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Exploring the performance of tacit knowledge: How to make ordinary people deliver extraordinary results in teams

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ABSTRACT

Our research question is how do we transform individual and collective tacit knowledge into collective, explicit and actionable knowledge in teams?.

As our methodological approach, we conducted a longitudinal survey study from 2012 to 2014 to of two teams of staff employed with a Norwegian furniture manufacturer. Each team included designers, production engineers, and salespeople. The survey included the teams and the upper corporate team. The survey monitored the design, production and market processes involved in launching furniture to the marketplace (30 months).

The teams decided to rotate their professional roles as designers, production engineers, and salespeople. This rotating role mechanism and socialization process encouraged the sharing of knowledge. The team members transformed their tacit knowledge into collective explicit knowledge, allowing it to deliver innovative results within a time limit. As a theoretical implication, we have found a workable means of transforming tacit, productive, individual and collective knowing into explicit actionable knowledge. Productive team knowledge was converted into tacit managerial knowledge in upper management personnel, enabling the group to translate knowledge into explicit business actions. We propose, as a general theory, that by rotating professional roles within a team individual tacit knowledge can be transformed into collective explicit knowledge. The productive team tacit knowledge that was transferred was identified as expert, nodding, familiarity and holistic knowledge.

As a practical implication, we show that rotating professional roles within a team works when a team is afforded enough time to develop a socialization process. When professionals are given direction, trust, responsibility and time to develop results, they break out of their comfort zones and deliver extraordinary results together. As a practical implication, we show that this process can be planned, managed and controlled. Role rotation facilitates both the creation of high-performance teams and the transformation of tacit professional knowledge into explicit knowledge. The transformation of tacit knowledge into explicit knowledge helps increase efficiency and effectiveness in knowledge-intensive corporations. Therefore, practically, is it possible to create a corporate flywheel from tacit knowledge? The conversion of productive tacit knowledge into tacit managerial knowledge converted into specific business actions can create an explicit corporate flywheel while maintaining tacit knowledge as a competitive advantage.

1. Introduction

We examine how tacit knowledge converts into explicit knowledge in teams and how this can be managed and controlled by upper management. We first ask what kind of professional knowledge is transferred and managed? We imagine that professional knowledge is divided into four types:

1 Expert knowledge derived from education and practical experience accumulated through one's profession. The expert applies his knowledge, skills, and attitudes to be regarded as a professional. Designers, production engineers, and marketing specialists are, in this case, experts in their fields.
2 Working knowledge wielded by the professional with a working familiarity with a company or branch. All involved professionals have a working familiarity with other fields.
3 Recognizing or nodding knowledge wielded by the professional who is familiar with the current situation, as in this case of Norway's largest furniture company.
4 A combination of expert, working and nodding knowing transformed into holistic professional knowledge. A team leader possesses holistic professional knowledge.

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Expert and holistic knowledge mainly reflect tacit forms of knowledge. The processing of knowledge is tacit, while generated results are explicit. Working knowledge (e.g., knowledge of procedures) and nodding knowledge (e.g., the recognition of patterns) can be stored in information systems and reused. We cannot store tacit knowledge or reuse it, while explicit knowledge can be stored and reused. For any business, access to tacit knowledge is a competitive advantage, while explicit knowledge is available to all companies. The transformation of tacit knowledge into collective explicit knowledge in a corporation generates more possibilities and opportunities for synergy and innovation. We have been examining ways to transfer and share tacit knowledge since Polanyi (1958, 1966) first coined the concept. Polyani defined tacit knowledge as difficult for individuals to articulate because it is practical knowledge developed by individuals as they attempt to master various tasks over time. Nonaka and Takeuchi (1995) presented tacit knowledge as an essential facet of "The knowledge creating company". In their view, an organization creates knowledge through interactions and through conversion between tacit and explicit dimensions. Barney (1991) and Spender (1996) identified tacit knowledge as an essential strategic resource for a firm. Baumard (1999) and Choo (1998) studied the management and importance of tacit knowledge in organizations and teams. Organizations face considerable challenges in extracting benefits from knowledge not converted into a more explicit form. It is considered necessary to observe tacit knowledge under working conditions, to find a knowledge worker as a mentor, or to develop a culture that encourages the development of tacit knowledge. Two later studies conclude that research conducted on the transformation of tacit knowledge has come to a standstill without offering practical implications on the transformation of tacit knowledge (Aarseth, 2014; Pettersen, 2015). In particular, little progress has been made in developing an understanding of the nature and extent of the contributions of tacit knowledge in terms of improving the performance of a business or production process (Shamsie & Mannor, 2013). Wallace, Van Fleet, and Downs (2011) concluded that this lack of progress is rooted in a lack of "established social science research methods … in refereed journals in knowledge management" (p. 19), as articles do "… not meet typical criteria for formal research methods" (p.19) and do not address difficult research questions regarding the performance of tacit knowledge. Zahedia, Shahinb, and Babar (2016) concluded that " organizational contextual information is missing from a large number of studies" (2015, p. 995), making it impossible to understand contexts of tacit knowledge and knowledge sharing. Duguid (2005) concluded that studies based on readily available explicit knowledge to the exclusion of tacit knowledge take us back, not forward.

Wang, Huang, Davison, and Yang (2018) revealed that knowledge transfer positively relates to team performance and that knowledge sharing among individuals is necessary for the effective and efficient completion of team tasks. We do not, however, have longitudinal studies on the rotation of professional work roles in teams as a means of transforming tacit knowledge (Olaisen & Revang, 2017a,b). There is, in general, a lack of research on the transformation of tacit professional knowledge in teams. We decided for these reasons to examine the following research question: How do we transform individual and collective tacit knowledge into collective, explicit, actionable knowledge in teams? We were afforded the empirical opportunity to follow the processes of two teams for the whole study period until the developed product was launched (30 months). The point of production launch represents the linking of tacit knowledge to business performance and industrial production.

2. Methodology and study design

This study is explorative and conceptual and uses concepts of knowledge management together with in-depth interviews with two Norwegian teams creating new furniture designs. The design process represents the meeting of the art of design, craftsmanship and the market. Each team included seven members. Two of the members were professional external designers, two were production engineers, two were salespeople, and one was part of the upper management team.

