

A MULTI-PERSPECTIVE APPROACH TO KNOWLEDGE MANAGEMENT IN COMPLEX ENVIRONMENTS: A CASE STUDY IN AN AUSTRALIAN GOVERNMENT

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Abstract

The growing complexity of organisations has resulted in collaboration between multiple stakeholders becoming a demanding and critical issue, which organisations must then manage in order to ensure their systems are sustainable. The challenge is to tackle the complex issues in organisations, facing contemporary organisations and their stakeholders, there is a necessity to settle upon a modelling method that can be used to analyse change management and to improve adaptation. The use of a multiple-perspective framework to improve understanding of the complex relationships affecting such systems has been examined. A multiple-case field study was conducted in order to demonstrate the proposed methodology of analysis and examination for knowledge-based systems in an actual organisational setting. In particular, the case study focused on the Australian Government's Nation Building Economic Stimulus Plan (NBESP) which provided \$1.9 billion to construct social housing across the State over two years. The empirical findings in this study present a new understanding of the model's ability to manage system evolution and to provide a practical approach for integrating multi-perspective views. This paper will benefit government agencies involving multiple stakeholders.

Keywords: Complexity, Collaboration, Sustainability, Multiple perspectives.

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1 INTRODUCTION

This paper describes a way to model knowledge management in the increasingly complex and wicked environments. Many current methods on knowledge management focus on predefined flows that follow an analytical approach to address predefined problems of complex issues. The continually emerging complex environments, on the other hand, require quick searches for knowledge needed to address newly emergent requirements and ways to combine knowledge to create innovative solutions. This calls for both new modelling methods and design processes in complex environments. This paper describes new modelling methods based on a multiperspective approach combined with design thinking as the design process.

Design thinking (Martin, 2009) in contrast to analytical thinking (Brown and Wyatt, 2010) calls for continuous innovation in any process to search for new knowledge and combine it. It also requires quick adaption of perspectives other than the traditional analytical process. The use of a number of perspectives provides additional cognitive support to generate innovative heuristics that characterise design thinking. In this paper we focus on three perspectives in addition to the knowledge perspective. These are organisation, social networks and the business perspective. These include knowing where the knowledge is using an organisational perspective. It also requires knowledge of social structure to see who owns the knowledge and who includes the tacit knowledge skills to interpret the knowledge given the emerging situation. The business activity perspective describes how the knowledge is used.

This paper then proposes open models which could be used to better manage and understand the complexity of organisations through the relationships and interactions of the different perspectives. The multi-perspective approach complements design thinking as it provides ways for designers to consider different solutions through different choices in each perspective.

2 RESEARCH

This research focuses on a multi perspective approach to knowledge sharing is appropriate to organisations that find themselves in increasingly complex environments. These require them not only to focus on the capture and distribution of knowledge but to create collaborative networks to promote the development of valuable interrelationships between stakeholders. As a consequence more effective approaches to model knowledge flows in complex organisations are required. Such new approaches are needed for organisations analyse Information System (IS) requirements. Literature indicates that using existing methods (Aversano et al., 2004; Moller, 2007) do not provide the structures to model the increasingly complex relationships now found in practice. Our research is to show that a multi-perspective approach can easily show such relationships and allow users to quickly adapt to changing situations.

The major purposes of the present study were as follows: 1) to examine whether a multiple perspectives framework improves the ability to manage change in complex organisation, 2) to examine whether the model is based on a multi perspective approach that will help to identify knowledge flow for unforeseen circumstances, and 3) to examine how the organisation responds to unforeseen circumstances needed for better knowledge flow. Following sections will discuss our study focus.

2.1 Wicked Problems in Complex System

McElory (2000) highlights the integration of multiple organisational perspectives as a key issue. Complexity theory, wicked problem and self-organisation (Mason, 2007; Head and Alford, 2008; Kauffman, 1993) can be used to describe current trends in organisational and competitive contexts. However, in this research, the multiple perspectives model is applied in the context of knowledge and

social networks where collaboration occurs across different New South Wales (NSW) State government agencies in Australia. For example, organisations have the option to control the importance of continual adaptation to a changing environment (Heylighen, 2001). Moreover, organisations ensure that new structures emerge in a consistent way and achieve the benefits associated with effective operations. In the current competitive and ever-changing enterprise environment, the need for organisational change demands better business processes, particularly social behaviour, which requires sensitive assessment of impacts on overall performance. However, the implications of adopting the new perspective models in the management of system evolution have only been partially addressed.

Recent authors Head and Alford (2008) have also emphasized that challenges to tackle wicked problems often leads to social complexity. In literature the key finding around wicked problems is that it causes social complexities rather than technical complexities.

