K-BEST for Supply Chain Knowledge
A System for Knowledge Management in Supply Chains

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Abstract: A supply chain is as an important strategic framework because it provides a powerful infrastructure to enable the coordination of practices to meet customers' requirements. Best practices knowledge in supply chains needs contextualisation to reveal favourable and unfavourable consequences. In order to provide contextualisation, a more formalised and systematic approach to understand practices is required but no suitable existing scheme was identified to represent Supply Chain Knowledge (SCK). This research is focused on the creation of a knowledge management approach to address the structure, contextualisation and control of SCK. The approach adopted combined theoretical knowledge management concepts and supply chain practitioner valuation using three iterative research cycles. The first was focused on research into the structure of SCK. The second was to research into contextualisation of SCK. The third cycle to research into knowledge control processes and evaluated the feasibility of the proposed scheme. Findings were incorporated into a demonstrator tool, which is a web-based software application. This research confirmed the feasibility of the scheme components and suggested further benefits such as self-learning of SCK and that it is both feasible and important to practitioners that an approach, similar to the one proposed, is adopted.

1 INTRODUCTION

Supply chain management is an extremely popular research field owing to both its multi-functional and interdisciplinary focus and its potential to revitalise organisational competitiveness. In order to realise these improvements, it is necessary to integrate an organisation's knowledge and practices using appropriate mechanisms that monitor and evaluate progress.

This research focuses on how knowledge management can serve as an enabler for supply chains (Marra et al., 2010), mainly by developing a system knowledge management system, known as K-BEST.

1.1 Supply Chains

Continuous improvement is required for an organisation to remain competitive by enhancing its capabilities or enablers (Axelsson et al., 2005). 'It is becoming increasingly apparent that competitive advantage derives from the combined capabilities of the network of linked organisations that today is called supply chain' (Magretta, 1998). In other words, in order to improve organizations performance it is necessary to consider both the efficiency and the effectiveness of the supply chain.

1.1.1 Practices Integration

The integration of practices along the supply chain is a key competence. Integration of practices implies planning and controlling all operations so they can fit together as 'a unified whole' (Barki and Pinsonneault 2005). An integration of practices is required not only within an organisation but also with customers and suppliers. Hence, Laugen et al., (2005) suggest that, owing to competitive pressures, companies while developing their capabilities should maintain a higher level of integration between their strategy, action programmes, operations and performance.

Integration of all practices in a supply chain requires what Trent (2008) defines as an 'end-to-end perspective', which is to look across the whole

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supply chain processes, for instance, from planning to delivery (Stewart, 1997) products or services. In order to meet the challenges in today's business environments to improve capabilities and ensure the integration of practices, the adoption of selected or appropriate best practices, has invigorating knowledge and it has become an important business issue.

1.1.2 Best Practices

Similarly, Coyle and Bardi (2003) state that 'a series of integrated enterprises must share information and physical execution to ensure a smooth, integrated flow of goods, services, information and cash'. In a responsive supply chain, maintaining integrated practices is crucial along with best practices adoption. Laugen et al., (2005) state that 'continuous improvement of best practices in all areas of the organization will lead to superior performance capability leading to increased competitiveness'. The dissemination of best practices is considered one of the success factors for supply chains (Cooper 1993).

Best practices are regularly defined as 'generic, constant cures for everyone' (Laugen et al., 2005). According to Beaumont (2005) a 'best practice is not unique and that different practices can work well in different contexts, cultures and organisations'. Swan et al., (1999) have shown that 'the notion of best practices in the adoption of information systems is illusory and potentially disruptive'.

2 SUPPLY CHAIN KNOWLEDGE

Supply Chain Knowledge (SCK) has been defined for this investigation as context-specific and applied best practices knowledge. Indeed, Nonaka and Teece (2001) suggest that organisations should concentrate their efforts on knowledge as the one resource in production which helps resolve conflicts in coordination. Therefore, in order to integrate knowledge management for supply chains, a system system has been constructed to support the core knowledge processes in an organisation within a specific supply chain.

