European Journal of Workplace Innovation

Volume 3, Number 2, December 2017

EUROPEAN JOURNAL OF WORKPLACE INNOVATION

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The European Journal of Workplace Innovation (EJWI) is an open-access, net-based, peer reviewed and English-language journal. The Journal invites research-based empirical, theoretical or synoptic articles focusing on innovation and workplace development. The aim of the journal is:

- To develop insights into workplace innovation
- Provide case studies from Europe as well as comparative studies from other continents
- Develop and present new theories in the field of workplace innovation
- To increase international publication within the field
- To become an important publication channel for workplace innovation researches as well as the international research community

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Editorial: Coping with the future

Richard Ennals

Introduction

The *European Journal of Workplace Innovation (EJWI)* was launched as part of a wider initiative. It is intended to enable researchers and practitioners to sketch future directions in advance of calls for proposals. It stimulates continued organic collaboration in the wider network associated with the *European Workplace Innovation Network (EUWIN).* It is thus in part an outcome of EUWIN, with which it shares a common ancestry. *EJWI* can add value to project-based development work, offering free, online, open access. The scale of operations could be scaled up in advance of a return to major consistent funding. Importantly, it is a practical implementation of the idea of a "Penny University", engaging a wider community in open access learning and debate.

European Commission project officers are valued network partners, rather than simply sources of funding. Several Directorates-General support a range of networks, with overlapping membership. Partner journals such as the *International Journal of Action Research (IJAR)* and *EJWI* are also networks, with global reach, including North and South America, Africa, and Asia. The movement can work through conferences based on networks, which can support increasing virtual participation. Publishers can be potential long-term partners. The roles of universities can be redefined, for example as hosts for regional development coalitions.

Researchers and practitioners need to maintain network connections, regardless of developments such as Brexit. Groups from Norway and UK seek to remain associated with EU

colleagues and programmes. *EJWI* can highlight similar objectives of research communities with different starting points. It can enable processes of dialogue and social benchmarking, as a core of researchers have experience of working across borders. As with the proposal for a *European Lifelong Learning Network (TRIPOD)* in 2003, *EJWI* and *EUWIN* can build on existing networks, supporting processes of bottom up continuous improvement.

There are European themes which cut across DGs and national programmes, which can be addressed in *EJWI*, such as Workplace Innovation, Lifelong Learning, Regional Development, the European Social Pillar, Ageing Workers (including ageing researchers), and Succession Planning beyond the Horizon. In summary, as Björn Gustavsen and I argued in 1999, Europe is a "Development Coalition". We continue to show that much can be done with finite resources.

Articles

In *EJWI* 3.2, We publish four new articles, focused around Industry 4.0 and Workplace Innovation, which demonstrate the continuing vitality of the field. We can see the development of central debates based on the emerging literature of Workplace Innovation, including earlier issues of *EJWI.*

Papke and Wagner discuss how approaches to Agile organisations can make practical and effective use of project management methods, such as Scrum, to deliver objectives of Workplace Innovation.

Mühlbradt and Kuyhlang introduce Industrial Cognitive Engineering (ICE), which brings together Workplace Innovation and Systems Thinking, drawing on a wider research tradition and an international network.

Lied outlines how Leadership and Improvement are vital issues for Trade Unions in the context of Lean Manufacturing. This extends the debate beyond company management, and draws on the distinctive legacy of the Nordic model.

Totterdill, one of the co-ordinators of *EUWIN*, considers Corporate Responses to Industry 4.0. He warns of the dangers of successive management fads, and presents a fresh motivational account of "The Essential Fifth Element", which integrates and adds value to Innovative Work Practices. The article includes extensive references to the literature.

Reviews

EJWI 3.2 includes my reviews of three books.

Workplace Innovation: Theory, Research and Practice (eds. Oeij, Rus and Pot; Springer 2017) brings together the work of leading researchers. It is full of insightful overviews, with few detailed cases. There is some rhetoric, and repetition of key themes such as "The Essential Fifth Element". A movement has been developed, which has continued beyond the end of EU funding. We could see Workplace Innovation in terms of "family resemblances" between diverse cases, rather than necessarily sharing a common essence.

Learning Factories: The Nordic Model of Manufacturing (Holtskog, Carayannis, Kaloudis and Ringen; Palgrave 2018) deals with a successful and interesting set of cases, with a focus on automobile manufacturing, where innovation is vital for survival in a global competitive market. The context of the Norwegian national PhD programme in Enterprise Development and Working Life (EDWOR) is interesting, but hard to generalise across Europe. The Raufoss regional phenomenon is unique and instructive, with echoes of Silicon Valley in California.

Microcosmographia Academica: Being a Guide for the Young Academic Politician (Cornford; Bowes & Bowes 1908) reminds us that these issues are not entirely new. The leading researchers in the field were "Young Men in a Hurry". They are now older, but still impatient.

A fourth book was published in April 2018, in hardback and paperback. *Coping with the Future: Rethinking Assumptions for Society, Business and Work* (eds. Johnsen, Holtskog and Ennals; Routledge 2018) recognises that we do not know what will happen in the future, and considers the role of social science. Using a central discussion of "Kodak Moments", involving transformative and disruptive change, this collaboratively written book opens up new debates which go beyond the Nordic context. The resulting discourse exemplifies the Nordic model, and offers an approach to society, business and work after the financial crises which exposed key weaknesses in liberal capitalism.

Conferences

In our planning to date for the *Coping with the Future* conference at the University of Agder 8th – 10th October 2018, we have built on a long-standing culture of dialogue, in which *IJAR*, *EUWIN* and *EJWI* have played roles. Our conference is led by *EUWIN* on 8th October, with a focus on business; by *EJWI* on 9th October, with a call for papers from researchers and practitioners; and *IJAR* on 10th October, with invited speakers on the future of social science. The conference organiser is Professor Hans Christian Garmann Johnsen of the University of Agder, who is managing editor of *EJWI.*

We also provide details of two further conferences, *EURAM* in June 2018, and *IWOT22* in September 2018

EUROPEAN JOURNAL OF WORKPLACE INNOVATION

Agile Workplace Innovation

Thomas Papke and Dirk Nicolas Wagner

Abstract

Agile methods, such as Scrum, first re-invented project management in software engineering. It then quickly spread into all kinds of areas and industries. Scrum is "a framework within which people can address complex adaptive problems" (Schwaber and Sutherland 2013), and it changes the way work is done. It can be shown that Scrum is a suitable method to support Workplace Innovation. The concept of Workplace Innovation, described here with the 'Fifth Element Concept' (Totterdill 2015), comprises practices that empower and enable employees and that are beneficial for organisations. To obtain an understanding of how Scrum supports Workplace Innovation, guided interviews were conducted and analysed. Five practitioners of Scrum were interviewed, and the analysis was carried out using Mayring's qualitative content analysis with an inductive coding. This article aims to gain insights into how and where Scrum can support Workplace Innovation, and what other factors have a significant influence. Scrum may not be a silver bullet, but it can be instrumental in supporting many elements of Workplace Innovation.

Keywords: Agile Management, Scrum, The Fifth Element, Workplace Innovation

Introduction

The challenge to achieve Workplace Innovation

Examples for Workplace Innovation are practices which give employees the power of decision in their day-to-day activity, enable them to contribute ideas, question established ways of business and allow them the opportunity to be heard at the top management level. Nowadays there is more and more evidence showing that Workplace Innovation contributes towards better results for businesses while also enhancing health and engagement amongst the workforce (Totterdill 2015, p.56).

Totterdill (2015, p.57) ascribes great importance to the concept of Workplace Innovation as a constant social process. Workplace Innovation defines the contributive process of innovation that flows into outcomes in the shape of participatory workplace practices. Participatory methods, based on reflection, learning and improvement, support the process of innovation in managing, organising work and applying technologies.

Ennals (2014, p.112) highlights, that Workplace Innovation cannot be treated as an isolated object, but should incorporate experiences from various contexts in working life. Totterdill (2015, p.56) proposes a framework, the 'Fifth Element Concept', which should help to understand, stimulate and enable high-performing workplaces through empowering employees and fostering their engagement.

According to Ennals (2014, p.112), this framework is vital and effective for organisations and considers state of the art research. Gkiontsi and Karanika-Murray (2016) provide an example of how the framework can be applied systematically in the specific context of demographic change. The framework was initially designed to allow employers and employees and other stakeholders in policy making, research, social partnership or consulting to be involved in shaping a vision of a high performance and high quality of working life organisation by contributing their knowledge and experience. As it is a complex concept, an emphasis was put on making it more communicable, bearing in mind the extensive underlying research (Totterdill 2015, p.62).

The first element of the framework is work organisation. Employees taking the initiative and being able to work without supervision are valued, as it enables the workforce to make decisions based on their practical experience and to avoid delays that happen during coordination with management. Employees often know best what their customers want and their co-workers need. Job design is the starting point in building a workplace that enables the workforce to deploy its skills, develop him or herself and get creative. Good job design should be integrated into an organisation's context. The core concept to achieve this is teamwork. Teamwork has a long tradition in European management thinking, and is one of the key concepts in the new organisation of workplaces. Teams that enjoy empowerment and self-organise are one of the key factors in workplace innovation (Totterdill 2015, p.65).

The second element is structures and systems, which deals with reducing organisational walls and ceilings, supporting initiative amongst employees, ensuring fairness and equality and building trust. People should no longer be allocated to departments and divisions, but rather be able to interact with others in their organisation to understand their tasks, problems and skills. To become an innovative workplace, it is necessary to embed the idea of empowerment in all

systems, and into all policies of an organisation. Good coaching for high performance, when managers act as team leaders, leads to continuous improvement. Managers should see it as a way to enhance the performance of a whole team, which can be achieved through sharing best practices and discussing problems on a team level in an open and target-orientated environment (Totterdill 2015, p.66-67).

The third building block is learning, reflection and innovation (Totterdill 2015, p.67). Pot states that managerial and organisational innovation seems to be more important than technological innovation (Pot 2011, p.406). Consistently generating ideas to improve the business should be incorporated into the daily work. Continuously getting new ideas for products, services or improved process is important for organisations. This can happen during dedicated times, in certain places or during everyday business if it enables dialogue and creativity amongst the workforce (Totterdill 2015, p.68). Tidd and Bessant (2013, p.130-131) state that this kind of innovation, as shown above, known as high involvement innovation, needs to be rooted deeply in an organisation. Employee engagement needs to be channelled from upper management to support empowerment and cleverness in daily work to ensure sustainability and effectiveness. Ramstad also argues that high involvement innovation practices, such as decentralised decision making and cooperation, can lead to valuable results for organisations and the workforce (Ramstad 2014, p.25).

The fourth element is workplace partnership, which is about dialogue, representative presentation, an open and commutative work environment, being involved in change processes and the integration of tacit and strategic knowledge (Totterdill 2015, p.69). Cressey et. al. (2013, p. 240) state, that workplace partnership is moving away from its focus on industrial relations, and is changing into a possible driver of organisational innovation.

The integration of many aspects has synergetic effects, which Totterdill identified to be customer focus, employee engagement and enabling culture. Furthermore, he regards resilience, positive employee relations and enterprising behaviour as synergetic effects (Totterdill 2015, p.64). Totterdill (2015, p.70) highlights that an adequate amount of research demonstrates how none of the building blocks exists in isolation, but rather are under the influence of one another. His concept illustrates the significance of understanding the interdependence amongst the workplace practices that are specified here and he concludes that if all this comes together, the outcomes are “high performance, good work and sustainable organisations” (Totterdill 2015, p.64).

Kalmi et. al. (2008, p.437) highlight that previous research had different outcomes concerning the impact of Workplace Innovation. However, Pot and Koningsveld show that the benefits of developing workplaces are plenty, but also hint that doing so is difficult. To do so successfully, participatory schemes that include employees seem superior to top-down approaches (Pot and Koningsveld 2009, p.421). The conditions for success or failure in Workplace Innovation, in general, are elaborate. The most important condition for success appears to be the commitment of management, together with the participation of the workforce (Pot 2011, p.412).

1.2. How agile management methods may lead to Workplace Innovation

Salesforce.com, a global software company, is an example of a company successfully using Scrum, after transforming itself from traditional management in just three months in 2007. Since then they achieved remarkable results. In the first year after the changes, Salesforce.com released 94% more features, output per developer rose by 38% and customer value by 500%, compared to the year before. After the implementation, Salesforce.com asked its employees about their experience with Scrum. Before implementing Scrum, only 40% had a good time working there. Afterwards, 86% did and 92% of the workforce would advocate Scrum to others (Denning 2013, p.6). In this case, Scrum had a positive effect on many aspects of Workplace Innovation.

Agile methods are based on the idea of the agile manifesto from 2001, which values, "individuals and interactions over processes and tools, working software over comprehensive documentation, customer collaboration over contract negotiation and responding to change over following a plan" (Kent et. al 2001). For years, neither business schools nor senior managers paid much attention to agile management methods. Although it is widespread in software development, for more than a decade, not much research was undertaken on it as an innovative managerial practice (Denning 2013, p.7).

Scrum is the leading form of agile management (Denning 2013, p.6). It can be used in other sectors than software development to improve quality and collaboration radically. With Scrum, an automotive supplier reported improvements in team autonomy, decision power and collaboration. Scrum showed its power through its rituals, transparency and roles. Good coaching through a so-called "Scrum Master" improved work results and supported the transition phase towards agile management. Besides that, team building was done on the job, as teams got better quickly over time as they had quick wins each week (Brandes et. al 2014, p.162-164).

Today agile methods are used in various industries and business functions. They are utilised to develop machinery at John Deere, create National Public Radio's programme, shape marketing at the cloud company Itronis, or are applied in everything from production to human resource at companies such as logistics provider C.H. Robinson, Mission Bell Winery, or GE (Rigby et.al. 2016).

There is evidence that may lead to the conclusion that companies from most industries face comparable problems and challenges when it comes to innovation. Many companies already use agile approaches, even though more traditional industries seem less keen to implement agile methods. In general, agile methods can well be used in other sectors, possibly at least for innovation projects, or tasks that ask for more flexible management than before (Conforto et. al. 2014, p.27-31). Hence, in the future, agile management methods are likely to become more and more important for organisations outside software development (Randall 2014, p.26-29).

Moe et. al (2009, p.480-490) conducted a field study in a company that had implemented Scrum, hoping for improvements in their ability to deliver iteratively, improving quality and better teamwork. They found that teams are better off when they self-manage, and agile methods enabled them to do so. Trying to establish what teams think of agile approaches such as Scrum, Williams (2012, p.72-76) conducted two surveys, which showed significant support for the principles of the agile manifesto.

Scrum has been associated with many positive (psychological) effects on the workforce, such as shared responsibility through dedicated roles, self-management of the workload, and motivation due to the feasibility of the increments. Furthermore, Scrum is designed to enable teams to openly talk about problems with their work and their work environment, and find a solution by adjusting the plan. Additionally, all information is shared, and help can be provided easily as all team members are informed about the progress. Under Scrum, problems and their solutions are perceived as emergent. Hence, this takes away the pressure to perform and fear of failure. The chance to regularly talk about one's work eases pressure and allows everyone to be heard (Goll and Hommel 2015, p.110-111).

It has been shown that Scrum can improve team productivity and employee satisfaction. With Scrum, the time spent on unnecessary meetings and documentation of processes can be reduced. In collaboration with customers, their engagement and satisfaction can be increased, as it leads to more transparency and adaptability to their needs during the process. Ideally, Scrum teams are interdisciplinary, which supports the organisational learning and builds trust and respect among coworkers. Moreover, the approach can have positive effects on senior management, as it frees up their time when they no longer squander their time on project management tasks. Hence, they can spend it on tasks of higher importance, such as prioritising strategic projects, increasing collaboration across departments and removing impediments (Rigby et.al. 2016).

Tasks, Roles and Workflow within Scrum

Scrum is rooted in Japanese thought and practice (Sutherland 2014, p.38). Nonaka and Takeuchi state in their much-regarded classic paper, that speed and flexibility are highly essential for new product development. As companies no longer get the results they seek, their analysis proposes a holistic approach for successful teams. It has six characteristics: "built-in instability, self-organising project teams, overlapping development phases, "multilearning," subtle control, and organisational transfer of learning (…) companies are using a holistic method--as in rugby, the ball gets passed within the team as it moves as a unit up the field" (Nonaka and Takeuchi 1986, p.137). The term Scrum refers to the above-described way "the team works together through careful alignment, unity of purpose and clarity of goal" (Sutherland 2014, p.8). Ken Schwaber and Jeff Sutherland defined Scrum, in their "Scrum Guide", as "a framework within which people can address complex adaptive problems, while productively and creatively delivering products of the highest possible value" (Schwaber and Sutherland 2013).

The Scrum team consists of three roles, the Product Owner, the Scrum Master and the development team. Firstly, the Product Owner is responsible for what will be done and when in the development process. She has the authority to decide what will be done, communicates the vision of what the team is about to achieve and collaborates with the other roles. The Scrum Master is in charge to guide the team towards an adjusted process for the task based on the Scrum framework. She ensures understanding of the values, principles and practices of Scrum and embraces them. The Scrum Master as a facilitator supports the organisation in change processes, removes obstacles and provides expertise, leadership and protection from disturbing outside intervention. Even though her role is not the one of a project manager, it can be the one of a leader. Lastly, the development team decides independently how it will get done what is asked for. In general Scrum teams are cross-functional, diverse, no larger than five to nine

members and should have all the skills they need for the task. Scrum teams are self-organising, thus they can decide best how to achieve their targets (Rubin 2012, p.14-16).

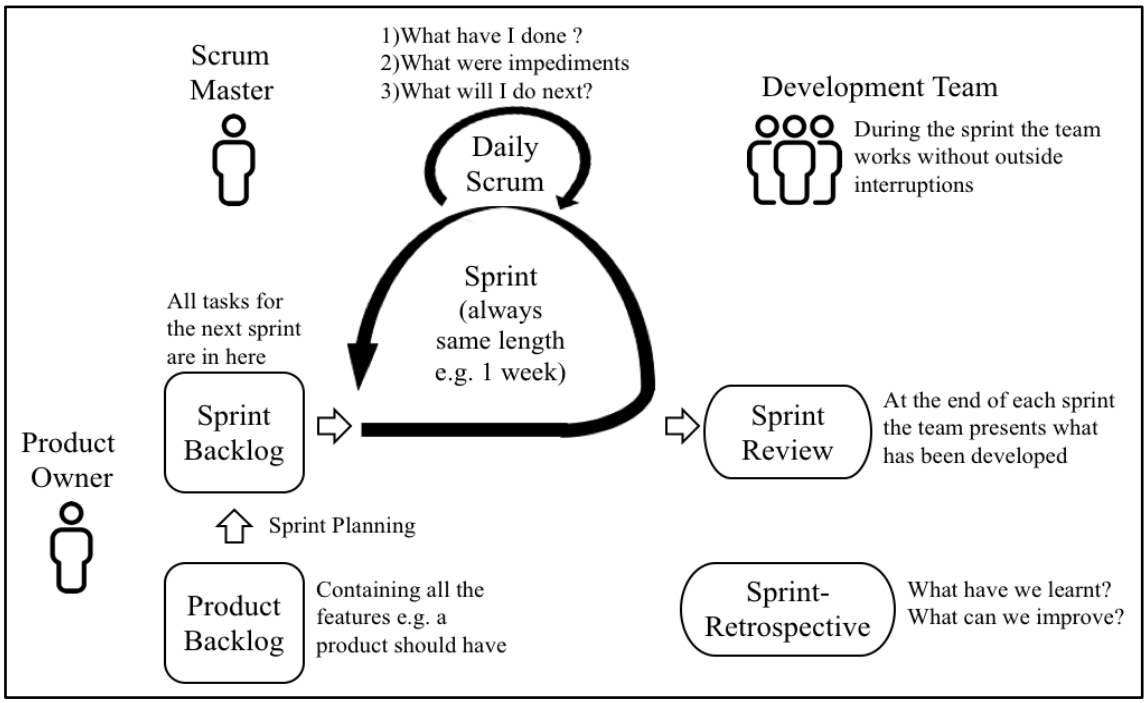

Figure 1: The Scrum Workcycle (adopted from it-agile.com (2015))

For the purpose of this study it is useful to briefly summarise how Scrum teams work: At the outset, the Product Owner writes all the requirements into a so-called Product Backlog (Rubin 2012, p.17-18). To build the Product Backlog, the Product Owner might make use of techniques such as Design Thinking or Crowdsourcing (Rigby et.al. 2016). Its content is prioritised by the estimated value the items provide to customers and stakeholders. As the Product Backlog (1) is too large to be completed in one go, the development team must decide on a portion of the tasks that they think they can complete in one Sprint. This is done as part of the beforehand Sprint planning (2). To get to work so-called Sprints (3), which are work cycles with the same length (for example two weeks), are held. To ensure that targets are met, the development team does not only forecast, but also commits to their goals. To support the development team during the Sprint, they create a Sprint Backlog (4) in which in further detail they break down their plan on how to complete features in one Sprint time. Next up, the Sprint is held, and the team gets to work. During the Sprint so called Daily Scrums (5) are held, where the team gets together to ensure the flow of their work by synchronising each other, doing a check-up on their work and adjusting their planning. As they complete one Sprint, they should have achieved one increment of their product. Now Scrum, which works in cycles, repeats, and starts with the next Sprint. Usually, after each Sprint, the team conducts a Sprint Review (6), where the stakeholders and the team examine what has been done. After one or more Sprints, the Scrum team itself does a Sprint Retrospective (7) where they review their Scrum process. They reflect on how they worked together and what they can change. (Rubin 2012, p.17-18).

