

APPLYING SOCIAL NETWORK ANALYSIS TO MONITOR WEB-ENABLED BUSINESS PROCESSES

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Keywords: Business processes, Social network analysis, Process monitoring, Service science, Health sector.

Abstract: The unprecedented growth in service-based business processes over a short period of time has underscored the need for understanding the mechanisms and theorising the business models and business process management adopted across many organisations today. This is more evident within the Irish health sector. This research summarises a survey of the literature and argues that the inability of current Business Process Management (BPM) techniques to visualise and monitor web-enabled business processes prevents us from transforming information on network activity and infrastructures. Thus, this research sets out to propose the need to develop a framework to enhance manager's ability to monitor key performance indicators (KPIs) while improving business process restructuring practices.

1 INTRODUCTION

In 1993, Hammer and Champy advised us to “*forget everything you have known about how business should work – most of it is wrong*”. In 2010, the literature indicates that this is largely true as we are beginning to realise that we are still unclear about how business processes and services interact and what is their contribution within and across organisation (Huffman, 1997; Cross and Parker, 2004; Huysman and Wulf, 2006; Lundqvist, 2007; Van Heck and Vervest, 2007; Hassan, 2009). This paper proposes the need to determine introduce methods to measure service network contributory value. service network In recent years there has been significant interest in our ability to manage service-oriented architecture (SOA), i.e. in our ability to manage and engineer services. Organisations are beginning to move away from the traditional corporate hub of business practice towards a more diffused and distributed web of relationships and agile alliances. These webs of relationships are often comprised of people, information and communication technology (ICT), and paper-based records. Across academia and industry we are

beginning to recognise the significance of service innovation and service systems within the global ‘service’ economy. Understanding the mechanisms and theory of managing service business models and processes adopted across many organisations required the recent introduction of the Service Science Management and Engineering (SSME) discipline. However, it is clear that managers continue to face serious issues in managing ‘invisible assets’ which inhibit their ability to monitor and exploit the value of agile service networks (ASN). Understanding the functionality of these networks and the challenge of managing and co-coordinating their relationships is becoming more complex. The literature indicates that there is little emphasis on service discovery and design. Understanding the value of these relationships, especially from a technological perspective can prove to be extremely problematic. In addition, tools to create, track, and manage business process opportunities are incompatible, slow, and difficult to use. It is also reported throughout literature that critical business data is not properly collected, shared, standardised, or analysed to provide business intelligence.

Within the increasingly complex day-to-day operation of the Irish health service sector (IHSS), health care providers face a difficult environment which is abundant in problems particularly in health informatics. The main area of concern from an ICT perspective is its ability to manage and engineer a networked infrastructure. This is largely due to the lack of ICT investment and process engineering within this sector. The literature indicates that technology and business monitoring techniques fail to provide managers with insight on network interactions (e.g. Wetzstein et al., 2009), and as many business practices continue to become more virtualised, there is an urgency to address this significant research gap, both in literature and in industry. Despite considerable progress, the IHSS remains poorly ranked throughout Europe. The main areas of concern from an ICT perspective include patient safety, service quality, compliance processes, and financial effectiveness. This is largely due to the lack of ICT investment (i.e. reliance on a paper-based system) and process engineering within this sector.

The research in this paper borrows from SNA theory to present a new approach to monitoring and managing service networks across several dimensions. This method simulates future research attention towards network behaviour and capability. To understand ASN affordances, we can model web-enabled business process using SNA. This allows us to place greater attention on business process dynamics to deploy, monitor, and update cross-organisation relational functions within the IHSS.

2 BACKGROUND – STATE OF THE ART

For over the past half century the implementation of ICT has served many needs throughout the business environment. It is evident that ICT has been considered a supportive asset in today's business environment. Despite all the attention, business processes are still relatively poorly understood (Wetzstein et al., 2009). Significant transformations have taken place to how business is performed and to what now contribute towards business performance metrics. We live in an unpredictable world. In recent years information requirements for organisations have changed and it has become more difficult to plan for informational requirements to build robust systems, hence the increasing interest and move towards more agile approaches (Desouza, 2007).