The design process lasted for two years. We conducted a longitudinal survey study from 2012 to 2014 of the whole design, production and market process. We conducted a total of 21 individual interviews with each team 6, 12 and 18 months after the start of the process. We held two team meetings before conducting the survey and two team meetings after the completion of the survey for reflection and discussion. We sent interview transcripts and summaries of the sessions to each team member to solicit comments, additions, and criticisms. We held a one day-long meeting with each team after the completion of the process. The teams were employed with the Norwegian furniture producer Ekornes. The design process involved collaboration between two Ekornes production sites. We followed the process through to the introduction of the designed furniture into the marketplace. The total survey process lasted 30 months. We interviewed the upper corporate management group (9 individuals) of Ekornes twice (18 interviews) to solicit their views on critical success factors. Each member of the upper management team was given a summary of the interviews and was asked to correct and include additional information through emails and phone calls. After 30 months, we held a meeting with the upper management team. We conducted a total of 60 in-depth interviews and held seven meetings.

We referred to Baugh (1990); Yin (2009), and Richter (1998), together with Alvesson and Kärreman (2007), to develop the methodological basis for the study. We designed the study as a conceptual study focused on developing and applying concepts of the modes of knowing. Our descriptions, analyses, and theoretical approach are thus integrated.

3. The case

Ekornes is a leading Norwegian furniture producer with annual sales of 420 million Euros and 2300 employees. Its main production site has always been located in the small town of Sykkylven (8200 inhabitants) located on the north-western coast of Norway. Ekornes values sustainable production together with the development of its workers' knowledge, skills, and professional attitudes. Ekornes has long cooperated with all senior high schools in its area in educating and recruiting new staff. The company's turnover rate is very low. Ekornes recruits all of its leaders through the Ekornes pipeline system. Ekornes views competence and design as central to market survival. The company has emphasized teamwork through self-governed working groups for more than 30 years. Ekornes shares its profits with its employees and shareholders. No bonuses are given throughout the year because its personnel is expected to work from intrinsic motivation with a permanent salary and yearly bonus dependent on company profits. Ekornes exports 91% of its products to the EU and USA. Ekornes is known for producing well-designed furniture and high-quality products. Its most widely known product is the "Stressless" chair, which has been produced in various styles since 1984 (Ekornes, 2018).

4. Modes of knowing

4.1. Rotation of team roles

Rather than focusing on types of knowledge, we discuss ways of knowing, as it is our perception that knowing involves an on-going process. Types of knowledge only provide us with a snapshot of this process and thus provide us with a static idea of knowledge. Hence, our modes of knowing model applies a fluid scale of non-representable to representable knowing in which boundaries between the levels are unclear (Topp, 1999; Nag & Gioia, 2012). We have selected three knowing modes. One is non-representable knowing, which refers to the

notion that it is impossible to make tacit knowledge explicit. Another mode is non-represented knowing, which means that through specific processes or means it is possible to externalize facets of knowledge. Finally, representable knowing is easily externalized and represented through formal and informal communication (Rosendahl, Olaisen, & Revang, 2014). We must relate a typology of knowledge to each mode to understand which form of knowledge each knowing modus represents.

1 What we know is defined as representable knowledge.
2 What we do not know is defined by what we know. We identify this as non-represented knowledge.
3 What we do not know that we know is defined as non-representable knowledge, as we must render such knowledge non-represented before it can be representable and known.

The two teams adopted a regular professional mode of representable knowing. Both teams understood, after four months, that they could not go on mainly using representable knowing as a basis for their work. They decided to switch roles and to allow designers to become production engineers, to allow marketing personnel to act as designers, and to allow production engineers to act as marketing personnel. They worked like this for four months and found that they were sharing knowledge much more effectively. They decided to rotate functions for another four months, with team leaders rotated every four months for each task. Leadership roles were changed every two months to afford each professional leadership experience. The group had returned to its initial arrangement after 18 months. Split roles (e.g., designing/production, designer/marketing, marketing/production) were then adopted for three months, with the professional leader acting as the group leader for the last three months before the team decided to conclude its work based on initial team roles. As a result, each team experienced an exceptional means of sharing knowledge and developed an excellent understanding of the process from design to production for the market. The two teams underwent a process that represented all modes of knowing. The two teams shared their experiences every second month, and no significant differences were observed between the two teams. Ties within the teams were strong, which eased the transformation of expert, working familiarity and nodding knowledge. The importance of close ties corresponds with the findings of Zhong, Huang, Davison, Yang, and Chen (2012), as strong ties eased the sharing of expert knowledge and team coordination.

4.2. Non-representable knowing

Non-representable knowing is a mode that individuals and groups develop over time and that cannot be made explicit. Non-representable knowing itself thus takes place as individuals or groups gain experience, but it remains non-representable. Examples of non-representable knowing on a personal level include intuitive knowledge and emotions. While it may not be easy to express why we make decisions, from "gut feelings" we determine the right thing to do.

Collective non-representable knowing is represented in culture through, for instance, unwritten rules. This can have, for example, synergistic effects, i.e., positive effects of practices and relationships that develop when individuals work together over time. We generate such results through the links and relationships that connect members of a professional society (Boisot, 1998). While it can be difficult to identify what culture is, it still has a significant impact on the behaviours and development of a society and its members. Bonora and Revang (1993) supported this conclusion in arguing that knowledge is always deeply embedded in an organization's culture. They stated that culture represents "a system of shared values and beliefs that produce norms of behaviour and establish an organizational way of life" (p. 208). Aarseth (2014) argues that times are changing and that each project team creates its own culture and thus unique forms of tacit knowledge. Olaisen and Revang (2017a) show how virtual teams create their own work cultures. Non-representable knowing constitutes a part of temporary project culture. Non-representable knowing is a central part of the link between designers, production engineers, and marketing/salespeople. The creation of new furniture designs involves the transformation of non-representable knowing into non-represented knowing and when possible into representable knowing. The latter exchange involves the inclusion of the market and thus the consumers of furniture. The professional designer with 5–7 years of professional training and with extensive product design experience offers a considerable amount of non-representable knowing. To transform the process of sitting in the snow into the design of a chair involves a tacit process that is often challenging for production engineers and salespeople to understand. The idea that a customer can put together three or four parts of a sofa as he wishes is more easily understood but difficult to design. The cooperation of engineering and design knowledge is however needed to make a sofa as stable as possible in one piece. We have found however that the production engineer's role in robotics production is as complex and demanding as the designer's role. The economics and marketing of products are crucial to survival. What we observe is an integration of functions in modern design. The designing job is the most prestigious and challenging, but the introduction of robotics into production has rendered engineering roles more complex and demanding. At the same time, the global market must make adjustments to national and regional preferences. International success for the examined company requires a high degree of integration and rapid adaptation to market changes after launching furniture into the marketplace. Tacit non-representable knowledge must be transformed into tacit non-represented knowing. Non-represented knowing must be converted into explicit knowing. The teams started by sharing their working familiarity and continued to share their nodding familiarity and finally their expert knowledge. They trusted one another through team identification and developed a strong corporate identity through cooperation with upper management personnel. The personnel conversed with confidence, and a continuum of tacit knowledge to explicit knowledge and of explicit knowledge to tacit knowledge resulted. Solutions generated in turn become more important than team members' professional roles.