The question then becomes what are good modelling methods in this complex environment. The majority of current modelling methods are suitable for structured systems. A complex environment requires strong knowledge-sharing networks and an understanding of self-organisation in order to work constructively in search of innovative solutions to complex issues. Heylighen (2001) defined self-organisation as the spontaneous emergence of new structures and continual adaptation to a changing environment. Efficient self-organisation reinforces the importance of newly emerging structures that involve multiple levels of complexity (Merali, 2006) in organisations. Moreover, he described complex organisations and processes may refer to organisations that have many people, processes, rules, strategies and basic units in the emergent domain.

We find that the multiple perspectives model attempts to combine self-organisation with different dimensions of the organisation's architecture for easy management when significant changes occur. For example, an organisation tackles complex problems by examining the business processes and strategic goals rather than making an effort to change a behavioural relationship between the roles and activities that take place in the environment.

In organisational context, wicked problems create the social complexity which makes communication and interaction difficult among multiple stakeholders. Most current modelling methods are suitable for structured systems, however needs to explicitly address the new emerging structures to improve the collaborative process. It requires strong knowledge shared networks and understanding of self-organisation to work constructively in search of innovative solutions to complex issues.

Solution to wicked problems usually involves coordinated action by a range of stakeholders including organisations. For example, the public housing issues cannot be dealt with at any one level of government. They require action at every level government as well as action by the non-profit community organisations. In summary, literature emphasises that attempts to resolve the Wicked Problem leads to the emergence of social complexity. Therefore the multi perspective framework helps to tackle these problems by identifying the origin and eventual processes leading to the output of solutions.

Literatures on complexity theory (Mason, 2007) in self-organisation, emergence and other social complexity perspective approaches to understanding of knowledge flow as created in organisations through collaborative interactions across organisations. In particular, the framework discussed in this study has focused on linkage of multi perspective dimensions to better manage complex processes. Some gaps remain while this provides an effective groundwork for analysing knowledge flows in complex organisation.

Recent research (Heylighen, 2001; McElroy, 2000; Merali, 2006; Smith and Humphries, 2004) indicated that there is a need for integration of multiple perspectives to understand the complex problems in a rapidly changing environment. A key area of research is to validate the use of multi perspective (Alman, 2003; Ferlie, 2007; Linstone, 1985; McElroy, 2000) framework and its impact on knowledge flow analysis.

3 INDIVIDUAL PERSPECTIVE APPROACH

Individual perspective works from four different dimensions as outlined in the subsequent section. Table 1 describes the different approaches in modelling complex system and it derived from the literature.

| Approach | Authors | Advantage / Disadvantage |
|-------------------------------|---|--|
| Organisational perspective | <ul style="list-style-type: none"> • Maguire 2006 • Mason 2007 | <ul style="list-style-type: none"> • distinction / lack connection • exploring the relationship between complexity and organisational behaviour • focus on organisational studies |
| Business perspective | <ul style="list-style-type: none"> • Hammer and Champney 1995 | <ul style="list-style-type: none"> • focus on the business culture • rapid reconfiguration of links based on collaborative activities |
| Knowledge perspective | <ul style="list-style-type: none"> • McElroy 2000 • Li et al., 2004 | <ul style="list-style-type: none"> • knowledge objects changing between people • adaptive strategies for sensing change |
| Social complexity perspective | <ul style="list-style-type: none"> • Conklin 2005 • Schulz 2005 • Head and Alford 2008 | <ul style="list-style-type: none"> • distinction / lack connection • focus on the social communities aspect • exploring the dynamics of self-organisation |

Table 1. Different dimensions to model complex system

The organisational perspective anticipates an environmental uncertainty which includes complexity and sustainability. Thompson (1967, p. 6) describes a complex organisation as a set of interdependent parts, which together make up a whole that is interdependent with a larger environment. With regard to organisations, Anderson (1999, p. 216) describes complexity as a structural variable that characterizes both organisations and their environments. Participants in this study were asked about the importance of the organisational perspective in controlling changes in the unlikely event of unforeseen circumstances.

The business perspective of cooperative activities describes the objectives in a business plan required for a group to share goals. Business activities, which include task identification and investigation, provide an insight into the organisational context of the business culture. Shipp et al. (2008) argue that activities lead to learning and discovery, which in turn inspires innovation and knowledge to enable problem-solving. Participants were asked how the business perspective is an important factor in responding to unforeseen circumstances in a rapidly changing environment.

