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Towards Effective Knowledge Management: A Requirements Analysis of European Manufacturing SMEs

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Abstract: Knowledge is a key resource that must be managed within European organisations in general and because of their importance to the economy Manufacturing SMEs in particular. The key challenges that face such organisations are; ensuring that they have the appropriate knowledge to support their operations and ensuring that they optimise these knowledge resources available to them. In recent years, researchers, consultants and industrialists have developed approaches in an attempt to address these requirements. However, research indicates that organisations are still failing to convert individual skills and competencies into tangible products and services. In other words, companies are not reaping the full benefits of knowledge management projects. This paper explores the main problems with sharing knowledge within and between teams in Manufacturing SMEs. Findings from a qualitative study suggest that the key problems are person centric and consequently managers should focus their efforts on improving critical areas such as communication, motivation and trust as well as people oriented systems, methods and tools.

1. Introduction

Manufacturing remains a key generator of wealth and is still at the heart of economic growth in industrialised economies. The number of manufacturing enterprises (classified as NACE D¹) is around 2.5 million in Europe which represents approximately 22% of the EU GNP. Manufacturing also has a very high multiplier effect. It stimulates much economic activity in its upstream and downstream functions and leads to living standards unmatched by any other sector. However, in recent years profound changes have taken place in manufacturing in Europe. The industry is shifting from “*a resource based and centralized paradigm to a knowledge-intensive, innovation-based, adaptive, digital and networked one*” (see ManuFUTURE, IMS etc). Consequently, effective knowledge generation and transfer are replacing the traditional manual skills as the organisational basis for adding value [1]. Competitive advantage in European manufacturing now rests on the ability to innovate.

¹ Manufacturing sectors are classified according to sub-sectors, ranging from clothing and textiles to machinery, from wood-related products to leather and footwear, from electronics to aeronautics, from instruments and control systems to motor vehicles.

Innovation is the process of making changes to something established by introducing something new [2]. It is a function of idea generation, development and exploitation [3]. It is not a linear process but arises from circles of exchange and is fostered by information and knowledge. A company's success now depends on making the most of its collective knowledge and that means supporting the people and the processes required to accumulate, structure, and transfer knowledge effectively. This advantage can be realized in outputs such as opening new markets, more innovative designs, faster development times, reduced cost, creation of ancillary intellectual property and even a more robust network. Therefore, given the prominence of manufacturing in Europe, the ability to manage knowledge effectively in order to innovate is essential for prosperity.

2. Importance of Knowledge Sharing

Drucker [2] notes that *"knowledge is the only meaningful resource today"* and adds that, *"the traditional factors of production have become secondary, they can be obtained easily, provided there is knowledge"*. In this view, the generation and implementation of new knowledge is fast becoming the only remaining sustainable source of competitive advantage for first world organisations. A company's success depends on making the most of its collective knowledge and that means supporting the people and the processes required to accumulate, structure, and transfer knowledge effectively. Having immediate access to the latest information including information from external sources can provide a critical competitive edge. According to Knock et al [4], *"the single most important factor that ultimately defines the competitiveness of an organisation is its ability to acquire, evaluate, store, use and discard knowledge and information"*. Therefore, organisations must manage knowledge effectively in order to gain competitive advantage. This advantage can be realized in outputs such as entering new markets, more innovative designs, faster development times, reduced cost and the creation of ancillary intellectual property. Thus knowledge is a key resource that must be managed if innovative efforts are to succeed and businesses are to remain competitive in global markets.

Thus, it is critical to their future success that organisations focus attention on how knowledge may be leveraged within and between teams. However this process is intricate and complex and is difficult to manage [5, 6]. Knowledge must be explicated and separated from the knowledge workers, so that the critical knowledge is trapped and not forgotten [7, 8]. To this end organisations must seek to transform employees' tacit knowledge into a collective asset and improve the processes by which knowledge is shared and exploited [9, 10]. Leaders must facilitate a culture of collaboration and knowledge sharing [11, 12]. They must also address potential conflicts that may exist between the desire to protect the organisations intellectual competitive advantage from their competitors and the need to share this knowledge freely within the organisation.

