MEETINGS – THE INNOVATIVE GLUE BETWEEN THE ORGANISATION SYSTEM AND INFORMATION SYSTEM

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Abstract: The research presented aims for enhanced utilization of human skills, collaboration, and information sharing. This paper concerns the production context, and the needs and challenges of people striving for high-quality, innovative, and efficient work. The paper presents a model of the information system (IS) and organisations system (OS) and their integration. Main conclusions are that these systems overlap, and create an innovative working arena for the different working processes. People with knowledge gather into meetings held for different purposes supported by technical systems. These meetings provide a core element for efficient and innovative collaboration, requiring parallel development of IS and OS.

Keywords: Human-centred Production, Knowledge-sharing, Learning Organisation, Information Systems, Meeting

1. INTRODUCTION

Essential for good performance of every organisation are the people that while working to meet the targets, exploit their competencies, collaborate, and communicate, and continuously both generate and use information. Many information systems are intended to support design and analyses, coordinate planning and improve management control. Also essential are the information systems that store, communicate, work, and present the information. Information is a vital resource in development activities of any business (Gupta, 2011). But, these systems also play a very important role in the knowledge sharing of an organisation – when people are aware of possibilities to share knowledge and form communities, information systems could be vital (Krogh, 2002). In order to properly bridge over from the information system to the organisation system, the transformation process from data, via information, to knowledge becomes vital to understand (Rowley, 2007). Furthermore, there is need for a broader vision among information systems professionals about the roles of the communal resources to support knowledge sharing. This would help to focus future information systems research on the social fabric of organisations that constrain and enable knowledge sharing (Krogh, 2002).

Organisation and competence of individuals in team organisations are regarded as important issues in order to enhance involvement and cross-functional collaboration (Eklund, 2000). Results from studies of success factors for future industrial work (Harlin *et al*., 2010) show that operator work is characterized by multi-dimensional work, with many tasks, need for high and broad competence, opportunities for improvement, and development work, thus with potential for offering development and learning opportunities (Ellström, 1992; Marsick, 1990). The availability of efficient collaboration and communication arenas is a requirement for well-functioning organisations. Robson and Hansson (2007) presented a study that showed that deepening both social relationships and job content enhances the intention to stay at the company. Encouraging and sustaining social interactions through meetings are likely to strengthen this. Factors influencing the decision to share knowledge in face-to-face versus technology-aided interactions are likely different, e.g., employees who are high in extraversion may be more likely to share knowledge in a face-to-face compared to an electronic context because knowledge exchange is more relationship-based (Wang & Noe, 2010). Consequently, to address these

challenges, organisations and information systems are important, and it is important to understand how and why humans interact in work places. Using this knowledge through the process of designing and developing information and communication technologies will be crucial to support increased creativity, knowledge sharing and learning in the organisation.

This paper is part of the project MEET which is aimed at enhanced utilization of human skills, increasing the knowledge sharing within the organisation, collaboration, information sharing, and at having more effective and innovative meetings. The idea is that there is a great potential of improvement in the way the organisation system (OS) and information system (IS) are joined together. The project will propose meeting solutions mainly addressing four major challenges: (i) complexity of production, (ii) limitations of present Information and Communication Technology (ICT) solutions, (iii) competence requirements in new organisations, and (iv) forthcoming consequences of the demographics in Sweden and Europe. This paper concerns a brief analysis the context of industrial production and the needs and challenges of people striving for high-quality, innovative, and efficient work. The paper describes and defines the OS and IS systems, the structure and important components, visualize co-dependence, and define gaps and opportunities of developing an innovative glue between these systems. In Sections 2 and 3, a brief analysis and review are provided for knowledge sharing in general and the meeting situations specifically. Sections 4 and 5 present analyses and review of organisation and information systems, making possible and supporting knowledge sharing and meetings. Finally, in Section 6, a framework model for OS, IS, and meetings is presented.