The knowledge perspective controls the flow of information and access to the right information for sharing and reuse. It is difficult to identify the experts involved, the community of practice and communication with multiple stakeholders among business units and other agencies. Wenger (1998) refers to communities as the containers of competences, and explains how learning occurs on different levels. Wenger further states that interactions between communities' members play an important role in social learning systems.

The social perspective focuses on the roles and responsibilities that change in the diverse culture and social interactions between business units and among all stakeholders. In particular, it is difficult to identify integration through roles and adaptation to changes. This study particularly focused on a

social complexity and network (Conklin, 2005; Pralahad and Krishnan, 2008) that possesses the role of the functional units and multiple stakeholders.

In summary, literature reveals that none of these individual perspectives have provided an output of a successful solution for effective modelling of knowledge flow as each are divergent, isolated approaches.

4 MULTIPLE PERSPECTIVES APPROACH

A proposed multi perspective framework includes four dimensions namely; the first dimension, organisation perspective, refers to the positions in the organisations; the second dimension is knowledge perspective which illustrates the knowledge shared in the communities of practice; third dimension is business perspective, which shows how business activities are formalised, the interaction with different roles in the organisations (Hawryszkiewicz, 2010). Consequently, the fourth dimension is social perspective that illustrates the social complexity and process of change within and across other perspectives.

Figure 1 shows that the collaborative infrastructure platform across all organisation and the knowledge flow from one to other perspectives. A multi perspective model displays the relationship between the activities and the roles that change in a dynamic environment (Yoo et al., 2012). Moreover, a multiple perspectives approach will complete the gaps in the integration of different views to understand the complex issues. It provides a way to show all the relationships at the same time and thus foster the creation of new heuristics that can lead users to make informed choices as to how to reorganise their work.

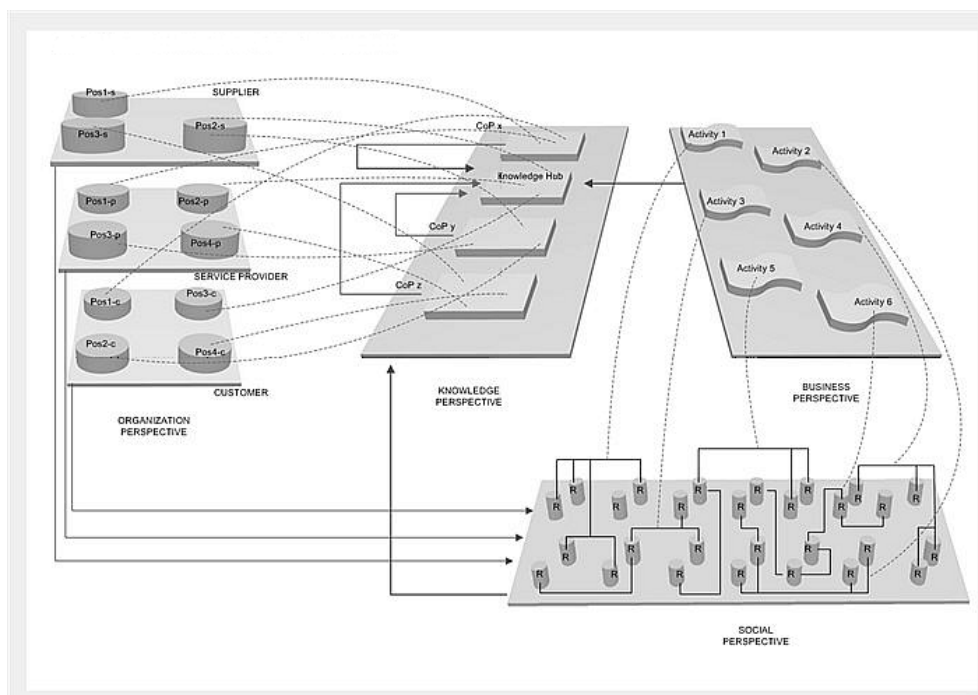


Figure 1. Multi perspective dimensions

From a social perspective, roles can be identified as an imperative dynamic to adapt to changes in organisational structures. Pralahad and Krishnan (2008) emphasize the importance of social networks that encourage innovative behaviour. For example, this method displays the ways in which people interact and create knowledge. Furthermore, it demonstrates how initial knowledge infrastructure is

created and how it adapts to evolving systems. A model of the social perspective draws on techniques used in social networking but extends them into an organisational framework by focusing on roles, responsibilities and relationships between these roles. A business social network may support different types of responsibility, such as coordinating decision-making. It requires the creation and use of enterprise knowledge in order to continuously improve the performance of organisational processes that manage interactions among the members. Enterprise social network modelling efforts may be categorised according to their emphasis on roles, complexity of activities (Schulz, 2005) and organisation.

