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The Control of Human Factors in Catastrophic Financial Systems Risk using Ontologies

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Abstract: This paper examines a possible response to local and global socio-economic instability created as a consequence of the global financial crisis starting in 2007 to 2009 which still reverberates. The crisis was at least in part, precipitated by systemic failures in financial regulatory systems, including those systems supposedly designed to monitor for dangerous events. This paper outlines a study which tries to address the predominant failure to appropriately incorporate human factors in systemic financial systems and utilise important features of advanced control systems such as semantic technologies and ontology. The study will ultimately develop a risk management ontology which addresses interoperability issues in the management of risk in the financial sector.

Keywords: risk, financial stability, information systems.

1. INTRODUCTION

This paper is a response to the local and global socio-economic instability created as a consequence of the global financial crisis starting in 2007 to 2009 which still reverberates. For example, the Global Peace Index (2016) indicates that the world has become less peaceful following the global financial crisis and has contributed to increasing numbers of displaced persons estimated at 65 million (UNHCR, 2016). The crisis was at least in part, precipitated by systemic failures in financial regulatory systems, including those supposedly designed to monitor for dangerous events. The IFAC community is ideally placed to engage in debates which offer interdisciplinary and intergenerational perspectives on managing the challenges brought about by risk management and related control failures. This paper addresses the predominant failure to appropriately incorporate human factors in systemic financial systems and utilise important features of advanced control systems such as semantic technologies and ontology. This paper sketches a research approach for developing a risk management ontology which addresses interoperability issues in the management of risk in the international financial domain and provides a basis for new standards which address more holistically human factors in financial technology risk management.

2. RESEARCH QUESTIONS

This paper presents part of a larger study of financial system failures and control issues in Irish banking sector. This working paper does not fully address all these questions as it remains a work in progress. However the paper presents some preliminary findings which address whether there is a need or not for a new approach for systemic risk management in international financial services. Therefore the working research questions for this present paper are as follows:

Research Question 1) Is a new approach to systemic risk management in financial services needed?
Research Question 2) How can the researcher organise the key concepts of this new approach into a systemic model of risk engagement knowledge more generally?

3. RISK IN SYSTEMS ENGINEERING

Risk is a highly complex matter which draws from a number of different disciplines (Kearnes, 2012; Chapman, 2011; Renn, 2008). However, those disciplines in isolation cannot grasp the concept fully. Therefore it is necessary to synthesise efforts from multiple different perspectives to develop an effective approach to understanding and managing risk. Current theories on risk management are driven by a functionalist orthodoxy. The tendency has been to reduce risk management to a problem that can be resolved using technology or mathematical formula.

Traditionally, the emphasis in systems engineering has been on the technology and its implementation. This was especially so when bespoke systems and very little networking of systems was common place (Ashenden, 2008; Jones and Ashenden, 2005; Hubbard, 2005; Tryfonas et al., 2001). Bainbridge (1983) in Ironies of Automation states that the human component can be a significant source of problems in systems development, but are important because they are still used in instances were automation isn't possible. Project management has focused on the people and the associated processes of systems development (Jones and Ashenden, 2005). The use of enterprise wide risk assessments has been driven by changes in governance and the regulatory environment.

For example, in the financial sector Basel II (Jones and Ashenden, 2005) addresses the risks from technology; it treats technological risk on the same grounds as other factors

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contributing to financial risk (Ciborra, 2007; 2002). Whilst the information systems literature focus on frameworks and methods the reality is, that the most prominent technological developments (e.g. The Internet) happened not from adherence to a particular method, but from the ingenuity and tinkering of systems developers (Ciborra, 2007; 2002). In fact, many of those methods are utilised as a smoke screen to give an image of dominance or status, and are, in fact too mechanical to be of any use in systems development (Nandhakumar and Avison; 1999).

