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Introduction

At the end of the day, there are always people behind new technology or innovation. Machines, technologies, software and hardware, and the processes and structures in an organization may be helpful, but hardly make the primary initiative or carry out the innovation process through all the steps of development and fundamental decision-making. Despite advances in artificial intelligence and other such fields (or perhaps even because of those) technology-oriented organizations are more dependent on knowledgeable, competent employees than ever (Guthrie, 2000). People as employees, entrepreneurs, and innovators are the initiators and originators of technological developments (e.g., Adler, 1995; Alegre et al., 2013; Camelo-Ordaz et al., 2011; Wright et al. 1994). They are invaluable in generating ideas, collecting and combining information and knowledge, pushing ideas forward, and in accepting—or rejecting—suggestions regarding unconventional solutions to more and less surprising problems.

At the same time, people present the issue of the "human factor". All things considered, individuals are unpredictable in many ways (Glaser et al., 2015; Olander et al., 2015). Therefore, it is not surprising that people-related issues are rapidly gaining momentum in R&D, innovation, and technology development (Frishammar et al., 2015; Hannah and Robertson, 2015; Järvenpää and Majchrzak, 2016; Rau et al., 2016; Wendelken et al., 2014). Managing people hardly is straightforward. There are numerous motivational, social, cognitive, informative, and other factors that play a role in how innovation processes begin, develop, and finally turn out, and what kind of outcomes they yield (see, e.g., Hannah and Robertson, 2015;

Nickerson et al., 2007). The dispersion of the responsibility of innovation generation (Stovel and Bontis, 2002) further increases complexity. Finding general solutions and suggestions for people management is therefore difficult.

Nevertheless, looking for improvement is a goal worth pursuing. We argue here, that how well this goal can be reached, depends on what kind of knowledge on managing people is used as the basis. While many people-related aspects have been addressed in earlier innovation studies, these are, in the search for simplicity, often addressed from one side only, considering only a small part of innovation activity, and seeing some activities or features as either positive or negative for development of new technologies. This easily leads to not capturing the context-dependence of specific phenomenon, the shades of grey, or the counterintuitive elements. For example, there are not many studies examining why, or to what extent the not-invented-here syndrome (e.g., Michailova and Husted, 2003; Antons and Piller, 2015) would be good, or why predisposed (biased) views or dominance by a single individual manager (Nickerson et al., 2007) might be beneficial for developing technological innovation. Still, some indication exists, that such questions deserve to be asked. For example, while employees want to be trusted and trust in general is a positive force, recent studies suggest that this easily turns into a burden (Baer et al., 2015; Dai et al., 2017). Employees become overly stressed. Likewise, somewhat surprisingly, there are findings showing that employee proactivity and initiative may, in fact, be detrimental rather than useful for value creation (Glaser et al., 2015). Yet another example is that it seems that high commitment and low employee turnover is not always beneficial (Husted and Michailova, 2010), even if that easily is the first thought and intuitive expectation.

Limited or one-sided insight is problematic in the contemporary innovation environment. The changing work cultures, increasing attention to humanization and emotions, and expectations of younger generation of employees (Bencsik et al. 2016; Romero and Pescosolido, 2008; Winter and Jackson, 2016), among other things, put pressure on management. For example, there is a chance that there could be more and more “Lonely wolves” (Husted and Michailova, 2010) type of R&D workers emerging in the future, and those management practices that have been found beneficial earlier, may not fit the new environment. These kinds of changes need to be accommodated.

At the same time, it needs to be kept in mind that going to the extremes might not be feasible or beneficial, especially if the groundwork for this does not exist or is not in line with the planned activities. Flexible modes of work, for example, could be considered to match nicely with the flexibility requirements inherent to innovation (Godart et al., 2017), but this may, actually, be an idea that leads to unjust expectations and problems with regard efficiency and innovation performance (McAlpine, 2018). Managing technology does

not equal to managing people. The details of managing people with the goal of enhancing and creating innovation are multiple, and they change constantly. Therefore, having insight on these issues is highly relevant.