4.3. Non-represented knowing

The scale of representable knowledge flows toward non-represented knowing. This mode reflects the tacit knowledge that Nonaka and Takeuchi (1995) viewed as transferable through observation. We found that it was transferred to our two teams through social mechanisms. It can be viewed as know-how generated from experiences that individuals, groups or societies have. Orr (1990) described this mode of knowing as "both the ability to do things without being able to explain them thoroughly and also the inability to learn to do them from a theoretical understanding of the task" (p. 170).

Through observation and the rotation of all theoretical and practical tasks, we obtained a stream of observations, reflections, and dialogue pertaining to the transformation of non-represented knowing into explicit knowledge. This transformation mainly occurred through the rotation of work tasks, which also increased the levels of trust among the team members. This trust in turn encouraged the sharing and transformation of knowledge. The confidence and sense of humour of the team members played a significant role in the development of non-representing knowledge. Observations illustrated only a fraction of the transfer achieved through rotation. The team's production engineer nearly completed the equivalent of a Master's course in design and sales through the process, while the opposite was the case for the designers and salespeople. This additional learning thus facilitated the transfer of tacit knowledge into explicit knowledge in the group. The rotation process transferred professional tacit knowledge related to each role to those of other professions, and as a result the teams were able to hold

highly qualified discussions on design, production and market functions. The teams delivered ahead of schedule, and their specifications were set into production only six months after completion. The production engineers translated the teams' specifications into robotics production, and the teams digitalized all organizational processes. This knowledge sharing thus resulted in the integration of all processes. Ekornes plans to use this team process as a model for its design processes.

4.4. Representable knowing

While distinctions among representable knowing, information and data are difficult to make, we have found information and data on how representable knowing is transformed from other modes of knowing. However, such knowing is a product of the context involved. The two teams investigated, interpreted and applied information and data as a means of information seeking. The design of furniture mainly involves the application of non-representable and non-represented knowing, the craftsmanship of production involves the use of non-represented and representable knowing, and market exchange primarily involves the use of representable knowing. The leadership role involves the integration of professional and managerial roles. The three modes of knowing described form part of all four functions. A team consists of individuals who succeed in rendering the whole process collective and integrated. Converting individual knowing into collective knowing involves synergizing and causing two plus two to equal at least five. In Fig. 1, we illustrate the link among the three knowing modes developed through teamwork and the rotation of roles. The ellipses with arrows shown on each end illustrate that knowing can shift in all directions, e.g., towards, from, and within a mode.

The above model visualizes how the different modes interact with one another and how they can shift from one degree of mode of knowing to another. We can see from the figure that non-representable knowing only tangents the different modes. This process illustrates that the non-representable means of knowing affects the other modes, though it is difficult to convert it into more representable modes. What the two teams enabled was a shift into the non-represented and representable modes and a crucial shift back to the use of tacit knowing. These variations were allowed through the observation and rotation of roles.

In the teams, the in-house craftsmen and marketing staff worked well together, while working with the external designers proved more difficult. Societal views of the team members proved essential in adopting the use of collective representing knowledge from which concrete results were pinned down. The rotating of roles allowed the participants to accept and respect their roles, which again encouraged additional learning and creativity. Supplementary learning enabled a high degree of mutual trust and respect. Everyone carries biases where, for instance, managerial and sales personnel are viewed as 'necessary idiots'. Rotation eliminates stereotypes, and by trying different positions, the professional learns the complexities and challenges of each role. The rotation approach shifted non-representable knowing to non-represented knowing, and finally to the represented knowing modus. The rotation method was key to the adoption of new knowing modes. Converting non-representable and non-represented knowledge into representable knowledge required creativity, intuition, and imagination (Fig. 1).

Missing in Fig. 1 are the relationships between individual and collective knowing. These missing ties are what we explore next.

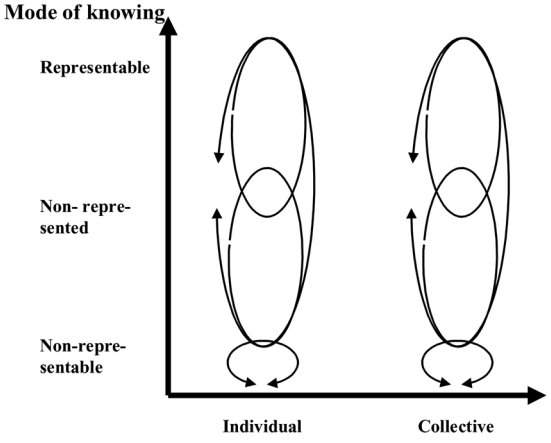

Fig. 1. Modes of knowing.

5. Knowing as a collective activity

Shared knowing is not something that happens. From common sense, observations and articles we can conclude that shared knowing is the result of a long and continuously ongoing process of uncertainty, conflict, needs and wants. Certain factors must be present for collective knowing to take place, and there also seems to be a need for means or tools that enable shared knowing (Arikan, 2009; Orr, 1990; Tortoriello, 2015). What these are and how they support shared knowing is what we try to establish here.

Blackler (1995) that knowing is purposive and object-orientated. To enable shared knowing, there must be a purpose or objective. A goal does however not merely arise out of nowhere. There must be an identified context or situation from which a need for knowing can arise. Once our adventurers have agreed on a goal and plan on how to achieve it, they must also determine what their current level of knowing is and what knowing is necessary to reach the established goal. The knowledge base of a firm constitutes the core basis of knowledge and of required complementary knowledge (Saviotti, 1998). Complementary knowledge forms the basis for innovation (Esterhuizen, Schutte, & du Toit, 2012). Teams must in turn identify a knowledge gap.