3. Research Problem

Over the last decade, researchers, consultants and industrialists have developed a plethora of tools, methods and solutions in an attempt to address perceived knowledge management problems. Most of these approaches have been technology oriented. In other words, the implementation of information technology systems is seen as the solution to enterprise knowledge management problems. Despite this, research indicates that organisations are still failing to convert individual skills and competencies into tangible products and services. It seems that the concept of knowledge management is still not very well understood or managed in practice. Consequently, new knowledge initiatives are not exploited to their full potential. In other words, companies are not reaping the full benefits of knowledge management project investments.

The MITHRAS project was established in an attempt to address this deficit. The goal of this project is to develop a better understanding of the actual dynamics of knowledge sharing within European Manufacturing SMEs and to develop specific support structures (e.g. training programmes, methodologies, systems and enabling tools) to facilitate effective knowledge exchange and exploitation. The project is funded by the European Commission under the Leonardo Da Vinci initiative. The project team has a strong industrial focus and comprises representatives from technology transfer organisations, business incubation centres, federations of small and medium sized enterprise, chambers of commerce, as well as owner managers of European SMEs representing 8 European regions in Spain, Italy, Netherlands, Denmark, Czech Republic, Poland, Ireland and UK. The research focuses on identifying and prioritising the critical barriers or impediments to knowledge sharing both within and across organisational boundaries. Through understanding where the impediments to effective knowledge sharing exist in a real life setting, practitioners can focus their efforts on avoiding the pitfalls. They are also in a better position to design and develop specific structures and systems to overcome these problems.

4. Research Strategy

In order to identify where the barriers that currently exist with respect to knowledge sharing in manufacturing organisations an initial study was undertaken by innovate using focused workshop techniques. The aim of the workshop was to identify and prioritise the key problems to knowledge sharing that these organisations face on a daily basis. A socio-technical systems approach was adopted. This approach encourages participants to focus on both hard issues (such as information technology infrastructure and enabling technologies) and soft issues (such as culture, beliefs and management of people).

The primary research mechanism used to organise and correlate the workshop output was nominal group techniques. Nominal group techniques provide a reliable structure for a group discussion (see 13, 14, 15, 16, 17]. This method is particularly useful when (a) the issues that surrounding the problem appear large and complex, (b) the information relevant to the problem appears in unorganised thoughts and ideas and finally (c) where group consensus is required (or desired). This approach is an effective use of both time and effort and also facilitates the cross fertilisation of ideas. During the workshop each team member, in turn, identified key barriers to knowledge sharing and transfer across organisations in a network. Participants were then invited to reflect and record their suggestions on paper. Team members then discussed the merits of each item. Further discussions for the purpose of clarification also took place. Each item was then reviewed and duplications were eliminated by the facilitator who also ensured that all suggestions were clearly understood by all participants. Individual barriers were then grouped into related categories. The grouping helped to develop a common understanding of the problem. A voting procedure was used to rank all categories in order of priority. Here each participant was asked to select the top three items that (s)he considered to be the most important and rank them in order of priority. To do this they were each given three votes; one had a value of three points, the second had a value of two points and the third had a value of one point. They then assigned scores of three, two and one in order of importance to the categories they felt were the key barriers to knowledge sharing. Finally, the results were compiled and each category was assigned an aggregate score on the basis of the individual scores.

5. Key Findings and Discussion

While it is apparent that there are many factors that facilitate and thus impede effective knowledge sharing within manufacturing SMEs some issues came to the fore by mutual consensus (see Table 1). These include (in order of importance) (a) cross functional

communication problems, (b) language barriers (c) human barriers such as conflict and trust (d) problems with goals and plans (e) insufficient or inadequate training and finally (f) insufficient funding or high costs. These categories are not exclusive or exhaustive but rather blended and interlinked. They are explained in more detail in the table below.

