

The value of sustainable knowledge transfer methods for SMEs, utilizing socio-technical networks and complex systems

Dr Susu Nousala

Spatial Information Architecture Laboratory (SIAL) RMIT University, Melbourne Australia;
Susu.Nousala@rmit.edu.au

Dr Suthida Jamsai Whyte

Faculty of Management Science, Ubon Ratchathani University, Thailand

Suthida.Jamsai@bus.ubu.ac.th

ABSTRACT

This paper will examine the development of sustainable SME methods for tracking tacit (informal) knowledge transfer as a series of networks of larger complex system. Understanding sustainable systems begins with valuing tacit knowledge networks and their ability to produce connections on multiple levels. The behaviour of the social or socio aspects of a system in relation to the explicit formal/physical structures need to be understood and actively considered when utilizing methodologies for interacting within complex systems structures.

This paper utilizes theory from several previous studies to underpin the key case study discussed. This approach involved examining the behavioural phenomena of an SME knowledge network. The knowledge network elements were highlighted to identify their value within an SME structure. To understand the value of these emergent elements from between tacit and explicit knowledge networks, is to actively, simultaneously and continuous support sustainable development for SME organizations. The simultaneous links within and between groups of organizations is crucial for understanding sustainable networking structures of complex systems.

1. Introduction

For the purpose of this paper, tacit knowledge networks are defined as the informal transfer or exchange of knowledge between individuals and groups (as expertise) through informal networks. Nousala (Nousala et al. 2005b; Jamsai and Nousala 2007; Nousala and Terziovski 2007) described tacit knowledge exchange or transference through networks as being instrumental in the management and implementation of knowledge within and between distributed operations or organizations. Managers and business owners are grappling with finding an appropriate way or means to support monitor and maintain (in a sustainable manner) any new tacit knowledge that emerged during the development of new products and services. Maintaining sustainable processes is crucial for ensuring long term sustainable success for organizations and their extended networks through out the regions and cities in which they operate.

This poses the question of how individuals and relevant working groups within distributed SME organizations transfer or share their tacit knowledge beyond their organizational or regional boundaries or borders. This is not only a complex systems question but also one of scalability. Without understanding how and

why elements of networks behave in such complex systems, the issue of sustainability cannot be identified understood, or implemented. Scalability offers understanding towards the emergent dynamics of implementation methodologies within SME systems and their networks to achieve sustainability.

Scalability can be likened to the interoperability of emergent group elements that are crucial criteria for the support of a sustainable socio – technical network of knowledge exchange within and beyond a complex system (such as an organization or region). Organizations and their regions are complex systems with networks, simultaneously engaging in a multitude of functions and operations that have developed specific characteristics. Knowledge transfers for SMEs are particularly organizational specific within highly operational or project orientated environments (Nousala and John 2004). With regards to policies on sustainability, methodologies supporting these policies need to address the following key concerns:

- Dynamic methodologies are needed that consider the nature of SMEs interactions within their regions as complex organizational systems.
- Such methodologies need a holistic approach; reductionism as an approach will not work with complex systems.
- Scalability is a fundamental aspect of holistic methodology in understanding different levels within a system such as the scope and vulnerabilities.
- Integration of human based systems and the physical organizational operational processes and their networks are crucial as a basis for a holistic methodology.
- The areas of expertise required as part of a holistic methodology would be the combination of socio-technical systems thinking (bringing together practice, physical structure, purposes and

constraints, people, processes, infrastructure).

- The following are the areas of expertise which are needed in order to attempt a holistic methodological approach specifically designed with SMEs in mind;
 - o Knowledge networking systems engineering that focuses on the practical implementation aspects.
 - o Knowledge network systems facilitator, to support the formulation of business strategies.
 - o Knowledge network systems researcher/scientist, to support formulation and development of theory and innovative research for practical applications.

2. Methodology

2.1 Case Study approach

The case study, focused on an SME interacting with a larger global entity, based on a series of interviews over a six-month period (with follow up discussions). Access was given to all levels of the companies, with staff involvement openly supported by management (if not always understood). The series of interviews were developed as a “snapshot” approach, tackling the companies’ emergent issues relating to knowledge transfer, thus identifying and highlighting various aspects of their knowledge networks. The snapshot approached gathered in a short time the data required for the study. The snapshot profiles were built up over time through the series of interviews, rather than using a more lengthy surveys approach. Lengthy surveys were less effective in gathering elements of informal thinking that were necessary for understanding tacit knowledge network flows.