Negative effects of Scrum can be underestimating cross-sectional tasks, and only be thinking short term. Hesitating to make decisions may have adverse consequences because costs may rise over time (Goll and Hommel 2015, p.110-111). Morris (2013, p.91) further criticises that agile methodologies mainly focus on delivering an increment of work and hence run the risk of needing more resources than planned, exceeding budget, or not meeting schedule and scope requirements. Additionally, he emphasises the danger that focusing on short-term increments may lead to losing track of the overall progress in a project, which may hurt the overall value and realisation of benefits. However, he acknowledges the positive impact Scrum has had in software development.

How SCRUM can support Workplace Innovation: Business practice perspectives

Overview of Research Process

To explore how Scrum can support Workplace Innovation, based on primary data, guided interviews were undertaken. Interviews of an average length of 45 minutes were conducted with five practitioners of Scrum. The interviewees worked in various areas such as software development, project management services and consulting. All interviewees were made aware that the interviews would be recorded.

Qualitative methods were chosen over quantitative methods, as they enable more interaction and communication with the interviewee, more background on each of the topics, process-orientation, consistency and authenticity, further in-depth questions that prevent misconception and an individual approach. Besides that, they can add valuable input and ideas from the interviewees. The output of qualitative evaluation is more case-related and richer in context (Kuckartz 2008, p.66-70).

The gathered data was analysed with the help of software, as the goal was to systematically analyse linguistic material (Mayring 2010, p.110). This approach seems best, if one plans to work inductively, previous knowledge is small, and exploration is the primary goal (Kuckartz 2010, p.92-96), which was the case for this work. A qualitative analysis may be of use and might feature enlightening insights even if, as in this case, it was based on a small number of interviewees (Brinkmann 2013, p.90). Mayring's qualitative content analysis can be used to generate hypotheses (Mayring 2010, p.22). In this case, the categories were developed in an inductive way, as the interviewees quoted other factors, which do not fit into the concept of Workplace Innovation. There is an apparent overlap in the inductive categories and parts of the 'Fifth Element for Workplace Innovation'.

This work cannot fully represent the complexity of the underlying concepts. The authors acknowledge that the reliability and ability to draw generalisations from this work are clearly limited and the conclusions are subject to the authors' subjectivity.

The use of Scrum

Most interviewees used the whole Scrum framework in their organisations. Scrum had been introduced into the respective organisations on average more than four years ago. Mostly it had been tried in teams and then implemented following a bottom-up approach in other teams.

One interviewee stated that only parts of Scrum, such as the Daily Scrum, were used. This was done to improve communication among the team members. The quote from an interviewee: "What is definitely very helpful are the Daily Scrums, where one gets to know what the others are working on, where they struggle…can I maybe help them?" illustrates for example, how switching to daily meetings improved communication compared to longer weekly meetings that only led to frustration in the team. It was further said that "the people that before haven't talked to each other, suddenly work well together… and many topics are triggered from the team".

All interviewees agreed that Scrum is a very useful method in software development, but they were divided about the use of Scrum in other areas or projects with a big scope. The use of Scrum can also depend on the customer's requirements, and if results are needed quickly. In most cases, Scrum was still used in software development, but there were also efforts to embed Scrum or other agile methods into the whole organisation. Whether Scrum is utilised in other areas seems to depend on the industry, and the kind of project. One interviewee stated an example of Scrum used in hardware development, where he saw the same benefits as in other projects. One interviewee reported that he knew "…of examples from NGOS…or service departments such as HR or others, that switched to an agile approach". All interviewees agreed, even though Scrum might not be useful for all kinds of projects, they saw clear benefits in using Scrum and "would not like to go back to where our company came from, that usual project management business".

Scrum itself may only be a framework that will not solve any problems. But in the opinion of the interviewees, Scrum seemed superior to other methods. Nevertheless, there might be a danger to see Scrum as "a magic bullet that cures all problems that we see come up in projects".

Apparently, the implementation of Scrum often fails. When this happens, Scrum might become a neglected method, as its implementation failed due to various reasons. One interviewee stated that Scrum is often misunderstood "... as something for software developers. And not a cross-organisational management framework". To prevent a failure when implementing Scrum, good coaching seems vital. It was stated, that if teams see that Scrum has no benefits for them and their project, they stop using it.

As Scrum only provides a framework, it still is up to the teams to fill that , and make use of methods that fit into the framework. One interviewee said that „ ...there are no precise approaches. And I see this sceptically, because one can do much good, one can also make many mistakes." Suitable methods could, for example, be tools to structure the retrospective meetings or communities of practice that enable knowledge sharing across teams.

Furthermore, it was stated, that the teams are often not homogenous and hence an equal distribution of tasks may be difficult which may have a harmful impact on team performance. Scrum may best be used when the teams are small and located in one place. If teams are not

located in the same spatial area, Scrum was not the preferred method, as communication and Daily Scrum meetings are more complicated to organise.

Besides that, one interviewee stated, that self-management of teams is hard to do. To get to that state successfully, requires a manager, or in this case a Scrum Master, who is one of the most important factors when doing Scrum. Three of the interviewees were in the role of the Scrum Master. The all had different backgrounds and gained experience in various roles before becoming a Scrum Master. One interviewee described his role as a facilitator, where his task was to ensure that the Scrum process itself works smoothly and excellent products are produced.

All interviewees saw the power of Scrum in the short work cycles, which enabled better planning and predictability, as this statement shows: "The benefit of the method Scrum is, that usually one has a manageable timeframe and comparatively small tasks (…) that possibility of manageable iterative planning."

It was also emphasised, that currently, Scrum is a trending topic, "…which has led to a bit of hype around it. There is a danger that Scrum might quickly lose popularity and vanish from management's attention, just because sadly things are not done properly." What appears to be critical here is the fact that many managers put a lot of promises into it. But as Scrum is hard to do, and if the managers themselves do not see the necessity to change, the implementation of Scrum might fail. Currently, many organisations are experimenting with agile methods such as Scrum, but quite often these methods are not implemented correctly.

Work Organisation

The question how Scrum can contribute to Workplace Innovation was examined based on the experience of the interview partners. From the interviews, one can draw the conclusion, that Scrum supports job autonomy, if the team is composed of members that are willing to work autonomously. For some, it is an incentive to work more independently, but it can also lead to team members just drifting along and relying on others to plan and decide. Besides that, some team members may tend to cherry picking, which is counterproductive for the team result. Scrum, if done right, can be a method to empower employees.

One interviewee stated, that "the to do is already set, but the teams are free to decide on how to achieve it". However, the degree of freedom may vary. It may be the case that team members on their own identify tasks and problems, which according to the interviewees will not be the case in projects that are planned in a waterfall project management approach.

Regarding the aspect of self-managed teams, the impact of Scrum can be mostly positive but can also have negative implications, for example, if team members unlearned how to work on their own. What all interviewees agreed on is that the ability to self-manage is dependent on each team. They all quoted examples of teams, who quickly after having adopted the method Scrum, defined their own goals and were willing to do good work. But on the other hand, it can also be the case that teams do not develop themselves, or remain reluctant and are stuck in the expectation of being told what to do next, and how. This may be because they do not want to or they feel unable to do so. Apparently Scrum itself will not lead to self-managing teams but enables them. It is one of the Scrum Master's tasks to support the team in getting to that state.

Scrum can also be a management system that allows the employee to achieve his or her goals in their way. The Scrum Master may also support the team by taking over "…many organisational matters…also for the individual responsibility of the team."

That teams can truly be self-managing is an illusion from the view of the interview partners, because some team members naturally take over more responsibility than others. But strong teams can self-regulate, if team members do not carry their weight. In an excellent way, the team divides its tasks considering the strengths and weaknesses of each team member.

Scrum may make employees more flexible in organising their own work, as they talk about their work in the Daily Scrum and "ideally the people divide the tasks independently amongst themselves." From one interviewee's perspective, Scrum, in general, can help to provide flexibility and to make use of it for every team member. But in some cases, employees can also misuse this flexibility.

Another aspect that was stated and can be related to the category of work organisation is improved planning. Planning drastically improved, as one could say much better what was available when. The iterative work style leads to results at the end of each Sprint, which can be as short as a week.

In conclusion, Scrum was identified to: in the experience of the interviewees, have had a positive impact on the aspect of work organisation, as described in "The Fifth Element concept." Whether Scrum supports Workplace Innovation or not appears to depend on how well Scrum is implemented and utilised.

Structure and Systems

The interviewees all reported that trust is vital for working together and that it is supported by Scrum. When the team with the help of the Scrum Master or a coach "… is being led there in the right way. (…) it works incredibly well, people who have not spoken to each other before, suddenly work well together and communicate openly with each other." Scrum appeared to build trust amongst team members even if they distrusted each other before. This may also happen if a natural hierarchy has already been established in the team. To build trust, management needs to let go, and the team members have to get to a point where they trust in the work of others. In teams, there are always different kinds of people who can deal with this better than others, but in general Scrum seems to support building and maintaining trust.

Scrum apparently also fostered employee initiative, and "for some is an incentive to work more independently". If used as prescribed, Scrum is a method to give more responsibility to teams and they often seem to appreciate this by showing more initiative. In the interviewees' experience, they observed more input, more suggestions and that "new tasks are recognised independently and proposed. You can not claim that in traditional project management, for example in the waterfall model." This might be due to the fact, that the team self-organised and had hence probably a better overview of the bigger picture. In some cases, this effect may also depend on the scope and topic of the project, but in general it seems to support employee initiative.

Scrum may enable teams to be fair and treat each other as equals. It is not clear whether this is

only a result of Scrum or has already been, at least partially, the case. In general, it seems to have depended on the team and its team spirit. It does not inevitably lead to equality, but it "…enables a higher transparency. (…) the cherry-picking ones are easily spotted in such an environment". Teams differed in their reaction to such behaviour. Some teams exposed the weakest team member, while other teams tried to involve her or him better, to be able to achieve their goals on time together. What Scrum probably can provide, is that team members feel well incorporated and not left out.

Scrum may not be clearly attributed to reducing organisational walls and ceilings. In most of the interviewees' organisations, organisational barriers were already low. This might also be a prerequisite for the implementation of Scrum. But what can be said, is that in Scrum teams there are no fixed roles or hierarchy positions. Interestingly two interviewees stated:" … that the physical walls in the office's spaces are no longer existent" as well. Most of the Scrum teams were seated in an open-office space to enable collaboration and improve personal communication.

Reflection and Innovation

Scrum seems to support the continuous improvement process of outcomes and processes. What needs to be in place to do so is that changes are noticeable for all team members. It is essential that issues that are under discussion are solved quickly and accordingly actions are taken.

In the interviewees' experience, Scrum led to better communication about problems and impediments among the team. Team members appeared to communicate not only more, "…but also more target-oriented. Interestingly enough, the results at this point are better." Significant parts of Scrum, which support the continuous improvement process, seem to be the retrospective meetings. This ritual kind of communication in the team appears to support the improvement process. Teams were able to talk about "what went wrong and what went right. In reality, it is mostly what went wrong." In one case, it was stated, that the team did a retrospective of the retrospective to see how well they improved their performance, whether measurements have been put into action and if not why they got off track.

It appears that teams must have the intention to change and improve, and Scrum only enables teams to do so more effectively. Sometimes suggestions came from the team's continuous improvement process that also contributes towards the continuous improvement of the company. One interviewee put it "plan, do, check, act, that is the premise that influences our daily actions (…) this conventional continuous improvement process, where we steadily want to get better. One the one hand better in the process and of course in the product too." In more detail, this means that plans (in the case of Scrum, Sprints are planned) are drafted to see what the task is about. Then the doing follows. Afterwards follows the check, which leads to act, where changes and improvements are done. Through its short work cycles and rituals Scrum leads teams to go through a PDCA-Cycle much more often than other methods. Hence this supports the continuous improvement process. It was also highlighted that the Scrum Master could guide the team towards improvement.

From the interviews, it appears to be likely that Scrum supports the sharing of knowledge and experience. It probably is not the only trigger but intensifies the sharing. For example, the daily meetings enabled teams to share their experience. These meetings provided a platform for giving an impulse on an issue, which was then discussed in further detail afterwards. Scrum seems to provide a framework, which supports sharing of knowledge and experience, although it has been highlighted, that one should also utilise other methods.

As Scrum plans iteratively, team members are enabled to work on various small tasks, and can take over tasks that they normally would not have been able to. This can also be counterproductive when team members only do the tasks they are familiar with and walk away from challenging tasks. Sharing of knowledge and experience seems to be supported by Scrum even though it appears to depend on the team members. It should be valued and lived by teams as said here: "lack of knowledge is not bad here, only the ignorance not to ask questions"

Scrum seems to support high-involvement innovation, as every team member is deeply integrated into the process and is enabled to contribute towards innovation. Especially the constant exchange among the team appears to help here. What also seems to be beneficial overall here, is that in 3 out of 4 cases the interviewee's teams were multidisciplinary. On the one hand, thus not every team member could do every task, but the heterogeneity had a positive impact on working with customers and getting creative results. This is a factor that cannot be traced back to Scrum but might have a positive impact on Workplace Innovation.

Workplace Partnership

Concerning the impact of Scrum on the dialogue about the company, and being involved in change, the interviews showed mixed results. One interviewee attributed the fact that he felt well informed on a strategic level of the company to the size and structure of the company, and not to Scrum. Others though stated, that working with Scrum had a major impact on the whole company. In one example, the interviewee explained that through Scrum suggestions for the whole company were made. In this case, after having used Scrum in software development, it was rolled out in other areas of the company. The impulse for doing so came from the first Scrum Team.

In one example, candidates for a position in a Scrum team were also recruited and chosen by the Scrum Team itself: "We as a team want to present us in a job interview. But also get to know the candidate better". Although this is not an aspect of the Scrum framework itself, it might be a result of how the team has gained empowerment and self-manages through Scrum, and hence expanded its scope of action inside the company.

The aspect of integrating tacit and strategic knowledge is mostly covered in the above category of shared knowledge and experience, due to the interdependence of its aspects. Scrum has no impact on representative presentation.

Synergy Effects

Scrum appears to support an enabling culture well. It is necessary that the upper management is willing to understand agile methods and to implement them intransigently into the organisation. If an organisations' management is unwilling to do so or is afraid of the

consequences of using agile methods, then “agile life will be stopped”, or it will become difficult for an organisation to get there.

Interestingly none of the interviewees talked about team members who disapproved of the new way work is done. Scrum seemed to have improved team culture and may as well improve company culture. If Scrum is embedded in a bigger organisational structure, which allows failure, values respect and shows , it apparently works well.

If employees had bad experiences, such as ”broken organisations (…) where people unlearnt to have their own standards (…) and they want again and again be told what to do”, Scrum is less likely to be beneficial. Another aspect that was quoted is that of employee happiness. Scrum apparently has improved the happiness about work in the team, as stated by one interviewee. As happiness is a complex concept, this factor will not be investigated any further here.

The interviewees were at odds when it comes to the question, whether Scrum leads to more customer focus. This may be the case, if “(…) you get feedback which then flows into the planning for the next iteration. This is a much quicker exchange that in common projects. But you have to use it.” The Product Owner seems to play a major role here. The interviews suggested that certain employees just tend to think more customer-oriented than others. What Scrum can contribute towards customer orientation is that it enables regular feedback opportunities as the customer can easily participate in the review meetings. As after each Sprint increments are delivered, the customer can give feedback on each of the increments, and has no longer to wait for months to see the whole outcome. Hence more interaction is possible when customers ask questions like: “Why did you do it like this? Like this or like that would be way better! This gives impulses and stimulation and helps the developers to comprehend how the customers think”. In conclusion Scrum provides an opportunity for more customer focus, but the teams need to utilise it actively.

None of the interviewees saw that Scrum supported entrepreneurial behaviour among the team members. If employees think like an entrepreneur, this was perceived as given and was already in place before or was influenced by the size and structure of the company.

Furthermore, it seems to be the case that Scrum does not lead directly to more employee engagement. In the respective cases Scrum, led to a state where more work was done in the same amount of time with the previous methods. But this was characterised to be a secondary effect.

Other factors that are indirectly linked to parts of the concept

In the interviews, many other things came up, that either might contribute indirectly towards Workplace Innovation or seem otherwise relevant. The importance of an agile mindset is striking. Within most teams the agile mindset was already present, but Scrum further deepened the attitude. One of the main challenges when trying to use Scrum in organisations appears to be that management has to develop such an agile mindset. The idea of the agile principles, and how they impact work, is crucial to understand. In some cases, it turned out to be beneficial that the employees had no experience with Scrum, and in other situations having already worked in

agile environments helped too. There seems to be no best practice, as the successful use and implementation of Scrum also depends on many other factors.

Another aspect, which is not part of the Fifth Element concept, but was often stated, is that communication improved significantly with the use of Scrum. People, who had not spoken with each other before, talked about projects and the processes. This was apparently mostly triggered by the regular meetings that became rituals. Again, the importance of the Scrum Master who can support the team was highlighted. One example is the daily meeting, as it allows the team members to get an insight into their co-workers work, and to share their problems and challenges. Being able to talk about impediments and obstacles may help to get those out of the way quicker.

Besides that, Scrum also had an impact on transparency, as it becomes clear how fast work gets done and what can probably be done in which amount of time. Teams were also able to see who does what, and if any team members misused their freedom to self-manage and let their team down.

It appears to be the case that employees with a high level of self-motivation profited from the implementation of Scrum. These employees were motivated by their own results, and as Scrum helped to deliver results in a short time span, it probably contributed to consistently high levels of motivation. But there were also teams that had no self-motivation, and hence Scrum could not support them.

What also appears to be important is the role and influence of senior managers of an organisation. As soon as managers were not willing to change, and if they perceived Scrum as something that is only for software development, the implementation of Scrum was unlikely to be successful. Then organisations fell back into old habits and processes and only used a "Zombie-Scrum (…) that has nothing to do with the mindset of a genuinely agile organisation." To implement Scrum successfully, management needs to let go, and potentially be supported and coached by Scrum experts. It is a change of mind from command and control, towards putting more trust into the teams, and the belief that they get the work done.

