Exploring knowledge transfer configuration profiles in global operations

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Abstract

This research looks to integrate network configuration and knowledge transfer (KT) approaches. The developed framework was tested using an in-depth case study involving three manufacturing networks at different stages of maturity. Current and future knowledge transfer configuration profiles and supporting KT mechanisms for each network are presented and discussed.

Keywords: Network Configuration, Knowledge Transfer

Introduction

This paper looks to provide an overview of the key factors and dimensions affecting the transfer of knowledge in a network context. A 'knowledge transfer configuration' framework is developed; integrating the network configuration approach, with knowledge transfer mechanisms as a means to representing current (and desired future) state knowledge transfer network configuration profiles within an organisation.

The 'knowledge transfer configuration' framework was tested and refined using case studies involving a number of global manufacturing networks and their associated knowledge sharing networks. The relationship between the key network actors as well as the perceived ideal knowledge transfer mechanisms for production lines at various states of maturity was explored. The research provides a bespoke framework may be used to assess and support the set-up of more effective knowledge transfer/sharing networks.

Literature Review

An extensive literature review was carried out in order to provide the relevant dimensions of analysis for the investigative phases of this research. The overall research design is summarized in figure 1. For the purpose of this paper, the following key domains are summarized:

- *Network Configuration*
- *Knowledge Context*

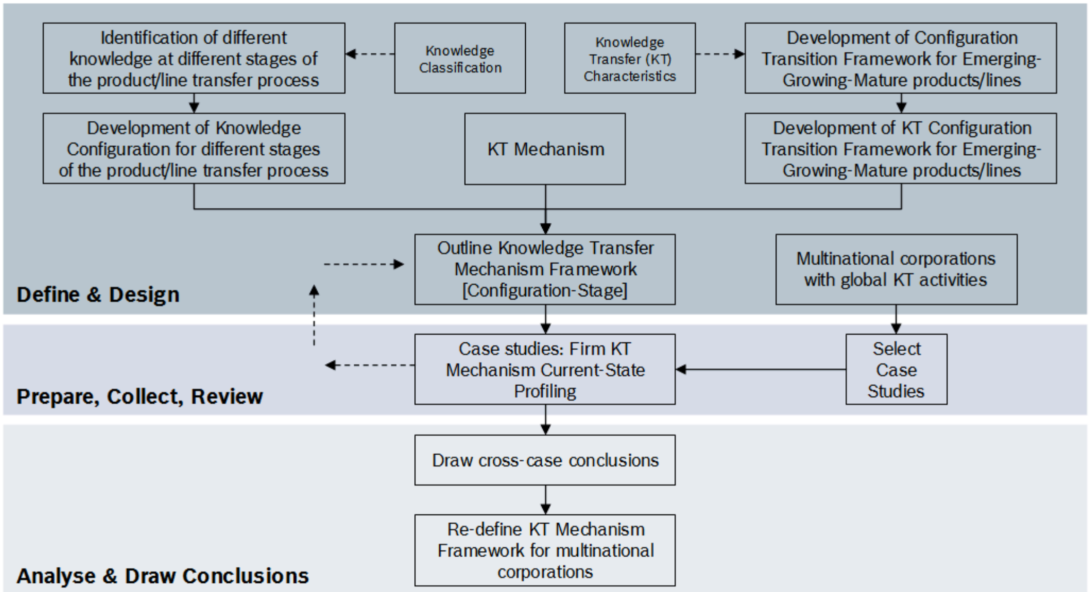

Figure 1. Research Design in the development of a 'knowledge transfer configuration' framework

Network Configuration

Historically, the configuration concept has primarily been focused at the firm strategy level (e.g. mission, resources, markets) and in the organisation structure literature (e.g. levels of centralization, co-ordination mechanisms, matrix structures) (Srai and Gregory, 2008). More recently, as business activities have become increasingly dispersed across geography and ownership boundaries, there is a growing research community working on network configuration, especially in operations management and strategic management (e.g. Bozarth and McDermott 1998, Harrington and Srai 2012, Oltra et al. 2005, Shi and Gregory 1998, Srai and Gregory 2008, Zhang et al. 2007).