These case studies in effect revealed:

- The core elements necessary for internal tacit knowledge network process.

- There were simultaneous links with external tacit knowledge networks.
- The relational links between processes and practices, for individuals, the organization, and their external environments.

2.2 Case Study

The case study illustrates the development of tacit knowledge and how it was transferred within and beyond the boundary of an SME to interact as part of a larger complex system.

This section is divided into two parts. The first part presents how the SME, in this case a Thai manufacturing company named Invincible Co. Ltd, overcome their tacit knowledge constraints in order to manufacture a new product for their customer, a large global company. Various methods were developed to track valuable tacit knowledge exchanges, occurring on a continuous basis, between key members of the global product network. Secondly, the activity of the global product network showed how the hierarchy of tacit knowledge and their boundaries behaved. This behaviour shows the importance of the tacit knowledge exchange role between different levels of social networks and the subsequent exchange between tacit and explicit knowledge, and emergent outcomes.

The theory, which informs the discussion of part one and part two in 2.2, is based on the Popper's three world model (1994; 1972). The exchange between tacit and explicit and the SME and their larger knowledge networks occurs between "World 2 and World 3" as shown in figure 1.

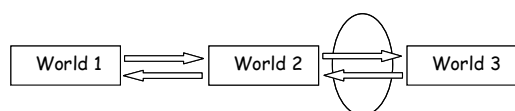


Figure 1. Modification of Popper's three worlds diagram to show cyclical movements, The circle emphasizes cyclic exchanges between world 2 and world 3 as world 2 attempts to represent and interact with world 1. (Nousala 2006)

The SME Company Invincible had only four engineers specializing in designing for product prototypes. The staff were approached with the tasked of working out the probability of designing and building bullet proof trucks for Thai conditions. For the SME, it was challenge, as it had not manufactured this type of product in the country previously. The decision to proceed involved bettering current manufacturing techniques. The management and staff (operating as a flat hierarchy) needed to find out what technical knowledge was required through openly exchanging within the SME knowledge network, and the external global company knowledge network. The SME was required to seek technical knowledge from engineers through their knowledge network of subsidiary companies, suppliers and other experts' (as an open source approach). However, they found constraints regarding confidentiality compounded with some information requiring levels of capability not found within the immediate SME knowledge network. Theoretically, the Popperian model (Popper 1994; 1972) of three world can be applied to describe the situation of tacit knowledge exchange. As the knowledge needed by the company Invincible went beyond the availability of their own networks they began to extend knowledge exchange processes with their global counterparts. The global members of the newly extended knowledge networks could achieve what the singular SME could not.

The theory which informs the discussion of the knowledge networking process of the SME company Invincible is not only based on the Popper's three world model (1994; 1972), it is also informed by emergent properties of autopoietic complex systems organizational behaviour as discussed in figure 2.

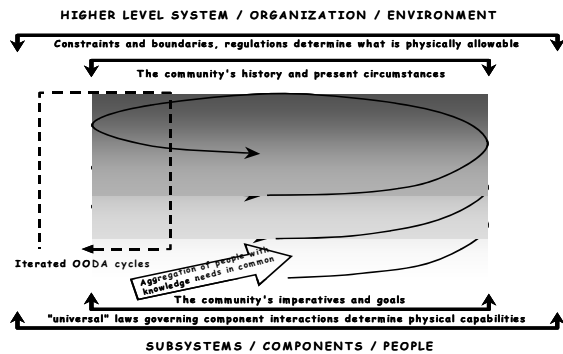


Figure 2. Emergence of an autopoietic community of practice places Nousala's spiral knowledge exchange model in the complex systems hierarchy of an autopoietic organization. Dynamic activities of entities at the focal level within the triad are enabled by laws governing interactions of subsystems and constrained by conditions imposed by the supersystem (Salthe 1993; Hall et al., 2005).

2.3 Theoretical Background

Human organizations are hierarchically complex adaptive systems. Within these systems knowledge exists at many different levels in tacit or objective forms. This knowledge is necessary for the survival of the organizational system. Individual and organizational knowledge is held in a variety of forms. These different forms of knowledge range from tacit organizational routines belonging to internal communities (Nelson and Winter 1982) to physical layout of plant and offices (Nelson and Winter 1982) and corporate documentation (Hall 2003a).