Towards Agile Workplace Innovation: Putting empirical findings in context

Scrum as an Engine for Fifth Element Workplace Innovation

Based on the empirical findings, Scrum can be interpreted to be an engine for Fifth Element Workplace Innovation. The interplay of Scrum and the Fifth Element Concept is illustrated and discussed below. Concerning the category of work organisation (1), Scrum may be able to support Workplace Innovation in many ways. Firstly, it may be, if implemented properly, a method to empower employees. Scrum can also be a management system that allows the employee to achieve his or her goals in their own way, which is a major aspect in Workplace Innovation. The empirical findings demonstrate the enabling role Scrum plays, as the approach itself will not lead to self-managing teams and teams themselves are rarely self-managing. "Employees taking the initiative and being able to work without supervision are valued, as it enables the workforce to make decisions based on their practical experience (…)" (Totterdill

2015, p.65). Scrum enables to do that as teams self-manage and improve their teamwork. As highlighted before, teamwork is one of the key concepts in the new organisation of workplaces (Totterdill 2015, p.65) and Scrum supports it well. Based on this study, there is no evidence that Scrum supports the integration of technology.

On the aspect of structures and systems (2), one can conclude that Scrum may not be clearly attributed with reducing organisational walls and ceilings. In the cases where interviewees described their organisations as barrier-free, this had already been a precondition. If Scrum was implemented properly, employee initiative rose, but not automatically. Employee initiative is supported by the fact that teams self-organise, and have a better overview. Scrum does not inevitably lead to equality, but it enables transparency mainly through the improved communication. In general, Scrum seems to support building and maintaining trust, by allowing transparency about the work. The aspect of transparency is not part of "The Fifth Element Concept" of Workplace Innovation, but it is evident that it plays a major role in supporting it in general.

Scrum also supports the aspect of reflection and innovation (3) in many ways. Firstly, the retrospective meetings support continuous improvement and lead to better communication about problems and impediments among the team. The short work cycle makes teams go through a PDCA-Cycle more often, and hence gives more opportunities for reflection and improvement. Scrum seems to support high-involvement innovation, as every team member is deeply integrated into the process and is enabled to contribute. High involvement practices, such as decentralised decision making and co-operation, can lead to valuable results for organisations and the workforce (Ramstad 2014, p.25) and Scrum enables that, as teams decide on how to achieve their goals. It can be concluded, that Scrum provides a framework, which supports sharing of knowledge and experience. For example, retrospective meetings enable to share experience and knowledge, but other methods should also be utilised.

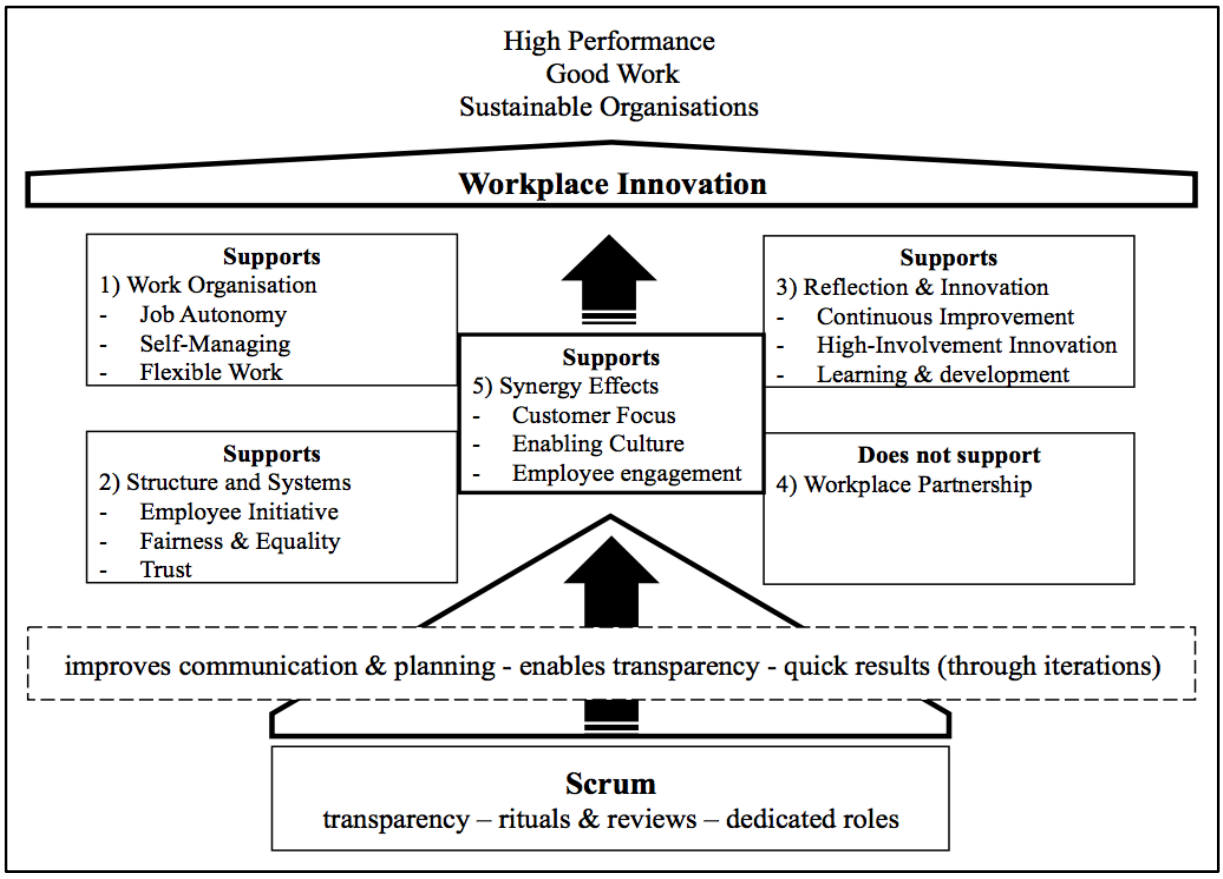

Figure 2:: Scrum and the Fifth Element Concept Summary of Results (adapted from Totterdill (2015))

From the conducted research one may conclude, that Scrum has no significant influence on the fourth aspect of workplace partnership (4), as none of the interviewees stated so. Scrum has had no impact on dialogue and representative presentation. Further research would be needed to confirm it, but it appears to be a result of Scrum, that teams expand their scope of action inside an organisation if they enjoy empowerment and self-manage over a longer period. For example, it was stated that a Scrum team took over the recruiting process. The aspect of integrating tacit and strategic knowledge is mostly covered in the above category of shared knowledge and experience, due to the interdependence of its aspects.

The coming together of the above aspects has synergy effects (5), which are partially supported by Scrum. It contributes towards customer focus through its regular feedback opportunities as the customer can easily participate in the review meetings and give feedback. As "employees often know best what their customers want" (Totterdill 2015, p.65), Scrum provides an opportunity for more customer focus, but it is up to the teams to make use of it. The factor of employee engagement has already been covered, with the aspect of employee initiative. Scrum appears to support an enabling culture well if it is embedded in a bigger organisational structure, which allows failure, values respect and shows appreciation. Since resilience is a broad concept, no conclusion can be made here on the impact of Scrum. As has been stated above, Scrum has no apparent influence on employee relations. Scrum also was not related to supporting entrepreneurial behaviour.

Other positive outcomes of Scrum that were stated and that potentially support Workplace Innovation are improved communication, improvements in planning and the fact that working iteratively gets quick results. Besides that, Scrum supports transparency, which might be one of the key success factors as "far too often in a company it is not really clear what everyone is working on, or how each person's daily activity advances the goals of the company" (Sutherland 2014, p.153).

In conclusion, Scrum can support Workplace Innovation on many levels, mainly on the aspects of Work Organisation (1), Structure and Systems (2) and Reflection and Innovation (3). It does not explicitly support Workplace Partnership (4) and all Synergy Effects (5), but it leads to other positive outcomes, which may, in turn, support Workplace Innovation. Scrum cannot be a magic bullet, but may be a useful framework, along with other (agile) methods, to support Workplace Innovation.

Implications and Constraints

It should be noted, that academic literature on Scrum is still rare, and Workplace Innovation is still a rather new concept. The qualitative research presented here provides only finite insights, as the number of interviews was small.

For the perspective of Scrum, it would have been interesting to hear the insights of Product Owners and members of the development team. Furthermore, there was no expert on Workplace Innovation available in the respective time frame as an interview partner. Hence the results are based on insights from Scrum practitioners only.

Most importantly it should be noted, that the net effect of Scrum cannot be isolated, as there regularly are other factors which also contribute to Workplace Innovation. It may well be the case that certain environments already were on a good path towards Workplace Innovation, and that this was one of the reasons why that organisation started using Scrum. In general, it was difficult to divide between what changed with the implementation of Scrum, and what had already been given in the particular cases.

Having in mind the vast body of research on each of the elements in the concept of Workplace Innovation, the contribution of the work presented here remains rather limited. But there is a lack of research on Workplace Innovation as a general concept. The goal was to investigate the whole concept, and not its aspects, because the concept of Workplace Innovation is about the coming together of the elements. This work still can provide a starting point for further in-depth research, and has shown that Scrum and Workplace Innovation are subjects that are worth further investigation.

Proposed follow-up research questions and outlook on further work

Future research may look deeper into the individual elements of the Fifth Element framework, to seek a better understanding of the contribution of agile methods to workplace innovation. This could entail specific reviews of the dedicated roles under Scrum, like the Scrum Master, the Product Owner and the development team. A complementary approach can be to track the

co-evolution of agile methods and Workplace Innovation in different industries and functional areas, especially outside software engineering, like for example agile R&D (Rodriguez et.al. 2012), agile purchasing (Diekmann 2017) or agile manufacturing (Leite and Braz 2016). It will be instructive to connect to the related fields like New Work (Laloux 2014 and Appelo, 2011) or democratic approaches to corporate organisation (Sattelberger et. al. 2015).

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EUROPEAN JOURNAL OF WORKPLACE INNOVATION

Industrial Cognitive Engineering

Thomas Mühlbradt and Peter Kuhlang

Abstract

The term "cognition" describes mental processes, such as perception, memory, thought, learning, and language. Independent, although interacting, developments contribute to the fact that the proportion of cognitive functions in industrial work systems is steadily increasing and that their contribution to value added is becoming more performance-defining. Companies across-the-board are not sufficiently prepared for changes of this kind. Consequently, there is a strong demand for reliable methods with the help of which all tasks related to cognitive functions and the resulting complexity of industrial value added can be mastered in a target-oriented way and on an appropriate industrial level. "Industrial Cognitive Engineering" meets both these requirements. It combines cognitive engineering with the approved practical approaches and experiences of industrial engineering. Furthermore, its integration into the framework of workplace innovation is discussed.

Keywords: Cognition, Industrial Cognitive Engineering, Industrial Work Systems, Value Added, Workplace Innovation

Cognitive Functions in Industrial Work Systems

By “cognition” we mean mental processes, such as perception, memory, thought, learning, and language. Cognitive sciences, an interdisciplinary approach including psychology, neuro sciences and linguistics (Miller 2003), has been doing research work on cognition since the 1950s.

Man, potentially machines, and man-machine-systems (MMS) are “cognitive systems”: “A cognitive system produces "intelligent action", that is, its behaviour is goal oriented, based on symbol manipulation and it uses knowledge of the world (heuristic knowledge) for guidance. Furthermore, a cognitive system is adaptive, and able to view a problem in more than one way. A cognitive system operates using knowledge about itself and the environment, in the sense that it is able to plan and modify its actions on the basis of that knowledge. It is thus not only data driven, but also concept driven. Man is obviously a cognitive system. Machines are potentially if not actually, cognitive systems. An MMS, regarded as a whole, is definitely a cognitive system.” (Hollnagel & Woods 1983, p. 589).

The proportion of cognitive functions in industrial work systems is steadily increasing and their contribution to added value is continually becoming more performance-defining. Many independent, although interacting developments contribute to this:

- Progressing digitalization of processes and tools
- Complex interfaces in man-machine systems
- Down-shifting of tasks and responsibilities to the value-added level
- Consolidated performance due to focussing on value-adding processes
- Necessity for continuous improvement of work processes due to competition
- Local accumulation of knowledge and experiences in work systems

In other words: knowledge work is becoming a prevailing feature of ever more work systems. This applies to both direct and indirect areas (North & Güldenberg 2008; Pfeiffer 2008). Companies in many sectors of the market are not sufficiently prepared for changes of this kind.

- Traditional approaches to maintain knowledge and competences are unsatisfactory (Staudt & Kriegesmann 1999; Bauer, et al. 2010) and the chances for informal learning at work, as a source for innovations, are far from being exhausted (Garibaldo 2011; Hartmann & Garibaldo 2011)
- Consolidated performance in combination with inappropriate work equipment and basic conditions, results in work-induced stress. Today, the negative implications on health caused by chronic stress are considered a blanket problem by experts (Lohmann-Haislah 2012; Morschhäuser et al. 2014)

- Demographic change in the industrialised countries (Mühlbradt & Schultetus 2004; Mühlbradt & Grumbach 2005) often is beyond the companies' capabilities for generation management in sectors such as staff assignment, competence management, and knowledge transfer.

Consequently, there is a strong demand for approaches that focus on all tasks related to cognitive functions and the resulting complexity of industrial value added, and that can be applied, at the same time, on an appropriate industrial level. "Industrial Cognitive Engineering" meets both these requirements.

Industrial Cognitive Engineering

Bokrantz & Landau (2012, p. 37) define industrial engineering as: "… selecting and applying adequate methods within productivity management, aiming at the preventive and consistent optimisation of productivity." Apart from being widely applied in industry, industrial engineering is also part of university programmes, such as ergonomics and industrial science. In addition, there are IE associations that develop and maintain the methods and offer certified vocational training and training across-the-board. At the same time, these technical associations, offering a variety of communication media and platforms, serve as "communities of practice" (Wenger 1998) for the industrial engineers in the companies. To this day, in practical industrial engineering the methods of industrial science dominate relevant courses and lectures, methods compilations, and educational offers.

There are certain features that characterise the application of industrial engineering in the field, such as:

- The design of practicable solutions in industrial daily work is highly target- and implementation-oriented.
- Stress is laid on objective, if possible quantitative data for the design and assessment of work systems, as well as, on the application of parameters for controlling and optimising work systems.
- The methods are widely applied in industry, accompanied by a community of practice.
- Methods compilations as condensation nuclei of technical competence, defined as standards, are passed on by specifically trained instructors in the community of practice, and are adapted to new requirements through the dialogue with the community.
- Establishing and securing the professional competence of industrial engineers by combining scientific basics, methods, practical experience, and the exchange of experiences.

- Suitability as reference methods for the regulations in company and collective agreements.

It is against this background that the long-standing global success of industrial engineering has to be understood (Landau 2013). Today, the relevance of industrial engineering for innovations and competitiveness is acknowledged not only by industry and engineering sciences: „… the involvement of … industrial organisations … should be further increased and developed in all types of programmes, with particular regard to workplace-centred programmes. Among these intermediary organisations, those employing widely-accepted methods and standards of work design should receive special attention." (CEDEFOP[1] 2012, p. 11).

Independent of Industrial engineering, various authors have invented the term "cognitive [systems] engineering" in the early 1980s. It is an interdisciplinary approach required by the increasing number of computers in the companies, and the disastrous failure of complex technical systems, as was the case in the Three Mile Island accident.

Cognitive engineering „[is] … a type of applied Cognitive Science, trying to apply what is known from science to the design and construction of machines"(Norman 1986, p. 31). Hollnagel & Woods (1983) demand: "The design of properly functioning MMS requires a different kind of knowledge which describes the cognitive or mental functions of the MMS" (loc. cit., p. 583). In the German-speaking countries, the term "engineering psychology", as a subfield of applied psychology, has been invented as early as the 1960s (Hacker 1986). In a very similar way, engineering psychology strives to integrate the knowledge of human features into technical systems. Initially the understanding of "cognitive engineering" was strongly linked to the design of the man-machine interaction; in the recent past, however, a more broadly based conception can be observed. Woods & Roth write (2005, p. 62): "Cognitive engineering is about human behaviour in complex worlds."

Thus, in the given context, the object of study in "cognitive engineering" can be said to be work systems, the performance of which is based on high cognitive requirements. The cognitive requirements of the task, the usage of tools and devices, human interaction or a combination of such sources, result in a complexity that affects the experiencing and behaviour of the people involved. Cognitive engineering aims at analysing cognitive processes and structures within work systems, at designing them, if possible, prospectively, and at assessing them with the goal of achieving security, productivity and a complexity that is ideal for the well-being (Buffet et al. 2013) for all people involved.

For Industrial Cognitive Engineering (ICE), knowledge of cognition and complexity has to be interlinked with approved practical approaches and experiences made in industrial engineering. Typical fields of application of ICE are:

- Development and design of cognitive equipment

[1] CEDEFOP: European Centre for the Development of Vocational Training.

- Human interaction combined with machine intelligence
- Company information and knowledge management
- Reduction of psychic strain at work
- Design of work systems that stimulate learning processes
- Intergenerational knowledge transfer within the company

In the sense of ICE, highly cognitive-oriented tasks revealing new contents may be successfully processed already today by means of the approved approaches of Industrial engineering, which focusses on realisation and methods. This is exemplarily illustrated in section 3. Section 4 approaches open questions, focusing on discussing ICE against the background of Workplace Innovation. Finally, section 5 begins to consider strategies to establish a sufficient number of ICE-experts in industry. In addition to the engineers and technicians that have already been addressed via the existing Industrial Engineering Community, new target groups for ICE can be reached and trained to be competent actors.

ICE Case Study "Intergenerational Knowledge Transfer"

Accumulated (experience-based) knowledge may get lost when the knowledge-bearer leaves. This applies, for example, to technical tasks or such tasks that involve customer-contact. In general, companies do not avail of strategies or tools for the identification and transfer of knowledge when the job holder changes. Particularly with respect to "implicit knowledge" (Nonaka & Takeuchi 1995) or "tacit knowledge" (Polanyi 1974) there is significant uncertainty concerning transferability. Knowledge transfer is performed implicitly or is improvised, which leads to unsatisfactory results. In case there is a demography-based round of retirement, i. e. if many employees retire within a short period of time, the companies' existing concepts and capacities are unable to cope with the resulting challenge.

In this case, it is beyond doubt that cognitive aspects, such as knowledge, knowledge structures, or visualisation and communication of knowledge, play a prominent role. The transition from old to new job holders represents a regular cognitive process within a work system. The question then is whether this process can be a subject-matter of ICE. For this the following preconditions should be met:

- A trainable and learnable method exists that can be applied irrespective of the person(s) involved.
- This method represents a standard that is expedient and efficient for the intended field of application.
- The method has been sufficiently tested in industrial practice.
- Professional competence results from the combination of basic knowledge, methods, and practical experience acquired in practical application.

Such methods may be found in practical work: the example of a medium-sized family company will help to illustrate this. The company is a specialist in the development and production of heavy-duty tires, transport castors, and the corresponding system components. Even for complete chassis system components this company has entered into design partnerships with its customers. The company produces in Germany and locations abroad, and avails of a worldwide sales organisation. In Germany, there are approximately 300 employees. 80 percent of these are qualified technicians or clerical workers. The average age today is roughly 44 years and will rise to more than 50 in 2020. For this reason, the company decided to develop a concept and to apply it as a standard in order to face the loss of knowledge when employees leave the company.

The method was designed to be used by a transfer attendant whose task it is to guide both the new and the old employee through the transfer process. The core elements of this method are:

- Preparation and transfer planning
- Modeling the leaving employee's knowledge structures
- Comparing them with the successor's current knowledge level
- Setting up a transfer plan, with contents, methods, and time schedule
- Systematic processing and documentation of the transfer
- Follow-up and assessment

The individual phases will be directly supported by specific instructions or patterns. Thus, the method creates a standardised process. At the beginning of the transfer process a knowledge map is drawn for the current job holder. The contents of this map is then compared with the knowledge of the successor. Based on the result of this comparison, all persons involved form a team and establish a written transfer plan, including all the relevant knowledge, intended procedures, and a transfer schedule. Figure 3 shows a transfer plan in part.