In this special issue, the focus of interest is in providing some of this insight. Combined, the articles included here paint a picture on the importance of combining different elements in the management approaches, paying attention to the interplay between leadership and organizational culture, acknowledging the social dimension, and comprehending the role of practices. Furthermore, the relevance of suitable environment and context—especially an innovation-embracing, human-centric climate, is brought forward. That is, this special issue sheds light on the critical elements of managing people when the goal is to generate valuable technological innovation in an environment where both individual and collaborative approaches are needed, where exploitation and exploration need to be balanced and accommodated in the same setting, and where flexibility and structures form a continuum along which the innovation activities can be organized. In the following, we discuss these issues in a more detailed manner.

Critical factors in managing people for technological innovation

The articles included in this special issue identify and address central elements of people management for technological innovation, covering different contexts and the innovation process at different stages. Despite the different points of view that the papers take, they communicate quite a coherent message.

The first point rising from the collection of the studies in this special issue is that people management is highly pervasive and prevalent. The study titled as "***Walking the Innovation Tightrope: Maintaining Balance with an Ambidextrous Organization***" by Aoibheann Gill, Kathryn Cormican and Trevor Clohessy indicates quite clearly, that the *people management for technological innovation definitely goes through the whole organization*. The structure, culture and the related practices and processes, and the top-management need to be tuned simultaneously toward the same direction in order to make sure that the level of contradictions and tension does not increase excessively and cause dissatisfaction in an organization. The same need for careful combination of different elements across an organization is visible in the paper "***Integrative leadership for technology innovation***" by Abraham Vlok, Marius Ungerer and Johan Malan. Prevalence in this sense seems to mean that promoting isolation, for instance, by means of creating separated contexts (e.g., units) is risky. For example, Vlok, Ungerer and Malan; Gill, Cormican and Clohessy—and Christian A. Mahringer, Martin Rost, and Birgit Renzl in their article "**Facilitating the Context for Open Innovation in a Pharmaceutical Packaging Machines Firm**"—all warn, that despite established

benefits, task partitioning and structural separation may cause adverse effects such as silo-behaviors, misconceptions about standards, and constraints to open innovation.

This is not to say that task allocation and formal processes and responsibilities, for example, would not be needed. Those too can be valuable for innovation to take place, as noted by Mahringer, Rost and Renzl. The point is that they need to be aligned with other relevant factors. Developing a functioning, coherent innovation context from the point of view of people management involves more than making sure that the "infrastructure", where people work, is in place. For example, Mahringer, Rost and Renzl point towards the issue that people management for technological innovation actually extends beyond the organizational boundaries also, and in this, the inherently social nature of the innovation activity is an aspect to be reckoned. The same issue of relevance of social nature also emerges in the works by Dirk J. Primus and Crystal Jiang, "***Crafting better team climate: The effects of using creative methods during team initiation***," and Mi Jin Noh, Hyeongyu Jang, and Beom-Jin Choi "***The relationship between emotional exhaustion and turnover intention with moderating roles of job characteristics and organizational support: An empirical study of IT departments of Korean firms***". Likewise, the matching of social and structural elements throughout the innovating organization is present in the "***Freedom-form organizations, innovation and quality of work life: An exploratory case-study,***" by Isabelle Corbett-Etchevers, Damien Richard, Colle Rodolphe, Christian Defélix, and Céline Perea, making it a relevant factor to be considered.

The paper by Primus and Jiang also makes visible another relevant point regarding the prevalence and reach of people management: *it not only goes through the organization, but also bears importance along the temporal dimension*. Primus and Jiang find that some practices introduced at innovation team initiation phase and at the beginning of innovation activities may have quite far-reaching effects that are felt at the later stages and subsequent activities. Vlok, Ungerer and Malan also consider these kinds of temporal dynamics when they touch upon the relevance of leadership competences for the whole innovation process—that is, for different stages. Applying varying leadership competences and practices is needed at all times, but to different extents. Gill, Cormican and Clohessy likewise bring up the need to adjust practices over time, as processes develop.

The need for continuous adjustment combined with the need to incorporate varying elements into the people management for technological innovation also brings up the issue of resources. If multiple means of management are employed simultaneously and are kept active constantly—whether or not they are actually needed—the organization easily becomes strained, and the outcomes are likely not as intended. Considering this aspect, we argue that *acknowledging the possible under- or over-emphasis on specific elements of people management in technological innovation and finding the ways to mitigate these is*

important. The more information there is on the specific situations where different means of management are applied—and on the alternative means, the easier it is to avoid inefficiencies caused by over-emphasis of redundant management activities, and to limit harmful effects of approaches that unnecessarily generate problematic tension. The articles in this special issue shed light on these aspects of people management, and give some guidance on how the principles can be taken into practice.