There has been much debate within literature as to the value of web-enabled business processes. One of the major issues is the lack of transparency of practical methods to monitor and measure 'invisible networks' (Cross et al., 2002) which support today's organisational environment. Understanding the functionality and contribution of these networks, while presented with the challenge of managing and co-coordinating networked relationships, is becoming more complex. In today's economic climate, the phrase "*organisational restructuring*" is rampant throughout our economy and within managerial mindsets. Many of the business shared processes amongst organisations have been 'flattened' (Friedman, 2006), and remain more hidden within industry. Understanding the value of these processes and relationships are of vital importance as more if the IHSS is to understand the true value of existing network and strategies.

Agility is a concept which attempts to address some of these issues. Defined by Van Oosterhout et al., (2007) agility is "*an innovative response to an unpredictable change*". It is concerned with taking greater control of unpredictable changes. Agility within an organisation is the collective ability to adapt rapidly, be cost efficient, and overall to operate as economically as possible, without jeopardising the quality of the product or service, in response to customer needs and changes in the business competitive environment. Web services allow business to initiate agile business processes to carry out a specific transaction on demand. Identifying changes within business processes is critical for either preventing or encouraging certain workflows across web services. Defined by Hung et al., (2004) a web service is "*an autonomous unit of application logic that provides either some business functionality or information to other applications through an Internet connection*". Web services are transcending from a 'promising technology' to becoming widely used within industry (Papazoglou, 2003). However, managing data across web services can be problematic. One of the major problems, as outlined by Becker (2007), is that managers are faced with a serious issue of how to manage "*a completely invisible asset*". Another major issue includes the overall lack of confidence amongst managers in today's business world (PriceWaterCooper, 2009).

There is also a lack of practical methods to monitor and measure invisible networks which support today's ASN environment. Understanding the functionality of these networks and the challenge of managing and co-coordinating their relationships is

becoming more complex. The literature indicates that there is little emphasis on service discovery and design (Qiu, 2008; Plumb and Zamfir, 2009; Hsu, 2009). This inhibits our ability to monitor large and dynamic digital networks. In addition, tools to create, track, and manage outsourcing business process opportunities are incompatible, slow, and difficult to use. It is also reported throughout literature that critical business data is not properly collected, shared, standardised, or analysed to provide business intelligence (Qiu, 2008; Plumb and Zamfir, 2009; Hsu, 2009). Thus, the research focuses on various areas including analysis and design of interactions between service network partners, service pattern behaviour of network partners, and enactment and management of service networks (people, ICT, and paper-based).

3 IDENTIFIED RESEARCH PROBLEM

The issue of agility across web-enabled business processes is not self-evident as one would expect in today's dynamic and distributed business environment. Galliers (2007) identifies three main problems when we discuss aligning business strategies with ICT:

- 1 The requirement of consistent flexibility or agility due to the dynamic nature of organisations;
- 2 The failure to forecast the future and therefore the dynamic change in information requirements;
- 3 The role in which information plays on assisting agile responses (to become proactive).

Although relevant in the IHSS context, many technologies and business models are incapable of meeting or modelling dynamic requirements of today's business world, and appear to employ a continuous 'reactive' approach, forcing organisations to compensate for technological inadequacies (Orlikowski, 1992; Doherty et al., 2003; Wetzstein et al, 2009). For example, Galliers (2007) explores how IS strategies tend to focus on a rational analysis "*either in response to an extant business strategy and/or an analysis of current ICT capability*" (p. 3). This is also true with respect to human knowledge transfer and paper-based record retrieval. Organisations fail to visualise and understand the contributory value to further enhance decision making tasks in relation to restructuring

business processes. Cross and Parker (2004), caution that this lack of understanding can have substantial consequences for both the individual and cross-organisational performance. This raises important questions in regard to modern trajectories of IHSS structures.