Transfer Plan

Job Situation 4: Supply Engineering

no.	task	deadline
4.1	document and update piping system	9-30-2006
4.2	electricity	9-30-2006
4.3	water	9-30-2006
4.4	compressed air	9-30-2006

no.	accompl.	documentation of task, comments	Sign.
4.1	8-31-2006	all plans updated	
4.2	9-15-2006	all processes documented	
4.3	9-15-2006	all processes documented	
4.4	9-15-2006	all processes discussed	

Job Situation 4: Supply Engineering Part 2: Details

no.	task
4.1	document and update piping system

learning content

GP means General plan exists
E means electric cable
W means pipes for fresh, used and rain water
FW means fire fighting water
CA means compressed air pipes
LS means letter shoot
LTC means low-tension current
GP means gas pipes

Figure 3: Transfer plan in part

The standard procedure can cover a limited amount of transfer knowledge only: methodical and time-related restrictions impose limits here. However, a reliable quota of 50 to 60 % of otherwise lost knowledge is sufficient to compensate the effort undertaken. There will also be cases of knowledge transfer for which the drafted methodical standards will not work. This may be the case, for example, if no temporal overlapping of the positions of predecessor and successor is possible. However, this is no substantial argument against the described approach, as in wide ranges of industry, it is necessary to perform a multitude of comparable tasks in adequate quality and at reasonable costs.

The presented example does not focus on profound and up-to-date findings related to human thought and knowledge structures, but rather on appropriate professional competence (cf. Dehnbostel 2010) resulting from a combination of technical knowledge, methodical routine, and practical experience. The required technical knowledge is limited and may definitely be imparted in condensed form. This distinguishes the described method from more scientifically-oriented approaches that cause significantly more costs, while providing mostly vague additional value (e.g. Irle 2008). Competence gain and methodical advancement do not require elaborate new theories in cognitive science, but rather ask for a vivid community of practice (Wenger 1998) that promotes an exchange of practical experiences and is jointly involved in securing and developing methods and qualification standards.

ICE in relation to Workplace Innovation

Research and development related to ICE will deal with the identification and editing of existing experiences on the one hand, and with the independent development and testing of new methods on the other hand. Existing and new methods are then collected into methods compilations that provide the basis for qualification measures. Apart from the described example of knowledge transfer, there are already approaches that promise to be suitable as future methodical standards. These include approaches in the fields of knowledge management (Mühlbradt 2007; 2008; Bohlander et al. 2011), demography management (Ruf & Mühlbradt 2013), and optimisation of load (Richter & Schütte 2013). Further methods will have to be established and tested in research and development projects. Applied research of this kind is currently being performed, for example, as part of the BMBF project "Engineering und Mainstreaming lernförderlicher industrieller Arbeitssysteme für die Industrie 4.0 (ELIAS)"[2]. Approved, efficient and appropriate methods for the identification and processing of job characteristics relevant for learning are already available for short-cycle routine jobs (e.g. Liker & Meier 2008). However, this cannot be claimed to be true for more complex jobs. For these jobs it is necessary to develop adequate methods and test them in an industrial environment, in order to systematically enlarge both the methodology and the range of ICE. Other sections of ICE require further advancement, for example the man-machine-interaction with respect to so-called "intelligent assistance systems" (Forschungsunion 2012).

In a wider research perspective, it has to be acknowledged that ICE is a necessary but not a sufficient condition for the design of future workplaces. Its cognitive perspective is vital in a world of digitisation but is fails to directly address questions of leadership (Dombrowski & Mielke 2014), learning culture (Mühlbradt et al. 2015) or work organization (Mühlbradt et al. in press). Therefore, it remains unclear how ICE is to be integrated in socio-technical system-design. This deficit can be overcome by considering the role of ICE within the context of Workplace Innovation.

For some time now, the term 'Workplace Innovation' has been discussed in academic literature (e.g. Applebaum et al 2010; Pot 2011; Oeij et al. 2012; Eeckelaert et al 2012; Totterdill 2015). Pot (2011, p. 1) defines Workplace Innovation as "…new and combined interventions in work organisation, human resource management and supportive technologies". Totterdill (2015, p. 57) writes: "Workplace Innovation seeks to build bridges between the strategic knowledge of the leadership, the professional and tacit knowledge of frontline employees, and the organisational design knowledge of experts." Dhondt & Hootegem (2015, p. 18) make an explicit connection to the digitisation of work, and see Workplace Innovation as an important design perspective. According to Totterdill, Dhondt & Milsome (2002), Workplace Innovation aims at improving the company's capacity for innovation and competitiveness while enhancing the quality of working life.

[2] Funded by BMBF on the basis of a decision by Deutscher Bundestag (German Federal Parliament), reference number 01XZ13001; www.projekt-elias.de

Totterdill (2015 p. 64) proposes a conceptual model of Workplace Innovation. This model comprises a considerable percentage of elements which have a strong relationship to the cognitive perspective and methods of ICE:

- Integration of technology
- Learning and development
- Shared knowledge and experience
- Integrating tacit and strategic knowledge

In order to treat these topics appropriately in an industrial context, it is necessary to apply specific knowledge and methods from ICE, and to utilise the competencies of ICE-experts. However, ICE-experts need to be able to understand their tasks as a contribution to a broader endeavour. This raises questions concerning training and recruitment, which will be addressed in the final section.

Establishing ICE-professionals

The innovative field of ICE combines industrial engineering and cognitive engineering. It provides practicable methods and industrial-scale competence, and serves the advancement of the methods within a community of practice. The theories and methods of cognitive engineering originate to a considerable extent from psychology. Apart from the fields of general and biological psychology, the application fields of work and organisational psychology or engineering psychology have to be mentioned. This perspective is interesting also with respect to the number of graduates. The number of graduates from this branch of university studies has increased significantly and steadily over the last decades. This development at universities has been paralleled for some time by a renaissance of 'Wirtschaftspsychologie' (Business Psychology, a phrase strongly connected to the German psychologist Hugo Münsterberg) at universities of applied sciences. Therefore, work and organisational, engineering and industrial psychologists may very well form a considerable part of future ICE-professionals. The focus on targets and their achievement, characteristic of industrial engineering, perfectly fits into the classical self-conception of Business Psychology: "Münsterberg took the view that science should serve the solution of practical problems, or even more, that science only justified itself by its practical utility." (Kanning et al. 2007, p. 238)[3]. Moreover, Business Psychology matches well with those elements of the conceptual model of Totterdill (2015) not directly addressed by ICE.

ICE as an interdisciplinary field may also contribute to improve on certain persistent problems of applied psychology. Despite the Bologna Reform, there still are complaints as to the lack of practical relevance of work and organisational psychology (von Rosenstiel 2004, 2005;

[3] For the academic-theoretical basis of such an application-oriented psychology see Hartmann (2005).

Kanning et al. 2007), and persistent problems in the relationship between theory and practice are stated: "Practitioners and students of psychology are left alone with questions of transformation of scientific results into practice. The study and the reflection of the relationship between theory and practice fall back to a level discussed 40 year ago" (Bergold 2008, p. 1). In programmes related to industrial psychology, the practical relevance is probably stronger, and the stress ratio between theory and practice weaker: however, at present these programmes definitely focus on topics of market and marketing psychology or organisational and personal psychology, rather than on contents related to work and engineering psychology (e. g. Brandenburg & Thielsch 2009).

In particular, industrial engineering associations with a close link to industry may assume an integrating and advancing function here, as work and organisational psychology seems to be ideally integrated into an engineering environment: "Work and engineering institutes in particular, are obviously well-suited to be home to the priority setting of work and organisational psychology in research and teaching." (von Rosenstiel 2004, p. 92).

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EUROPEAN JOURNAL OF WORKPLACE INNOVATION

Unions and industrial improvement projects: Building a common momentum

Lars Harald Lied

Abstract

The purpose of this article is to define the potential role unions can play in a general quest for improved practice in an industrial company. Workplace innovation (WPI) is one example of such a measure. Lean is another. The article outlines important elements when implementing improvement tools like Workplace Innovation and Lean practice. The efforts are focused at company level, and experiences from a Norwegian industrial company highlight the areas of importance. The amplifying role a union can play in an improvement process is discussed, and motives and processes are clarified, in order to show the role of unions in a broader sense. The "Nordic" tradition of organising work-life frames the considerations made in this paper, but elements of experience can also be valuable in other work-life traditions. Practical improvement is the ultimate goal in an improvement project, and this article shows how unions can play an active part and amplify the results when it comes to enhancing organisational performance. Theories and experiences are supported by interviews with experienced leaders and employee representatives. Changes are often met with resistance, and the article shows that unions, under certain circumstances, can play a facilitative role when it comes to the implementation of improved practice. Joint motives provide a unique opportunity to succeed, and Workplace Innovation and other improvement measures can represent a "win – win" formula in that sense. A democratic and dialogical approach towards Work Life design contributes to both efficiency and stimulating workplaces through Workplace Innovation and Lean Management.

Keywords: Co-determination, Organisational performance, Improvement projects involving unions, Job satisfaction, Lean Management, Organisational Performance, Workplace Innovation

Introduction

How can the union approve the implementation of Lean? Is Lean a rationalisation tool for downsizing when it demonstrates overcapacity? In some literature, Lean has been called an "*ideological assault upon organised labour" (* Stewart et al. (2009, p. IX). It is easy to make arguments for "Mean Lean" representing an improvement tool violating the interest of the employees. Old Lean interpretation came as a tool based reaction to mass production and Fordism. The original "*Toyota"* way of Lean practice became somehow lost and redefined in the American interpretation (Shimokawa 2012). Today, businesses around the world practice Lean principles in a way adapted to culture and values. Lean still has a strong position when it comes to improvement of practice. The evolution of Lean has gone through stages, and this history can tell us both positive and negative stories. Unions have played a significant role in the industrial development around Lean, and this article will focus on the important role unions can play in improvements processes on a company level. How can a modern interpretation and implementation of Lean and other tools of improvement become stronger through social partnering? This article will introduce relevant theories, methodologies and examples followed by discussion and conclusion.

Setting the stage

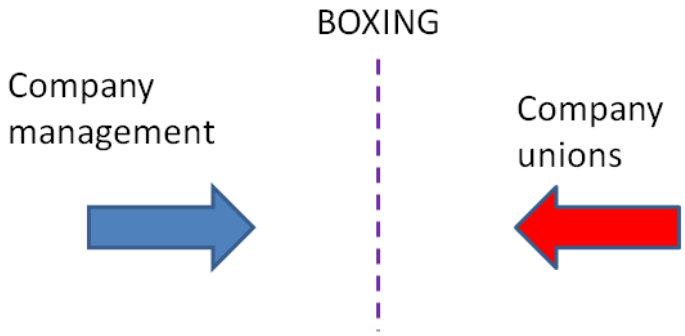
The unions represent the employees, and their objectives will always be focused upon them. They will promote the interest of their members. The role that the unions have been playing throughout history has changed, and it is now in their interest to revitalise, by highlighting new areas within the Work Life arena. New measures and new objectives can assure them a strong and influential role in the future. The union(s) must make choices regarding their positioning within the corporate sphere. These choices include different social partners and dimensions. According to Huzzard, Gregory & Scott (2004, p. 27) these choices are:

1. Choices on union missions historically are ideologically shaped and form the basic identity of the union organisation.
2. Choices are made on the scope of union activities and relationships
3. Decisions in terms of how they engage with civil society

A union must deal with members, employers, other unions and society within an economical framework (social partners). Interaction with social partners takes place at different levels (International, national, regional, local and company), and it takes place within a given political and cultural setting. How a union chooses to take a position depends on different conditions. They must set short and long term goals, and decide upon their mission. Historically unions emerged as the result of industrial growth and the traditional and conflict-ridden relationship between capital and labour. Huzzard, Gregory & Scott (2004) use "*boxing* and *dancing*" as a metaphor in their book *Strategic Unionism and* Partnership. The adversarial approach is represented by *boxing*, and the co-operative approach describes the *dancing*

Figure 1 Boxing and dancing illustration

(Huzzard, Gregory & Scott 2004, p. 3). It is a state of *war and peace.* Metaphors linked to boxing and dancing are used throughout the book as symbols of actions taking place in Work Life. The unions have many different social partners and different areas of interest. The combination of these "pieces" opens up a pathway to new and constructive solutions. The co-operative strategy may differ between the areas, but it requires strictly defined roles and a steady hand. The *fight* takes place on both an international / national arena and on a more local / company level. The *boxer's stance* is vital to how one part takes the punch from an opponent. This positioning has developed over time, and we have gradually seen other solutions aiming



Figur 2 Boxing and dancing illustration

for common advantages and constructive co-operation. Moving from *boxing* to *dancing* requires a *dance floor* where all participants can participate on level footing. The mindset of the *boxers* must be changed towards progress through collaboration and partnership. Co-operative measures have proved to be effective, and the power distance has been reduced. In Norway, the introduction of the Employment Protection Act of 1977 can be interpreted as a milestone in the change of discourse in Work Life.

After developing as a part of industrial revolutions, unions have succeeded in securing their fundamental interests such as decent working conditions and wages. They feel that their contribution has been most important in the creation of today's prosperous society, and in that sense feel "ownership". This notion is also present at company level. Not in a juridical way, but employees feel ownership of the success that is objectified by their company. We (the unions) are "a part" of the company because our efforts have been vital ingredients for success.

New situations require new measures, and the unions of today are in a position where they can choose to develop other areas of interest if their fundamental requirements are satisfied. These new areas of focus emerge through maturity, and they must be seen as supplements to more traditional areas of interest. From a union perspective, WPI and Lean practice are definitely areas of interest. According to the 3rd European Company Survey, Workplace Innovation (WPI) is:

A developed and implemented practice or combination of practices that structurally (through division of labour) and/or culturally (in terms of empowerment of staff) enable employees to participate in organisational change and renewal to improve the quality of working life and organisational performance (Oeij P 2015, p. 8).

Such a definition calls upon the attention of a union. Unions want to influence how implementation of such measures is carried out, and also ensure that such actions are aligned with the interests of their members.

If we make it a starting point that the basic needs of a union (salary and well-being) are generally fulfilled, we face other work-life challenges to solve on our way to better practice. WPI and Lean represent (among others) tools of practice that can help us reach higher levels of performance, and they have many common denominators. They require support from top management and must be implemented in the whole of the organisation on terms agreed upon. Lean and WPI are not concepts you practice on Fridays only! There must be a broad and knowledge-based understanding on all organisational levels, on how to employ these practices. Implementation requires knowledge and engagement from both management and employees. Such knowledge should be based upon organisational experiences and culture, because the process of implementation is sensitive and elements of alienation will weaken the progress. It is important that implementation occurs gradually, so that understanding and acceptance among participants can emerge through a natural maturation process, as participants "buy in" to changes. All participants must be prepared ahead of implementation via an open dialogue discussing the reasoning behind the launch of the initiative.

The Nordic tradition of organising Work Life evolved into a democratic and involving model after the Second World War. Democracy, trust, respect and transparency are common features of the Nordic work-life design, and it is observed in practice through employee involvement and dialogue. This egalitarian design has developed a *dance floor* over time, and today the co-operative model is robustly embedded in the handling of all work-life issues. There has been a movement from negotiation to collaboration between social partners over the last 40 years.

Union participation in business development is a sensitive issue. Marked by the traditional capital vs. labor confrontation, there are historically strong voices arguing that the representation of workforce interest is undesirable. Union participation in strategic decision-making processes, not least in the United States , is rare (Appelbaum & Hunter 2003). This reluctance goes both ways. (Appelbaum & Hunter 2003) refer to Thomas Donahue, an AFL-CIO Secretary- Treasurer, summarised the traditional viewpoint in a 1976 speech:

Because American unions have won equality at the bargaining table, we have not sought it in corporate boardrooms. We do not seek to be a partner in management to be, most likely, the junior partner in success and the senior partner in failure. We do not want to blur in any way the distinctions between the respective roles of management and labor in the plant. We guard our independence fiercely independent of government, independent of any political party, and independent of management.

This article does not address the question of whether it is right or wrong to launch cooperative measures between management and union even though it argues for such cooperation. Arguments must reflect the situation they describe. This speech was held 1976. Situations change, and our arguments must change accordingly.

Description

A practical example of an improvement project

In order to highlight the topic of this article, an example from Norwegian Work Life is used. The author of this article is an "insider" employed in the company used in the case study. In addition to 12 years' experience of employment, data was gathered during a Lean Management improvement project designed with the principles of action research. Such point of departure calls for special attention when it comes to validity, but all research must be valid in terms of process and documentation, and "*The research must go through the natives"* (Eikeland 2006, p. 209) .

This case study has some features that make it unique, but it shows a challenging process of change solved by common efforts. The Raufoss industrial park has 2500 employees distributed amongst 15 different industrial manufacturing companies. Industrial production goes back to the 1890's, and today the industrial activities are focused around defence products and light metal automotive products. Technology is a driving force, and highly skilled employees are found at every level of each organisation. Nammo Raufoss AS is a producer of defence related products, and the company has 760 employees. In a Norwegian context, this is a large company. There are approximately 400 blue collar workers, and they are all organised in the same union. The level of competence among the blue collar employees is high, and 70 % are skilled workers with a formal professional education! Industrial work-life is traditionally anchored, and basically founded on the principles of the Norwegian model. The last 130 years of industrial history contain many examples of *boxing* between unions and employers, but the modern day focus is more concentrated on keeping jobs safe in an international, automated and complex world (*dancing)*. According to the local union leader, today's employee – management partnership "*would have been unthinkable only 20 years ago"*. This statement emphasises a fast moving and continuously changing work-life. Labour productivity and quality are high; and these features, in combination with a strong capacity for innovation, have generated a strong industrial position that has resulted in profitability for several decades. Both the unions and the company's management are focused on further development of the company, and this attitude characterises the co-operative work-life design of the company (*dancing)*.

Nammo Raufoss AS is a part of an international corporation that is continuously working to improve its industrial performance (Nammo AS). The company has a long history of employing different improvement practices such as Agile, PDCA (continuous improvement) and Lean. Today, the parent company has chosen to consolidate their continuous improvement efforts in a Lean Six Sigma programme. Improvement work is strongly supported by internal courses in both Lean Six Sigma and Lean methodology in particular. These courses involve employees at every level. Engagement with employees at every level, combined with their high skill level, ensures broad involvement and a sense of ownership of the continuous improvement process among the employees. Lean methodology and practice have become a natural part of how work is organised, and it is strongly aligned with the corporate culture (Norwegian model). Unions

have gradually become a natural part of the implementation of Lean, and today they take a shared leadership role in its implementation.

In order to gather data around the role of the unions in industrial improvement projects, a series of interviews highlighting the issue of union participation in improvement projects were conducted. One round of semi-structured interviews with top management, white collar union leaders and blue collar union leaders was completed. The company is in the middle of a company-wide implementation of a Lean Six Sigma improvement process, and the development of leadership practices in facilitating Lean practice is highlighted. Practical training of leaders and employee representatives is being conducted, and this background framed these interviews. The response obtained during these interviews indicates some interesting features with regard to social partnership as they exist in the Norwegian work-life model. The constraints must, naturally, be evaluated in each situation, but the experiences from Nammo Raufoss AS can also be generalised.

The management representatives emphasised the importance of including the employees in major industrial improvement projects. The CEO stated that "*Employee representatives are also managers*". He described them as managers with clearly defined assignments within their area of responsibility. The managers taking part in the interview also stated that an early involvement of employees provided a smoother implementation and it created a higher degree of motivation. They pointed out that the blue collar union, due to its size, experience and constitution was able to play an active role in improvement processes. The blue collar union at Nammo Raufoss AS is in a position to choose whether or not they want to play an active part. By taking part, they have the ability to influence how new measures and practice take shape. Through early involvement, this influence can affect every part of the improvement process. One of the production managers pointed to practical improvement in production supported by the blue collars union. The interview with the managers also showed that influence on improvement processes can facilitate through structures other than the union. Individuals and departments can influence processes in both positive and negative ways, and it is important not to "go blind" by only focusing a single structure. Social and communicative complexity requires a holistic approach and understanding when it comes to managing improvement processes. The role of the leader is vital, and s/he was described as a person who actively needs to push the process forward. Today's leader role was described by the managers as new due to the increased level of competence among production workers. Compared to the previous leader role marked by "steering and control", today's leader role was described as more facilitative, and focused on the utilisation of competence held by the employees. Future industrial success requires a highly competent work force.