Identifying and managing risk is often not considered an important responsibility during systems development (Siponen and Willison, 2009; Siponen, 2006; Siponen, 2005; Sherer and Alter, 2004; Siponen and Baskerville, 2001). System developers may have a tendency to ignore problems that might arise during development and clients have a propensity to have exaggerated expectations (Siponen and Baskerville, 2001). A significant impediment to the incorporation of risk within the development process is that activities associated systems development and risk management (requirements analysis, programming, risk management and other systems development activities) are done in parallel, rather than in an integrated, manner (Siponen and Willison, 2009; Anderson and Choobineh, 2008; Choobineh et al., 2007; Mouratidis et al., 2005; Siponen, 2005; Nandhakumar and Avison; 1999). But the incorporation of risk management and systems development is important. Risk potentially introduces within the development process significant constrictions on the functionality of systems. Managing this throughout the development lifecycle will reduce the likelihood of conflict at some later stage (Mouratidis et al., 2005).This can manifest in the form of conflict between system risk requirements and other functional requirements of a system.

The nuclear incident at Fukushima Dauchi Nuclear power plant is a clear example of how risky incidents are shaped and consequences magnified from a multitude of human factors which can exacerbate an already dangerous situation. Whilst precipitated by a natural disaster, it clearly shows how risk is equally if not more acutely produced by the coupling of different human system elements (Organ and Stapleton, 2016; Organ and Stapleton, 2013; Lane et al., 2012; Kearnes, 2012).

4. THE HUMAN FACTOR

Technological development can distort how the world is seen, creating a techno-culture which sees our environment in terms of systems functionality and systems objects (Gill, 2012). In risk management, risks and events can give rise to complex consequences (Lacey, 2009). Often when enough information is not available judgements are made using logic and instinct. This situation is maintained because there is a lack of objective information in risk decision making (Lacey, 2009). The complex relationship between humans and technology is ignored as a result there is a failure to understand some risk concepts which are socially driven rather than technology derived (Coles-Kemp, 2009). Human understanding of risk is influenced by the frameworks and models used when dealing with risk (Coles-Kemp, 2009). Consequently the risk management literature is focused on frameworks and methodologies instead of the environment in which they are used (Coles-Kemp, 2009). In practice gaps begin to appear between methodologies used and risk reduction measures by organisations (Coles-Kemp, 2009).

Kutsch et al., (2013) undertook a study into engagement with risk management during information systems (IS) projects. Kutsch et al., (2013) study identified a number of attitudes which were driving the disengagement with risk management in IS projects.

- Legitimacy: The rigorous enforcement of standardised risk management can create a climate were activities falling outside those standards are considered illegitimate even if they are seen to be effective at dealing with a risk incident.
- Value: Where there is uncertainty as to the perceived usefulness of risk management standards developers have tended not to use them.
- Competence: Doubt amongst developer's ability to manage risk was a significant factor in the disengagement from risk management. Any standards that would show how far a project went out of kilter require developers to acknowledge failures, or their lack of control lead to disengagement amongst system developers.
- Fact: Risk factors which are perceived to be fictitious or imagined are not engaged with by systems developers.
- Authority: A limited authority to act instills a sense of powerlessness.

Kutsch et al., (2013) study clearly shows the need for a new paradigm on risk management within a systems development context. A knowledge model of systems risk that is no longer based on a limited theoretical orthodoxy of functionalism is what's needed going forward.

5. RETHINKING RISK MANAGEMENT

Techno-centrism is a belief that humans have direct control over our environment because of technology (Ciborra, 2002). That problem within our environment can be resolved with science and technology (Ciborra, 2002). Numerous authors (Alhawari et al., 2012; Chapman, 2011; Coles-Kemp, 2009; Keil et al., 2000) have recognised that traditional risk management practices have reinforced a techno-centric ideal of risk management that does not reflect the reality experienced by systems developers. There is a failure by systems developers to recognise that systems development does not revolve around a clear-cut relationship between the social and technological, that their relationship with technology is shaped by the everyday challenges of life (Ciborra, 2002). By failing to recognise this dynamic relationship systems developers have effectively viewed the physical and social entities that constitute technology as largely static, and ignored the multifaceted nature of some risk concepts, such as privacy, which are socially derived concepts (Coles-Kemp, 2009).