In the context of global operations, a key challenge for today's organizations is how best to 'reconfigure', 'optimize' and 'locate' the necessary 'competencies' to support the operation of increasingly dispersed and fragmented global networks, in response e.g. growth of (new) export markets serving an increasing diversity of customers. The configuration of the network (rather than the firm) becomes progressively more important with respect to future development potential. However, different network configurations may require different knowledge transfer, knowledge sharing, knowledge mobility mechanisms based on e.g. the concept of 'process maturity' associated with a product or service, charted from a R&D phase, through technology demonstration to volume production. A key strategy element is predicting at which phase of the maturity curve new products will fit and tailoring the product development process and network configuration accordingly. Different stages of 'process maturity' may require different approaches to associated knowledge transfer, knowledge sharing and knowledge 'mobility' mechanisms.

The network configuration approach supports development of the conceptual 'knowledge configuration' framework, through examining other potential configurations and highlight the key sources used in informing the development (see table 1). In the operations management literature, supply network 'profiles' have emerged based on alternative supply network management approaches, e.g. alternative approaches to differentiating ‘competitive priorities’ (Lamming et al. 2000), managing ‘supply uncertainty’ (Lee 2002), and ‘supply-demand dynamics’ (Srai and Mills 2005), each of which providing elements of network configuration to consider. Shi and Gregory (1998) contended that the dispersion and coordination of intra-firm manufacturing networks require different international manufacturing capabilities. The dispersion dimension refers to the structure of a network; and the coordination dimension emphasizes on the relationship between network members. Zhang et al (2007) identify types of contextual environments of global engineering networks; introducing support infrastructure as a new configuration dimension. Srai and Gregory (2008) describe the configuration of supply networks from the perspectives of network structure, flow of information and material between/within operation units; relationships between network partners; and product structure. The research highlights the importance of inter-firm network structure and dynamics, partner relationships, governance arrangements and the importance of product architectures in the overall assessment of ‘coherence’ of particular supply network configurations. The configuration concepts discussed in this section are largely from firm-based strategic and organisational perspectives. However, these have been extended to the operational domain and to the inter-firm engineering service network context through recent research by the authors on service supply networks, where tight constellations of interdependent multi-organisational networks provide integrated product-service solutions (Srai 2011, Harrington et al. 2012). The process was based on the network configuration literature and secondary data/multiple case studies from the academic literature to first understand network configuration from different perspectives (*see table 1*):

- Global engineering networks: seven in-depth cases in aerospace, automobile, electrics and electronics and FMCG sectors (Zhang et al. 2007)
- International manufacturing production networks: ten cases in aerospace, electronics, heavy engineering and pharmaceuticals (Shi and Gregory 1998)
- International supply networks: ten exploratory and ten in-depth cases in aerospace, electronics, FMCG, garments and pharmaceuticals (Srai and Gregory 2008).
- Service supply networks: four preliminary case studies involving large service contracts in the sectors of aerospace, naval, power and telecoms (Harrington et al. 2012, Srai 2011)
- Product-service system (PSS) networks: in-depth case study involving three diverse PSS networks operating across four lines of business, ten PSS platforms and twenty-six geographical locations (Harrington and Srai 2012)

Knowledge Context

For the purpose of this paper, this section focuses on the research of Cummings (2003) who identified five primary contexts that may affect knowledge internationalization, i.e. relationship between the ‘source’ and the ‘recipient’, the ‘form’ of the knowledge, the recipients learning preposition, source’s knowledge-sharing capability and the broader environment of the Knowledge Transfer process. He also highlighted ‘explicitness’ and ‘embedded-ness’ as the two main knowledge aspects that may influence the outcomes of Knowledge Sharing activities. Table 2 summarizes additional contributing literature in the areas of 'Knowledge, Knowledge Context, Knowledge Sharing (KS) and Knowledge Transfer (KT) etc. reviewed in order to identify (proposed) network configuration sub-dimensions of relevant in the area of networks and knowledge transfer.