The blue collar union leaders described their co-operation with management as very good. They clearly understood the potential for an active use of the union structure as an amplifier within improvement projects. Their collective strength is obvious, and it holds the potential to generate a positive momentum. The blue collar union leaders also pointed to relations between the leader and the employees as a key factor for success. According to them; "*bad leadership leads to dissension due to fuzzy directions, but good leadership provides an inspirational attitude among*

the workers". Personality traits of the leader were identified as essential for success. Members of the blue collar union are divided when it comes to the implementation of new practices such as Lean. This fact does not mean that an implementation will end up in failure, but it underlines the importance of providing relevant information, training and involvement. Blue collar union leaders described their own role as important to how changes, like Lean, were comprehended by their members (gatekeepers). They described their own impact as considerable. Enthusiasm was described as being essential, not only by the union leaders, but also by the local employee representatives in every department. Engagement is contagious, and possible resistance will be reduced over time with the engagement of union leaders from the beginning of the process.

The white collar union leaders also described their relation to the management as very good. They felt closeness to the way the management of the company was conducted. Since they are represented in all formal structures of decision-making, they described their interests as being taken good care of. The white collar representatives could not identify their role in an improvement process in the same way as described by the blue collar representatives. They saw the potential for such co-operation, but they have no previous experience of playing this role. According to Huzzard, Gregory & Scott (2004, p. 97) "*the involvement of white- collar unions in workplace development projects is less common",* and experience from this case study supports this statement. The main focus of these white collar unions have been on traditional union assignments like salary negotiation, educational measures and the well-being of their members. They have little experience beyond these traditional issues of union work.

The white collar unions in this case study do not have 100 % membership among their potential members. There are several different unions to choose among, and many white collars choose not to unionise even though there is an established culture for it.

The white collar representatives emphasised the importance of early involvement in processes (voice of the employees). Involvement does not necessarily mean the use of the union structure, but there can also be other structures for co-operative measures. The representatives pointed at the involvement itself as the main issue. This involvement is the prime source for acceptance and motivation among employees. The white collar representatives were willing to take part in future improvement processes, but they made it clear that an initiation of such measures was a management responsibility.

Discussion

1990's UK automotive production: an example from another time

In order to highlight the speed and breadth of the changes that have taken place, an example from the UK automotive industry is used. The automotive industry has been the cradle of industrial improvement work. The Toyota Production System (TPS) was the initial starting point of what we today refer to as Lean production. Lean practice emerged in the automotive industry due to the important principles of "flow" and "pull" in value adding processes (Liker 2004, p. 7).

The situation in the British automotive industry in the last decade of the twentieth century is well described in the book "*We sell our time no more*" (Stewart et al. 2009). The authors describe an industrial situation marked by economic recession and downsizing. The European car industry was struggling with overcapacity, takeovers and restructuring of the business. The situation was difficult, and the question of closing down production at certain plants became a question. The book describes a situation where the management used Lean as a tool of how to re-organise the business sector in a way that could create profitability. The description of how Lean was practiced (purified) is quite brutal, since it often resulted in sick leave and ill health among the employees (Stewart et al. 2009, p. 130). The human needs of the workers were ignored in order to reach economic targets. The authors further describe management as poor "*leaving a lot to be desired*", and all these factors lead to a "*poorly paid and poorly trained workforce*" (Stewart et al. 2009, p. 81). From the union's point of view, Lean became a threat and a management power game. "*Capacity adjustments*" were the objective, and Lean became the medium. It represented the opposite of the values the unions wanted to promote, and they were left without the possibility to influence how Lean should be practiced. Management forced their "*production regime*" upon the employees in a vulnerable situation. "*The Leaner the company became, the more organised labour "Embraced and changed", the more shop floor workers sensed a growing disempowerment*" (Stewart et al. 2009, p. 37).

The Norwegian and the UK examples represent two totally different situations. Times of prosperity or adversity result in different scenarios. It is not the intention to make a judgement in either of the cases, but it clearly shows how processes of change call for a climate that involves the employees in a genuine way. We often respond with resistance when decisions are made above our heads, and when solutions are forced upon us. The argument made in this article is that improvement processes, including change, should be facilitated by the involvement of the union. Most companies will probably find themselves somewhere "between" the two examples given, but it is important to understand the potential embedded in the social partnership design. Even though it requires a framework of prerequisites, a co-operative design can potentially add a greater momentum to the improvement process.

Workplace innovation

WPI is a concept with two major goals embedded. One is to enhance organisational performance. This objective can be reached through changes in organisational structures and procedures, and this first objective is mainly a management issue. The second goal embedded in WPI is the well-being of the employees. By listening to the "voice of the employees", it is possible to accommodate practical and productive solutions on their terms. Motivation and innovation increases through empowerment, and the employees are able to influence how their workplace is organised. The latter argument strongly fits the goal of a union. The challenge for "*a partnership approach lies in the need to produce outcomes that provide gains to satisfy both business and social needs*" (Huzzard, Gregory & Scott 2004, p. 76) . Listening to the voice of the employees and taking care of their well-being are also core issues in the Nordic model. The relationship to the concept or term of WPI as defined above is fairly weak in practical Norwegian Work Life. It does not mean that WPI is not practiced, but it is more about the

Norwegian WPI practice being a foundational element of the "Norwegian model" and is not derived solely from "WPI" theory. Many principles that constitute the practice of WPI are also fundamental parts of the Norwegian (or Nordic) model. As a result of the pre-existing conditions extant within the Norwegian model, introducing "WPI as a "new" concept becomes unnatural. According to Oeij P (2015, p. 42) "*each configurational combination of casual condition is an implicit strategy to become a WPI company*". There is no "one size fits all" when it comes to the practice of WPI. The potential of involvement in work-life has emerged throughout practice over time, and it has been categorised in five favourable arguments by Levin et al. (2012, p. 102):

- The argument of productivity
- The argument of quality
- The argument of attractiveness
- The argument of innovation
- The argument of preparedness

All these arguments could be made in the boardroom by the management. There is also an argument that the involvement of the union as a permanent part of a corporate democracy promotes the principles of WPI. Levin et al. (2012, p. 212) argues that the equilibrium of power in practical work-life creates WPI in practice. Strong union involvement calls for joint responsibility on every level of the organisation, and it is governed by a clear division of responsibilities.

Issues of importance to the union

The most important issue for employee representatives when it comes to the implementation of WPI (or Lean) is to ensure "*the voice of the employees*" (Oeij P 2015, p. 53). This topic even outranks "*Job and income security*". This observation clearly shows the importance of democratic values embedded in union related work. The request to influence your own work has risen in parallel with a higher degree of knowledge and education regarding work-life, and "*the voice of the employees*" must be regarded as important from both employer and employees point of view. It is one way in which management can show their respect and appreciation of the knowledge held by their employees.

Educational measures have become more important to unions. They want their members to feel empowered, and the possibility to enhance personal competence is important in this regard. It offers an opportunity to satisfy an employee's inner motivation by empowering her/him to take on more complex and interesting jobs. High levels of competence also contribute to competitive advantage for the firm, and improved job security for the individual employee, as the firm has invested in development of intellectual capital. A formal and higher degree of competence also

puts an employee in a position for better compensation. A union will try to formalise parts of work-life in order to structure them within a set of rules. When an issue is formalised in this way, it becomes a part of a structure open for negotiation.

Autonomy and freedom within motivational frames are also important to employees and their unions. This is the counterpart to the old "steering and control" regime commonly used in industrial settings previously (Taylorism). The rising claim for higher skills due to new technology and complex systems, has given us an industrial operator that holds specialised and vital skills in a defined area of experience. Highly educated and skilled workers are more likely to produce better than average (Black & Lynch 2004), and this benefits all social partners. Investing in a highly educated and skilled work-force can also lead to a more flexible work-force. It becomes easier to move employees around the organisation in response to the actual needs of the firm. This flexibility stands in contrast to rigid and fixed organisational structures, and it produces the freedom to adapt to varying needs. Such potential strengthens competitiveness in hard and changing times, and the unions have become more receptive to this need over time. Their ultimate goal is to secure safe and productive jobs that provide competitiveness for a firm and its employees in the long run.

The union has a choice when it comes to organisational processes. Do they want to *dance* (Huzzard, Gregory & Scott 2004, p. 14)? They can actively take part in it, or they can choose not to. Norway has a long history leading up to the egalitarian work-life model practiced today. Power is shared equally between work-life participants within different areas of responsibility. Within this framework, it is natural for the union to engage in areas of interest beyond worktime and wages, and they have become an important partner when it comes to the implementation of improvement processes in a company.

Management objectives

Management is hired to generate profits for owners. Seen in isolation, this statement assumes a top down perspective on how the company functions as an organisation, but hard competition and experience has given us a situation where we need to utilise other perspectives towards organisational behaviour. WPI includes job tasks and organisational redesign. It may also include management redesign, in terms of more deliberate and goal-oriented use of the potential represented by the unions. Such considerations should become an integral part of how management sets their strategic objectives, and approaches employees to reach them.

Management practice and the organisational design of a company must support such co-operative improvement efforts. Project design, including the union must be based on values of mutual respect and involvement. Mutual respect and involvement are vital when it comes to how a company succeeds in social partnerships. The value of unions in formulating strategy and achieving corporate objectives is often underestimated by management (Stewart et al. 2009, p. 131), and such miscalculations work against the possibility of defining objectives of common interest. Management and union objectives are not always the same, but it is a common

responsibility to define and develop potential areas of co-operative development. Organisational flexibility and high competence as mentioned previously both represent such areas.

Management objectives are often built up around key performance indicators (KPI's). Often, they are connected to economic values in a measurable way. If all organisational objectives are based on economic targets, a firm can miss the important dimension of human needs. In order to take care of human needs, the model should be revolved. Economic value creation should be the product of a work-life where the well-being of employees is integrated. Job re-engineering, when incorporated in Lean and WPI implementation, "*is not a one-way process with a single outcome for employees well-being*" (Anderson-Connolly et al. 2002, p. 390). It is a process creating multi-dimensional effects, some favourable and some unfavourable for workers. Management has a responsibility to ensure that change processes do not interfere with the well-being of the employees.

Change and resistance

Employees tend to meet changes in work-life with scepticism and resistance. Such a response is natural, since individuals and groups immediately start to ask themselves questions. What does this change mean to me? Is it a threat to me or my position? What is in this for me? Previous research shows that union membership is negatively related to the implementation of Lean when it comes to commitment (Angelis et al. 2011). This indicates that the union interprets the principles of Lean as running counter to their own agenda. Lean has by nature an intensifying effect on work since natural breaks are eliminated (waste), and this fact may provoke blue collar workers (Skorstod 1994, p. 449). Enhanced Lean commitment is conditional, and related to the effectiveness of management design and the practice of technological and human resource policies (Angelis et al. 2011). Managing change processes requires more than just leadership or management skills. In order to succeed with managing processes of change, you need to have knowledge of the elements important to the defined process. Leading change through competence is the only answer, according to Kotter (1996, p. IX). A union can play a facilitative role in the demanding process of implementing change. By participating in every part of a project they will not only act as a catalyst to the process, but they will also have the opportunity to influence matters of importance to the union. The "voice of the employees" is heard through union representation, and it secures commitment instead of resistance to the practical changes.

Where are the borders between failure and success? Preconditions for success

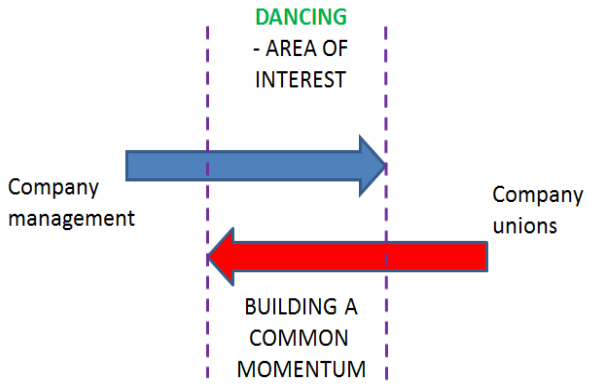
The model of amplifying an improvement process with strong and decisive union involvement needs some distinctive prerequisites. These preconditions are not fixed or absolute, but vary due to the corporate context. In order to succeed, the union must be well organised and also play a strong part in the culture of the company. Long and predictable relations of collaboration between union and management contribute to a productive process. The *dance floor* is cleared. The cultural heritage surrounding the process will act as a framework, and previous success will make a good starting point. The maturity of both the union and the management is

important for success. Both parties need skilled leadership who understands the potential gains offered by co-operative solutions. "*Inadequate skills at dialogue, on either side, can undermine the effectiveness of* partnership (Huzzard, Gregory & Scott 2004, p. 241). Embedded in this experience and maturity is a realisation that *boxing* between union and management results in energy draining confrontation. By choosing collaboration, both sides assume responsibility and make something better together.

As mentioned earlier, social partnership takes place on different levels and dimensions. In order to generate added value and progress for all partners, choices must be made. Social partners do not need to have a single strategy for interaction with other social partners. They can choose to adapt their approach and actions to the different arenas in which they participate. Such a multi-dimensional approach opens up possibilities for a combination of structures to produce added value. As an example, the unions can choose a historical approach to the core activities of negotiations regarding wages and working hours (*boxing)*. They can enhance their boxing skills in this specific area and at the same time dance with social partners in other arenas. There is connection between boxing and dancing. According to Huzzard, Gregory & Scott (2004, p. 247)*"it would be foolish to think that disconnecting boxing from dancing will make the dance more successful".* When it comes to the questions of taking part in improvement processes like WPI and Lean, the union can choose to actively take part and affect the decisions in the process. Their participation will also amplify the degree of success of the process (*dancing)*. This divided and selective strategy requires adherence to strict roles and firm leadership. The social partners involved must agree on defining an area for *dancing* that promotes added value for all parties. On a company level it could be illustrated as shown in the figure below:

All parties must "give and take" in the process of building something larger. Joint efforts generate a higher output on the defined area. The "*boxers*" decide the size and the content of the *"ring"* (Huzzard, Gregory & Scott 2004, p. 95).

The size of the company may be of some importance when considering joint improvement



project design. Smaller companies may experience that the role of the unions are somewhat vague, and it then becomes difficult to objectify their role as a potential partner in a project. One or few strong unions are important to make this union – management collaboration strong. When the union is strong, they represent a clear and distinctive partner in a potential co-operation. They also represent "the voice of the employees", which is a strong argument. The

strength of a union is measured by the numbers and share of members, network connections, experience and the organisational structure and capabilities they hold. An opposite situation with numerous unions makes it harder for management to arrange for joint project design. In the case study from Nammo Raufoss AS, the blue collar union represents 100 % of the 400 potential members, and they are easy to identify as a potential partner when designing an improvement activity. They also represent a large body of institutional knowledge experience that makes them a potentially attractive partner.

Previous positive experience of social partnership between management and unions facilitates a potential joint project design. You "*learn to dance*" when working together, and co-operation around a common objective creates more trust that is useful for further steps. It must be emphasised that union – management collaboration puts the union representatives in a difficult position. They must cope with both satisfying their members (mandate) together with the co-operative role they play towards the management. This is a demanding position leaving them "between a rock and a hard place", but a distinctive division of roles and objectives may ease this pressure. "*Dancing too closely with management can compromise the union's support from its members* (Huzzard, Gregory & Scott 2004, p. 78).You need to do two different things simultaneously, and it takes time to master this duality. Clarity and strict lines of responsibility help the employee representatives not to forget the interests of their constituents when working closely with company management.

Conclusion

There is a potential "win-win" for both management and unions in finding co-operative solutions when implementing improvement projects on a company level. Picture the company as an automotive engine, and the union can be seen to represent the "turbo charger" in a process of change. The process design must not create winners and losers, and all social partners must be involved on equal terms. Tasks and responsibilities are shared between stakeholders, and participants are motivated by taking part and contributing to something defined as common value. Transparency and openness are mandatory. When the prerequisites mentioned here are in place, improvement processes like WPI and Lean implementation are more likely to produce a positive result. Success in improvement yields improved competitiveness in an industrial setting.

WPI is more than a "*Nordic obsession*" (Totterdill, Cressey & Exton 2012), and the union can make a difference in such improvement targeted processes. WPI is, to a great extent, improvement work on terms favourable to the union. It is of utmost importance to steer the potential energy that the union represents in the same direction as the improvement project itself. This is possible when the union is invited to participate in all stages of an improvement project.

Relations between unions and management are historically marked by power struggles (*boxing)*. The unions have gained influence through the use of power, and today we see work-

life structures that are more balanced. We have all experienced situations where one party wins at the cost of the other. From a WPI perspective, the co-operative approach in improvement projects represents an area with latent added value. WPI or Lean cannot be implemented partially in an organisation. Such a project represents an opportunity to unite around something that brings the company further along the continuum of improvement.

Collaboration on terms like this does not mean that the union and management need to agree on every issue. They are not "married", and genuine involvement and practical use of the union in this manner does not mean a "union takeover" when it comes to management of the company. Different subjects must be managed separately, with tasks and responsibly shared accordingly. Equally shared power also requires a division of responsibility. Experience from previous processes clearly shows that conflicts often lead to energy draining situations with sub-optimal results. "Experience" is the key word, because a dogmatic attitude towards traditional management and union roles and responsibilities seldom benefits the objectives sought by the planned improvement process. By finding common solutions, it is possible to enhance the output of the process compared with a solution based on negotiation only.

This article argues that the management of a company could, in a more defined and conscious way, leverage the potential energy of the union in improvements processes. Actually, it is not only up to management. An invitation to *dance* can also be initiated by the union(s). Conducted correctly, there is a potential for improved outcomes in every part of the process, and the democratic principles are safeguarded since the "voice of the employees" is heard throughout the union representation. By involving the union early in the planning of an improvement project, management gains a partner instead of an opponent. Naturally, one can present both pros and cons regarding such an approach, but it is at least an option worth considering when working with industrial improvement processes.

You reap what you sow…….

The examples given here with the automotive unions in 1990's UK and the blue collar union at Nammo Raufoss AS today are, of course, two totally different scenarios. Time and setting is fundamentally different. Our perspective on Lean has changed much over the last 25 years, and done the right way in collaboration with the unions, it will greatly benefit all social partners. Modern interpretation of Lean is not theoretical. It is more practical, compounded and holistic compared to the original TPS. A union can support implementation of Lean when they are genuinely invited into the process.

This article was not intended as an assessment of the union's role in those mentioned scenarios, but rather to demonstrate that co-operative and productive solutions benefitting both parties can be achieved. Right co-operative measures between management and union creates added value. Some may find this co-operative design provocative, but the potential benefits of social partnership cannot be ignored on our way to optimal work-life practice. Some of the

characteristics that influence an improvement process have been high-lighted in this article, but it is important to emphasise that a co-operative design between social partners is not totally dependent on a positive economic framework. It is most likely easier to arrange such co-operative partnerships within a strong financial position, but the invitation to *dance* should also be considered when operating under economic strain. Added value lies in the combination of opportunities, and these opportunities appear in different dimensions. Today's Work Life offers much more than a traditional Marxist "employee vs. capital" approaches. Arrange for a *knock out* by learning to dance!

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EUROPEAN JOURNAL OF WORKPLACE INNOVATION

The Corporate Response to the Fourth Industrial Revolution

Peter Totterdill

Abstract

From a critical perspective, Industry 4.0 risks being no more than the latest in the long line of technological predictions based on exaggerated claims. It risks drawing corporate decision-makers into patterns of investment that ultimately fail, because they ignore the importance of synergy between the design and implementation of technologies on the one hand, and human and organisational factors on the other. There is a need to articulate the choices and alternative narrative surrounding Industry 4.0.