The multiple case studies show that collaboration is such a concern as a result of organisations work to increase the integration of their processes which must be integrated both internally and with the key business partners. The government agencies and business are transforming the way they conduct business embracing the concept of service oriented environment. Shared services are the realization of a robust, locally interconnected network environment that includes infrastructure, people, processes, systems and services.

Head and Alford (2008) suggest that the techniques to manage the wicked problems by modelling the different perspective. In particular, their approach focuses on the social system dynamics. Based on this method, the researcher was able to transform the collaboration relationship of organisations to multiple perspectives framework. For example, making better strategic decisions in organisation perspective, understanding each other's cultures in business perspective, establishing knowledge to share in knowledge perspective and promoting interactions amongst stakeholders whilst building trust in social perspective.

4.1 Collaborative Common Framework

The multi-perspective framework has the overall task of managing the processes of organisation and the development of new knowledge through integration and adaptation to changes. It is also capable of identifying requirements and social complexities. This study extends these perspectives on collaborative architecture by identifying new characteristics for the effective system design of the common framework. Integrating the multiple-perspective views is necessary to understand organisational complexity and to improve knowledge flows in the complex environment. This new model leads to analysing, defining and managing the interdependencies across agencies engaged in a partnership alliance is proposed.

From an organisational perspective, policy may refer to organisational rules and the actual practices of government (Colebatch, 2002). Successful organisations need to understand how each functional unit interacts with other units and how policy derives from expert groups. Recognition of unique cultures is particularly important for organisational changes. For example, the organisational perspective approach helps to understand the current state of play and to easily identify the change in culture due to the strategic direction in question. Moreover, this method provides an organisational learning process and is used for business relationships. It also recognises the interaction between organisational units and their activity and responsibility.

From a business perspective, activities may be categorised as services that are required to build successful organisations. The objective of this method is to enable activity groups to understand how they can achieve and deliver key business goals. For example, the business perspective method enables change to be made for the benefit of a business and assists interactions between stakeholders. It also generates knowledge that can be used to build better relationships between government agencies.

From a knowledge perspective, second generation knowledge management (McElroy, 1999) may be defined as organisational practices that create knowledge processes to produce organisational learning. This method supports unstructured communities and enables them to share knowledge, for example between control, expert, policy and governance groups. It also facilitates collaboration and innovation to support emergence. The knowledge perspective uses rich pictures from soft system

methodologies to describe the knowledge-sharing and learning that takes place within collaborative environments.

From a social perspective, change roles and responsibility may be categorised as services that are requires building strong relationship and corresponding between the functional units and communities. This method provides the system with greater adaptability when handling collaborative task. For example, the social perspective method establish closer relationship, working in teams promotes collaboration and improve connectivity amongst multiple stakeholders across organisations.

5 CASE STUDY OVERVIEW

Four case studies have been investigated with a new developed multi-perspective model based on relevant literature. This model was verified based on a collaborative design through a pilot case study, prior to employing the multiple case study research method to further refine the model. The method of case studies was from a qualitative method that was a popular research practice in information systems (Orlikowski and Baroudi, 1991 and Alavi and Carlson, 1992). The case study method is an empirical form of enquiry that investigates an emerging area in which multiple sources of evidence are used (Yin, 2002). Our research model was validated through a multiple case study involving four case studies across three Australian government agencies. The resulting conceptual model can be easily evaluated as an instrument of analysis designed to capture and record evidence for further validation of the successful model. The following section outlines the approach used in the research design that validates the model through the multiple case studies.

5.1 Case Study Design and Data Analysis

The main aim of this study was to identify and develop a multiple-perspective framework to model complex services across organisations. Organisational complexity is often defined as the measure of diversity in internal and environmental factors (Mason, 2007). Whilst complexity as a theory has been the subject of research, complexity science has only recently been used to interpret behaviour in other fields, including organisational studies (Maguire, 2006). Organisations are becoming more diverse and dispersed. However, another view of complexity may provide the knowledge required for organisational architecture.