Organizations need to respond fast to solve problems (Boyd 1996). Yet, the rationality of organizational decisions is bounded by limited processing resources and time to identify access and assemble relevant knowledge. The best decisions the organization can strive for are 'just good enough' (Simon 1955, 1957). Although it is possible for people to articulate and document much of what an organization knows, because of time and cost, this is not done. Snowden's (2002) concept that people "always know more than [they] can tell, and ... will always tell more than [they] can write down" also applies to

organizations. Also, even where the organization holds large bodies of explicit knowledge, personal knowledge may still be required to access and apply it (Cowan et al. 2000; Tsoukas 2005). It is people belonging to the organization who know (Nousala et al. 2005b):

- what knowledge is needed
- who may know the answer
- where the explicit knowledge may be found
- why the knowledge is important or why it was created
- when the knowledge was last needed or may be needed in the future
- how to apply the knowledge

Previous approaches have developed theoretical frameworks based on Karl Popper's evolutionary epistemology. Personal narratives were collected from key knowledge holders using a semi-structured interview approach guided by mind maps. Personal narratives were analyzed to develop an ontological structure for dissecting interviews into knowledge nuggets, employment history and additional metadata. The ontology was then mapped into a data aggregation engine providing a graphical interface for navigating through the disassembled narratives to retrieve appropriately knowledgeable people. Note this is a very bottom up approach (Nousala et al. 2005b; Nousala 2006).

For organizations to maintain themselves against entropy, change and competition, they must assemble, deploy, preserve and replicate knowledge to respond. Knowledge in the organizational context is any kind of information that has survival value (Nousala et al. 2005b). The growth of knowledge and learning at any level of organization is cyclical, summarized by Popper (1972) as a "tetradic schema": $P_n \rightarrow TT/TS \rightarrow EE \rightarrow P_{n+1}$. P_n is a problem. TT/TS are guesses, tentative theories or tentative solutions to that problem. EE is an error elimination process that removes those theories or attempted solutions that fail to solve the problem. P_{n+1} is the somewhat

changed, new problem state faced by the entity that has solved P_n . Organizational sustainability requires positive and negative constraints within the dynamic structure of the organization to support the emergence and sustenance of learning cycles. *Organizational learning cycles* begin with and involve coordinating the learning cycles of the organization's individual members, who then share, combine and extend personal knowledge to build organizational knowledge.

3. Findings

The case study revealed that the understanding of the elements necessary for sustainable practice and processes is relevant to the successful development and sustainability of the working group, small divisional team or SME's organizational tacit knowledge exchange. Without the foundation of sustainable practice and processes, the build up of the internal knowledge networks will not occur. Instead, there will only be information systems and management, which do not function in the same way and can not take the place of tacit knowledge networks (Nousala and John 2004; Nousala et al. 2005b; Jamsai and Nousala 2007). This was evident through participating individual members of the SME organization, as they were in effect "champions" or representatives within their SME organization, and also externally during the tacit knowledge transfer process. Each member involved with specific practices and processes were in effect "gate keepers" (Dunphy, Griffiths, Benn 2003, p14) who attended the meetings and negotiated standards and contribute qualities with a view to making this process as sustainable as possible. Without this input, it would not possible to sustain the knowledge transfer process (Nousala and John 2004).

4. Key Lessons learned

There were lessons learned via the small teams that were operating within larger companies or networks. The small teams had variations of skill depth, depending on what was required. Typically, the organization used small teams, which covered several business areas. This

meant that the individuals involved carried with them a broader set of experiences acquired over a shorter period of time (shorter than usual for the skill sets involved) than that of their other colleagues restrict to single projects and areas. The experiences of the small teams and the way they worked encouraged innovative strategies to emerge, out of solution-focused approaches, because working as focused teams, they knew their own work and each other's. This was a significant as this was "known" amongst the teams but was not something that was formally recognized, it had to be learnt by having contact with other team members. This approach resolved problems and issues that previously, seemingly, had no solution. The strength and dynamics of these small teams needs to be more actively understood, with regard to the development of project/business structural innovation processes as sustainable systems.

5. Conclusion

The SME had to understand how engage with the dynamic knowledge network levels to gain product development success. Management and staff were actively aware of the dynamic nature of their knowledge networks levels, using it to their advantage, where possible.

Clarity is needed for understanding what the necessary elements for the development of a tacit knowledge base. Without this understanding, it is difficult to track the "threads" of development between the tacit knowledge networks which support tacit knowledge transfer (Nousala et al. 2005b). Elements, which are present during the development of tacit knowledge networks, are also needed for the stability for the emergence of tacit knowledge transfer to occur within any knowledge network. Understanding scalability (the relevant level of appropriate operation) is an extremely important aspect of the entire tacit knowledge network and transfer process, and is a holistic approach. So-called soft or social systems thinking have far reaching consequences, physically impacting

organizations and their regions. These impacts are not currently understood as well as they need to be.