When there is agreement on the knowledge gap at play, everybody must work to close this knowledge gap to be able to achieve the desired goal (Fig. 2). The project team must grow to share knowing to be able to achieve its goal. Social constructionists argue that knowing is found in social relationships between individuals. Shared knowing thus takes place as a group spends time together and gets to know one another. This process may however not be free of conflict. According to Weick (1993), the individual's role as a knower is to take part in the development of shared knowing and in turn influence it. However, when project members of a team have different perceptions of what form of knowing that is needed, shared knowing will take much longer to develop (Nonaka, 1994; Easterby-Smith, Graca, Antonacopoulou, & Ferdinand, 2008; Hotho, Becker-Ritterspach, & Saka-Helmhout, 2012). Performance depends on the conversion of team shared productive knowledge to managerial shared knowledge facilitating business performance.

Available technological platforms have allowed teams to use online

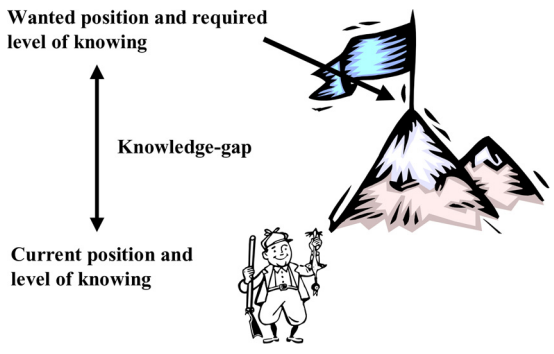

Fig. 2. Knowledge gap identification.

meetings. Online meetings have been found to be as effective as offline meetings. Teams do share their knowledge online as efficiently as they do offline. We have passed the point at which we need to meet physically to enjoy an effective exchange of knowledge. This saves teams time and travel requirements. Teams in turn work smarter and greener (Olaisen & Revang, 2017a).

The team leaders studied have ensured the utilization of external knowledge, and team members have used social media and their social networks to enhance the meta-knowledge of the team (Cao & Ali, 2018). Ekornes uses an information system but encourages all employees to use Facebook, Instagram, LinkedIn and Twitter, as information today is not only individualized but also belongs to the network itself (Yu, Hao, Dong, & Khalifa, 2013). Formal and informal networking has been necessary for the team members. All of the interviewed team members and upper management staff reported that they use social media as a responsible means of communicating and of linking themselves and others as a community. This community is used to identify alternative solutions and unsolvable problems through teamwork. Social technology platforms have created a virtual community that we virtually adapt and work within. The examined teams have worked virtually among themselves and with their networks.

The two investigated teams have combined their socialization and professional work to agree upon new and future conditions and to be able to accept knowledge gaps and what it takes to obtain desired outcomes. The two team leaders have worked to achieve a collective agreement and have sacrificed to agree upon desired outcomes. The team leaders have also worked extensively to have everyone on the team understand their views and that they must work as a collective to achieve desired goals. The team leaders have used conflicts to identify creative solutions. Disagreements have allowed team leaders to facilitate intense discussions to reach agreements whereby everyone compromises but achieves collective bargaining. Both teams have found that this use of conflicts has proven to be an excellent leadership approach. There would be no goals of the day or week if team members were not in agreement with the knowledge gap and positions involved. The teams have celebrated each small milestone throughout the project's development. Lean tools as described by Tyagi, Cai, Yang, and Chambers (2015, p. 205) have been used to facilitate knowledge creation. Two years of work have given rise to 24 milestone celebrations. The teams have contributed until the designed furniture's the market introduction. Relating the processes of modes has created possibilities for innovation, and the management of such processes has been essential in launching new products and services. The pace of this process depends upon market conditions.

6. The role of socialization

The initiation of collective knowing requires a shared experience or context. Socialization can serve as an internal network of people exchanging information, ideas, skills, and experience. Socialization creates a context in which communication can take place and thereby also serves as an opportunity for knowledge sharing. Kim (1993); Nonaka and Konno (1998); Boisot (1998) argue that the communication of personal knowledge requires the parties to be co-present and to share in the concrete experiences jointly. Volberda, Foss, and Lyles (2010) define this as a significant absorptive capacity following from Cohen and Levinthal (1990).

Katzenbach and Smith (2015) states "Most team research focus on the logical, rational economic man missing out the irrational behaviour" (p. 103). Interactions between our two teams was, however, dependent upon non-logical situations wherein team members have left their comfort zones. One team member took the other team members on a fieldtrip and asked them to sit in deep snow. Images of their sitting positions were used as models demonstrating how snow can be used to design a chair or sofa. The team has also placed a gutted 12-kilo codfish on a meeting table with the model of a couch placed underneath. Our findings are crystal clear. Taking the team members out of their comfort zones has facilitated the creation of representable and representing knowledge. The shift from tacit to explicit knowledge has taken the team members out of their professional comfort zones, and this has served as a primary mechanism for achieving transference among the three modes of knowing. When team members are out of their comfort zones, they must rethink their professional roles to understand functions of engineering, sales, and leadership. This rethinking and reworking of roles creates a foundation for transforming knowing of the three modes.

The knowledge management literature describes socialization as the use of planned and directed explicit knowledge (Blackler, 1993; Choo, 1998; Topp, 1999, Nag & Gioia, 2012; Pettersen, 2015). A significant finding shows that socialization represents tacit knowing. Socialization encourages the use of explicit knowing. The studied team members can drink, ski or paddle together without achieving anything else but sharing what they already know. The team leaders did not plan this socialization process, and they allow the team members to engage in socialization together. The rotation of roles has brought about another form of socialization through which individuals reflect on their own and other's professional positions. The socialization process took a long time to manifest and started to work fully after the first year. Socialization was in one respect planned by upper management and the team leaders, while also being unplanned and undirected. The teams did not engage in extensive travelling or physical activities in their socialization. Socialization became a part of professional work through the sharing of milestones and through the identification of solutions drawn on napkins at team parties. The socialization process facilitated the transformation of tacit knowledge, as the process helped everyone trust one another.