Barrier	Description	Score
Cross functional Communication	Operators can sometimes be left out of problem solving activities, when they are more often than not, the key to solving the issue Internal departments do not communicate together e.g. quality with manufacturing and purchasing Sometimes production takes precedence over the quality of a product. Quality issues are not highlighted and are left unresolved which may damage customer confidence In most organisation there does not appear to be effective communication systems in place There is a lack of communication, co-ordination, co-operation between departments Different departments have different levels of priorities e.g. high priority for laboratory work in Quality Dept. may lower priority in IT	38 points
Language Barrier	Format of information no consistent i.e. different date for Europe & USA People do not understand language used e.g. technical or scientific There is a language and culture barrier between workers The use of abbreviation makes it difficult for different departments to understand what is being discussed	16 points
Human Barrier	Too much information can make defining priorities difficult Unnecessary repetition of information on paperwork There is bad morale, employees believe they are not getting paid enough in comparison to management salaries and bonuses. Too much red tape in big organisation Nobody wants to be responsibility There are many personal disagreements and conflict between key individuals.	15 points
Planning	There is a failure to plan correctly and implement plans correctly Top management do not make the transfer of knowledge a priority so it is not filtered through the organisation. Example: Production cell 1 and Production cell 2 are making duplicate orders for the same customer Inability to access files which are needed every day due to lack of access codes which slows down work The computer system is too slow and prevents access to necessary files needed for every day use	14 points
Training	The training in the organisation is being organised by a person who does not work at the organisation and therefore does not know enough about the processes People are not trained to see the big picture. They do not know the knock on effects their job has An employee with knowledge of new equipment will not share this knowledge with other colleagues People do not use IT systems correctly e.g. entering data Lack of knowledge, skills and training	14 points
Costs	Resources not available for communication and implementing change Profit and sales are the only concern Cost constraints	6 points

Table 1: Key Findings

These findings suggest that many of knowledge sharing problems relate to “soft” issues rather than “hard” issues like an organisation’s technical infrastructure. It seems that the key problems with knowledge sharing lie with the individual and organising the individual in an organisational setting. Consequently, attention must be paid to redesigning and restructuring internal processes to support this new collaborative business environment. Astute changes in the work environment can make substantial improvements in knowledge sharing. Therefore, if organisations wish to either encourage or optimise knowledge sharing they must explore the range of identifying factors. However, the task of managing a climate conducive to sharing is not trivial. Management can influence what the company wants to do and what it can do. By focusing on specific new strategies and measures, the employees can change their motivation and goals, and by generating better resources the company can improve its sharing potential. Successful initiatives require support and backing from key leaders in order to overcome the natural resistance of organisations to change. Cross functional collaboration may demand even greater leadership and support than previous internally focused initiatives. Therefore leaders must focus on the specific, tangible business benefits of these efforts, and participants across collaborating organisations must understand and support those benefits. Such foundation building will be critical in overcoming the barriers to inert firm collaboration.

6. Knowledge Sharing Audit

Based on the findings from this study a knowledge sharing audit was developed. This audit can be completed on a stand alone basis or it can act as a guide for structured interviews. It contains an explicit set of carefully chosen and justified statements. The statements have been formulated from best practice concepts that have been compiled from workshops and justified by literature searches. Here respondents are requested to circle the extent to which they agree or disagree with the statements. The audit also comprises a set of probing open ended questions where respondents are given the opportunity to tell their own story. The aim of this knowledge sharing audit is to ascertain (a) the extent and nature of knowledge sharing that takes place within the organisation; (b) the barriers experienced; and finally (c) whether specific structures, systems and culture are in place to enable effective knowledge sharing. See table 2 for a complete list of survey questions.

The knowledge sharing audit should help to identify the relative strengths (to be exploited) and weakness (to be improved) regarding knowledge sharing in the organization. Furthermore, bottlenecks and potential problems can to be brought to the fore. This will enable managers and decision makers to get an overview of their company’s strengths and weaknesses with regard to knowledge sharing and transfer highlighting those areas that require attention. Other key benefits of a knowledge audit include:

- It helps the organisation clearly identify what knowledge is needed to support overall organisational goals and individual and team activities.
- It gives tangible evidence of the extent to which knowledge is being effectively managed and indicates where improvements are needed.
- It provides an evidence-based account of the knowledge that exists in an organisation, and how that knowledge moves around in, and is used by, that organisation.
- It provides an analysis of knowledge and communication flows and networks, revealing both examples of good practice and blockages and barriers to good practice.

- It facilitates the development of effective knowledge management programmes and initiatives that are directly relevant to the organisation's specific knowledge needs and current situation.

The audit was piloted in two organisations to ensure that (a) it was easy to understand; (b) covered all the correct relevant material; and finally (c) applicable to the specific target audience. On receipt of this feedback the audit was amended and altered according to the comments received from the organisations. The audit was also tested and validated by senior researchers and academics table 3 provides a list of the criteria for assessment.