In particular, the case study focused on the Australian Government's Nation Building Economic Stimulus Plan (NBESP) which involved three government agencies working together in a complex collaborative setting. The researcher involved participants in the completion of interview questionnaires where the duration of each session appeared to be from one to one and a half hours approximately. The project took the researcher eight months to complete. The researcher conducted the interviews in the premises of the NSW State Government. The interview process consisted of two phases. During the first stage, the researcher began with general questionnaires and then moved on to the specific questionnaires to understand and clarify answers. The researcher made notes and observations during the interview and these, along with the individual responses that were transcribed after the completion of each interview. In particular, project managers collaborate with the numerous people working across nine different project development firms. The researcher interviewed thirty-five participants individually, suggesting that the responses were reasonably balanced. The questionnaire consisted of 58 questions to validate research questions in measuring the success of multi-perspective modelling through participants' experience in their organisations. The researcher continuously analysed the results of experiments and carried out statistical analysis of these data and archived materials in order to expand and test the validity and reliability of modelling dimensions.

The researcher used NVivo© software to code each participant's transcribed semi-structured interview (DeNardo & Lopez-Levers, 2002). The researcher read the codes from each participant interview. The researcher distilled these themes from the coded text to reflect the themes critical to the central question.

6 FINDINGS

The most significant and highly relevant themes emerging from the aggregation of the invariant constitutes illustrates that common framework requires to collaborate with multiple stakeholders. After carrying out this study, it was found that the themes were supported therefore the multiple perspective model helps in understanding complexity. Themes generated from the thematic categories and the invariant constituents responses for general conclusions to describe how thirty five participants perceived their knowledge and understanding of complex processes and multiple perspectives approach.

Themes generated from the thematic categories serve as general conclusions to the analysis by representing and describing how the participants perceived their knowledge and understanding of organisations.

Theme 1: Organisation Perspective

The high frequency responses within thematic categories of major category 2 (How does the organisation respond to unforeseen circumstances needed for better knowledge flow), organisational objectives, resources/improvement, and performance, provided evidence for suggesting a general understanding of organisational perspective in controlling changes in the unlikely event of unforeseen circumstances. Organisational objectives were the most cited type of organisational perspective. The groups for the most part represented perceptions and ideas that showed good knowledge of organisational perspective. The researcher asked participants in this study about the importance of the organisational perspective in controlling changes in the unlikely event of unforeseen circumstances. Participant #3 stated, *"I continuously improve process that, what is work and what is not through brainstorming and place right processes to set up and get approval in most effective way. And also consider on evidence basis to analyse benefit of the changes."*

Theme 2: Business Perspective

The high frequency responses within thematic categories of major category 3 (How can changes in circumstances affect knowledge flow in organisations), business activity/plan, and business culture, provided evidence for suggesting a general understanding of the business perspective as an important factor in responding to unforeseen circumstances in a rapidly changing environment. Business activity/plan was the most cited type of business perspective. The groups for the most part represented perceptions and ideas that showed good knowledge of business perspective. Participants mentioned business activity/plan when they described a situation where the rules and guidelines were not clear. Participant #4 stated, *"During the delivery of NBESP projects, I come across that planning requirement and procedures are not clear from the commonwealth government. I have to exercise my best ability to clarify the issues with all stakeholders and develop procedure for implementation."*

Theme 3: Knowledge Perspective

The high frequency responses within thematic categories of major category 4 (Is the model based on a multi perspective approach that will help to identify knowledge flow for unforeseen circumstances), information flow and effectiveness of decision process provided evidence for suggesting a general understanding of the knowledge perspective for unforeseen circumstances. Information flow was the most cited type of business perspective. The groups for the most part represented perceptions and ideas that showed good knowledge of knowledge perspective. 49% of the sample described the importance of information flow such as other experts' knowledge and stated, *"I seek information from project experts and investigate fully on all aspects of programs to manage the projects within deadlines. It is critical for the business. I obtain the knowledge from everywhere for example, meeting, forums, information system, discussion, social network, workshop, seminars, training etc."*

Theme 4: Social Perspective

The high frequency responses within thematic categories of major category 5 (Does the model help organisation to learn how to discover knowledge), relationship/exchange, experience and not sure provided evidence for suggesting a general understanding of the social perspective.

Relationship/exchange experience was the most cited type of social perspective. The groups for the most part represented perceptions and ideas that showed good knowledge of social perspective. Some participants were faced with challenges while they were coordinating work with other units and departments, and felt that other units and departments were uncooperative. Participant #7 was faced with challenges when he stated, *“I have noticed that there are different political views and generally speaking, others are uncooperative. I also faced with different challenges in particular issues individual capabilities for collaboration. I consult with senior management to get advice through meeting and report to resolve the issue.”*

Theme 5: Multiple Perspectives

The high frequency responses within thematic categories of major category 6 (Does a multiple perspectives framework improve the ability to manage change in complex organisation), common framework, approval workflow and effectiveness of decision process provided evidence for suggesting a general understanding of the multiple perspectives. Common framework was the most cited type of multiple perspectives. The groups for the most part represented perceptions and ideas that showed good knowledge of multiple perspectives. Most participants mentioned that a common framework is important for collaborative environments. Participant #12 stated, *“Multi perspective framework is very important for multiple stakeholders. Organisation must create the common platform for all key stakeholders prior to complex project commences.”*

Open Modelling Methods

This paper describes a new set of open modelling methods used in the different perspectives which focus on the boundary roles. These draw on existing methods and multiple perspectives framework approach, amending them to realise the modelling goals catering for evolution and self-organisation.