Upper management directed the teams to create a relationship-focused culture based on a rules, risk taking and a focus on results. These cultural features represent the values and norms of Ekornes (2018). They also reflect the socialization, combination, externalization and internalization of knowledge (Vick, Nagano, & Popadiuk, 2015). Ekornes balances project agility with project performance to allow for autonomy alongside both power and control.

7. Mental models

There are both individual and shared mental models (Kim, 1993; Nag & Gioia, 2012). During socialization, an individual's conceptions, understanding, and mental models change. However, the redefinition of different mental models can only take place when people face a situation that is relevant to them (Rosendahl et al., 2014). An individual must experience a position that affords him/her an alternative set of assumptions that is appealing – an alternative set of assumptions that they think can help them understand or cope with their reality in a better way. When this does not occur, there is no need or incentive to change mental models, and there is thus no reason for knowing to take place (Argyris, 1994; Tortoriello, 2015; Olaisen & Revang, 2017b).

Kim argued that "(u)organizational learning is dependent on individuals improving their mental models; making those mental models explicit is crucial to developing new shared mental models" (44:1993). Rendering mental models representable can however be difficult. This may also be an uncomfortable process because by expressing our deeply rooted assumptions we also expose them to critique and revision. Blackler (1995), however, argue that incoherencies, inconsistencies, and conflicts create opportunities for learning. In facing incoherencies, contradictions and conflicts, an individual is exposed to alternative assumptions and can thereby choose to adopt these or continue to use old ones (see Fig. 3 below). To be forced into new realms, new models must be adopted to develop new furniture designs. New assumptions and models are made when team members leave their traditional comfort zones. Knowledge in itself does not move them forward. They must act practically. Non-representable and non-representing knowing

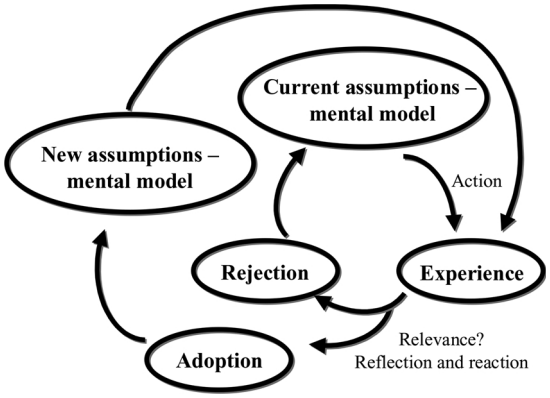

Fig. 3. Development of new mental models.

are converted into representing knowing when a team leaves its comfort zone into a new stage of co-creation. This team co-creation allows the team to climb all the way to the summit of the mountain. New mental models have afforded the studied members the flexibility they need to work together to create innovative and functional furniture. The two teams have capitalized on their model's strengths. The teams have created several models of the furniture, which were presented to corporate leadership personnel to help them understand that they had a choice and a say. Knowledge used was a combination of constructed and factual knowledge. Elements of constructions were indistinctly used as facts and vice versa. Different forms of knowledge are not epistemologically mutually exclusive as noted by Serna (2012). Knowledge used in a team is contextual. We determine what is true and not true, what is and is not acceptable, and what is and is not adequate depending on the situation. Our assumptions and mental models are changing and flexible. Plessis (2008) expressed this clearly with the following quote: "The spirit of knowledge management may be defined as individually knowing what we know collectively and applying it" (p. 286).

We found that the two teams acted practically and communicated, interpreted, improvised, negotiated, enacted, re-enacted, unlearned and learned. These processes enabled the teams to identify new assumptions and models.

The development of shared mental models affects both non-represented and non-representable knowing at the individual and collective levels. As individuals face new situations and meet new people, their assumptions and thus mental models are revised. Depending on the context, they also develop some degree of shared knowing, some of which becomes deeply rooted in the collective culture (and thus non-representable) and some of which is more easily expressed as knowing. The current state of collective non-representable knowing and shared mental models will have a substantial impact on future collective knowing like individual mental models. Even when this depends on the present state of knowing, this reflects a new state of understanding that will create a new way of looking at furniture. We must ask what is new about a given piece of furniture. The answer is that the furniture in itself represents a new mode of design and functionality. The company's couch composed of multiple pieces allows the customer to configure a couch as desired that is as stable as a couch consisting of one piece. Tacit proper knowledge has moved into collective explicit knowledge through design, production and market exchange. This process involves societal and professional meetings and business meetings to create a new product. To address further complexity and ambiguity, the teams play multiple roles to bring them together, determine what they do and do not know from knowing modes, and apply what they know to a real piece of furniture. Both teams in the end convert "what we do not know that we know". The transformation of tacit knowledge into explicit knowledge ensures this result.

8. Communication, language, and metaphors

Weick (1993) stated that "language is both the tool and the repository of learning. It is the critical tool for reflection, both at the inter- and intra-personal level. Additionally, language is a social phenomenon or stated differently, learning is embedded in relationships or relating knowledge is an inherent property not of an individual or an organization, but rather resides in the quality and the nature of the relationship, between levels of consciousness" (p. 18). Hence, language is a tool that helps individuals and collectives render their knowing representable. When our team members speak to one another through group socialization, their knowing becomes a part of shared knowing.

Nonaka (1994) supported Weick (1993) when he argues "… communication is like a wave that passes through people's bodies and culminates when everyone synchronizes himself with the tide. The sharing of mental and physical rhythm among participants of a field through metaphors may serve as the driving force of socialization" (p. 105). Our empirical approach does not stress the importance of metaphors. Our team members did not speak in metaphors. They used professional language very directly and without metaphors. They quarrelled among themselves regarding which group was the best: the design, production or marketing team. They understood that they needed to use their collective knowledge to deliver their designs to the market. Ordinary people do not use metaphors or advanced wording as they work. Communication is the essence of simplicity and simplicity is the essence of selection and priority. The rotation of roles rendered the interface more exact, direct and open. Attitudes were more frequently expressed through body language, and the teams did not need to dedicate as much time to communication. The more the teams worked together, the simpler we found their arguments and priorities. Simplicity in communication and language is critical to success. The development of simple communication in both teams facilitated the transformation of tacit knowledge into explicit knowledge. The closer the teams worked, the simpler their communication became. Simplicity may be the ultimate facet of a high-performance team.