Table 2: Knowledge Sharing Audit

Criteria		Description					
Effective	Does the methodology work? Does it solve the problems, or produce the products, for which it is intended?						
Please circle the extent to which you agree or disagree with the following statements							
1 represents Strongly Disagree and 5 represents Strongly Agree							
Efficient	Is there any redundant effort?						
1 (a)	People share information and knowledge throughout our organisation		1	2	3	4	5
1 (b)	Universally applicable. Individuals collaborate with others to solve problems. Particular organization or management style.	Does the methodology work in any organization size or culture, or does it assume a particular organization or management style.	1	2	3	4	5
1 (c)	Alliances are formed with other organisations for mutual benefit	If there are any restrictions on the range of situations that the methodology can handle, are these restrictions well understood?	1	2	3	4	5
2 (a)	Is it easy to share knowledge throughout the company		1	2	3	4	5
2 (b)	Reliable. Communication among team members is efficient and effective	What risks are involved in using the methodology?	1	2	3	4	5
2 (c)	Accurate. Communication between project teams is efficient and effective	How are the risks minimized?	1	2	3	4	5
3 (a)	Employees feel that knowledge sharing is worthwhile for them	Is the methodology tolerant of minor errors and alterations?	1	2	3	4	5
3 (b)	Individuals feel that the methodology is personally beneficial	Does the methodology allow for human imperfection?	1	2	3	4	5
3 (c)	Robust. Individuals understand the benefits of knowledge sharing	Does the methodology allow for personal self-paced knowledge sharing, to maintain its relevance within the organization?	1	2	3	4	5
4 (a)	Flexible. Individuals trust others with technological opportunities?	Is the methodology capable of incremental change, to cope with new ideas or technological opportunities?	1	2	3	4	5
4 (b)	People are comfortable asking for information from others in our organisation	Is the methodology capable of incorporating improvements learned from experience?	1	2	3	4	5
4 (c)	There is a high level of trust in the organisation		1	2	3	4	5
5 (a)	Simple & easy to learn and use	Is the methodology targeted at a well-defined population?	1	2	3	4	5
5 (b)	Our organisation values knowledge sharing	Is the methodology based on a coherent set of concepts and techniques?	1	2	3	4	5
5 (c)	Acceptable to participants	Are all the concepts and techniques strictly necessary?	1	2	3	4	5
5 (c)	Knowledge sharing and reuse is rewarded	Is it easy to motivate people to adhere to the methodology?	1	2	3	4	5
6 (a)	The organisation's structure promotes knowledge generation and learning	To what extent are relevant tools, skills and services currently available to support this methodology?	1	2	3	4	5
6 (b)	Well supported		1	2	3	4	5
6 (c)	There a high level of co-operation across the organisation's units		1	2	3	4	5
6 (c)	Communities of practice are used to optimise core competencies		1	2	3	4	5
7 (a)	There are formal systems in place to share knowledge in our organisation		1	2	3	4	5
7 (b)	There are specific people in our organisation who act as knowledge sharing brokers		1	2	3	4	5
7 (c)	Employees receive adequate training on knowledge sharing		1	2	3	4	5
8	How do you normally share information and knowledge?						
9	Where are the key barriers to sharing knowledge?						
10	Describe a problem or talk through a specific case.						
11	What prevents individuals from sharing knowledge with others?						
12	What kind of training would you like to receive in this area?						
13	How would you like it delivered?						
14	Any other comments or observations?						

Table 3: Validation Criteria

7. Conclusion

The business environment for European manufacturing SMEs is changing at an accelerated pace. These organisations are now highly dependant on knowledge sharing in order to survive in dynamic markets. The MITHRAS project aims to improve the capacity of Manufacturing SMEs to share knowledge. To do this the team aims to identify and prioritise the key barriers that currently exist to knowledge sharing. In order to acquire an initial understanding of these problems a qualitative study was conducted. The findings from this study revealed that the factors that impede successful knowledge sharing in manufacturing SMEs include; (a) cross functional communication; (b) language barrier; (c) human barrier; (d) planning; (e) training and (f) costs. These barriers together with a review of the relevant literature helped to develop a knowledge sharing audit. The audit was tested with a number of personnel to ensure that it was accurate, relevant and easy to follow. It is hoped that all the partners in the MITHRAS project will use this audit in their regions to assess the nature of knowledge sharing and the barriers that impede it. From this analysis we hope to gain an accurate representation of the training needs and enabling tools required in European Manufacturing SMEs. Based on this information specific support structures (e.g. training programmes, methodologies, systems and enabling tools) will be developed and validated in industry. This will equip SME managers with the skills, structures and systems to share knowledge within and between teams and thus increase competitiveness, sustained growth and profits.

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