary	Faster, more informed decision making. Input from legal and business experts adds intelligence to compliance data.
Compliance Decision Making	
Issue management	Users can collaboratively evaluate, escalate and address compliance issues.
Risk ratings	Shows the history of risk for each issue.
Impact	Users can see the impact of regulations on products and business activities.
Assignments	Managers can quickly delegate and monitor issues and responsibilities.
Action plans	Users can create milestones and manage tasks for each issue.
Reminders	Users can set reminders and track assigned areas of responsibility.
Personal dashboard	Users see their own compliance issues, searches, bookmarks, reminders and alerts.
Custom reports	Users can compile reports according to their issues and products.
Multiple views	Users can move easily between summary views and detailed data.
Knowledge Management and Creation	
Comments	Captures the discussion thread between users.
Context	Users can create contexts for classifying and reporting the evolving impact of issues.
History links	Audit view of the history of all changes and updates.
Watches	E-mail notification when changes are made to areas of critical interest.
Alerts	Changes to a user's area of responsibility triggers an alert.
Attachments	Easy document storage and retrieval.
Search	Users can run queries and produce reports based on specific parameters.

Table 2 Compliance-to-Product: Functions and Features

There are three primary categories of users of C2P: members of Compliance and Risks' Legal Data Team (LDT) and that company's Data Partners; Napa's compliance function; and managers and

engineers in the company's product R&D and manufacturing functions. The key differentiating feature for potential adopters, such as Napa Inc., is that the External Regulatory Requirements Gathering Processes are conducted by Compliance & Risk's Legal Data Team (LDT) and augmented by other experts. The LDT is comprised of lawyers, paralegals, engineers and environmental specialists in Europe and the United States. Practitioners in Compliance and Risks LDT argue that understanding and contextualizing compliance imperatives is informed by a deep knowledge of the way in which such imperatives develop over time, and are applied in different ways across diverse regulatory jurisdictions. Thus, the LDT's primary function is to convert legislation from diverse global environments to create C2P's Compliance Knowledge Repository.

One of the key features of C2P that facilitates sense making of global regulations is the Terms and Definitions feature which facilitates definition, interpretation, and analysis of regulatory, legal and business terms, especially where these or related terms introduce ambiguity or opaqueness to compliance imperatives and related regulatory requirements. These are configured as structured data that describes compliance requirements, related organizations, geographical areas, exceptions and the impacts of exemptions. Another important feature is the Smart Link facility which helps make associations between regulatory imperatives, related requirements and their impacts on product families, down to individual products and component substances (e.g. lead, mercury etc.). The application is dynamic in that it facilitates Frequent Data Updates by the LDT and other experts while pushing new or modified/revised compliance imperatives to client organizations as Alerts. Significantly, it also captures Advisory Commentaries on compliance imperatives and data from legal experts to inform and enhance decision making by compliance officers, R&D engineers, and others.