9. Observation and imitation

Barney (1991); Spender (1998); Baumard (1999) and Hotho et al. (2012) argued strongly that individual non-represented knowing is of limited value to an organization when it remains personal. Knowing must be representable and then used for innovation and product development. Through observation and imitation, the observer can both internalize collective non-represented knowing and contribute to its development. Let us take hikers as an example. On their hike, they meet a man who wants to join them. To understand the group's prevailing culture and unwritten rules, i.e., non-representable knowing, he must follow the group members and watch their behaviours as they approach their goal. If he regards their conduct as relevant, he will imitate it and adopt shared non-represented and non-representable knowing. However, if he actively participates in the hike, he will also share his own non-represented and non-representable knowing and thereby affect shared knowing. External furniture designers of the examined teams offer vital external knowledge.

Fig. 4 illustrates dynamics of individual and collective knowing. The ellipses with arrows on both ends show how knowing moves within and between modes and collectives. As is shown in Fig. 1, non-representable knowing serves as a basis for other modes of knowing, as it filters the impressions, alternative assumptions and mental models that a group adopts.

From the above figure we also find the means or tools that enable and support the link between individual and collective knowing. Socialization contributes to all modes of knowing but is of particular importance for non-represented and non-representative knowing. We illustrate this with a horizontal ellipse that connects individual knowing to collective non-represented and non-representable knowing.

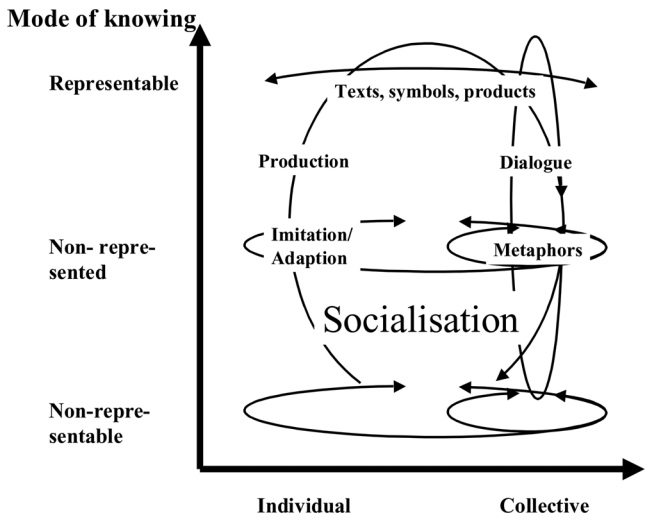

Fig. 4. Knowing as a collective project activity.

Socialization contributes to both personal and collective knowing because it illustrates the challenges of individual and shared mental models. Socialization and dialogue afford individuals an opportunity to develop and share metaphors and stories relating non-represented knowing to non-representable knowing (illustrated by the vertical ellipse flowing through all three meaningful modes). We use texts as a means of distributing metaphors and stories. However, as documents are static, only a one-way link from representable to non-represented knowing is established. Dialogues, on the other hand, allow for the interactive development of a story. In Fig. 4, the line that links the individual to collective representable knowing illustrates this.

Texts, symbols, and products are tools that primarily support individuals' represented knowing. An individual who creates solutions and solves problems by producing goods or services contributes to collective knowing. In the figure this is visualized by the arrow running from individual non-representable knowing through non-represented and representable knowing and then through the standard knowing modes. While the opposite case, where collective knowing contributes to one's own knowing, can of course also occur, we choose not to focus on this link here. We thus also do not discuss dynamics of personal knowing.

Observation, imitation, and adaptation enable both personal and collective knowing to take place, but they are of particular importance when a team is to share non-represented and non-representable knowing. The socialization process adopted by the furniture teams allowed the team members to trust one another in sharing all available information and knowledge. Socialization cannot be designed or planned and constitutes part of the tacit knowledge of the three knowing modes. The goal was to identify innovations, and in turn, new chairs and sofas were produced as prototypes over two years with the intention for them to reach the market within three years. The teams also work quickly to enter the marketplace faster. One of the teams took 22 months rather than 24 months to complete the design process and delivered a new sofa to the market within 30 months. The other team completed its design and spec proposal within 24 months and introduced a chair to the marketplace within 30 months. Ekornes has decided to automate its production of new furniture as much as possible with the use of new robot technologies, shortening the length of time between design and marketplace entry. This has been the case for two reasons: detailed team specifications and upper leadership involvement throughout the design process.

10. The pace of sharing knowledge: a proposed conceptual framework

What we have not accounted for hitherto is the speed at which knowing takes place. We share knowing at different pace depending on what mode the pace is in and how well a team is socialized. We share representable knowing instantly, whereas non-representable knowing can take years to share. Both of the studied teams delivered their products to the marketplace in time. They became high-performance teams that started out less efficient and eventually entered the fast track. We assume that starting slow is necessary to achieving full role rotation and socialization.

All knowing takes place over time, but at what pace is determined by how well individuals know one another and by what means they use to support knowing. Our understanding is not that the more time people spend together in planned socialization the faster the pace at which knowing becomes collective. The socialization process is, in our view, very tacit. We can design, plan, manage and determine this process. When the studied team members rotated their roles and broke out of their comfort zones, the unplanned socialization process caused them to them move back and forth through modes of knowing. Tacit and explicit knowledge interact along a continuum of modes. Such interactions convert personal tacit knowledge into collective explicit knowledge. Personal obstacles to such conversion are removed to obtain a collective modus linked the process shown in Fig. 5. This process involves a complete collective conversion of tacit knowledge into explicit knowledge at a fast rate. The studied team members and their corporation have developed a high-performance team culture. The company's team culture fosters autonomy to facilitate knowledge integration by enhancing trust among team members (Basaglia, Caporarello, Magni, & Pennarol, 2010). This culture has led team members to be more inclined to share and integrate knowledge for team and corporate success.