The technological advances represented by Industry 4.0 potentially offer real economic and also social benefits. At the same time, realising this potential, and avoiding the mistakes of the past, means recognising the importance of a new and more inclusive paradigm of innovation. The challenge is that of reconciling the ordered, rational organisation of work offered by emergent technologies with the creative, dialogical, serendipitous and even chaotic human interactions that can stimulate innovation.

Keywords: Competitiveness; determinism; digitalisation; employment, empowerment; Industry 4.0; innovation; quality of working life; skills; technology; workplace innovation.

A critical perspective

When does a popular idea begin to outlive its usefulness, gradually obscuring the reality which it was intended to explain? How do we distinguish transient fashions in thinking and practice from underlying truths?

During my professional life I have seen (and sometimes contributed to) successive yet always short-lived fashions in predicting the future of work and the economy: Flexible Specialisation (Piore and Sabel 1984); the Virtual Organisation (Davidow & Malone 1993); The End of Work (Rifkin 1995); the New Economy (1990s -); Sociocracy and the Death of Hierarchy (e.g.: Endenberg 1998); the Millennial Workforce . . . and so on. 'The Fourth Industrial Revolution', more commonly known in Europe as 'Industry 4.0' since its adoption by the German Federal Government, is the latest in this long line of attempts to make sense of emerging forces in what is undoubtedly an increasingly volatile global economic environment.

In line with its predecessors in prediction, Industry 4.0 contributes important insights and enhances understanding of the challenges and opportunities facing corporations and policymakers alike. Yet claims that it offers a comprehensive, global narrative on the future of work and the economy, and indeed that it represents an inevitable as well as a desirable development, should be treated with caution. The concept is being driven "by computer scientists, engineers, innovation policy actors, influential business associations and larger technology-intensive enterprises" (Hirsch-Kreinsen 2014, p. 421), and as with other fads it contains much speculation, contradictory evidence and, most importantly, a tendency to conceal choices. As German researchers Kopp et al. (2017) argue, Industry 4.0 can easily become 'Technological Determinism 4.0', repeating the mistakes of previous eras in which technocratic reductionism became so pervasive in some industrial settings leading to expensive failure. Corporate and public discourse needs to recognise the existence of alternative narratives and competing choices.

Kopp et al. suggest that when the initial, still undiminished euphoria surrounding Industry 4.0 dies down, the choices and dilemmas which surround it will become much more evident. Indeed, economic and workplace futures in democratic societies will continue to be shaped by choices and decisions made by diverse stakeholders including politicians, scientists, thinkers and individuals rather than determined by a linear technological imperative.

In Europe, the public policy approach centres on raising the competitiveness of advanced manufacturing through enhanced innovative capacity, productivity, growth and employment, recognising the critical role of human factors and 'inclusive growth' (European Commission 2010). This article explores the corporate choices and opportunities involved in realising that goal.

The promise (and threat) of Industry 4.0

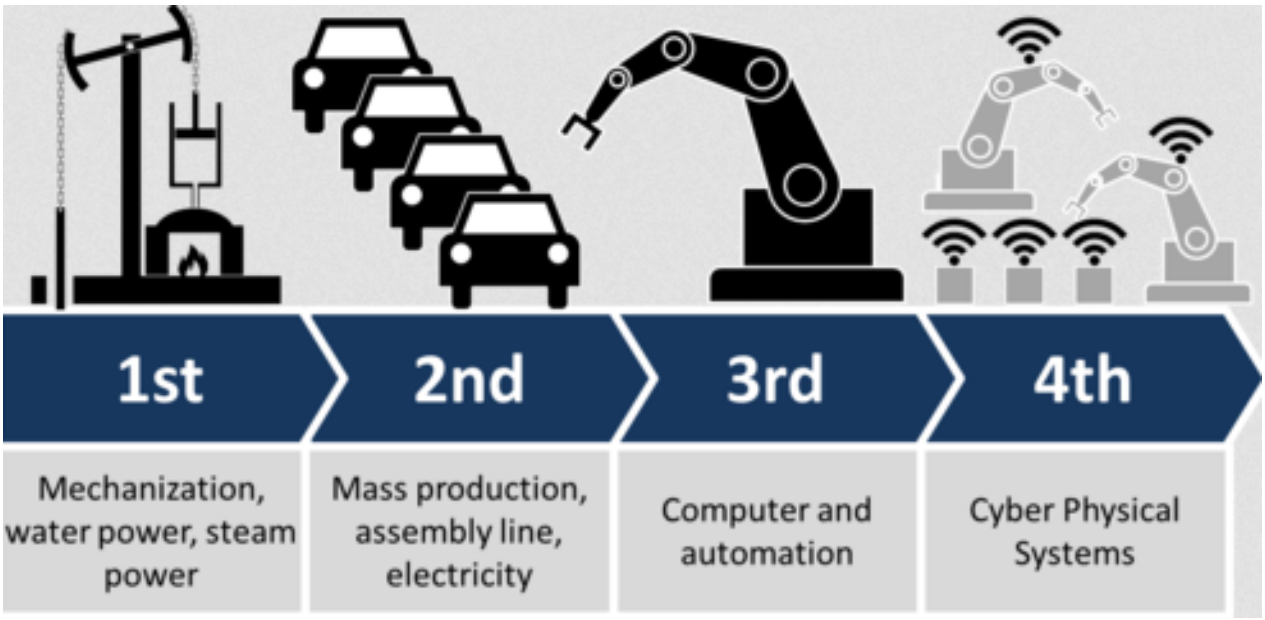

Figure 1: Industry 4.0. Source: Wikipedia

'Industry 4.0' describes a new level of organisation and management of the entire value chain across the product life-cycle, able to meet increasingly individualised customer wishes so that even one-off items can be manufactured profitably. It can form extended value creation chains linking manufacturers with their suppliers and customers, encompassing idea generation, product development, production, delivery to the end customer and eventually recycling.

The European Parliamentary Research Service (2015) summarises the new and innovative technological developments on which Industry 4.0 depends as follows:

- The application of information and communication technology (ICT) to digitise information and integrate systems at all stages of product creation and use (including logistics and supply), both inside companies and across company boundaries.
- Cyber-physical systems that use ICTs to monitor and control physical processes and systems.
- Network communications including wireless and internet technologies that link machines, work products, systems and people.
- Simulation, modelling and virtualisation in the design of products and the establishment of manufacturing processes.
- Collection of vast quantities of data, and their analysis and exploitation, either immediately on the factory floor, or through big data analysis and cloud computing.
- Greater ICT-based support for human workers, including robots, augmented reality and intelligent tools.

Transmission of data through the manufacturing chain, automation of production and the use of configurable robots lead to greatly enhanced flexibility and mass customisation since a variety of different products can be produced in small batches in the same facility. Such flexibility also encourages innovation, since prototypes or new products can be produced

quickly without complicated retooling or setting up new production lines. Digital designs and virtual modelling of manufacturing process can reduce the time between product conception and delivery.

Customers will be able to be more involved in the design process. Production can also be located close to the customer because, if manufacturing is largely automated, it does not need to be 'off-shored' or located in low labour cost countries, and ‘re-shoring’ is already occurring in parts of Europe[4].

Integrating product development with digital and physical production has also been associated with large improvements in product quality and significantly reduced error rates since data from sensors can be used to monitor every piece produced rather than using sampling to detect errors, and error-correcting machinery can adjust production processes in real time.

Productivity can also increase. By using advanced analytics in predictive maintenance programmes, manufacturing companies can avoid machine failures on the factory floor and cut downtime significantly. Some companies are already setting up 'lights out' factories where automated robots continue production without light or heat after staff leave for home.

Industry 4.0 can also enable long-sought changes in business models. Rather than ‘low road’ competitive strategies based primarily on cost, Industry 4.0 may allow companies in high labour cost countries to compete on the basis of innovation, able to deliver new products rapidly to customer-driven designs with the assurance of high quality standards. Falling costs for digital technologies may also help to close the productivity gap between SMEs and large companies found in some European countries. Even more significantly, technologies such as 3D printing have the potential to decentralise the production of many consumer goods to local or even domestic sites, while current corporate manufacturers become pure software companies[5].

Some argue[6] that, in addition, Industry 4.0 will address and solve social and environment challenges such as resource efficiency and demographic change. For example, workers can be released from routine tasks, enabling them to focus on creative, value added activities. Older workers will be able to extend working lives and remain productive for longer, ameliorating the impact of an ageing workforce in many European countries. Flexible work organisation should also enable workers to combine work, private lives and continuing professional development more effectively.

Yet these promises conceal considerable anxiety about how the transition to a better, brighter future will affect current jobs and businesses. Polarisation in European labour markets has been observed for some time (for example: Lundvall 1996). Low-skilled workers are offered few opportunities to upgrade their skills while those with higher education are offered more. The OECD Jobs Study (1994) showed that this process had already begun in the mid-1980s and it has continued ever since in Europe. Lundvall et al. (2008) found that growing income inequality excluded and marginalised low skilled workers from new employment opportunities. Arguably

4 https://reshoring.eurofound.europa.eu/

5 www.forbes.com/sites/ricksmith/2015/07/07/5-incredible-trends-that-will-shape-our-3d-printed-future/#58799301fa48

6 See for example www.workplaceinnovation.org/nl/kennis/kennisbank/industry-4-0/1241

the consequences of this widening and cumulative process of marginalisation are reflected in growing political volatility represented by the election of President Trump in the USA, Brexit in the UK, and the rise of the far right in countries such as Germany, Hungary and Poland.

It is certainly clear that that greater use of digital industrial technologies will reduce the number of traditional assembly and production jobs, yet the scale of the loss is heavily contested. Based on a detailed analysis of several forecasts and projections, Bakhshi et al. (2017, pp.22-23) show that alarming and widely-publicised headline findings suggesting, for example, that "47% of US workers' jobs are at high risk of automation" have been challenged by other researchers, and that once detailed task variations are taken into account the figure may be closer to 9%. In the UK, they predict (p.13) that by 2030 "Around one-fifth (of employees) are in occupations that will likely shrink", and that these are mainly in low- or medium-skilled occupations in both manufacturing and administration. These projections are much lower than other recent studies of automation have suggested, reinforcing a view that in many occupations complete automation is not realistic and that improvements in productivity will be achieved mainly through enhancing human labour through digital assistance rather than replacing it[7].

On the positive side, Gregory et al. (2016) estimate that automation boosted net labour demand across Europe by up to 11.6 million jobs over the period 1990–2010, as its job-destroying effects were offset by lower unit costs and prices which stimulate higher demand for products, and that surplus income from innovation was converted into additional spending, so generating demand for extra jobs in more automation resistant sectors.

Bakhshi et al. (2017, p.13) predict that in the UK "around one-tenth of the workforce are in occupations that are likely to grow as a percentage of the workforce" by 2030. Creative, digital, design and engineering occupations have bright outlooks and are strongly complemented by digital technology. They also cite US data which suggests that roles such as management analysts and training, development and labour relations specialists, all occupations associated with the reorganisation of work, are projected to grow. However, "roughly seven in ten people are currently in jobs where we simply cannot know for certain what will happen."

Old skills for new jobs

A common feature of projections about the employment impact of Industry 4.0 lies in the prediction that higher-order cognitive skills will feature prominently in the future demand for labour. Originality, fluency of ideas and active learning will be highly important as well as system thinking, judgement and decision-making skills, not just because they are necessary to manage complex technological systems but also because they feed the creativity required by a culture of innovation.

Social skills will also continue to grow in importance in building customer service and negotiating the co-ordination frameworks required by Industry 4.0 which will often involve the creation of high-trust relationships across the globe (Bakhshi et al. 2017; McKinsey 2017; PwC 2016). Strikingly, nearly all US job growth since 1980 has been in relatively social skill-

[7] See for example www.forbes.com/sites/haroldsirkin/2016/04/19/advanced-manufacturing-is-not-a-job-killer-its-a-job-creator/#220cfa9d5ddd

intensive occupations, and occupations with high analytical but low social skill requirements shrank over the same period (Deming 2015).

Bakhshi et al. (p.13) express optimism that "occupation redesign coupled with workforce retraining" could promote growth in occupations whose future is uncertain and enable the adaptation of workers whose jobs are under threat. Conceivably, digitally assisted work environments could ease the transition to new jobs and even encourage some older workers to return to work.

Lundvall's emphasis on the importance of 'discretionary learning jobs' is helpful in this context. Discretionary learning refers to a job situation where the employee has a certain freedom (discretion) to decide how to solve problems and where, in consequence, (s)he continuously learns new skills. It stands in contrast to Taylorist work where there is both little freedom to act and very limited learning for the employee. Arundel et al. (2007) found very clear patterns showing that in countries where ordinary workers are engaged in discretionary learning jobs, domestic enterprises were more engaged in radical innovation. Yet overall less than 40% of Europe's workers are employed in discretionary learning jobs (Lundvall 2014).

The challenge remains. Europe's track record in managing the transition of workers in declining industries to secure, skilled employment in other fields is at best patchy: and it is impossible not to think of the continuing marginalisation or exclusion of former coal miners, steel workers or sewing machinists in many communities. Active interventions to support workforce adjustment are certainly possible but this is no guarantee that this will happen, as Lundvall et al. (2008) found in their analysis of labour market polarisation discussed above.

The emergence of a new innovation paradigm

As we have seen, the Industry 4.0 narrative emphasises its potential to facilitate product and service innovation through digital design, virtual modelling and rapid prototyping. The key challenge is to understand the organisational conditions under which human creativity can realise this potential.

Innovation has often been seen as the prerogative of a scientific, entrepreneurial or management élite, yet recent research shows that it thrives in egalitarian learning economies where ordinary workers enjoy jobs that make full use of their skills and learning capacity (for example Lundvall et al., 2008). Likewise the traditional view of innovation has been challenged from several other complementary directions, for example "open innovation" (Chesbrough 2003), "customer-driven innovation" (Desouza et al. 2004), "co-creation" (Prahalad et al., 2004) and "networked innovation" (Valkokari et al. 2012) mirror important aspects of an emerging innovation paradigm that has to be considered alongside the technological dimensions of Industry 4.0. A tangible example can be found in the rise of 'FabLabs' and the 'Maker Movement'[8]. These have close links to 'free and open source' thinking including the open source software movement, sharing the philosophy that all can be empowered to use and shape creative technologies. They are being created by universities and colleges, by not-for-profit entities in local communities and, increasingly, by companies who want to supercharge innovation by forming spaces where

[8] See for example www.create-hub.com/comment/the-maker-movement-shifting-uk-manufacturing/

frontline employees, customers and other stakeholders can think 'out of the box', collaborate and discover the potential for serendipitous breakthroughs.

Totterdill et al. (2016) argue that in the early 1990s a significant shift in Europe's economy could be observed, fuelled by information technology. This shift reversed the historical pattern in which tangible capital was considered the main asset in companies. From around 1990, investments in intangible capital (as a percentage of adjusted GNP) such as patents, R&D, marketing and organisational competences became higher than investments in tangible capital (Corrado and Hulten 2010). The conviction grew in Europe that 'social innovation' in the workplace could be more important than 'technological innovation' in explaining company performance (Bolwijn et al. 1986). Developing and utilising the full range of skills and competences in the present and future workforce is therefore a vital component of competitive and knowledge-based global economy (European Commission 2014). Likewise the *OECD Innovation Strategy*, the culmination of a 3-year, multi-disciplinary and multi-stakeholder effort, emphasises that "empowering people to innovate" and "fostering innovative workplaces" is important for creativity, innovation and productivity (OECD 2010b). Moreover organisations only achieve a full return on investment in technological innovation if it is embedded in workplace innovation, in other words making the technology work by achieving a full synergy with human and organisational factors.

Jensen et al. (2007) used survey data from around 700 Danish firms to link their mode of learning to innovation performance, and the statistical analysis led to four clusters of firms: Low Learning, Science-Based Learning, Experience-Based Learning and a combination of Science- and Experience-Based Learning. Science-Based Learning refers to a process where systematic research plays a major role and the knowledge produced is often codified. Experience-Based Learning refers to learning by doing, learning by using and learning by interacting, and here much of the knowledge remains tacit, embodied in people and embedded in organisations.

Jensen et al. show that firms engaged in innovation need to combine the two modes. While firms that practised one of the two learning modes were twice as innovative as those with Low Learning, firms that combined the two modes were five times as innovative as those with Low Learning. Innovation management at corporate level therefore needs to focus on building a learning organisation and a pervasive culture of 'high involvement' and 'employee-driven' innovation (Tidd and Bessant 2009; Totterdill 2015).

High involvement innovation and Industry 4.0

To summarise the argument so far, the potential of Industry 4.0 will only be fully realised if the technocratic reductionism of previous eras is rejected and there is a reconciliation of what might be seen (Ennals et al., 2018) as two conflicting models: one focused on structure and order in order to attain the rational organisation of work, and the other in which creativity and human dialogue drive innovation:

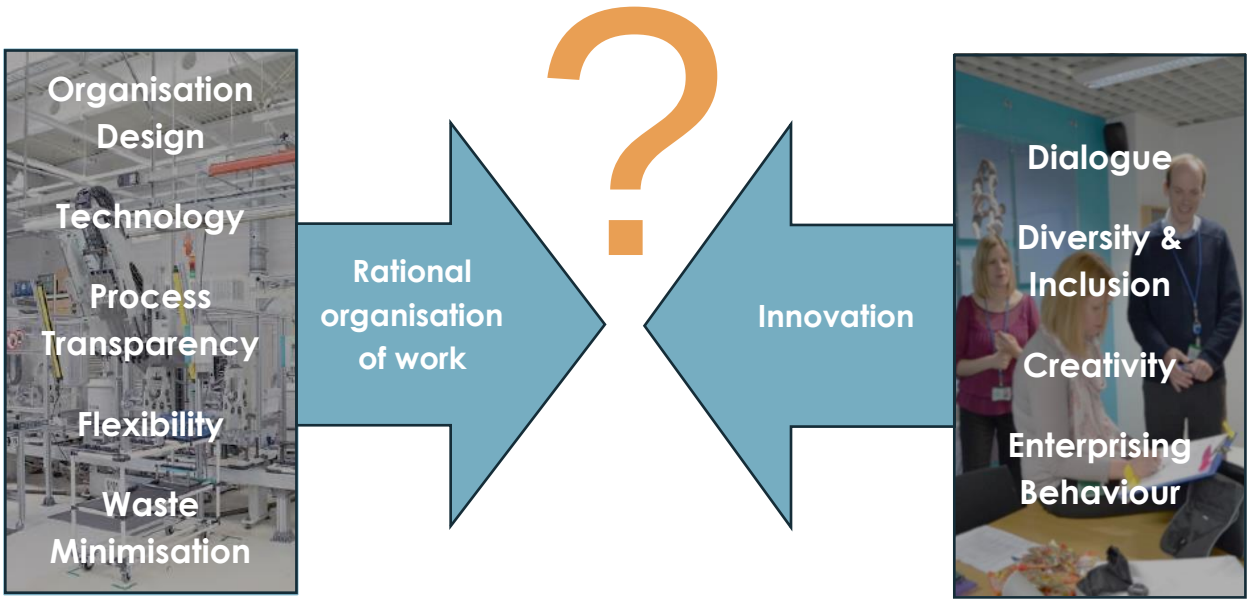

Figure 2: Structure and Order v. Dialogue and Creativity

In reconciling these two models, our starting point lies with the vast and growing body of evidence demonstrating that workplace practices which empower employees to contribute ideas and be heard at the most senior levels of an organisation lead to improved productivity and capacity for innovation, as well as enhanced workforce health and engagement (Pot 2011; Ramstad 2009; Totterdill 2015). Such practices have increasingly been described as 'workplace innovation' since the early years of the present century.