2. KNOWLEDGE SHARING

Work in flexible and complex production systems is increasingly characterized by skills, competences and knowledge. One challenge is to spread individual know-how and facilitate a learning organisation (Horwitz *et al* 2003). Nonaka (1994) suggests a framework describing knowledge transfer among employees in an organisation. It involves a four steps combining tacit and explicit knowledge with individuals and teams: (i) Tacit knowledge is spread through socialization, (ii) different explicit knowledge is combined, (iii) one individuals tacit knowledge is made explicit and accessible to others, and (iv) explicit knowledge is learned or internalized into an employee's own tacit knowledge. Another concern regards how to motivate knowledge workers and push them to actively contribute to knowledge sharing. According to Ehin (2008), the more an institution supports principles of self-organisation openly, the more social capital and tacit knowledge it will generate – and in turn lead to increased innovation, commitment and entrepreneurship. A series of key factors are identified for knowledge transfer (ibid): organisational structures, organisational culture, relationship between top management and knowledge workers, the control level, IT systems that provide communication and storage, and willingness of every worker to communicate and work in teams. Thus, every organisational system carry carries competence along their work flow and offer an environment for learning.

Different perspectives on learning may be compared to some main strategies for knowledge management; the personalization strategy, and the codification strategy (Hansen *et al*., 1999). In the personalization strategy, knowledge is closely tied to the persons who developed it and is shared mainly through person-to-person interactions. Computers are then used to help people communicate knowledge, not to store it. Networks are developed for linking people so that tacit knowledge can be shared. With the aim to utilize knowledge across the organisation, communication between individuals and teamwork is emphasized where technology should be used as an important aid to make rules, procedures and processes explicit (Kakabadse *et al*., 2003). Information and Communication Technologies (ICT) are considered suitable for codification, storing and re-use of knowledge. In the codification strategy, within knowledge management, knowledge is codified and stored in databases, where it can be accessed and used easily by anyone in the company. Electronic document systems are developed that codify, store, disseminate, and allow re-use of knowledge. In summary, learning and knowledge sharing for increased production competitiveness requires combined considerations of human/social, organisational and technical aspects and further development of meeting structures and ICT-support.

3. MEETING SITUATION

Generally, a meeting is an assembly of people for a particular purpose, which can take many forms. Meetings can be formal and informal, and are characterized by location, ground rules and norms for information exchange (Purser, *et al* 1992). Exchange of information directly between people is the basic purpose, but this communication can be made or supported by different types of information systems, e.g. for presentation, calculation, simulation, or communication. This makes it possible to arrange meetings between people not co-located, and also to transmit information between people over time. These time and space dimensions combined create for different meeting types: same time/same place, same time/different place, different time/same place,

and different time/different place (Baecker, R.M., 1993). Furthermore, meetings can have many different purposes, e.g. developing ideas, planning, problem solving, decision making, develop understanding, or informing. In methods within Lean concepts, the capacities of the human resources are essential to develop and utilize. For Lean production, team meetings are used for e.g. daily planning and continuous improvement (Liker, 2004). In Lean product development (Morgan and Liker, 2006) the concept of Oobeya (big room in japanese) is established for use for many purposes: war room, working room, meeting room, discovery room, sharing room, workflow room, or visual management room (Aasland and Blankenburg, 2012). Other aspects relevant for meetings are the number of people, if the communication is symmetric (dialogue) or assymetric, or if it is a meeting in a series of meetings (e.g. weekly, daily). Finally, meetings can be structured, semi-structured or unstructured (Stebbins and Shani, 1995).