Both teams viewed the conversion of learned practices into explicit and usable knowledge for Ekornes as beneficial. This corporate identification contradicts the findings of Janhonen and Johanson (2011). The two teams achieved success through modes of working managed by their corporation. There is a misunderstanding in the team literature that this cannot be managed (Katzenbach & Smith, 2015; Olaisen & Revang, 2017a). Our survey shows that this process can indeed be managed and controlled through close collaboration between upper management and project teams. Scandinavian values of equality, cooperation, trust, and commitment are essential. Ekornes' plan is to direct and manage all processes, however. The use of robot technologies

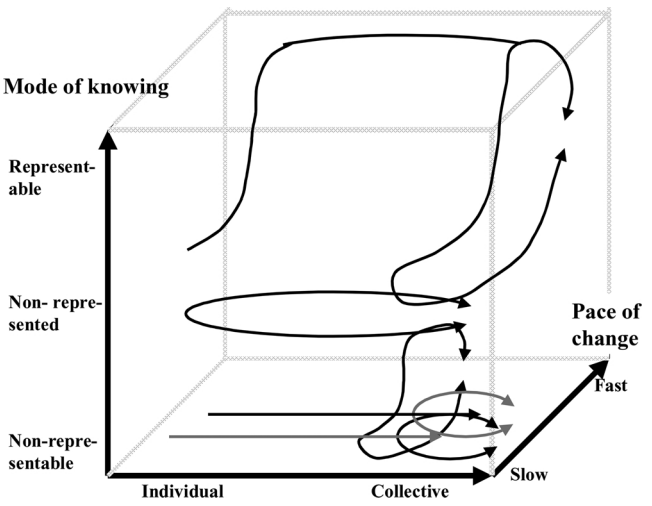

Fig. 5. Pace of understanding observed within a group and between individuals and groups.

to achieve the highest possible levels of efficiency is adopted as part of the design process and is accepted by the company's production workers. Advanced technologies used are transferred to other realms of production by leveraging experiences gleaned from this project to improve lines of production. The profit sharing approach renders employees eager to use new technologies.

Nonaka (1994) argued that interactions between tacit and explicit knowledge become more substantial in scale and more efficient as more actors within and around an organization become involved. This may be the case because the more people there are in a group, the more diverse individual knowing is and thus the more challenging assumptions and mental models applied become. However, the pace of change involved is also dependent on team structures, leadership styles and environments used for team cooperation. The two teams studied enjoyed high levels of team and organizational identification while avoiding disparities in knowledge sharing, which enhanced sharing, transfer and learning capabilities (Zhu, 2016).

In Fig. 5, we illustrate the dynamics of understanding found within a team and between individuals and groups.

The greyed-out lines in the figure illustrate that there are no perfect ends of the scales. In a new team, it takes some time for team members get to know one another, to define their individual roles, and to develop a shared culture and shared mental models. This process took a year for the examined teams to complete via role rotation. The black circle shown in the lower right-hand corner illustrates this. Further, in the early stages of team establishment, the new members had more influence than when the teams are more established. A lack of an actively shared culture makes it easier to influence the development of a collective culture. The studied team members did not have a shared culture to refer to at first and thus were able to create a collective culture. The black line running from individual to collective non-representable knowing illustrates this. The grey line shown below, on the other hand, illustrates that once a team culture was defined, the team tended to be sceptical of new ideas and assumptions, making the culture more difficult to change. While our teams worked well in developing innovative furniture, in the end, they developed a typical model. The pace of non-representable knowing is faster when project team members get to know one another through role rotation. As we conclude above, the adoption of rotation methods is slow at first and then accelerates throughout the process. Support of the teams from corporate leadership proved essential.

The line running from personal non-represented knowing to collective non-represented and non-representable knowing illustrates how individual know-how can affect collective knowing. When an individual leaves the non-represented mode from the representable mode, the process is somewhat slow. The rotation of roles accelerates this process. However, individual representable knowing is converted into collective representable knowing faster, while the conversion of knowing into the non-representable mode occurs more gradually. We found that, after the first year, the team members quickly switched between modes of knowing. Once the team members had left their comfort zones, they found it easier to remain there. This finding contradicts nearly all research results describing this process as time intensive.

11. Upper management's perspective

We held a debate with Ekornes' upper corporate management team. We discussed the follow question: what has been critical to the success of the two teams?

The main answer given is crystal clear. What has worked is the balancing of leadership and management power. The teams were given direction on what they must deliver as well as a clear plan and timeframe for delivery. Expectations were made crystal clear. The teams could decide how to organize and work, but upper management personnel required that a report on the teams' progress be submitted every three months. Upper management personnel regarded their role as crucial to the generation of results. They supported and controlled the teams throughout the process. Liu and Phillips (2011) also documented the crucial importance of leadership for knowledge creation in teams. In their view, leadership controls the balance of team freedom and team control. The upper managers studied guided the co-creation of innovation, costs, quality levels and the amount of time to market entry. Standalone tacit knowledge developed into explicit knowledge shared among upper management personnel. This knowledge proved instrumental to the planning and execution of the production process.

The upper management team elected one representative to serve in each design team. This role was initially designed as a standalone managerial role related to upper management concerns. In the end, each representative served as a manager who shared team results with upper management staff, affording upper management personnel tacit knowledge of the teams.

The external designer knew that the project involved would shape the design company's reputation in Scandinavia. Members of the team were pressured to deliver results through this top priority project. Upper management staff regarded this as involving a combination of leadership (giving direction) and power (they needed to succeed). Upper management staff met and discussed the teams' progress and expectations to place on the teams. As a practical implication, power, control and follow-up meetings are essential to self-governed teams. No bonuses were given for results, as the upper management team regarded inner motivations as central to achieving results in due time.

12. The productive performance of tacit knowledge

The teams worked together with upper management personnel for six months to automate the production process as much as possible. Ekornes wished to use robotics production systems to render its production system as cost-effective as possible. Cooperation among the teams, upper management personnel, and production workers and their trade union worked very well. The plan was to create new furniture to illustrate how robotics could be used for full furniture production. The teams, production workers, and upper management staff worked as an extended working group to solve all relevant problems over a six-month period. The teams served as mediators between upper management personnel and the production workers and their union. The teams secured the cost, quality and the timing of the process. The teams operated as translators between workers and upper management personnel. Upper management personnel regarded this form of management as involving the application of tacit administrative knowledge that they had not known or used prior to this process. The managers had not known that these translation resources existed. The extension of teamwork into the production process was a great success for both upper management personnel and the workers. The process secured the company's profitability through more extensive production while maintaining a workforce of the same size.