The core research question focuses on how IHSS business processes can be modelled, managed, and improved in a dynamic and agile environment: "*how can we develop a framework to identify, monitor, and map KPIs of web-enable business processes across agile service networks (structure, formation, and behaviour)?*"

4 OUTLINE OF OBJECTIVES

This research aims to explore service discovery and design approaches to business process architecture within the IHSS. More specifically, the research will explore methods to monitor, map, and manage processes across an agile service network. The aim and focus of this research can be further specified through the following objectives:

- 1 Explore the current state of business process patterns within the IHSS.
- 2 Propose and validate a modelling and methodological framework to discover and design service processes across agile service networks.

The rationale behind these objects is centred on the need to investigate service discovery, traceability, and design, i.e. modelling processes (human, ICT, and paper-based) and KPIs within the IHSS. This will allow management to embrace the concept of agility within service networks and manage change more effectively. Within this research, agility focuses on the IHSS ability to reconfigure according to changing information requirements or change within the systems environment. This can be modelled at various levels, including business (processes and information), services (intermediate level), and software (applications level).

5 METHODOLOGY

The strategy will employ a number of case studies (using both questionnaires, semi-structured interviews) across a number of departments in the IHSS using SNA. SNA is an approach and set of techniques which studies the exchange of resources through staff, ICT, and paper-based records. SNA

focuses on patterns of relations among nodes such as people, groups, organisations, or information systems (Scott, 1991). SNA demonstrates the ties and relationships between each node to provide a visual and mathematical representation of interaction and exchanges which influence behaviour. Managers realise that the key to continued success is within their understanding of how workflows and business processes can be optimised (e.g. Papazoglou, 2002). Few studies explore how people, ICT, and paper-based exchange contribute towards business processes. Hassan (2009) demonstrates that by studying IT-enabled processes within an organisation, we can identify the contribution of IT to business process success, or improved performance by mapping business process contributions and performance metrics. Therefore, SNA is a very fitting methodology to deploy within this research to uncover more 'truths' as to the activities and their patterns within agile service networks mapping the contributions and performance metrics across the KPIs.

6 CONCLUSIONS AND FUTURE RESEARCH

This paper has introduced some of the main concerns within BPM and organisational performance literature and summarises the state of the art literature. It has identified some of the key problems and the need to introduce methods to visualise agile service networks across the IHSS. We will model service interactions through a number of phases (human, ICT, paper-based network exchange network). The expected outcome of this research is to present a reusable and practical framework which will empower managers within IHSS to perform ad-hoc analysis of web-enabled business processes across ASN.

ACKNOWLEDGEMENTS

The research leading to these results has received funding from the European Community's Seventh Framework Programme FP7/2007-2013 under grant agreement 215483 (S-Cube). For further information please visit: <http://www.s-cube-network.eu/>. Partially supported by Science Foundation Grant no 03/CE2/I303.1 to Lero – the Irish Software Engineering Research Centre.