First, leadership emerges as an essential issue in many papers. Vlok, Ungerer and Malan suggest that the leader competencies needed to guide teams in technology innovation process are relatively poorly understood, and that paying attention to them can provide direction for balanced people management. They acknowledge that a challenging issue is that technological changes have taken innovation related discussion forward faster than that leadership has developed. As a result, leadership—and the related discussion—easily lags behind the reshaping of operations and innovation environment. This kind of discrepancy can cause quite a few challenges for managerial practice, especially if it is not clear what kind of leadership behaviors and practices contribute to the emergence of technological innovation.

Turning their attention to these problematics, Vlok, Ungerer and Malan find in their work, that while there are some leadership competences that seem to be universally relevant in varying settings (including the current innovation environment), there are also such competencies, such as integrative ones, that are more specific to technological innovation generation and its management when people are taken into the focus. Pinpointing those specific competences is essential. This notion is related to a corresponding finding in the study by Gill, Cormican and Clohessy, where it is suggested, that not all elements of management are pivotal for the (dis)satisfaction of employees and the subsequent outcomes. It may be that there are such factors at play, that are be beneficial, but not necessary. For example, while in general (and as suggested above), it may be that "dynamic and flexible [context] allows individuals to use their own judgement to determine how they divide their time between alignment-oriented and adaption-oriented", flexibility as such is not as relevant as valuing and rewarding employees for their judgement and decisions (Gill, Cormican and Clohessy). At the same time, it seems that those factors that are specific to promoting technological innovation processes through managing people (e.g., integrative competencies of leaders that allow them to combine technology, business, and people elements together), are definitely needed (Gill, Cormican and Clohessy, as well as Vlok, Ungerer and Malan).

Another important element accompanying leadership and the related competencies is the context where people work. The article by Gill, Cormican and Clohessy suggests that one of the most crucial tasks in people management is to create environments that genuinely support innovative endeavors. They refer to the need of ambidexterity in people management, and bring forward culture and context, among other

things, as factors to be reckoned. This does not mean introducing a vast amount of different tools or setting up complex arrangements, however. For example, Primus and Jiang find evidence in their paper on collaborative technology (e.g. different communication platforms) not being necessarily the best alternative when innovative teams are initiated. Technological tools may, for example, be quite useful for creating repositories of generated knowledge, but when a creative climate is to be built and promoted, such technologies may become distractive. Instead, facilitating friendly competition and setting up time constraints that give just the needed push for activation likely is the approach to be selected (Primus and Jiang). Again, a conclusion to make is that not all means of management need to be utilized simultaneously, even if they need to be available for the organization in general. In fact, it may be better to put aside certain approaches at times. While already the finding of Primus and Jiang on the potentially distracting and time consuming tools indicates, that adverse effects may result from overemphasis of specific management approaches, the works of Corbett-Etchevers, Richard, Rodolphe, Defélix and Perea, as well as Noh, Jang, and Choi show this even more explicitly.

Although the Freedom-form organization introduced by Corbett-Etchevers, Richard, Rodolphe, Defélix, and Perea indicates that Freedom-form organization, as one manifestation of self-managing organizations, can be highly innovation-promoting way of organizing, there are also downsides related to going to the extreme. According to their study, 'f-form organizations' are team led—meaning that the leadership is shared—mainly because innovative employees are assumed to crave for freedom and have 'intrapreneurial' take on their work. The downside is that employees may become over-engaged and feel stressed by the social control in the peer group. The employee well-being and the related quality of work life connect also to the study by Noh, Jang, and Choi, where emotional exhaustion is linked to experiencing stress and injustice in the work place. Then attention needs to be turned to those issues that function as remedies or preventing factors for these harmful outcomes. For example, Noh, Jang and Choi indicate that "procedures are perceived as fairer when they are not motivated by authorities' self-interests, and when they allow members to voice their opinion". In fact, the studies in the special issue indicate that social skills and support from colleagues (rather than just superiors; see Noh, Jang and Choi) are relevant contributors for limiting unwanted outcomes. Corbett-Etchevers, Richard, Rodolphe, Defélix, and Perea also find a positive reinforcing cycle between quality of work life and innovation capability, which means that management needs to incorporate this idea also.