Knowledge Explicitness and Embedded-ness

A primary distinction of knowledge is its tacit-ness or explicitness when defining characteristics. Explicitness describes the degree to which knowledge is transmittable and can be articulated through formal systems. Whereas the process of acquiring tactic knowledge is very complex, time and resource intensive, it involves an intensive communication process, which will engage both parties and increase their motivation to share and acquire (Cummings 2003). Knowledge may also be can be embedded in different organisational elements. Mostly recognized are people-embedded, product/tool/technology-embedded and routine-embedded knowledge.

Table 1. Network Configuration Dimensions (adapted from Srai and Fleet, 2010)

Network Configuration Dimensions	**Engineering Networks** (Zhang et al. 2007)	**International manufacturing Production Networks** (Shi and Gregory 1998)	**International Supply Networks** (Srai and Gregory 2008)	**Service Supply and PSS Networks** (Harrington and Srai 2012, Harrington et al. 2012, Srai 2011)
Structure	Geographic dispersion; resources/ roles of engineering centres; rationales for network structure design	Plant role characteristics; geographic dispersion; network evolution	Supply network tier structure and shape; geographical dispersion; supply network mapping; integrating mechanisms	Multi-organizational network structure; service archetypes
Network Dynamics	Operational processes supporting engineering information flows	Response mechanisms	Flow of materials and information between/within key unit operations; replenishment mode, supply-demand dynamics	Service supply contracting mode; through-life perspectives
Governance and Coordination	Governance, including authority structure and performance measures	Horizontal and vertical coordination	Role of key network partners and inter-firm governance mechanisms	Service network governance modes
Support Infrastructure	Support, e.g. engineering tools and IT systems			Support systems
Relationships		Intra-firm dynamic capability building	Role of key network partners and inter-firm relationships	Partnering modes; firm and network value sets
'Product'		Product lifecycle and KT	Product modularity; SKU portfolio/profile	Service offering; outcomes/effects

*Table 2. Network Configuration sub-dimensions of global operations with contributing literature in a knowledge context (*denotes new consideration)*

Network Configuration Dimensions	**Network Configuration Sub-dimensions**	**Definition**	**Contributing literature in a Knowledge Context**
Structure	Dispersion	Shape of the network with respect to levels of integration	Argote 1999, Granovetter 1985, Tushman 1977, Uzzi 1996
	Interdependence	Self-sufficiency of subsidiaries based on relationship and flexibility	Phene at al. 2005, Zhao and Luo 2005
	*Organizational context**	Organizational structural arrangements (e.g. JVs)	Argote1999, Granovetter 1985
	*Subsidiaries location**	Physical distance between locations	Davenport and Prusak 1998, Galbraith 1990, Jacobs 1969, Wheeler 2001
	*KT Network**	Range, members and their role	Berryman 2005, Doz and Prahalad 1991, Dreyfus and Dreyfus 1986
	*Source Abilities**	Establishment in terms of their reputation, practice and motivation	Cohen and Levinthal 1990, Dixon 2000, Hamel 1991, Szulanski 1996
	*Recipient Abilities**	Establishment in terms of their motivation, intention, practice and capacity	Argyris 1990, Bandura 1986, Hamel 1991, Pfeffer and Sutton, 2000, Prusak 1999, Yeung et al. 1999
Network Dynamics	Standardization	Strategic orientation of manufacturing processes and key activities	Harrington and Baril 2012, Peteraf and Shanley 1997
	*Production Line**	Strategic orientation of manufacturing material and information flow	Harrington and Baril 2012
	*Knowledge Status**	Value of Knowledge and sharing within the organization	Dixon 1994, Hedburg 1981, Kostova 1999
Governance and Coordination	Commercial and Engineering Control	Governance systems and coordination systems concerning both Commercial and Engineering Control	Andrews 1971, Barney 1991, Harrington and Baril 2012, Yeung et al. 1999
	*Performance measures**	Variables determining success	Barney 1991, Cowan and Foray 1997, Harrington and Baril 2012, Harrington et al. 2012
	*Economic/Labor/IP Incentives**	Governance and coordination system impacts	Argote 1999, Baliga and Jaeger 1984
Support Infrastructure	Engineering Systems. *Manufacturing Capabilities**	Engineering systems supporting manufacturing efficiencies	Appleyard 1996, Harrington and Baril 2012, Von Hippel 1988
	Engineering Resources. *People Skills**	Engineering resources supporting manufacturing efficiencies	Almeida and Kogut 1999, Graham 1985, Harrington and Baril 2012, Hofstede 1980
	*KT Systems**	Mechanism in place across the whole network, usage	Davenport et al. 1996, Hansen 1999, Lev 2001, Szulanski 1996
	*Culture**	Cultural establishment between subsidiaries (country, organizational, multi-organizational)	Cullen 2002, Harrington and Baril 2012, Harrington et al. 2012, Hofstede 1997, Hofstede 2001, Schein 1985
	*Language**	Status on settlement of a common language	Almeida and Phene 2004, Enright 2000, Song et al. 2003