REFERENCES

- Becker, F. (2007), Organizational Ecology and Knowledge Networks, *California Management Review*, Volume 49, Number 2, pp. 42-61, Winter.
- Carr, N., (2004). "Does IT Matter? Information Technology and the Corrosion of Competitive Advantage". Boston: Harvard Business School Press.
- Cross, R. L. and Parker, A. (2004), *The Hidden Power of Social Networks: Understanding how Work Really Gets Done in Organizations*, Harvard Business Press.
- Cross, R., Borgatti, S., and Parker, A. (2002). Making invisible work visible: Using social network analysis to support strategic collaboration. *California Management Review*, Volume 44, Number 2, pp. 25-46.
- Desouza, K. C. (2007). *Agile Information Systems, Conceptualization, Construction, and Management*. Butterworth-Heinemann.
- Doherty, N.F, King, M., and Al-Mushayt, O., (2003). "The Impact of Inadequacies in the Treatment of Organizational Issues on Information Systems Development Projects", *Information & Management*, Volume 14, pp.49-62.
- Friedman, T. L. (2006). *The world is flat*. New York, Penguin Books
- Galliers, R. D. (2007). *Strategizing for Agility: Confronting Information Systems Inflexibility in Dynamic Environments*. Chapter 1, pp. 1-15. In Desouza, K. C. (2007). *Agile Information Systems, Conceptualization, Construction, and Management*. Butterworth-Heinemann.
- Hammer, M. and Champy, J. (1993), *Reengineering the Corporation: A Manifesto for Business Revolution*. New York, NY: HarperCollins Publishers.
- Hassan, N. R., (2009), 'Using Social Network Analysis to Measure IT-Enabled Business Process Performance', *Information Systems Management*, Volume 26, Issue 1, pp 61-76
- Hsu, C., (2009). *Service Science and Network Science*, *Service Science*, Volume 1, Issue 2, pp. i-ii. Retrieved from Website: <http://www.sersci.com/ServiceScience/upload/12401848830.pdf>
- Huffman, J.L. (1997). "The four Re's of total improvement", *Quality Progress*, Volume 30, Number 1, pp. 83-88.
- Hung, P. C. K., Li, H., and Jeng, J.-J. (2004). WS-Negotiation: An overview of research issues, in *Proceedings of the 37th Hawaii International Conference on System Sciences (HICSS'04)*, Big Island, Hawaii, January, pp. 33-42
- Huysman, M., and Wulf, V., (2006). IT to support knowledge sharing in communities: towards a social capital analysis, *Journal of Information Technology*, Volume 21, Issue 1, pp. 40-51.
- Lundqvist, M. (2007). *Information Demand and Use: Improving Information Flow within Small-scale Business Contexts*. PhD Thesis, Linköping Institute of Technology at Linköping University

- Orlikowski, W.J. (1992). "The Duality of Technology: Rethinking the Concept of Technology in Organizations", *Organization Science*, Volume 3, Number 3, pp.398-427.
- Papazoglou, M.P. (2002). *The World of e-Business: Web-Services, Workflows, and Business Transactions*. In *Lecture Notes In Computer Science, CAiSE '02/ WES '02: Revised Papers from the International Workshop on Web Services, E-Business, and the Semantic Web*, Volume 2512, pp, 153-173. London, UK. Springer-Verlag.
- Papazoglou, M., P., (2003). *Web Services and Business Transactions*. *World Wide Web: Internet and Web Information Systems*, Volume 6, pp. 49-91. Kluwer Academic Publishers.
- Plumb, I., and Zamfir, A., (2009). *Managing Service Quality within the Knowledge-Based Economy: Opportunities and Challenges*, *The AMFITEATRU ECONOMIC Journal*, Volume 11, Issue 26, pp. 373-382,
- PriceWaterCooper (2009), *12th Annual Global CEO Survey, Redefining success, Future Proof Plans*. Available from Website: <http://www.pwc.com/gx/en/ceo-survey/index.jhtml> (last retrieved on 24/11/2009)
- Qiu, R. G. (2008). *Service Science: Scientific Study of Service Systems*, *Service Science*. Retrieved from website: <http://www.sersci.com/ServiceScience//upload/12273736560.pdf>, last accessed December 10th, 2009.
- Scott, J. (1991), *Social Network Analysis: A Handbook*. London. Sage
- Van Heck, E., and Vervest, P., (2007). *Smart business networks: how the network wins*, *Communication ACM*, Volume 50, Number 6, pp. 28-37
- Van Oosterhout, M., Waarts, E., van Heck, E., and van Hillegersberg, J., (2007). *Business Agility: Need, Readiness and Alignment with IT Strategies*, Chapter 5, pp. 52-69. In *Desouza, K. C., (2007). Agile Information Systems: Conceptualization, Construction and Management*. Butterworth/Heinemann: London.
- Wetzstein, B., Leitner, P., Rosenberg, F., Brandic, I., Dustdar, S., Leymann, F., (2009). *Monitoring and Analyzing Influential Factors of Business Process Performance*. In: *Proceedings of the 13th IEEE Enterprise Distributed Object Conference (EDOC 2009)*.