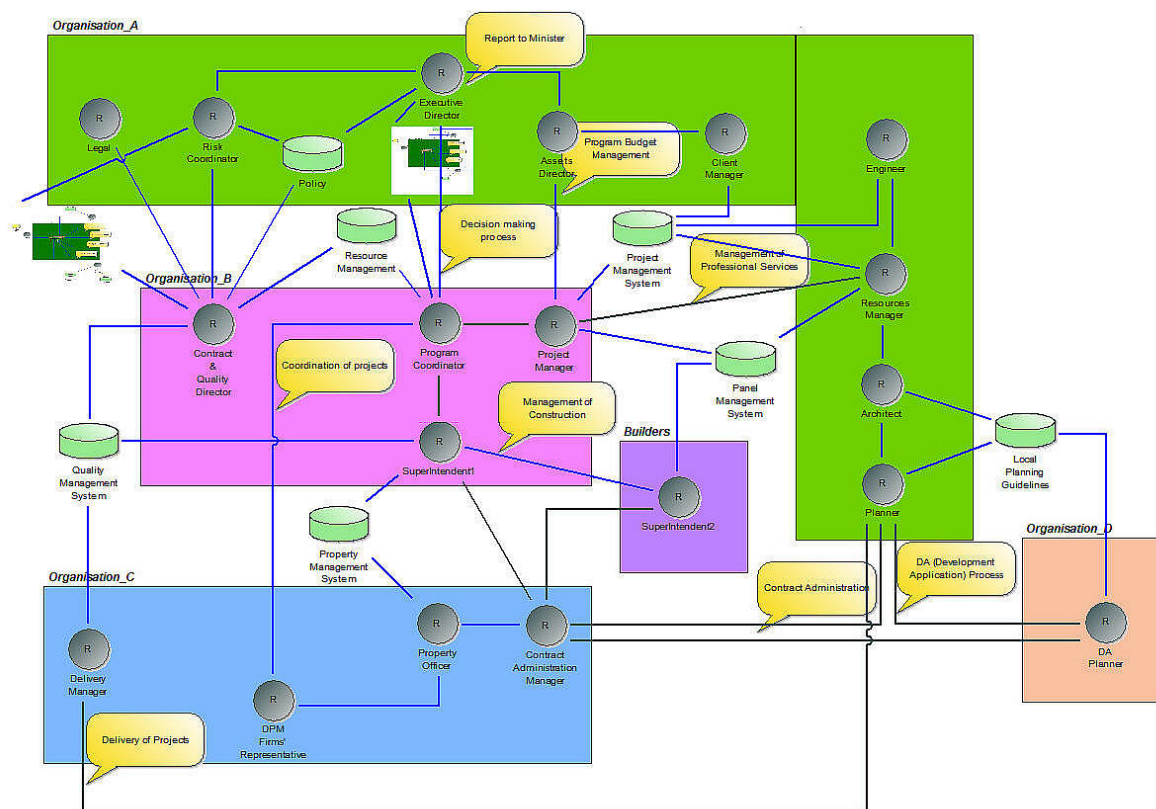


Figure 2. Enterprise boundary knowledge flow model

Figure 2 illustrates the enterprise model framework using Methods for designing large scale collaborative processes (MeLCA). The model displays the collaboration amongst multiple

stakeholders and organisations. In particular, it visualise the characters and the relationship between the boundary roles. The open model design methods focus on processes that support knowledge sharing and creation through collaboration. They identify the social structures and a community that must be supported in such processes and tools needed to support complex organisation (Hawryszkiewicz, 2010). The case study shows that the use of open model tool allows for successful management of collaborative environments for example, using MeLCa to understand the collaboration between the boundary roles. The tool provides the features that allow its users to experiment with the relationships between the components or add and delete components to easily show alternate structures and thus provide a basis for making an alternate choice. In summary, MeLCa is effective tool to reorganise knowledge flow from emerging environments which become important for social perspective.