According to the Hi-Res study, a meta-analysis of 120 case studies across ten European countries, workplace innovation takes diverse forms but is always characterised by:

". . . a clear focus on those factors in the work environment which determine the extent to which employees can develop and use their competencies and creative potential to the fullest extent, thereby enhancing the company's capacity for innovation and competitiveness while enhancing quality of working life." (Totterdill et al. 2002).

Such factors in the work environment include empowering job design, self-organised teamworking, structured opportunities for reflection, learning and improvement, high involvement innovation practices, the encouragement of entrepreneurial behaviour at all levels of the organisation, and employee representation in strategic decision-making.

Workplace innovation is an inherently social process, creating self-sustaining processes of development by learning from diverse sources and by experimentation. It seeks to build bridges between the strategic knowledge of the leadership, the professional and tacit knowledge of frontline employees, and the organisational design knowledge of experts, engaging all stakeholders in dialogue in which the force of the better argument prevails (Pot et al. 2016; Gustavsen 1992).

Thus, in defining workplace innovation, it is important to recognise both process and outcomes. The term describes the participatory *process* of innovation which leads to *outcomes* in the form of participatory workplace practices. Such practices grounded in continuing reflection, learning

and improvement sustain the process of innovation in management, work organisation and the deployment of technologies.

Explaining workplace innovation

Workplace innovation now occupies an important place in EU innovation and competitiveness policy, and led to the creation of the European Commission's Workplace Innovation Network[9] (EUWIN) in 2012, jointly led by TNO[10] and Workplace Innovation Europe[11].

The creation of EUWIN provided an opportunity to address the need for a new type of dialogue between researchers and practitioners. EUWIN's task is to promote the dissemination of workplace innovation throughout Europe through knowledge sharing and dialogue[12].

With limited resources, a clear framework for communication was a priority for EUWIN partners. Workplace innovation is a hard-to-grasp concept, and it was important to make it more communicable, without breaking the link with the large and complex body of research evidence that underpins it. This led to the formulation of *The Fifth Element* concept by the Workplace Innovation Europe team as a means of providing practical and actionable insights into evidence and experience underpinning workplace practices associated with high performance, innovation and quality of working life (Totterdill 2015).

The Fifth Element is based on an analysis of more than one hundred articles and a similar number of case studies from which four main bundles of workplace practices (or 'Elements') were detected, each associated with improved performance and quality of working life:

1. Jobs and Teams
2. Organisational Structures, Management and Procedures
3. Employee-Driven Improvement and Innovation
4. Co-Created Leadership and Employee Voice.

Each of these bundles does not exist in isolation but is influenced, for better or worse, by the others. Workplace innovation cannot be reduced to fragmented practices if it is to realise its potential. The literature emphasises the importance of internally consistent policies and practices combining different forms of representative and direct participation in achieving superior outcomes for organisations and their employees which are greater than the sum of individual measures (Lado and Wilson, 1994; Huselid, Jackson and Schuler 1997; Teague 2005). Likewise studies of failed workplace innovation emphasise the role of "partial change" in undermining the introduction of empowering working practices (Business Decisions Limited 2002). This provides the starting point for *The Fifth Element*.

Sustainable convergence between high performance and high quality of working life is explained by cumulative causation in which empowering workplace practices are aligned at

9 http://ec.europa.eu/growth/industry/innovation/policy/workplace/index_en.htm

10 www.tno.nl

11 www.workplaceinnovation.eu

12 http://uk.ukwon.eu/euwin-resources-new

each level of the organisation. The mutually-reinforcing impact of workplace partnership, shared learning, high involvement innovation, enabling organisational structures and systems, self-organised teams and empowering job design can create a tangible effect in workplaces which is hard to quantify but which is often described in terms of "engagement" and "culture". By implication, the route to achieving high levels of employee engagement and a culture of innovation is not a direct one but must embrace the contents of each Element.

The Fifth Element has been adopted by EUWIN and subsequently by economic development agencies in the Basque Country, France and Scotland as a framework for raising awareness of workplace innovation and supporting its implementation.

The Fifth Element in practice

The metaphor of *The Fifth Element* is a useful way of capturing this essential quality, describing an alchemic transformation that can only take place when the other four elements combine. The concept is explained further on the EUWIN Knowledge Bank and in a short film[13].

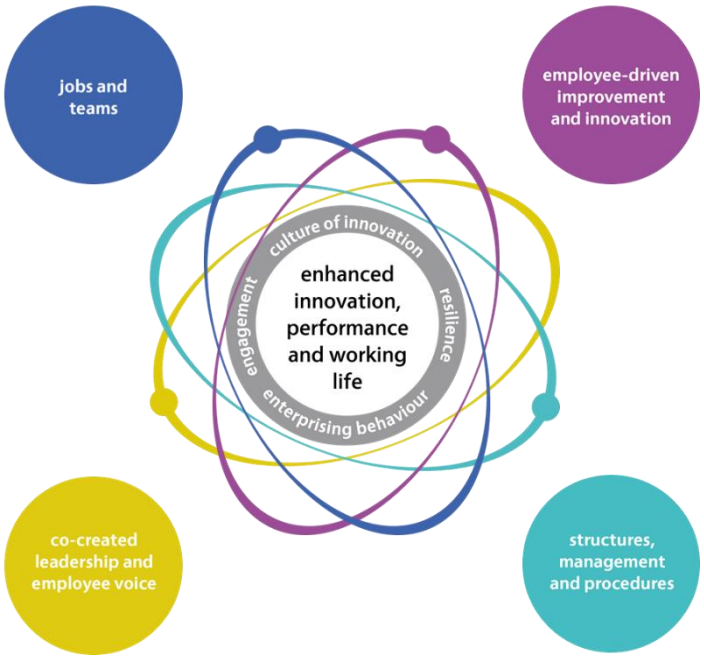

Figure 3: *The Fifth Element*: conceptualising the characteristics and outcomes of workplace innovation

The First Element: Jobs and Teams

Building workplaces in which employees can develop and deploy their competencies and creative potential begins with job design. Well-designed jobs that provide constructive challenges, opportunities for day-to-day problem solving, variety and collaboration help people manage the demands placed on them and avoid the psychological stress and disengagement associated with repetitive and disempowering work (Bakker and Demerouti 2007; Morgeson and Humphrey 2006; Shantz et al. 2013; Truss et al. 2013). Moreover through exercising

13 http://uk.ukwon.eu/the-fifth-element-new

discretion in such "complex jobs" employees acquire skills that are transferable, increasing their adaptability and resilience within the organisation and their employability outside it, even in quite different occupations (CEDEFOP 2015).

In De Sitter's STSD theory the central idea is the balance between 'control requirements' (quantitative and qualitative demands) and 'control capacity' (job control). "It's not the problems and disturbances in the work that cause stress, but the hindrances to solve them" (De Sitter 1981, p.155). In order to maintain this balance, control capacity is required regarding the performance of a given job on individual job level as well as regarding the division of labour on production group and plant level: "from complex organisations with simple jobs to simple organisations with complex jobs" (De Sitter et al. 1997). Besides internal control capacity, complex jobs also include participation in external control activities at production group and plant level (for example shop floor consultation on processes, division of labour and targets). The aim of such sociotechnical design is to simultaneously result in improved organisational performance, quality of working life and better labour relations.

De Sitter (1981) integrated the 'job demands-control-model' (Karasek 1979) in his theory. The job demands-control (JDC) model holds two predictions. High job demand and low job control separately represent risk factors that are detrimental to (mental) health outcomes such as work stress and coronary heart disease. The model also predicts that high job demand, as well as high job control fosters motivation and learning. The most commonly used definition of job control (or decision latitude): which describes the features of jobs and not of individual job performers, is primarily the ability of the worker to use his or her skills on the job and to have authority to make decisions regarding how the work is done, and to set the schedule for completing work activities. Central features of the JDC model are also the strain and learning hypotheses, referring to two interaction hypotheses on the balance between job demands and job control. Jobs with high demands and low control can be called 'high strain jobs' which are a risk for work-related stress. Moreover, stress inhibits learning. But jobs with high demands as well as high control are called 'active jobs' which offer opportunities for learning and coping with stressors (Karasek 1979; Karasek and Theorell 1990). Later, this JDC model was extended with the social support dimension (support of colleagues and supervisor) and with innovative and productive work behaviour (Karasek and Theorell 1990). Empirical evidence for the JDC model can be found in De Lange et al. 2003, 2005; Taris et al. 2003; Häusser et al. 2010; Demerouti et al. 2001; Taris et al. 2003; Lyness et al.2012; Stansfeld et al. 2013; Gallie 2013; Dhondt et al. 2014.

Effective job design must develop in synchrony with the wider organisational context. The key concept here is teamworking, one of the defining characteristics of workplace innovation, with deep roots in European thinking about management and organisation dating back to the work of the Tavistock Institute in the 1940s and 50s. Extensive research demonstrates that empowered and self-managed teams are more productive in factories and offices, provide better customer service, and even save lives in places like hospitals (Totterdill et al. 2002; West 2012; European Foundation for the Improvement of Living and Working Conditions 1997).

However 'teamwork' is increasingly used to describe such a diverse range of workplace situations that arguably the term is in danger of becoming meaningless. While teamworking may refer to a general 'sense of community', or a limited enlargement of jobs to enhance

organisational flexibility, empowered teamworking will involve a radical re-appraisal of jobs, systems and procedures throughout the whole organisation (West and Lyubovnikova 2012).

'Real' teams are more than groups of co-located employees; they share knowledge and problems, break down barriers and demarcations, and generate ideas for improvement, innovation and growth using the insight that day-to-day work experiences give them. All team members must have the potential for a high level of reflexivity unconstrained by internal demarcations and privileges (Gustavsen 1992).

Teams in which the specific knowledge and expertise of each team member are valued and make a tangible contribution to product and workplace innovation meet important criteria for convergence between enhanced productivity and enhanced quality of working life. Yet convergence is only possible and sustainable when structures, systems, industrial relations and leadership are fully aligned with the empowerment of employees in their day-to-day jobs (Boxall and Purcell 2003; Buchanan and Preston 1992; Teague 2005), hence the interdependence with the Second, Third and Fourth Elements.

The Second Element: Organisational Structures, Management and Procedures

The Fifth Element approach recognises the need for a consistent approach to empowerment, learning and development running through every aspect of corporate policy from reward systems and performance appraisal to flexible working and budget devolution.

Hierarchical management layers inevitably put distance between decision-making and the frontline, disempowering and diminishing the voice of those at the lower levels as well as creating an implementation gap. Hierarchy breeds caution amongst managers, encouraging decisions to be delegated upwards with consequent loss of productivity and responsiveness. Such vertically organised structures create silos and add to the difficulties of building bridges between functional specialisms. This often causes frustration in resolving day-to-day issues and can have a particularly negative effect on the capacity for innovation (Mumford 2006). Flexible and decentralised structures and systems that are consistent and fair are required to eliminate feelings of disbelief and mistrust, to reduce management distance and to create a culture conducive to innovation (Judge et al. 1997; Martins 2000; Saunders & Thornhill 2003).

Flat organisations rely on a decentralised approach to management and require a high degree of employee involvement in decision-making (Ghiselli et al. 1972). Control in flat companies lies in mutual agreements between self-managing, self-organising and self-designing teams and employees who take personal responsibility for satisfactory outcomes. This in turn empowers employees, facilitates information sharing, breaks down divisions between roles, shares competencies, and uses team or organisation-wide reward systems.

Yet even within more flexible structures, mistrust and disempowerment can be embedded in the systems and processes that shape decision-making, resource allocation, standard operating procedures and performance management. They can reflect a culture of centralised control and micro-management which requires careful dismantling.

For example, managing performance is often reduced to a necessary but poorly understood ritual. Line managers go through the motions of annual appraisals to demonstrate compliance with established procedures but there is little evidence of a strong impact on motivation,

personal and team development, or the removal of obstacles to high performance. Employees themselves often approach performance discussions either with indifference or with the anxiety that some aspect of underperformance may be sprung upon them. Yet effective coaching for high performance can produce continuous and sustainable improvements. In such cases managers recognise performance coaching as a valuable resource in their overall approach as team leaders.

The Third Element: Employee-Driven Innovation and Improvement

Studies of innovation in complex organisations emphasise the importance of large numbers of people empowered to act in entrepreneurial ways in pursuit of shared goals (Buchanan 2006; Høyrup et al. 2012).

Good and sustainable organisations build a set of internal reflexive mechanisms. Systematic opportunities for shared learning and 'productive reflection' (Boud et al. 2006) are well embedded in these workplaces. This is reflected in times and spaces where people at work can discuss ideas with co-workers or in team meetings. It can be as simple as establishing regular forums that enable people at all levels of an organisation to leave job titles and hierarchies behind, and to explore new ideas through open and free-thinking discussion.

Such organisations provide employees with regular opportunities to join cross-functional teams to identify and drive forward product or process changes that would otherwise be lost under the pressure of day-to-day workloads, and such practices appear in recommendations for the successful implementation of Industry 4.0 (for example PwC 2016). Time-out sessions, 'down-tools weeks' and hackathons, bringing people together who otherwise wouldn't meet, can become fountains of constructive dialogue, creativity and innovation[14]. These companies recognise the importance of experimentation and 'fast failure' as sources of shared learning, removing 'blame cultures' when things go wrong.

For an increasing number of organisations it means creating dedicated innovation spaces or 'FabLabs' that bring diverse combinations of people together, thinking in different ways, sharing technical knowledge and insights, creating new products or services and reinventing work processes. Increasingly the importance of the physical workplace may lie more in its ability to support serendipitous contact, congeniality, emotional engagement and the sharing of tacit knowledge, than to support the delivery of routine tasks. This is already being reflected in contemporary office design.

Ideas for improving the business should also be part of the day job. Many companies argue strongly that new ideas can come from anyone and reject the idea of setting up a separate innovation team. Networks of volunteer 'guerrillas', recruited from every level of the organisation, trained in facilitation techniques and empowered to ask difficult questions, can be used to establish a culture of innovation[15].

Tidd and Bessant (2009) argue that such examples of high involvement innovation must reflect deeper structural practices within each organisation: sustainable and effective employee

14 http://uk.ukwon.eu/learning-reflection-and-innovation-new

15 See for example http://uk.ukwon.eu/met-office

engagement cannot happen in isolation but must be driven from the top and reinforced by empowerment and autonomy in day-to-day working.

The Fourth Element: Co-Created Leadership and Employee Voice

Leadership theory is a highly contested field but leadership development has nonetheless gained increasing prominence through business school curricula, professional institutions and consultant offerings. Early theories were primarily focused on the distinction between "task focus" and "people orientation" (for example Vroom and Yetton 1988) but the emergence of "New Leadership Theories" led to the celebration of "transformational", "charismatic", "visionary" and "inspirational" leadership (Storey and Holti 2013), often drawing on the burgeoning hagiographies of business leaders such as Jack Welch and Steve Jobs.

The dark side of such leadership approaches soon began to emerge including the potential for abuse of power, narcissism, destabilisation, blind obedience and fear of questioning. It can even be argued that the extraordinary trust in the power of charismatic CEOs displayed in these leadership approaches "resembles less a mature faith than it does a belief in magic" (Khurana 2002).

Alternative approaches focused on leadership as a creative and collective process (Senge, 1990) were less concerned with the central, charismatic individual and more with the creation of opportunities for employees to seize the initiative and contribute to decision making. Such "shared and distributed leadership" relates to a concern with empowerment (Caldwell 2005) and "change agency", a phenomenon characterised by dispersed responsibility for change and not to be confused with the more heroic or charismatic models of "change leadership" (Buchanan et al. 2007). For Gronn (2002) the principle advantage of distributed leadership is that it builds organisational capability, and is therefore a key element of workplace innovation in that it helps to release the full range of employee knowledge, skills, experience and creativity (Totterdill 2015).

Leadership is therefore a collaborative, or *Co-Created* process. It is not dependent on individual charisma or authority but creates shared direction and purpose through organisation-wide opportunities for strategic thinking, shared reflection and learning, and employee voice in decision-making. *Employee Voice* describes the alignment of strategic priorities and decision-making at senior levels with the practical knowledge, experience and engagement of employees throughout the organisation. It brings together *direct participation* through, for example, self-managed teams and improvement groups, with *representative participation* in the form of employee or union-management partnership forums.

Representative participation, or workplace partnership between management, employees and/or trade unions is an important aspect of this process of co-creation. At its most basic level partnership agreements and structures are a way of dealing proactively with industrial relations issues, ensuring early consultation on pay and conditions, employment changes and organisational restructuring. Employers pursuing high-performance, high-involvement practices are particularly "likely to be impatient with traditional adversarial approaches to collective representation" (Kessler and Purcell 1995).

Partnership between management, employees and trade unions can take many forms, but always requires openness, transparency and two-way communication. Nobel-prize winner Akerlof

(1982) contends from an economic perspective that participation needs to take the form of gift-exchange or reciprocity to be effective. Gustavsen (1992) emphasises the need for democratic relations to optimise the outcomes for management and employees alike. At the very least it can be an effective tool for positive industrial relations, minimising conflict and resistance to change.

An important body of research has begun to show that representative partnership structures (such as works councils and management-union partnership forums) on their own may have little direct impact on performance or quality of working life. Rather they can exert a positive influence on the development of activities and practices that do so. Representative partnership creates opportunities for employees to exercise greater autonomy and direct participation (Batt and Appelbaum 1995). Workplace partnership thus moves away from its traditional focus on industrial relations, emerging as a potentially important driver of, and resource for, organisational innovation in the broadest sense (Huzzard et al. 2005; Cressey et al. 2013).

When partnership arrangements exist alongside the types of participative workplace practices described in the previous three Elements it creates a system of mutually reinforcing practices leading to improved information sharing, greater levels of trust, reduced resistance to change and heightened performance. This combination of representative and direct involvement is known as "employee voice" (Boxall and Purcell 2003).

The Alchemy of The Fifth Element

The Fifth Element highlights the importance of understanding the interdependence between the workplace practices described in each of the four Elements. There is sufficient research to demonstrate that each bundle of practices described above does not exist in isolation but is influenced, for better or worse, by the extent to which the values and goals that underpin it are supported by those of the others.

The Fifth Element can be related to the 'configurational approach of strategic human resource management' (SHRM): "In general, configurational theories are concerned with how the pattern of multiple independent variables is related to a dependent variable rather than with how individual independent variables are related to the dependent variable" (Delery and Doty 1996, p.804). Thus, bundles of practices are more effective than separate interventions (Sheehan 2013).

Undoubtedly the nature of this interdependence requires further research, but the coming together of knowledge and experience from diverse researchers and practitioners within the framework of *The Fifth Element* is providing a rich resource for such work.

Conclusion

Industry 4.0 must be approached from a critical perspective, not least because of the hype and exaggeration which surrounds its claims and potential impact. Drawing on past history, there are real dangers that a technocratic-driven narrative will draw corporate decision-makers into reductionist models and patterns of investment that ultimately fail, because they ignore the importance of synergy between the design and implementation of technologies and human and organisational factors.

This paper has discussed two separate narratives: the first focused on the ordered, rational organisation of work offered by emergent technologies; the second on the creative, dialogical, serendipitous and even chaotic human interactions that can stimulate innovation. Reconciling these narratives is essential if past mistakes are to be avoided and the positive potential of Industry 4.0 is to be realised.

The concept of Workplace Innovation, predating Industry 4.0 by a decade or so, prefigures many of its attributes. Like Industry 4.0, Workplace Innovation also seeks a transition between business models focused on cost-based competition to those based on innovation. It seeks the removal of monotonous work and its replacement with jobs focused on analysis, problem-solving, judgement, social interaction and creativity.

Learning from companies that have broken the mould will play a vital role in understanding the choices available to corporate decision-makers. The EUWIN Knowledge Bank[16] contains inspiring cases of new-generation companies in sector as diverse as IT, food production and pharmaceuticals that demonstrate the competitive importance of flat organisational structures, self-managed teams and co-created leadership, offering clear signposts to the future. Equally it provides evidence that long-established companies can change in radical ways through journeys of experimentation and learning.