An effective adoption of practices not only requires best practices but an understanding an organisation's own practices. For the success of supply chains, a continual integration of practices and development of capabilities are necessary, which together imply a continuous understanding of practices. 'Management of improvements and changes reflects the increasing importance of identifying and distributing tacit and explicit knowledge such as best practices, ideas and suggestions' (Heisig and Vorbeck 2001). Continuous performance improvement implies a continual understanding of the impacts from the organisation's own practices on the whole supply chain.

Knowledge is essential to defend a competitive position in organisations. Al-Mudimigh et al. (2004) state that knowledge is the most important element to optimize the supply chain value, just after price pressures and communication. In today's economic world, knowledge is attributed as a decisive competitive factor (Heisig et al., 2001). Therefore, knowledge in the supply chain domain is strategically important and requires best practice knowledge, which has been applied and is actionable in specific contexts.

Best practices knowledge, for this research project, is referred to practices that have worked before and represent a source of knowledge. The adoption of practices and practitioners' awareness of the impact of its practices can be affected by the variety of interpretations about how and what a supply chain is. In relation to this, Grant et al., (2006) state that 'shippers and carriers do not act in concert because of differences in perceptions'.

Swan et al., (1999) highlight that open relationships between stakeholders will remain difficult if they have different perspectives of what best practices involve. Understanding of practices is fundamental for the desired integration and coordination of practices in supply chain for the creation of value. There is a need of a continuous understanding of practices, not only sharing information, for a successful adoption and integration of practices. Thus, focusing on the *understanding of practices* is needed in order to support integration and coordination, which implies that SCK (SCK) is important.

3 THE K-BEST SYSTEM

A system has been built to support and enable the four main processes: discovery, capture, share, application (Becerra et al., 1994) of knowledge management in businesses, known as K-BEST (Knowledge-Based Expert Supply chain Tool), which aims to reinforce the integration of multi-tasks in a supply chain.

3.1 Architecture

The main use of the K-BEST system is to explore, grow, diagnose (contextualize), transfer, record, analyse and visualize practices of the same company and stakeholders. The K-BEST system was created in 3 research cycles. The first was focused on research into the structure of SCK. The second was to research into contextualisation of it. The third cycle to research into knowledge control processes and evaluated the feasibility of the proposed scheme. This K-BEST tool aims to maintain core knowledge management processes.

3.2 Modules

The constructed K-BEST modules are the diagnosis, exploration, lessons learned, tracking and ranked forum, that represent the interface to the outside world aim to enable control of SCK (based on KM core processes).

1. *Diagnosis* module. It contrasts the recorded, structured and stored practices in the knowledge-based against those entered by a user.
2. *Exploration* module. It will allow the scanning of knowledge resources.
3. *Lessons learned* module. It helps understanding lessons (i.e. mistakes) against the uncertainty of adopting practices and up to date knowledge.
4. *Tracking* module. It supports the application of knowledge by allowing practitioners to define projects and track the actions to be taken derived from diagnosis.
5. *Ranked forum.* It allows practitioners to input their knowledge (i.e. enquiries, questions, experiences)

Impressions from the focus groups (presenting the system) and interviews were also useful feedback about feasibility of the modules. The knowledge content used to test the K-BEST modules included some modern best practices selected from a survey of members' interests carried out by the UK's Chartered Institute of Logistics and Transport (CILT). The modules' logic was continually tested during this research project by uploading knowledge content (best practices) in K-BEST. Also, in order to validate the constructed modules, drafts of these were continually presented to the members of the CILT's Manufacturing Forum, in Corby, UK. Such interviews included small-sized and large companies, such as Tetra Pak Ltd., Tingdene Homes, Helphire Group Plc, Leyland Trucks Ltd. and CHEP.

3.3 Functions

The construction of this system has followed four main stages and three cycles. The stages are: exploration, design, construction and validation. In three cycles investigating:

1. SCK structure
2. SCK contextualisation
3. SCK control

During the exploration stage, various focus groups with specialists on supply chain management and manufacturing were used. In order to establish a preliminary structure, the exploration stage in cycle 1 comprised the access to literature, in particular, from the perspective of knowledge representation, theoretical frameworks and systems architecture in knowledge engineering. In the exploration stage, every knowledge source was related to the researched structure.