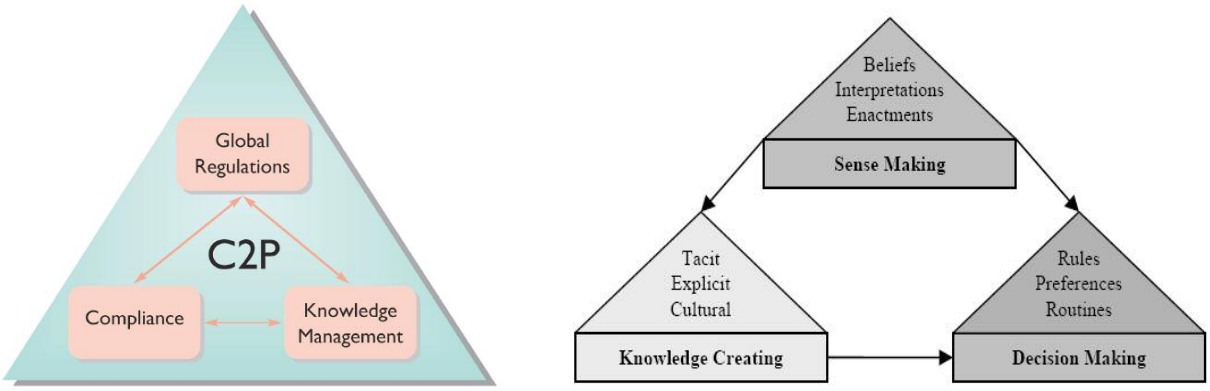

Figure 3 Similarities Between C2P Architecture and Choo's (2006) Model

Client users can view the Impacts of compliance imperatives in terms of their effects on product attributes. This helps identify compliance-related Issues for compliance officers and product design engineers in order to inform their decision making. Other features that enable compliance-related decision making is that the C2P application supports users to collectively and collaboratively evaluate, escalate, and address Compliance Issues: for example, compliance officers or managers can quickly delegate to, or monitor Issues with, relevant product design engineers. The application can also enable users to generate Action Plans so they can manage decisions taken to address compliance Issues. The Reminders feature helps users track and manage compliance Issue-related responsibilities assigned to relevant others, such as product engineers. A versatile Personal Dashboard features permit users to view their own compliance Issues, Searches, Bookmarks, and with the ability to generate Reports, Reminders and Alerts (see Figure 4). Finally, a Risk Ratings facility helps illustrate the level and history of risk for each compliance Issue, which is highly visible throughout C2P. Collectively these features constitute the compliance decision making and management aspects of C2P.

Compliance Knowledge Management is effected by several of the application's features; for example, the multiple views/features the C2P application affords users an opportunity of to see information from all sources in one place. In addition, C2P captures users' discussion threads on compliance imperatives and their Impacts and Issues as Comments. Furthermore, users can create Contexts for classifying and reporting the evolving implications of Issues. In addition, History Links provide an audit view of all changes and updates and any changes to a user area of responsibility triggers an Alert, in the form of an automatic email notification to responsible users. There is also an Attachment feature that permits users to link related documents for easy storage and retrieval. Finally, a sophisticated Search feature permits users to run queries and generate reports based on specific parameters. Collectively, such features are characteristic of those found in knowledge management systems (KMS), in that users are facilitated to make organizationally tacit knowledge explicit and to share that knowledge with others in their 'communities of practice' (Butler and Murphy 2007).

Napa's Compliance Officer summed up comments from colleagues by stating that "C2P has shown us that the era of paying external organizations to dump information on our doorstep has come to an end." He maintained that the application "enables our compliance team to move away from the inordinate amount of time spent on tracking and monitoring activities and to focus on activities…which are the bits that really add value to the company." Another member of the Napa's compliance team supported this and stated that "C2P helps us to a specific risk assessment for all affected products, getting quickly to impacts and risks…all the elements that determine the successful implementation of a regulatory mandate are now under one roof—C2P." Thus, the C2P application was thoroughly adopted by and was of tangible help to Napa Inc. in managing product compliance and minimizing any risk to the company by being out of compliance.