Meetings can thus can be characterized differently, e.g. different time and space, purposes and structure. To be able to support meeting situations, it is important to know what cognitive processes are active and how they should be supported in meetings. To support interaction and optimize performance it is important to first understand the operator's cognitive processes (Rasmussen, 1983) in a situation and then incorporate needs, resources (people e.g. roles and organisation, information system and the meeting room), and limitations in order to reach a better productivity, safety or skill/competence development. A way to support this complexity is to simplify and thereby reduce the complexity (Wiendahl and Scholtissek, 1994). If the information handling is simplified, then personnel will be able understand and receive information so that appropriate actions can take place (Bäckstrand, *et al.*, 2010). The reason for this is that how a person subjectively understands a situation, is governed by his/her actions not objective aspects of the situation is, (Hollnagel, 1997). There is need to develop, for collaborating teams of "knowledge workers", smart ICT infrastructures and tools for virtual meetings, to complement physical meeting spaces. Thereby human skill could be better utilized and work could also be stimulating, sustainable and attractive.

To make meetings more smart and effective in production it is important to support operation, continuous improvement and radical changes of advanced production systems. An example of this is the brief morning meeting often used in industry, where personnel in the production shift participate standing on the floor next to the production cell using white-boards to write, draw and comment. Quick and efficient human-to-human communication is essential. Problems, events, and experiences are communicated verbally and visually. Frequent use of acronyms, abbreviations, and keywords usually makes the communication incomprehensible to persons outside the group (comp. military briefings). Events are commented, credit and feedback are given, conclusions are drawn, to do lists are made, and plans are made for operators and staff. Without these meetings, new shift of workers are likely to repeat errors, decrease situation awareness and decision ability, increase insecurity, and experience risk of accidents.

4. ORGANISATION SYSTEM (OS)

To suffice in the current dynamic era with increased cross-organizational and cross-functional collaboration, production systems require development of organizational structures supporting knowledge work and learning processes. Tacit knowledge such as individual's know-how, skills and intuition cannot be codified or articulated because it is embedded in an individual's brain or experiences, where explicit knowledge is more easily expressed and possible to communicate in the form of written documents, such as reports, manuals and drawings (Nonaka, 1994). A challenge is to create appropriate conditions in both the organization system and in the information system (as described in chapter 5) enhancing knowledge sharing among employees, and promote organizational learning. Crossan, *et al.* (1999) provides a structure for organizational learning including learning/renewal in organizations in four processes (Intuiting, Interpreting, Integrating, and Institutionalization) in three levels (Individual, Group, and Organization), see Table 1.

Table 1. Four processes for Learning in organizations, through three levels (Crossan, Lane, & White, 1999)

LEVEL	PROCESS	INPUT / OUTCOME
Individual	Intuiting	Experiences, Images, Metaphors
	Interpreting	Language, Cognitive map, Conversation / dialogue
Group	Integrating	Shared understanding, Mutual adjustment, Interactive systems
Organization	Institutionalizing	Routines, Diagnostic systems, Rules and procedures

At the individual level, the learning process is intuitive where individuals earn experiences, develop metaphors and images which may be shared and interpreted by other individuals. When action takes place in relations between individuals and with groups, the interpreting process may blend into the integrating process. Here, there

are opportunities for development of shared understanding and coordinated actions, and eventually forming formal procedures, routines etc. Further, the process of institutionalization occurs where these formalized areas are embedded in the organization, existing independently of specific individuals (ibid).

Work in complex production systems is increasingly dependent of people – human resources – with high skills and competences, who require appropriate conditions and decision support for a variety of tasks. Knowledge workers are by definition persons that cherish autonomy and need space (Massaro, 2011), they are usually willing to share their knowledge in benefit of the organisation unless mismanaged and demotivated. According to Ehin (2008) the more an institution supports principles of selforganization openly, the more social capital and tacit knowledge it will generate – and in turn lead to increased innovation, commitment and entrepreneurship. A survey based on of 2010 employees in multiple industries, show that employees are increasingly willing to share their knowledge if they experience a knowledge exchange relationship, feel enjoyment of the process of performning the activity itself, as well as if their social interactions are close and friendly (Yong, *et al.* 2013).