6. Future direction

Oral history has the ability to weave from words the interaction of experiential threads into networks of active, living intersections “baskets” that contain and sustain. It means something belongs or is engaged and is interactive, like branches of shared experiences. These shared experiences behave as holistic systems of mutually accepted interactions of a cognitive virtual tacit systems. These systems exist to support knowledge flows of “living” cognitive complex systems. Words and oral history form formidable frameworks for scalable networks to emerge and grow, allowing through lived experience and movement emergence “signs” to be sent or communicated to one another to “signify” significant actions. This “conveyance” is only possible through movement (in all its forms) as static signs are just things.

References

- Boyd, JR 1976–1996, Unpublished briefings under the name ‘A discourse on winning and losing’: Introduction (1996), Patterns of conflict (1986), Organic design for command and control (1987), Strategic game of ? and ? (1987), Destruction and creation (1976), and the Essence of winning and losing (1996). Available via Defence and the National Interest. http://www.d-n-i.net/second_level/boyd_military.htm.
- Cowan, R, David, PA & Foray, D 2000, ‘, *Industrial and Corporate Change*, vol. 9, no. 2, pp. 211–254.
- Dunphy, D., Griffiths, A. and Benn, S., 2003, *Organizational Change For Corporate Sustainability*, Routledge Taylor & Francis Group, London, New York.
- Hall, WP 2005, ‘Biological nature of knowledge in the learning organization’, *The Learning Organization*, vol. 12, no. 2, pp. 169–188. <http://www.hotkey.net.au/~bill.hall/TheBiologicalNatureshortrevjmf1bh3.pdf>.
- Hall, WP 2003a, ‘Managing maintenance knowledge in the context of large engineering projects – theory and case study’, *Journal of Information and Knowledge Management*, vol. 2, no. 2 [Corrected version reprinted in vol. 2, no. 3, pp. 1–17].
- Jamsai, S., and Nousala, S, *Managing Innovation Capability: A case study of Invincible Company Limited Thailand*, Book Chapter, *Imperial College Press*, London 2007.
- Nelson, RR & Winter, SG 1982, *An evolutionary theory of economic change*, Harvard University Press, Cambridge, Massachusetts.
- Nousala, S., Terziovski, M, *How Innovation Capability is developed and Exploited at a Defence Project Engineering Company (DPEC)*, Book Chapter, *Imperial College Press*, London 2007.
- Nousala, S., John, S. Jamsai, S, “knowledge strategies and implementation in complex organizations: A Thai engineering company case study”, *International Journal of Knowledge, Cultural and Change management*, [Volume 5, Issue 5](#), 2005a, pp.177–182.
- Nousala, S., Miles, A., Hall, W.P., Kilpatrick, B. “Team expertise access maps (TEAM) using mind mapping technologies”. Submitted, for *Journal of Enterprise Information Management*, November, 2005b.
- Nousala, S., Miles, A., Kilpatrick, B., Hall, W.P. 2005. [Building knowledge sharing communities using team expertise access maps \(TEAM\)](#). Proceedings, KMAP05 Knowledge Management in Asia Pacific Wellington, N.Z. 28–29 November 2005b.
- Nousala, S., 2006. PhD, “Tacit Knowledge Networks and their implementation in complex organizations”. <http://tinyurl.com/2feky6>
- Nousala, S. H, and John S., 2004, *Tacit Knowledge Management Networks and its Implication in Organisational Prosperity*, Qualcon 2004 Conference proceeding, AQQ, South Australia, Adelaide.
- Popper, KR 1994, *Knowledge and the body–mind problem: In defence of interaction*, MA Notturmo (ed.), Routledge, London, 158 pp.
- Popper, KR 1972, *Objective knowledge: an evolutionary approach*, Oxford University Press, London.
- Salthe, S 1993, *Development and evolution: complexity and change in biology*, MIT Press, Cambridge, Massachusetts.
- Simon, HA 1957, *Models of man*, Wiley, New York.
- Simon, HA 1955, ‘A behavioral model of rational choice’, *Quarterly Journal of Economics*, vol. 69, pp. 99–118.
- Snowden, D 2002, *Journal of Knowledge Management*, vol. 6, no. 2, pp. 100–111. <http://www.circleofstatelibrarians.co.uk/snowden>
- Tsoukas, H 2005, *Complex knowledge: studies in organizational epistemology*, Oxford University Press, Oxford.