Finally, in the intersection of the leadership, contextual elements, and social dimension, are the practices that emerge as relevant part of people management for technology innovation. In particular, the studies by Mahringer, Rost and Renzl; Corbett-Etchevers, Richard, Rodolphe, Defélix, and Perea; and Primus and Jiang talk about these issues. Mahringer, Rost and Renzl, note that open innovation "covers a variety of different

practices that might broadly be categorized as inbound, outbound and coupled activities". They continue that "those activities differ substantially from each other", making it important for managers to acknowledge the variation, and the role of individuals. The nuances are considered relevant also in the study discussing the 'f-form' that has similarities with participative management practices (e.g., reduction of hierarchical levels, self-organizing, committed teams, and employee decision-making). However, as the 'f-form organization' "extends decision authority to all areas of decision making beyond work execution, and to the whole organization", there are definite differences to be reckoned. In particular, the matching of innovation practices and human resource practices is needed. Primus and Jiang refer to similar aspects in discussing the relevance of creativity-supporting, team building practices that inherently call for leadership, context, and social elements to be aligned. In sum, people management is not just a question of leadership, context and structures, but also of the interconnections among co-workers and peers, and practices that emerge in the everyday innovation-related activity.

Methodological considerations

Aside substance matter, this special issue also gathers together some ideas and insights on methodologies that can be employed when studying people management issues in technological innovation. A variety of approaches can be utilized to capture the central phenomenon theoretically—and also to evaluate realization of people management in practice.

The study by Mahringer, Rost and Renzl uses a case-study approach where the central sources of empirical information are documents, interviews (with critical incidents), and an expert survey, and where the analysis follows a traditional case-study research. Corbett-Etchevers, Richard, Rodolphe, Defélix, and Perea, likewise, opt for an exploratory single-case study.

Gill, Cormican and Clohessy, for their part, start with systematic review of literature, proceed to semi-structured interviews, and—finalizing the mixed-method approach meant to "draw from the strengths and minimize the weaknesses of both qualitative and quantitative research"—use a survey within a single organization. This study employs the Kano Model (Kano et al., 1984), where two questions are presented for each variable—one positive, and one negative—to construe the significance of individual factors. The methodological choice of Primus and Jiang also utilizes mixed-method approach, but in a slightly different way. Primus and Jiang use "quantitative survey data to understand and quantify the basic form of" the relations of interest, and qualitative content analysis to "afford explanations for quantitative results". Mixed-methods approach also characterized the study by Vlok, Ungerer and Malan. Their exploratory study started with interpretive qualitative phase, and proceeded to quantitative survey-based phase.

Noh, Jang and Choi conduct their study relying on self-administrated questionnaire, and structural equation modeling, completing the continuum of qualitative and quantitative research in this special issue. The survey tools used in the studies, for example, could be modified to match information needs of individual organizations when they generate, use, and evaluate their people management approaches.

Future research avenues

The articles in this special issue provide their view on managing people that generate technological innovation in different organizations. An evident issue is that despite the contributions to existing discussion, they also point toward the need to study these issues more. For example, Gill, Cormican and Clohessy note that tensions related to managing people could be studied, for instance, in relation to specific technological innovations and contexts, such as medical manufacturing. The suitability of the 'f-form' organization in different settings is an issue that Corbett-Etchevers, Richard, Rodolphe, Defélix, and Perea raise as a potential avenue for future research. Broader generalizability of findings is also called for in the study by Vlok, Ungerer and Malan, who also indicate that while moves away from industrial age approaches have taken place, the details of the change raise many questions that call for attention in the future. In the study by Primus and Jiang, such notions emerge that point toward unconventional measures being potentially promising in future people management, and these elements undoubtedly need to be scrutinized more in future research, for example, through comparative examination. Mahringer, Rost and Renzl bring up especially practices, and the plausible entanglement of practices with context, as something to be addressed in the future also. Work remains to be done, and the articles in this special issue pave the way for their part.

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