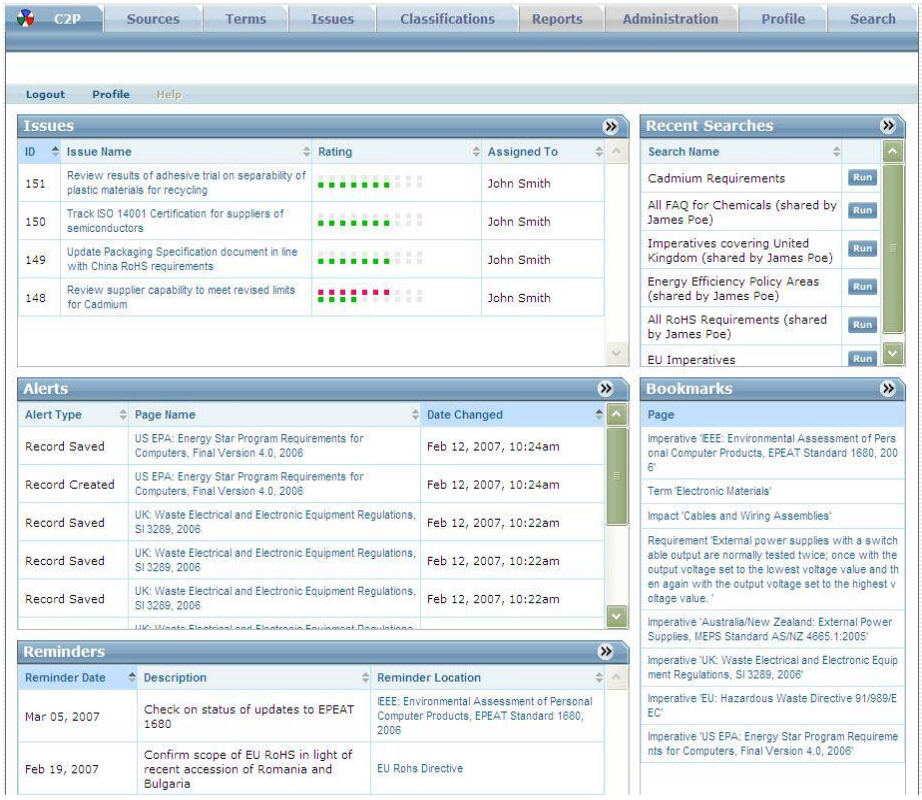

Figure 4 C2P Customizable Homepage and Dashboard

It is significant that Sonoma Inc., a Fortune 100 IT manufacturer of internetworking solutions, subsequently evaluated and adopted C2P. Initial feedback confirmed the potential of C2P capabilities as an organizational compliance knowledge management system viz. one manager stated that "it is the best out-of-the-box software that I've ever seen—and that's saying something", while another stated

that "It rocks! In terms of speed, it sets it so far apart from any other application at [Sonoma]…[it'll] set new standards for performance." The following section helps identify some general findings by examining C2P in the light of extant theory on knowledge management in organizations.

5 DISCUSSION AND CONCLUSIONS

The paper's first contribution is that it draws on institutional theory to explain the exogenous forces acting on organizations in relation to environmental compliance, and on organizational theory to indicate the endogenous responses that organizations need to make in response. Inter alia, these need to be supported using appropriate IT-based solutions in order to effectively address the problems of product compliance with environmental regulations. The second contribution is that this study's findings describe the features of the Compliance-to-Product application and how it benefited the adopting organization—Napa Inc.—in its efforts to maximize global compliance and minimize related risks. The final contributions are outlined in the following discussion of the findings in the context of the theoretical model earlier presented.

Choo's (2006) integrative theoretical model of the 'knowing organization' is now employed to examine the contribution of C2P within the context of its implementation in Napa Inc. Drawing on organizational theory and information science, Choo argues that knowing organizations, organizational units, and sub-groupings participate in sense making, decision making and knowledge creation—i.e. Loop III Learning. Prior to the implementation of C2P, Napa's compliance team was faced with an extreme case of the problem of bounded rationality, when faced with making compliance-related decisions, due to the complexity of meeting all compliance imperatives in the global marketplace. Thus, satisficing was not really an option for decision makers at Napa, given the potential consequences to the organization in terms of damage to brand image, exclusion from markets and financial penalties levied by regulatory institutions. As was seen above, tracking and monitoring global regulatory requirements was proving to be increasingly problematic for Napa due to deficiencies in sense making capabilities within the organization and the poor levels of support provided by regulatory agencies and legal consultants. Compliance and Risks' use of dedicated legal subject matter experts in interpreting and making sense of regulatory requirements and capturing their interpretations in a highly structured format in the C2P knowledge repository reduced the sense making burden on Napa's compliance team and helped address the bounded rationality problem for them. Hence, in Choo's (2006) schema, they were able to move more fully from single-loop or Loop I Learning, around routine rule-based decision making, to double-loop or Loop II learning, involving sense making and decision taking (Argyris and Schön 1996). It was clear, however, that the informating capabilities of C2P, in terms of its abilities at enhancing communication and knowledge sharing within and across functions, permitted knowledge creation around Napa's compliance and risk activities. For example, while the compliance team might have been aware of the regulatory requirements and compliance imperatives concerning particular hazardous substances in specific geographical areas, the full range of compliance-related impacts and issues were not understood—the application's knowledge sharing features therefore enabled compliance officers, product engineers and other users to question the assumptions on which product decisions were made, thus facilitating, what Choo (2006) terms, Loop III Learning. Thus practitioners at Napa were pleased, but not necessarily surprised, to discover that a growing number of previously unidentified 'Issues' and 'Alerts' began to emerge in relation to product design/attributes and compliance with particular regulatory regimes—these surfaced through IT-enabled communication- and collaboration-based knowledge sharing among the compliance team and design/manufacturing engineers. Hence, the C2P application provided Napa's compliance team and other related organizational actors with a shared context, integrated analytic and communication tools, and a data/information/knowledge repository that enhanced sense making, knowledge sharing and decision taking.

In conclusion, practitioners at Compliance and Risks Ltd. drew on their own practical theory to integrate features into, and provide data services for, their C2P application which facilitates sense making, decision making, and knowledge creation in adopting organizations. Practitioners at C&R incorporated into C2P, albeit unknowingly, the functionality that enabled Napa Inc. to become a

'knowing organization' according to Choo's theoretical model (see Figure 3). This, perhaps, explains why the application it was adopted successfully by Fortune 500 organizations.

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