Individuals´ work tasks are often multiple and contributes to different work processes and in different contexts, where knowledge dwells in the communities of practice (Lave and Wenger, 1991) and dialogues for reflection are crucial for learning organizations (Döös, 2003). Schulz and Klugemann (2005) noted that knowledge flows in organizations are important because they feed into sub-unit learning processes. Thus, to firms there are many reasons to encourage the exchange of tacit knowledge in networks (Augier and Vendelø, 1999). However, appropriate organizational structures and conditions need to be set for learning arenas, where meeting platforms, organized discussion-forums are needed to support a knowledge sharing flow-dialogue between individuals/groups/functions etc (Kjellberg, *et al* 2014). Thus, individuals given appropriate management, organizational and technical support, there is a potential of creating an active learning culture with committed and engaged employees.

5. INFORMATION SYSTEM (IS)

DeLone and McLean (1992) presented a model for Information System (IS) success which have become the most used and most cited model. The model defines six distinct dimensions of IS success: system quality, information quality, use, user satisfaction, individual impact, organisational impact and net benefits (DeLone and McLean, 2003; W. H. Delone and McLean, 1992). Since the model was published, a lot has happened within IS development – the IS research field has during the past decade documented a significant transformation from applications to infrastructures (Bygstad, 2010). Furthermore, few studies have examined the relationship between information quality and use at both the individual and organisational levels (Petter, *et al*., 2008). One reason for this is that information quality tends to be measured as a component of user satisfaction measures, rather than being evaluated as a separate construct.

Information Architecture is the highest level in the OS-M-IS model, illustrated in Figure 1. This can be defined as the process of designing, implementing and evaluating information spaces that are humanly and socially acceptable to their intended stakeholders (Dillon, 2002). In 1987, Brancheau and Wetherbe (1987) stated that organisations that prosper in the future will be those that integrate appropriate new IS technologies into their entire operation, which this is still true 27 years later.

Technology can be defined in three different ways; beliefs, artefacts, and evaluation routines (Garud, 1994). All the three areas of technology has evolved into more intelligent ways of both presenting and communicating information. One example is groupware which reflects a change in emphasis from using the computer to solve problems to using the computer to facilitate human interaction (Ellis, *et al.* , 1991). Groupware can be defined as: Computer-based systems that support groups of people engaged in a common task (or goal) and that provide an interface to a shared environment. Presentation of information can be broken down into two parts; carrier (how) and content (what) of information. Carrier concerns the medium of which the information is transferred e.g. paper, whiteboards, screens, or PDAs, while the content concerns the mode of information e.g. text, pictures, sound or movies (Fässberg, *et al.*, 2012). McLuhan provided a well-known aphorism "the medium is the message" (McLuhan, 1964). When interpreting this, we can state that a medium shapes content in ways that are advantageous to the biases of that medium, as all media have biases. These biases influence not only the content but also the experience of the user (Koltay, 2011). According to Kehoe et al. (Kehoe, *et al.* , 1992) efficient information flow rely on six measurable criteria. The first three are connected to the logic level in the OS-M-IS model, seen in Figure 1, while the others belong to the information level, and plays an important role for infromation quality (DeLone and McLean, 2003).

1. *Relevance:* Users benefit in their decision or action because of it. If a human searches for information, only relevant results should be presented. Relevance are achieved by utilising metadata (Duval, 2001)

and/or connecting close to the source. e.g. by applying QR codes at a machine that connects to a specific task.

2. *Timeliness:* Information need to be available in time.
3. *Accuracy:* Information is free from errors.
4. *Accessibility*: Information is readily available, closely related to relevance of information.
5. *Comprehensiveness*: Information is free from omissions and redundant data.
6. *Format*: Effectiveness with which information is perceived.

Excellence in IS quality involves using state-of-the-art technology, following industry ‘‘best practice” software standards, and delivering ‘‘error-free” performance (Gorla, *et al.,* 2010). Most previous empirical studies related to IS success models have dealt with individual benefits rather than organisational benefits (Petter, *et al*., 2008; Sabherwal, *et al*., 2006; Gorla *et al.,* 2010), therefore there is a need for not only looking solely at the IS but also what OS could gain from IS excellence.