3.3.1 Structuring SCK

In the design stage of Cycle 1 the research tasks included analysing and combining the explored theoretical frameworks (i.e. knowledge representation in knowledge engineering) and impressions from practitioners (i.e. the need to quantify practices).

The structure presents the logic carried out by the diagnosis approach programmed into a computer system that is able to generate a report of possible impacts from a given context of supply chain practices. The logic of the diagnosis presented aims to produce a diagnosis report about the potential impacts of a best practice implementation in a given context, which is important for supply chains collaboration. This knowledge base has the content to be manipulated by the modules in particular the diagnosis.

Best practices workshops and content (i.e. texts) were selected and analysed, which were combined with practitioners' perceptions and technical considerations. In Cycle 3 best practices were consolidated into matrices, which would enable subsequent incorporation in the demonstrator tool (K-BEST).

Through the administration module the capture of knowledge is possible in a more structured manner, by constructing a structure (imposing order to best practices knowledge) for SCK representation. The structure constructed was based upon theoretical concepts of knowledge engineering and supply chain practitioners' impressions, and has been shown to be

successful in codifying and therefore representing the knowledge contained within best practices knowledge. The structure imposes order to knowledge content providing key components that were identified during the research process. The structure represents a useful means to gain the benefits of knowledge production and control in the supply chain domain.

3.3.2 Contextualising SCK

The diagnosis is the principal module constructed in this research, which contextualise best practices knowledge. The diagnosis helps to reveal the possible unfavourable impacts of supply chain practices. The module quantifies SCK, such as, entities, attributes and relationships. The module is rule-based based on the structure constructed and uploading best practices knowledge content and validation by practitioners validated it. Evaluations of the diagnosis were positive and it was found to be an effective method of bridging the in understanding best practices between academic knowledge and practitioners.

New knowledge from ranked answers, lessons learned or experiences shared can be generated during the tracking of actions that have been derived from the diagnosis or while exploring knowledge resources of knowledge in the exploration module. Then, such knowledge should be coded following the structure developed previously and captured into the knowledge base.

3.3.3 Controlling SCK

With the lessons learned module is an alternative where new knowledge can be acquired, uploaded into the knowledge base. As Al-Mudimigh et al., (2004) state 'the sharing of information is considered a key factor for the success of supply chains and effective networks in a collaborative environment build-up of synchronized supply chains´. Discovery or extraction of knowledge from information is supported through K-BEST by identifying and recording new issues, lesson learned or experiences, and then contextualised, from supply chain areas that may not have been questioned before.

One of the strategic strengths from the ranked forum is to obtain new and ranked knowledge. Consequently, knowledge can be expanded and kept relevant from highly ranked answers in the forum can be uploaded into the knowledge base. Including the structure and ranking the questions/answers posted the ranked forum could reuse information reused.

In the tracking module, practitioners are able to define projects recording/tracking its progress. The tracking module proved to be a useful tool for coordinating work by tracking the progress of actions and allowing the generation of new knowledge. The tracking module offers controls to allocate resources and track actions for a specific and/or critical condition to be modified, which shortens the conversion from information into action.

The exploration module allows searching knowledge resources (explicit knowledge) through the exploration module suggests the discovery of knowledge can be enabled. Practitioners seen the exploration module as a practical mean to search and find key knowledge.

The Internet accelerates the integration of knowledge and improves communication, incrementing collaborative dialogue because it can be accessed from anywhere anytime and enables stakeholders to update and moderate best practices knowledge from any computer with a web browser and Internet access. Internet technologies represent a useful and accessible tool for the pursued objective of controlling knowledge.

The Internet accelerates the integration of knowledge and improves communication, incrementing collaborative dialogue because can be accessed by stakeholders from anywhere anytime and enables stakeholders to update and moderate best practices knowledge from any computer with a web browser and Internet access. Internet technologies represent a useful and accessible tool for the pursued objective of controlling knowledge. In the construction stage of Cycle 3, a web-based infrastructure was selected because it offered advantages compared to desktop technologies.

This system was created using a technology named Dotnetnuke® (DNN) that is an open source software by Dotnetnuke Corporation for enterprise web applications. This source is freely available and it proved to be a relevant technology because it allows controlling the knowledge content, layout, membership and security of a website. DNN works in conjunction with a database system.