Recipient Context
Cummings (2003) summarized literature findings concerning the aspects affecting KT activities that refer to the 'recipient'. These aspects are related and very important for a successful Knowledge Transfer as the commitment and motivation of individuals is essential in order to receive and utilize knowledge. These are summarized as:

- *Motivation*: Motivation to acquire knowledge
- *Absorptive and learning capacity*: Resource profile to perform transfer
- *Intend*: Willingness to acquire knowledge
- *Knowledge experience*: Knowledge level prior to KT
- *Collaborative experience*: Prior interactions/ties with source
- *Retentive capacity*: Retain acquired knowledge
- *Learning culture*: Value learning as something important

Source Context
As well as for the recipient, Cummings (2003) summarized literature findings concerning the aspects affecting KT activities, which refer to the 'source':

- *Motivation*: Motivation to share knowledge and help receiver
- *Capability*: Helping, supporting, engaging, guiding receiver
- *Intend*: Willingness to share knowledge and support receiver
- *Collaborative experience*: Prior interactions/ties with receiver
- *Credibility*: Reputation and respect from the receiver
- *Learning culture*: Value KS as something important

The source interties the knowledge, which is highly valued by the recipient. This provides the source with a certain power, which it should be aware of and respect when interacting and communicating with the recipient. The source needs to be as committed and motivated as the recipient in order to make the Knowledge Transfer as effective as possible. Therefore, it is crucial for the source to understand its responsibilities and live up to recipient expectations.

Environmental Context
To summarize the environmental context, Cummings (2003) reviewed literature relating to the industrial context in which KT takes place (economic, cultural, political, institutional environments) and highlights factors, which affect the outcome of the KS activities as they:

- Create distance between parties (affects relational context)
- Make knowledge development challenging (affects knowledge context)
- Effect the intent and motivation of parties involved (affects source and recipient context)

Certain environments will support a learning culture more than others; aspects such as an entrepreneurial, learning or innovation focus, stability or tendency to change, the maturity of the knowledge and mobility of personnel may be critical.

Case Study Summary – Refinement of the 'Knowledge Configuration' Framework

The developed framework was tested and refined using an in-depth case study involving three manufacturing networks involving products A, B and C at different stages of maturity (*see figure 2*). Appendix I presents the key output from the case study i.e. a refined framework in terms of KT Phase and KT stage (presented here in terms of Product, Structure and KT Mechanism dimensions and sub-dimensions).