6. DISCUSSION

This paper takes a starting point in the context and needs of manufacturing industry, and the challenges of production and people pertaining to their aim for high-quality, innovative, efficient organisation. A key for achieving this is proper maintenance, development, and utilization of knowledge, reaching towards a learning organisation. For this, the company's organisation and information systems are fundamental. Much research and models are available for each of these areas. As depicted in Figure 1, the Organisation System can be described as a structure of people (human resources), carrying out activities, holding knowledge, some of which is tacit, some explicit. Likewise the Information System can be described as architecture of technological resources, conducting functions/logic, using/generating information, some of which is readily accessed and some is less used/hidden. We believe that it is appropriate to address the challenges and problems by specifically focusing on the way the information and organisation systems are linked together. We identify a need to support understanding of how organisation needs to be considered to include new ICT solutions, and vice versa how ICT solutions need to be formed to support knowledge organisations. There is need for models that show the elements and relations of the interface between OS and IS. In this interface, people meet with people and interact with information systems, forming an innovative working arena for different working processes. A major element of this arena are the meetings in the organisation, as these make possible the collaboration of workers and knowledge and information. The concept of meetings are elaborated further in the paper constituting dimensions of time, space, purpose, information, arena, tools, methods. We believe meetings provide for an underestimated potential to promote knowledge, learning, efficiency and innovation in production.

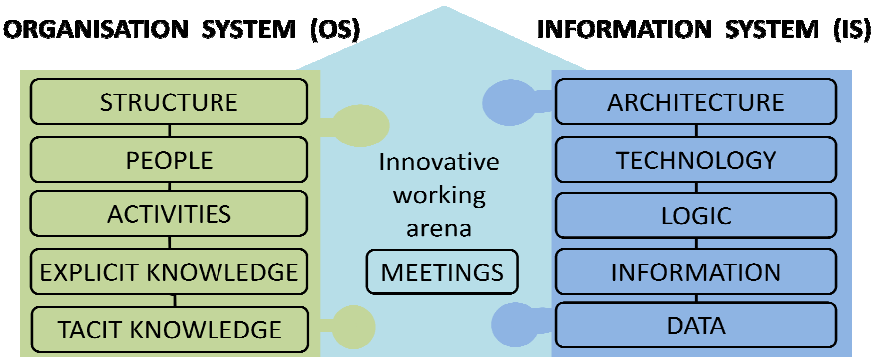

Fig. 1. The OS-M-IS model developed of Organisation Systems (OS) and the Information System (IS), overlapping in the innovative working arena, in which Meetings (M) play an important role.

6.1 Meeting context

Management of complex future production systems includes successfully managing the interactions between humans and technology (ElMaraghy, *et al.,* 2012). An example of a research area studying this, and especially focusing on the interaction between organisation and information system, is Computer Supported Collaborative Systems (CSCW). One central concern in CSCW has been to evaluate existing collaborative systems (Burkhardt, 2009). Many collaborate systems exists today but there are often problems of usability and lack of social studies connected to them and until now no full evaluation method has been proposed (Baker et al, 2001). Since a design of a system can make participants behave in different ways (Nacenta et al., 2007), how people behave and think about a new technology or system is important in improving that usability (Orlikowsky, 1992). Grudin showed

(1988) that there is a lack in CSCW because it does not focus on peoples differences and that the support in collaboration has to be on an entire group. *"If we are going to support groups that include any diversity at all, we will have to learn much more about how different kinds of people work (p.91) ... We need to have a better understanding of how groups and organizations function and evolve than is reflected in most of the systems that have been developed" (p. 90).* Therefore supporting meetings in that complex environment should be done by introducing appropriate and adapted information. A system model depicted in Figure 2, is used in the research reported in this paper to describe the meeting conditions and the addressed requirements.