7 DISCUSSION

As we aimed in the study, we examined the multiple perspectives through a proposed model in complex environment. From the study, the multiple perspectives framework takes on the following roles in our case study:

7.1 Ability to Manage Change in Complex Organisation

We found that a multiple perspectives framework improved the ability to manage change in complex organisation. For example, common framework for collaboration, this finding correlates with findings of the above studies that multiple perspectives significantly affected on the ability to manage change in complex organisation. However, some researchers have raised questions about the causal ordering of changes in circumstances and knowledge flow in organisations.

7.2 Multi perspectives and Knowledge Flow

Some researchers (Cil et al, 2005; Courtney, 2001) found that the multi perspectives approach helped to identify knowledge flow for unforeseen circumstances. For example, Cil et al (2005) found that the employees who use the multi perspectives approach gained more confidence in their ability to identify knowledge flow for unforeseen circumstances than the employees who don't use the multi perspectives approach.

In the present study, the model based on a multi perspective approach helped to identified knowledge for unforeseen circumstances. For example, managers showed clear illustration of information flow and effectiveness of decision making process. This finding correlates with findings of the above studies that the multi perspectives approach helps identify knowledge flow for unforeseen circumstances. However, there appears to be little evidence on the importance of the integration of multiple perspectives to tackle wicked problems.

7.3 Changes in Circumstances and Knowledge Flow

The case study results show that the organisation responded to unanticipated events needed for better knowledge flow to adapt changes rapidly in collaborative environments. Moreover, organisation perspective had an impact and was crucial to enhancing the quality of decision-making. For example, managers mentioned that clear organisational objectives, improvement of resource management and strategic direction are needed to deliver effective decision-making in unforeseen circumstances.

However, changes in complex organisation appear to be a significant factor to consider when given its relationship with knowledge flow in collaborative situations as indicated in the present study. Thus, additional research to further clarify the relationship between changes in organisational situation and knowledge flow in organisations is warranted.

8 CONCLUSION

The aim of this study was to determine the effect of the multi-perspective framework. Moreover, the researcher's objective was to develop a multiple perspectives model that managed the collaborative environment and knowledge flow in complex organisations. The study outlined the management of self-organisation and the analysis of knowledge flows, which pose a serious challenge to the public sector. As the results, proposed a new framework characterises the unstructured knowledge flow for effective management of collaborative interactions between stakeholders. The model enables organisations to respond to a rapidly changing environment. Moreover, it helps to manage system evolution and will have a significant impact in the public sector. These outcomes are likely to make a substantial contribution to both research on the social behavioural perspective and the modelling of multiple-perspective techniques. Significant findings on the effectiveness of the emergent structure for improving organisational collaboration were made. The empirical findings in this study present a new understanding of the model's ability to manage system evolution and to provide a practical approach for integrating multi-perspective views.

This study will offer a substantial contribution to both social behavioural perspective research and the modelling of multiple perspectives techniques. There will be a significant finding to prove the effectiveness of the emergent structure for improving organisational collaboration. The results from this study will make several contributions to the current literature.

- Firstly, providing further analysis of methods in relation to integrating complexity theory (McElroy, 2000);
- Secondly, addressing new characteristics of the organisation, noted by Merali (2006) and;
- Thirdly, a multiple perspective framework will improve collaborative architecture in a complex environment.

Further experimental work is needed to determine the extent to which the external validity of the multiple perspectives framework is beneficial to the complex organisation. The economic perspective also merits further attention.

References

- Alavi, M. and Carlson, P. (1992) "A review of MIS research and disciplinary development," *Journal of Management Information Systems* (8:4), 1992, pp. 45-62.
- Alman, J. (2003) 'The Challenge of the 21st century: Managing Technology and Ourselves in a Shrinking World' State University of New York Press, Albany, NY.
- Aversano, L., Bodhuin, T., Canfora, G., Exposito, R. & Tortorella, M. (2004), 'Evolution of business processes towards eBusiness using a critiquing approach', *Proceedings of the 2004 ACM symposium on Applied computing, Session: Organisational engineering (OE)*, pp. 1351-1358.
- Brown, T., & Wyatt, J. (2010). *Design Thinking for Social Innovation*. Stanford Social Innovation Review, Winter, 30-35.
- Caskey, M. (2010). "An organisational perspective of distributed leadership: A portrait of a Middle School". *Research in Middle Level Education*, Volume 33, No. 5.
- Cil I, Alpturk O & Yazgan H.R. (2005). "A new collaborative system framework based on a multiple perspective approach: InteliTeam". *Decision Support Systems*, Vol 39, pp 619 – 641.
- Colebatch, H. K. (2002). *Policy*, 2nd edition. Open University Press, Buckingham
- Conklin, J. (2005). "Dialogue Mapping: Building Shared Understanding of Wicked Problems", Wiley, Chapter 1.
- Courtney, J.F. (2001). "Decision making and knowledge management in inquiring organisations: toward a new decision-making paradigm for DSS". *Decision Support Systems*, Vol 31, pp 17.
- Denardo, A., & Levers, L.L. (2002). "Using Nvivo to analyze qualitative data". Paper presented at the 2002 14 th Annual Conference on Ethnographic and Qualitative Research in Education.
- Ferlie, E. (2007). "Complex organisations and contemporary public sector organisations". *International Public Management Journal*, 10(2), 153-165.
- Hawryszkiewicz, I.T. (2010). "Knowledge management" Pargrave Macmillan.