Case	SOP Lead Plant	SOP US Production Plant	N° of Production Lines	N° of Network Countries	Classification (Product/ US Product Line)
Product A	2001 (Initially US Lead Plant)		9 currently operating 10 due 08/2012	4 (Germany, USA, China, Japan)	Mature/ Mature
Product B	2005	07/2012	13 currently operating 1st US Line: N° 14	5 (Germany, USA, Turkey, China, Korea)	Established/ Emerging
Product C	2006	03/2013	4 currently operating 1st US Line: N° 6	4 (Germany, USA, China, Korea)	Early Established/ Emerging

Figure 2. Case Study Summary

Conclusions

This research paper provides a brief overview of the network configuration approach and associated dimensions and sub-dimensions of KS processes in order to understand the different aspects and the relationship affecting KT activities. The knowledge configuration framework (network configuration elements) may provide insights on how e.g. global production networks mature and how their configuration may evolve over time. The characterization of associated KT mechanisms provides an understanding not only on which mechanisms are applied within industry but also how such mechanisms are utilized within different network maturity levels.

In summary, the knowledge configuration framework has been applied in an industrial context and provides:

- a basis for visualizing and benchmarking activities; current state(s) may be mapped against desired future state(s)
- an approach to capture different perspectives of the key stakeholders involved, providing insights on where there is alignment and areas for knowledge configuration network development.

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Appendix I. Refined Knowledge Configuration Framework

KT Phase	Nurture	Growth	Maturity
KT Stage	Global -Formation	Global - Expansion	Global - Stabilisation
Product			
Establishment	Emerging product line	Established product line	Mature product line
Maturity	Emerging	Established	Mature
Configuration	Different product designs between the production and lead plant's product	Modular design changes between the production and lead plant's product	Identical product design between the production and lead plant's product
Structure			
Organisational Context	Defined inter-firm relationship (Joint venture)	Superficial intra-firm integration (perception of a contractor relationship)	Full intra-firm integration (perception of unity)
Interdependence	Dependent (Lead plant is responsibility owner)	Partially dependent (shared responsibilities)	Independent (Autonomy of production plant)
KT Network	Limited KT network between production plant and lead plant	Established KT network between lead plant and production plant	Fully established worldwide KT network
Lead Plant Abilities	First transfer	Transfer practiced (previous transfers of other products)	Transfer experienced (previous transfer of this product)
	Limited level of expertise	Moderate level of expertise, good reputation	High level of expertise, highly regarded
	Provide unsufficient knowlegde even when requested	Provide sufficient knowledge but only when requested	Provide sufficient knowledge independently
Production Plant Abilities	First transfer	Transfer practiced (previously received other products)	Transfer experienced (previously received this product)
	Limited knowledge level	Moderate knowledge level	Advanced knowledge level
	Unsufficient absorptive capacity	Sufficient absorptive capacity	Excessive absoptive capacity
Network Dynamics			
Governance			
Support Infrastructure			
Relationship			
KT Mechanism			
Transfer of Fundamental Knowledge	Local boundary spanner	Lead plant boundary spanner	Global boundary spanner
	Local audit	Audit in production plant and lead plant	Global audit of production plants
	Individual established/ copied standard procedures	With lead plant established standard operating process	Global established standard operating procedures
	Electronic linkages for local communication	Electronic linkages for communication w/ lead plant	Electronic linkages for global communication
Transfer of Intermediate Knowledge	Face-to-face meeting of plant experts	Meeting of production plant and lead plant experts	International forum (face-to-face meeting of global expert)
	International team (members are based at local plants)	International team (staff in product team at lead plant)	International team (global team located in lead plant)
	Individual established/ copied best practice guidelines	With lead plant established best practice guidelines	Global established best practice guidelines
	Access to benchmark reports	Benchmarking activities with lead plant	Global benchmarking of all production plants
Transfer of Advanced Knowledge	Expatriation (on-site experts from different departments)	Expatriation (lead plant experts at production plant)	Expatriation (global experts at product plent)
	Overseas training (initial/limited at lead plant)	Overseas training (wide based at lead plant)	Overseas training (at other global production locations)