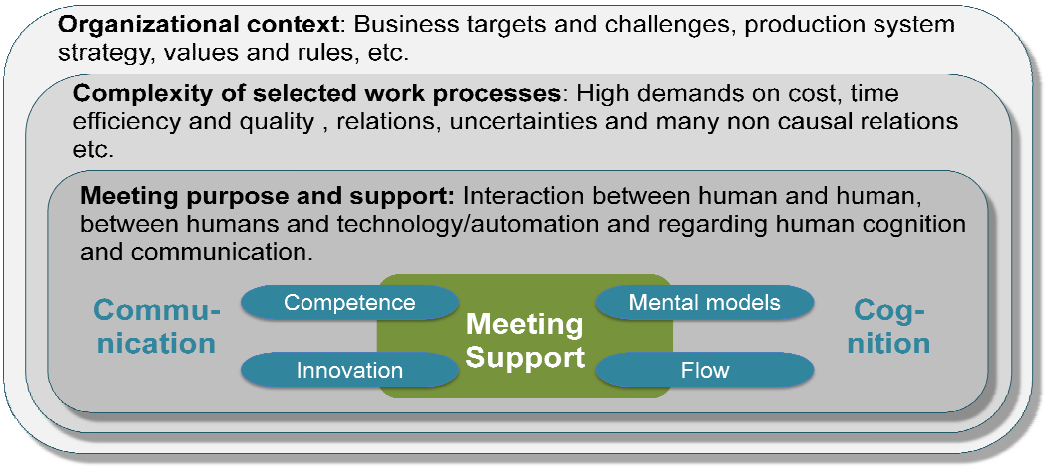

Fig. 2. The Model describing the meeting conditions and the addressed requirements

6.2 Innovative working arena to manage complexity

There is an ongoing trend in industry of increased complexity, and thus increased difficulty to understand and predict behaviour of the production, products, processes, etc (Gullander, *et al.*, 2011). Providing good support for the interaction between humans and technology in this context is therefore increasingly important (Galster, *et al.* 2002; Lee, 2008; Sanchez, 2009). Solutions are getting increasingly advanced, integrated, developed under harsh requirements with small margins for avoiding mistakes, high need for flexibilty, and frequent changes in products, processes, people, disturbances, and variations. All this, stress the need for collaboration between competences and functions to share information and knowledge, develop solutions, make decisions, solve problems. As a consequence, the need for a structured, innovative meeting arena is increasing.

Under such dynamic conditions it is difficult to establish a stable set of standardized work methods. To learn just one way of doing work is seldom sufficient, since new people need to be trained, or work need to be improved or changed because of changed conditions. Therefore, we believe that, as a complement to standardized work methods, there will be an increasing need to create a solid base in the working procedures and the organisation, that is capable adapting and handling the complexity. The structured meeting arena will need to be developed in future research. For different work processes, a set of meeting needs and purposes need to be defined. To support meetings getting more efficient, innovative, and qualitative, a set of solutions need to be developed both form the organisation system side, and the information system side. Results show that there are three main areas to focus on within the organisation: (1) New ways of working i.e. work processes and meeting structures; (2) Competence and learning i.e. knowledge sharing, tacit knowledge, and (3) Introduction of smart and innovative information and communication technologies (ICTs) i.e. finding tools to transfer and share the data, information and knowledge throughout both the IS and OS.

7. CONCLUSION

The paper reports the analyses of manufacturing industry's challenges to achieve a high-quality, innovative, and efficient organisation. Main results are a framework model visualizing the need for making the information system and the organisation system work well together. There is need for an innovative structured arena that can glue the systems together. Main conclusions are that meetings carried out in an organisation are the key elements of this glue. In meetings, the people, knowledge, information, and systems are joined for a purpose and crucial for commitment, knowledge sharing, learning, and creativity. Furthermore, the analysis concludes that information systems never can store all the knowledge/information needed – there will always be need for the knowledge that are made available only through humans. Also, the organization system cannot be sufficiently

efficient without a good support from the information system that stores, presents, handles the information. Thus, the two systems mutually need each other.

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