- Head, B and Alford, J. (2008). "Wicked Problems: The Implications for Public Management", International Research Society for Public Management, 12th Annual Conference. Brisbane.
- Heylighen, F. (2001). "The Science of Self-organization and Adaptivity", in: L. D. Kiel, (ed.) Knowledge Management, Organizational Intelligence and Learning, and Complexity, in: The Encyclopedia of Life Support Systems (EOLSS), Eolss Publishers, Oxford.
- Kauffman, S. A. (1995). *At home in the universe: The search for the laws of self-organisation and complexity*. Oxford, UK: Oxford University Press.
- Linstone, H. A. (1985), "Multiple perspectives: overcoming the weaknesses of MS/OR", *Interfaces*, Vol. 15 No. 4, pp. 77-85.
- Maguire, S., Mckelvey, B., Mirabeau, L. and Oztas, N. (2006). "Complexity Science and Organisation Studies, in S. R. Clegg, C. Hardy and T. Lawrence (eds.)", *The Sage Handbook of Organisation Studies*, 2nd Ed, Thousand Oaks, CA: Sage.
- Martin, R. (2009): "The Design of Business" Harvard Business Press. Martin, R.L. (2011): "The Innovation Catalysts" Harvard Business Review, June 2011, pp.82-88
- Mason, R. (2007). "The external environment's effect on management and strategy. A complexity theory approach". *Management Decision*, 45(1), 10-28.
- McElroy, M. W. (1999). "The Second Generation of Knowledge Management", *Knowledge Management*, pp. 86-88.
- McElroy, M. W. (2000). "Integrating complexity theory, knowledge management and organisational learning", *Journal of Knowledge Management*, Vol. 4, No. 3, pp. 195-203.
- Merali, Y. (2006). "Complexity and Information Systems: the emergent domain", *Journal of Information Technology*, London, Vol. 21, Iss. 4, pp. 216-241.
- Mitleton-Kelly E. (2003). 'Complexity Research - Approaches and Methods: The LSE Complexity Group Integrated Methodology' in Keskinen A, Aaltonen M, Mitleton-Kelly E "Organisational Complexity". Foreword by Stuart Kauffman. Scientific Papers 1/2003, TUTU Publications, Finland, Futures Research Centre, Helsinki, 2003.
- Narvekar, R. & Jain, K. (2006). 'A new framework to understand the technological innovation process', *Journal of Intellectual Capital*, vol. 7, no. 2, pp.174-186.
- Orlikowski, W.J. & Baroudi, J.J. (1991). "Studying Information Technology in Organisations: Research Approaches and Assumptions", *Information Systems Research* (2) 1991, pp. 1-28.
- Prahalad, C. K. and Krishnan, M. S. (2008). "The new age of innovation: driving cocreated value through global network", McGraw-Hills Company.
- Schulz, K-P. (2005). "Learning in complex organisations: A model development and application from a theory of practice perspective", *Journal of Workplace Learning*, Vol. 17, No. 8, pp. 493-507.
- Shipp, S., Stone, A., Ross, S. and Lal, B. (2008). "Measuring Innovation and Intangibles: A Business Perspective". Institute for Defense Analysis, Science and Technology Policy Institute, Washington, D.C.
- Smith, A. and Humphries, C. (2004). "Complexity theory as a practical management tool: a critical evaluation", *Organisation Management Journal*, Vol. 1 No. 2, pp. 91-106.
- Wenger, E. (1998) "Communities of practice: Learning, meaning and identity". Cambridge: Cambridge University Press.
- Yin, R. K. (2002). *Case Study Research, Design and Methods*, 3rd ed. Newbury Park, Sage Publications.
- Yoo, C. B., Hawryszkiewicz, I. and Kang, K. (2012). "Multiple Perspectives Framework to Model Complex Processes", The Australasian Conference on Information Systems (ACIS), Geelong, Australia.