Technologies considered in the exploration stage in cycle 3 included the Internet, which offers numerous advantages for knowledge sharing. Tayyab Maqsood (2007) state that 'paper-based systems are rapidly replaced by powerful, web-centred information systems'. Therefore, the web development technology stack selected was

considered appropriate for the constructing of the demonstrator tool (K-BEST) supporting this investigation.

However, other knowledge conversions along the supply chain should be promoted in order to enhance knowledge production; for example, face-to-face training and meetings. Also, leaders should create a knowledge culture that promotes a working environment of trust and respect of individuals' knowledge. Besides, the implementation of a knowledge system, which is a key element in a knowledge management initiative, should be easy to use at the first introduction, and contain relevant knowledge content, which is related to its integrity and quality. Also, training and manuals to all participating members is crucial to be motivated and understand the importance of knowledge management and successfully implement it.

Supply chains need to put more emphasis on knowledge mobilisation, mapping expertise resources, knowledge production and control. Further work needs to be carried out, for a better understanding of the relevant issues affecting the development and operation of this kind of systems, which incorporate a structure, contextualisation and control of knowledge in supply chains, before it is delivered for operation. For example, issues about the sustainability of knowledge were recognised, on which it would be interesting to carry out further investigation. For example, it is important to consider and maintain knowledge; this is its relevance, confidentiality (security), validity (credibility) and possible deterioration. In addition, recommendations for a possible future development operation were recognised in this investigation, which includes how to motivate knowledge sharing, sustainability, systems comparison, user acceptance, education and cultural differences. In regards to technology, an identified potential design is to encode knowledge using XML technologies, so knowledge can be structured at the same time it is written, by using a text editor as suggested by Mikroyannidis (2006).

4 CONCLUSIONS

The K-BEST system proposed offers a simple but significant opportunity to control knowledge in a more systematically way along supply chains; mainly by focusing on promoting the four knowledge management processes in a specific supply chain context. Supply chains' partners can be communicated through this system. Difficulties concerning knowledge control in supply chains were recognized in the literature review.

There is a vast amount of information growing in unstructured forms (e.g. e-mails, web, documents and manuals), which presents difficulties for converting information into knowledge. 'The modern knowledge worker simply does not have the time to absorb such an impressive amount of information' (Mikroyannidis et al., 2006). Nonaka and Teece (2001) highlighted 'a rapid evolution of organizational forms, which has generally proceeded faster than researchers capacity either to track developments or to theorize about them'.

In synchronization of supply chains is characterized by integration of practices (Lambert and Cooper, 2000). 'A supply chain must be connected, in communication and collaboration to improve efficiency in its practices' (Desouza and Chattaraj, 2003). Thus successful supply chains imply an efficient control (e.g. capture, store, sharing and application) of knowledge. In order to avoid the loss of knowledge and to gain value from knowledge creation, a systematically and continually control of knowledge is important.

Knowledge management helps in this endeavour to link all knowledge contained in actors of an organisations, in this case in supply chains' configurations among their partners. Thus, supply chains can coordinate and integrate partner's practices by implementing knowledge management in its operations.

This investigation has been focused on promoting an organic growth (structuring, contextualise and control) of SCK through the K-BEST main elements:

1. Administration module (knowledge acquisition)
2. Diagnosis
3. Lessons learned
4. Ranked forum
5. Tracking module (project management)
6. Exploration module

Coordination of practices is of strategic importance to supply chains for what knowledge is a critical resource. Hopgood (1993a) recognized that 'modern supply chain models seem to call for an inter-company collaboration, which stresses trust, cooperation and mutual dependence'. Although, Bessant (2003) has recognized that 'suppliers have not taken a consistent approach toward disseminating tools and techniques or lesson learned to their own suppliers'. Knowledge connectivity suggests a continual sharing of knowledge also seen in foresight frameworks. Thus, a more systematic,

similar to the proposed K-BEST system, creation, sharing and control of knowledge should be beneficial for supply chains.

Feasibility aspects of a structure, contextualisation and control of knowledge were explored in this investigation. Practitioners and experts in the supply chain domain are now in a position to structure, contextualise and control SCK in a more systematic way.

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