Blending the ordered rationality of engineering and technology with the empowering and creative practices associated with workplace innovation will not be easy, and certainly challenges established cultures in many large corporate organisations. From our own experience of working with engineers and scientists, as well as leaders in advanced technology companies, resistance to change is a powerful force even where the business case is clear.

Predictably many corporate decision-makers will choose what they perceive to be safe, technocratic routes which leave existing top-down or paternalistic cultures and working practices intact. Yet such risk-averse strategies ignore the lessons of previous eras, and indeed those of recent economic crises which show that survival is not compulsory even for the largest players.

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16 http://uk.ukwon.eu/euwin-knowledge-bank-menu-new

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EUROPEAN JOURNAL OF WORKPLACE INNOVATION

Book review:

Workplace Innovation: Theory, Research and Practice

Peter R.A. Oeij, Diana Rus and Frank D. Pot (Editors)
In the series Aligning Perspectives on Health, Safety and Well-Being
Springer, Switzerland 2017
ISBN 978-3-319-56332-9 413 pp

Reviewed by Richard Ennals

For over two decades there have been efforts within the European Union to build a world-leading approach to business and economic activity which had a strong social dimension. As the EU has grown in membership and economic strength, it has been important to develop a collaborative culture, in which differences are respected, and seen as a resource for learning. Rather than favouring business gurus, on the model of the USA or Japan, there have been a series of Framework Programmes, based on agreed work programmes, which have engaged participation from member countries. This has been the "European Project", which the UK government will now leave behind, with the UK's departure from the European Union.

This valuable anthology "Workplace Innovation: Theory, Research and Practice", brings together authoritative chapters from veteran leading researchers in the influential field of Workplace Innovation. Much of the work since 2012 has been associated with the *European Workplace Innovation Network (EUWIN),* led from the Netherlands and the UK, which had initial support from the European Commission, and has organised activities in some 30 European countries, networking and sharing experience, increasing the community of active practitioners. It usefully complements the foundations provided by the early volumes of the *European Journal of Workplace Innovation (EJWI)*. It provides a starting point for the design of future programmes.

The book provides insights into strong traditions of research and practice in Health, Safety and Well-Being, and their links with Workplace Innovation. It could be seen as an introduction to a distinct European "Variety of Capitalism", which can be distinguished from Liberal Capitalism, as exemplified by the USA and the UK. There are strong foundations from socio-technical systems thinking, and echoes from Human Centred Systems. Arguably this European Variety of Capitalism embodies many core principles and practices of Corporate Social Responsibility and Sustainability, meaning that separate programmes to advance CSR may be unnecessary, or at least significantly different from the "optional extra" approach which is found in Liberal Capitalism, and in other Varieties of Capitalism around the world.

The focus is on people in the workplace, and initiatives to address work organisation and work environment. It emphasises collaboration, partnership and networking, rather than top-down Taylorist management. The starting point is work, rather than business or entrepreneurship. Instead of a remorseless focus on profit and management strategy, Workplace Innovation deals with participation, engagement, learning, communication and responsibility.

As Liberal Capitalism has experienced crisis and disarray since the financial crash of 2008, and the subsequent recession, there has been a need to present practical and credible alternative perspectives. There have been calls for a movement, and programmes to share good practice. Initiatives from several Directorates-General of the European Commission have converged on EUWIN, which accepted the challenge of sustaining momentum between policy programmes. Numerous conferences and networking events have shared good practice cases, providing support and advice. However, funding for EUWIN from the European Commission ended in 2016.

As Totterdill points out, there is no evidence that the provision of "evidence", in itself, necessarily improves the quality of decision-making. The evidence needs to be encountered by readers who are themselves engaged in facilitating organisational change, and seeking to learn from the different practical experience of others. The Workplace Innovation movement relies on effective facilitation. Rather than simply relying on commercial consultants, there are roles for academic researchers, and in particular action researchers, converting abstract ideas into appropriate practice.

There is a debate to be held on whether there is a single unifying theoretical core behind Workplace Innovation, as is set out in Peter Totterdill's motivational account of "The Fifth Element", or whether it should be seen as a cluster of effective practices which have diverse origins. There is a continuing Dutch tradition of grand theory. There have been many competing models of innovation, often with a focus on products or processes, or on mechanistic technology-based approaches. Can one account of Workplace Innovation meet the requirements of all readers? Is it rather a matter of addressing diverse readers in the contexts where they find themselves? This may be accomplished through a constellation of practice-oriented case studies, such as those which have been collected by EUWIN.

For newcomers to this increasingly popular field, the book provides overviews of a European perspective, as well as descriptions of a number of distinct national programmes. The book does not make *EJWI* unnecessary. Rather it provides a complementary robust basis of analysis and references, which should now stimulate a rich flow of new accounts of case study experience.

The book is a product of the young culture of Workplace Innovation, but with many pointers towards longer traditions, such as socio-technical systems, health and well-being. It is an anthology, rather than an edited text with a single line of argument. It has been written by pioneers, with a great degree of overlap and repetition. That is not necessarily a problem, unless it is simply read from cover to cover, in sequence. It provides a reference handbook for aficionados, rather than being likely to make new converts. There are perhaps surprisingly few extended workplace case studies. Many of the case studies which are included are written from outside, rather than conveying the blood, sweat and tears of the Workplace Innovation process.

The book has undoubted relevance beyond the European Union, for example for regional groupings in Southern Africa, West Africa, Latin America and South Asia, where countries seek to work together for collaborative advantage. On that basis, it could be complemented by a set of evangelical and campaigning texts, highlighting links with local cases. Workplace Innovation requires energy.

Any serious university or business school should acquire copies of the book for their libraries, and as a tool for opening up new discussions about the future of work and organisations. Companies and individual practitioners will find valuable road maps, accounts of successful practice from which they could learn.

In summary, the book comes from an active international research community which has been looking back, huddling together for mutual support in times of adversity, and building a vision

for a better future. They are seeking new members, with a common commitment to Workplace Innovation. Like motherhood and apple pie, Workplace Innovation is hard to oppose, but well worth encouraging.

EUROPEAN JOURNAL OF WORKPLACE INNOVATION

Book review:

Learning Factories: The Nordic Model of Manufacturing

Halvor Holtskog, Elias G. Carayannis, Aris Kaloudis and Geir Ringen
Palgrave Studies in Democracy, Innovation and Entrepreneurship for Growth
Palgrave Macmillan, Switzerland 2018
ISBN 978-3-319-41886-5

Reviewed by Richard Ennals

The Norwegian "Value Creation 2010" programme included a national PhD programme, "Enterprise Development and Working Life" (EDWOR), with a methodological foundation of Action Research. The programme, hosted by the Norwegian University of Science and Technology (NTNU) brought together Norwegian researchers, with an international faculty from Norway, USA, Turkey and the UK. There were two cohorts of PhD students, leading to two sets of theses, which had benefited from ongoing debate and advice. The book "Learning Factories: The Nordic Model of Manufacturing" was based on a thesis by Halvor Holtskog in the second cohort (EDWOR 2). His co-authors are from NTNU in Gjovik, and George Washington University, USA, comprising a collaborative research team, using a range of methods over several years, which are presented in detail.

The focus of the book is made clear in the abstract for the Introductory Chapter, which "aims to provide deeper insight into how a modern and sophisticated management of employees plays an important and – in our view – key role for the successful reindustrialisation of the Western world. There are important lessons to learn from high cost countries that successfully compete in the global marketplace. In such contexts, the re-combination of tacit knowledge, people, competences and culture to create effective and efficient automated production is indeed essential."

The book deals with the "Nordic Model", which combines four key institutionalised societal mechanisms:

- Centrally led wage negotiations between trade unions and employer federations
- Safety nets of health insurance, welfare benefits, and pensions to all citizens
- Labour market flexibility, that is, a high degree of job mobility and career experimentation combined with a high degree of job safety
- Democratic decision processes and high employee participation in organising work tasks at all levels.

Holtskog and his colleagues explore the resulting style of collaboration and learning at work, which is different from what is found in the EU, USA or Japan. The focus is on the automotive industry, probably the most globalised industry in the world. Case study companies manufacture automobile parts.

The book is based in the Norwegian work life tradition, with an important role for "Employee Driven Innovation" (EDI). It deals with matrix organisations, where a person can be a leader and an employee. It considers how industries create knowledge. Within this context there is detailed analysis of long term company case studies, based in the Raufoss region, and with a focus on "Lean Manufacturing" within the Nordic Model.

The authors refer to "Industry 4.0", which has a strong technological base. "It involves sensors which gather data from each step of the automated process; identifying each nut and bolt is a

prerequisite, as is the usage of big data. However, little attention is given to people and the knowledge creation process".

There is a remarkable tone of optimism, as the case studies are presented with a formidable background of international research literature. What wider conclusions can be drawn?

As with Silicon Valley in the USA, Raufoss has unique characteristics, and the case study findings concerning successful and innovative manufacturing cannot simply be generalised across Norway and other Western economies. Both are special cases, distinctive regional phenomena. Powerful industry clusters have both close geographical proximity and global reach, developed over time. There is a narrow product focus, with frequent local restructuring, mergers and acquisitions, and changing ownership patterns. There are strong links to local universities and colleges, a background of defence funding, and a continued focus of national innovation strategy. Raufoss is an example of successful diversification from defence to civil production, with continued security and confidentiality, a continuing quality culture, and a focus on high end products. There is a distinctive employment culture, which is a magnet for international migrant workers. It offers an entry point for global industry, with pressure for continuous innovation.

The book reflects Norwegian pride in manufacturing success, and an awareness of a bubble of innovative development and debate at a time of economic difficulty elsewhere. It demonstrates a determination to maintain global competitiveness beyond the field of oil and gas, where the boom is currently coming to an end, raising questions about future industrial strategy.

Holtskog is concerned with technical innovation beyond the automotive industry, for example in skiing, where competitive advantage can be achieved. Given the applications in slalom and cross-country, and the outstanding results by Norwegian skiers in the 2018 Winter Olympics in Korea, it would be a mistake to suggest that the future is "all downhill" from now on!

EUROPEAN JOURNAL OF WORKPLACE INNOVATION

Book review:

Microcosmographia Academica: Being A Guide for the Young Academic Politician

F.M. Cornford
Bowes & Bowes Cambridge 1908
ISBN 0 370 00145 1

Reviewed by Richard Ennals

Social Anthropology of Innovation

It would be a mistake to regard the discussion of workplace innovation and organisational change as only a recent concern.

In 1971, the first elected student representatives completed their academic year as members of the College Council of King's College Cambridge, under Provost Edmund Leach, a controversial social anthropologist. It was resolved that all such representatives should be presented copies of "Microcosmographia Academica: Being A Guide for the Young Academic Politician" by F.M. Cornford, an eminent classics scholar at King's, who died in 1943. This sociological masterpiece was published in 1908, and Cornford later observed that it was relevant not only to academic politics, but also to Government departments in the first world war. Later editions, with the text unaltered, were popular in electrical engineering companies before the second world war, who saw the business world as in need of such advice.

The opening advertisement for the book provided a view of the intended audience:

"If you are young, do not read this book; it is not for you;

If you are old, throw it away; you have nothing to learn from it;

If you are unambitious, light the fire with it; you do not need its guidance.

But, if you are neither less than twenty-five years old, nor more than thirty;

And if you are ambitious withal, and your spirit hankers after academic politics;

Read, and may your soul (if you have a soul) find mercy!"

The Enemy

Cornford saw the enemy as inertia: "There is only one argument for doing something: the rest are arguments for doing nothing." The editor of the 1949 edition, W.K.C. Guthrie, concluded that the experience of two world wars, where arguments for doing nothing were often popular, suggested that "a few more of the qualities of the *Young Man in a Hurry* might have saved the situation".

Cornford speaks directly to his young audience: "My heart is full of pity for you, O young academic politician. If you will be a politician you have a painful path to follow, even though it be a short one, before you nestle down into a modest incompetence."

Later in their careers, he warns that "from far below you will mount the roar of a ruthless multitude of *Young Men in a Hurry*. You may perhaps grow to be aware of what they are in a hurry to do. They are in a hurry to get you out of the way."

Reason

Cornford mocks the simple idea that people in general listen to reason: "You think that you have only to state a reasonable case, and people must listen to reason and act upon it at once. It is just this conviction that makes you so unpleasant." Rather, he suggests: "Nothing is ever done until everyone is convinced that it ought to be done, and has been convinced for so long that it is now time to do something else. …. And are you not aware that conviction has never yet been produced by an appeal to reason, which only makes people uncomfortable …. You must address your arguments to prejudice and the political motive."

He provides an insightful summary of the parties in academic politics: "There are five, and they are called Conservative Liberals, Liberal Conservatives, Non-placets (committed to inaction), Adullamites (committed to seeking money), and *Young Men in a Hurry*".

The Young Man in a Hurry

His target audience are the last group.

"The *Young Man in a Hurry* is a narrow-minded and ridiculously youthful prig, who is inexperienced enough to imagine that something might be done before very long, and even to suggest definite things. His most dangerous defect being want of experience, everything should be done to prevent him from taking any part in affairs."

"The *Young Man in a Hurry* is afflicted with a conscience, which is apt to break out, like measles, in patches."

Cornford presents change as being brought about by informal Caucuses, with a system which is intended to maintain the balance of power, excluding all the *Young Men in a Hurry*. "The *Young Men in a Hurry* have no regular Caucus. They meet, by twos and threes, in desolate places, and gnash their teeth."

"All Caucuses have the following rule. At Caucus meetings which are only attended by one member (owing to that member's having omitted to summon the others), the said member shall be deemed to constitute a quorum, and may vote the meeting full powers to go on the square without further ceremony."

Business and Knowledge

The first challenge is to acquire influence. This, he says, is the province of business men. "All business men are good; and it is understood that they let who will be clever, provided he not be busy at their expense".

Decisions are left to a scattered body of older members, who lack corporate feeling. Actions require extensive prior consultation. Rules are introduced in order to free younger men from the burdensome feeling of moral or religious obligation. "Plainly, the more rules you can invent, the less need there will be to waste time over fruitless puzzling over right and wrong."

In the field of academic knowledge production, Cornford cited *The Principle of Sound Learning*: "the noise of vulgar fame should never trouble the cloistered calm of academic existence". He added: "If you should write a book (you had better not), be sure that it is unreadable; otherwise you will be called "brilliant" and forfeit all respect.

Doing Nothing

Cornford argued that "it is a mere theorist's paradox that doing nothing has just as many consequences as doing something. It is obvious that inaction can have no consequences at all."

The Principle of the Wedge is that "you should not act justly now for fear of raising expectations that you may act still more justly in the future".

The Principle of the Dangerous Precedent is that "you should not now do an admittedly right action for fear you …. should not have the courage to do right in some future case" …. "Every public action which is not customary, either is wrong, or if it is right, is a dangerous precedent. It follows that nothing should ever be done for the first time."

The Principle of Unripe Time is that "people should not do at the present moment what they think right at that moment, because the moment at which they think it right has not yet arrived."

Jobs

The most important part of political activity is, of course, connected with Jobs. "My Jobs are public-spirited proposals, which happen (much to my regret) to involve the advancement of a personal friend, or, (still more to my regret) of myself. Your Jobs are insidious intrigues for the advancement of yourself and your friends, speciously disguised as public-spirited proposals."

The Academic World

Cornford argues that when the reader reaches middle age, at the age of thirty five, a change may come. "Remember that other world, within the microcosm, the silent, reasonable world, where the only action is thought, and thought is free from fear."

As we consider workplace innovation in the knowledge society, we should recall the warning from Plato with which Cornford began:

"Any one of us might say, that although in words he is not able to meet you at each step of the argument, he sees as a fact that academic persons, when they carry on study, not only in youth as a part of education, but as the pursuit of their maturer years, most of them become decidedly queer, not to say rotten; and that those who may be considered the best of them are made useless to the world by the very study which you extol." (Plato, Republic, vi)

Biographical Note

Richard Ennals was an elected Student Member of the College Council of King's College Cambridge in the academic year 1971-72.

Conference call:

EURAM 2018

This symposium has the following programme

Workplace Innovation: present and future scoping of a new field

1.Introduction: Workplace Innovation: State of the Art and the Future

2. Research: Job crafting paving the way towards workplace innovation. Testing the effect of a workplace intervention based on job crafting.

3. Research: Workplace innovation facilitates innovation adoption

4. Policy intervention: Unleashing Workplace Innovation in Scotland

5. Policy: Positioning Workplace Innovation from different Socio-technical Perspectives on Logistics and Process Industries

See:
http://www.euram-online.org/annual-conference-2018.html.

GT14_00 General Track; Symposium: 14_01S Workplace Innovation (WPI)

http://euramonline.org/component/phocadownload/file/471-sig-14.html

EURAM 2018 Conference Dates

Conference: 20-23 June 2018

Important Deadlines

Early bird registration deadline: 11 April 2018

Authors registration deadline: 25 April 2018

Conference call:

IWOTT22 September 2018

Theme: Teamworking and Technology at Work// Call for papers

Today's work faces both disruptive and incremental innovations regards new technology – such as digitisation, robotics, nanotechnology, Internet-of-Things, Big Data, and Blockchain, just to mention a few -, and new organisational forms like platforms, networks, project based organisations, and web-based/virtual organisations. These developments will have significant consequences for teamworking and the work of team members. The 22nd edition of the International Workshop on Teamworking provides a forum for discussing the origins, causes and effects of 'new technology and work' for teamworking and the organisation and execution of team work and working in teams.

We especially welcome submissions that explore theoretical, empirical and practical aspects of teamworking from different scientific disciplines (sociology, psychology, management science and related disciplines).

Papers

Selected papers will be published in a special issue of *Team Performance Management* (listed in Thomson Reuter's Emerging Sources Index). See: http://www.emeraldinsight.com/journal/tpm. Opportunities for additional publications, especially on the workshop themes, will be investigated.

Visit the IWOT22 website: https://iwotblog.wordpress.com

Conference call:

Coping with the future:

Business, Work and Action Research in the Digital Age - A cross disciplinary conference

University of Agder, Kristiansand, Norway, October 8th, 9th and 10th, 2018

Organisers: Prof Hans Christian Garmann Johnsen, University of Agder, in co-operation with NTNU Gjøvik; European Network of Workplace Innovation EUWIN; International Journal of Action Research (IJAR); TNO, Leiden, The Netherlands; European Journal of Workplace Innovation (EJWI); HIVA - Research Institute for Work and Society, University of Leuven, Belgium; and Eurofound, Dublin, Ireland

The conference will include presentations by business leaders, panel discussion, key note speakers, paper sessions and general discussions.

Monday 8th October: Workplace Innovation 4.0 for Europe: EUWIN day

Companies in Europe are exploring the opportunities of Industry 4.0. This revolution is about technology, people and work organisation.

- Optimising relations between people, organisation and technology in the new paradigm
- Tackling skill gaps within organisations
- Promoting work-based learning
- Policies to facilitate the creation of Workplace Innovation 4.0
- How is workplace innovation related to technological innovation?
- Why should companies engage in workplace innovation programmes?
- Supporting development of 'innovative qualifications' and 'innovative behaviour'
- How does Workplace Innovation fit into the Nordic tradition?

Tuesday 9th October: Work in the Digital Age: EJWI Day

- How sustainable is the present collaborative and welfare model in systemic change?
- How will the digital revolution impact work?
- What policy changes are needed in relation to system change in business and work?
- How will social and political change parallel change in business and work?
- How can knowledge development be organised in a knowledge society?

Wednesday 10th October: Action Research in Social Transformation: IJAR Day

- Action Research and transformative social processes
- Why should Mainstream Social Researchers be interested in Action Research?
- Discourse Democracy at Work: Public Spheres in Private Enterprises
- Digitalisation of work
- Methodology for developmental work research
- Action Research and Public Political Education: The Latin American Strategy