13. Conclusions: key findings and theoretical and practical implications

13.1. Key findings

The key points emerging from this work are as follows:

1 The driving force behind team collaboration and socialization for the case examined was the rotation of professional roles. Such rotation forced each team member to rethink his position and in turn his approach to collaboration, sharing and knowledge transfer. The creation and adoption of new team roles converted tacit knowledge into collective explicit knowledge. The transfer of tacit professional knowledge most efficiently occurs through the rotation of team roles.
2 Upper management personnel directed the teamwork while

balancing the freedom and control of the teams. Follow-up meetings and support from upper management proved crucial to the teams' success.

3 The transformation of tacit professional knowledge into actionable explicit knowledge in teams can be planned, managed and controlled.

4 The two teams studied enjoyed high levels of team and organizational identification while avoiding disparities in knowledge sharing, facilitating sharing, transfer and learning capabilities.

5 Corporate and external social media served as essential tools for networking as a learning community. Online team meetings were as efficient as offline team meetings. Social technology platforms serve as a virtual community that we are virtually adapting to and working within.

6 The team participated in the automation of furniture production and secured the quality and cost- and time-effectiveness of the process. The teams operated as translators between production workers and upper management personnel. Production AI robotics was introduced as a facet of teamwork and as a sign of progress for all stakeholders involved.

13.2. Theoretical implications

1 Many studies show that tacit knowledge in a team cannot be communicated or shared with other team members or applied to the practical tasks of a team. We found that when we rotate all professional roles of a team and bring participants out of their professional comfort zones, tacit knowledge can be shared and converted into explicit knowledge.

2 Few empirical studies have attempted to differentiate the benefits derived by an organization from tacit knowledge and to specifically show how tacit knowledge enhances performance. We found that the benefits of shared tacit knowledge enhance team and corporate performance in terms of delivering on specifications in time at the right cost for new products ready for automated production.

3 We found a relationship between the tacit knowledge of upper management teams and that of the two designing teams. The translation of symbols and tasks between upper management personnel and the teams involved the use of shared explicit managerial knowledge. Team participation initially involved the delivery of standalone managerial tacit knowledge for upper management representatives and ended up involving the delivery of shared managerial tacit upper management knowledge. We identified the existence of productive and of management-based tacit knowledge. Tacit managerial knowledge related the knowledge of management groups to that of the teams, while productive knowledge connected the team members. Expert, working familiarity and nodding knowledge are personal and collectively related to conversable, productive and managerial situations. Relationships between productive and managerial tacit knowledge form holistic tacit knowledge. The conversion of holistic tacit knowledge into explicit holistic knowledge shapes business performance. Leadership, organizational processes, technologies, and tools are linked to meet market demands. Business flywheel rotation ensures explicit performance and a competitive advantage in collective tacit knowledge.

13.3. Implications for practice

Our findings have several practical implications for the creation of high-performance knowledge teams and for the performance of tacit, productive and managerial knowledge. The present study reveals a flywheel effect of corporate performance first through the creation of high-performance knowledge teams for innovation. Teamwork should be designed, planned and monitored on by upper management personnel. Upper management teams must identify new and innovative products and services and implement them. Engagement with innovation teams keeps corporate directors close to front-end professional innovations, new production technologies, and the marketplace. The participation of upper management must involve a team member who continuously reports to the group to ensure support from upper management personnel to teams. Team reports must also be created every three months to keep teams accountable and to create room for feedback and adjustments. Reporting standards also maintain a sense of team urgency.

Role rotation in teams must also occur every fourth months or six times over the course of a temporary team project. Continuous role rotation allows team members to break out from their comfort zones and to convert professional and tacit knowledge to explicit knowledge and vice versa. Team can in turn generate productive tacit knowledge for new services and products. Upper management personnel can participate in tacit productive knowledge formation and report back to upper management. Upper management personnel can in turn acquire tacit managerial knowledge through the connection of groups and teams. This linked process creates synchronicity in business actions.

A balance of leadership (giving the direction) and power (control, role expectations and time limits) is essential. The balance of team autonomy and leadership is key to understanding why teams succeed. This balancing act ensures that the process is managed and controlled even with a considerable degree of autonomy. As a practical implication, the balance of power and autonomy is central to the conversion of tacit knowledge into explicit knowledge. Upper management power and control secure the transformation of productive tacit knowledge into tacit managerial knowledge. Tacit managerial knowledge is in turn translated into explicit business action. Teams should propose production plans. Business decisions should involve drawing up a production plan on costs, quality levels, profits, time to market entry and suggestions for robotics production. Team should act as translator between upper management personnel and production groups regarding automated production. This mediating role can in turn remove top-down tension and encourage lateral collaboration for win-win results.

Several factors support flywheel rotation. One is the celebration of small wins. The examined teams celebrated 24 minor goals achieved over 30 months, four were celebrated with upper management personnel, and three were celebrated with the production workers. Minor wins show that we are on track and create a sense of confidence and togetherness.

Today, social networking is a part of working life. Internal information systems should be used together with external social media sources. Active networking professionals may possess more current information and may have more information and knowledge to share. Upper management teams should both participate in and promote social networking.

No personal bonuses should be given during the development period. New products and services can in turn be created through emotional learning and from knowledge motivation. Team members can also in turn create together without upper management, team or production bonuses. Bonuses should be given to all those involved when there are actual profits to share.

Planning is vital to all processes. Planning takes time, and it must be allowed to take time. Adjustments and changes should be possible to make within planned costs and timeframes. Innovation teams should be kept small, and corporations should use two teams rather than one large team, and at least two external team members should be involved.

Practically, is it possible to create a corporate flywheel from tacit knowledge? The conversion of productive tacit knowledge into tacit managerial knowledge that is converted into specific business action creates an explicit corporate flywheel while maintaining tacit knowledge as a competitive advantage.

13.4. Limitations and future research

Knowledge creation is not separate from the context in which

knowledge is created. Our empirical data were drawn from two teams working in one country (Norway), allowing us to conduct an in-depth longitude study. However, we in turn could not compare national contexts. We encourage the examination of teams related to upper management groups in other national contexts.

In closing, our focus on the role of various forms of tacit knowledge reveals different ways in which such knowledge can be explored and exploited by one Norwegian furniture producer. Distinctions made between productive and managerial knowledge related to business situations also reflect the strength of tacit knowledge as a critical resource. Future research must build on the many ways that firms can explore and exploit their tacit knowledge.

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