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RADICAL INNOVATION THEORY

Towards radical design of digital workplaces

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1 Background

Since Schumpeter introduced the concept of 'creative destruction' in *Capitalism, Socialism and Democracy* (Schumpeter, 1942), the academic community has pushed a simple but very powerful and popular concept, which is mostly referred to nowadays as 'radical innovation', or 'disruption'. Most scholars in economics and strategic management who analyse technological innovation refer to Schumpeter's seminal work. The concept of radical innovation has been then the subject of numerous publications covering specific and thematic issues such as uncertainty (Leifer et al., 2001; Rosenberg & Nathan, 1994), knowledge and learning (Lundvall, 1992), competition and technological race (Fudenberg et al., 1983; Reinganum, 1989; Scherer, 1991; Tirole & Jean, 1988) and the degree of substitutability (complementarity) between the existing and the new market (Battaggion & Grieco, 2009).

Chesbrough (2003), as a focal person in open innovation theories, states that in order to enhance firms' innovation capability for radical innovation, they must involve capable actors within and outside the firm. Although firms have become increasingly sophisticated in the development of incremental innovations, many companies struggle to generate radical innovations. Radical innovation has been responsible for some of society's greatest advances over the past one hundred years in fields as diverse as transportation, power, information technology, and medicine (Bers et al., 2009). One can wonder how radical innovations can make a difference in workplace management research now and in the future. Radical innovations are in the agenda of existing companies; however, new companies are also interesting due to the agile performance in radical innovations. The workplaces are more and more digital – how does it happen?

1.1 Concepts

Invention can be defined as the creation of a product or introduction of a process for the first time. Innovation, on the other hand, occurs if someone improves on or makes a significant contribution to an existing product, process, or service. Innovations can be classified as incremental and radical (disruptive) according to changes resulting from the innovation (see e.g. Leifer et al.,

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2000; Utterback, 1994). Innovation and discovery are important progress factors of human society. As a multifaceted concept innovation has been described as the quest for finding new ways of doing things. The concept innovation does however not only mean a change in the status quo; it also includes the creation and commercialisation of new knowledge and discoveries. Soken and Barnes (2014) argue that innovation is about creating value and that it requires individuals and organisations to embrace something novel. Integrating insights from management, economics, policy, and psychology, Samli (2011) argues that creativity can be channelled into innovation, and innovation can be channelled, in turn, toward economic development. Imagination is envisioning things that do not exist. Creativity is applying imagination to address a challenge. Innovation is applying creativity to generate unique solutions. Entrepreneurship is applying innovation, to bring unique ideas to fruition, inspiring others' imagination.

Innovation has been categorised into two different kinds, radical innovation and incremental innovation (Oke et al., 2009), and it is a shared belief that there exists a difference between the two concepts (Hurmelinna-Laukkanen et al., 2008). Incremental innovation is an 'improvement effort of something that already exists', whilst radical innovation is 'the discovery of something completely new' (Oke et al., 2009). Incremental innovations are based on prior knowledge and consist of substantial product, service or process improvements that, although they have a certain degree of novelty, do not clearly break away from the already existing product, service, or process (Jiménez-Jiménez & Sanz-Valle, 2011). Most innovations are incremental, being gradual enhancements or feature replacements to existing products, services, processes, and business models. Incremental innovations have a sustaining nature and allow an organisation to maintain its current approach to target markets. That is, they do not create new lines of business, nor do they create completely new markets for an existing product or service.

Radical innovations, by contrast, correspond to disruptive change. The disruptive change can be related to technology, markets, society, or all three. An innovation can be said to be radical when it has the potential to produce one or more of the following: (1) an entirely new set of performance features, (2) improvements in known performance features of five times or greater, or (3) a significant (30 percent or greater) reduction of cost (Leifer et al., 2000). Radical innovation is expected to imply more fundamental changes for the company's activities and is often related to higher risks during both the development and the commercialisation in comparison to incremental innovation (Büschgens et al., 2013). Gassmann et al. (2012, p. 121) define radical innovation as "products that have a high impact on existing markets or create wholly new markets by offering totally new benefits, significant improvements in known benefits, or significant reduction in costs". However, radical innovation should not only be related to products. Integrating Gassmann's definition with the OECD definition, one can claim: radical innovation is *product-*, *process-*, *marketing-* or *organisational innovation that has high impact* on an organisation's existing/new activities or *existing/new markets by offering totally new benefits, significant improvements in known benefits, or significant reduction in costs*.

1.2 Characteristics of radical innovation

Radical innovations are disruptive. Radical innovation is an innovation leadership concept aimed at destroying current products, services, and business models to create new markets and replace existing ones. While incremental innovation can be managed top–down, radical innovation requires mentoring, leadership, and facilitation from the ground. Radical innovation goes further than incremental innovation, in which the development and optimisation of existing products and services is in the foreground. A radical innovation significantly changes supply and demand conditions in a market. Radical innovations create new lines of business. The

introduction of consumer digital photography is a good example of a radical innovation that caused major disruptive technological and social changes. Such major disruptive changes are rare; but smaller-scale disruptive changes, affecting primarily the business of a single company, happen frequently (Paasi et al., 2008).

Radical innovations take time. Radical innovation is a leadership concept with the goal of long-term growth over the next five to ten years. Development projects for radical innovation are typically long in duration. It often takes several years from the discovery of a new business opportunity through the incubation (i.e. evolving the opportunity into a business proposition) to acceleration or ramping up of the business to stand on its own (O'Connor & Ayers, 2005). Ten years is not a long time for this process. Partially because of the long duration, development projects for radical innovations are surrounded by multiple uncertainties (Leifer et al., 2000; Utterback, 1994). Radical innovation life cycles are longer, more unpredictable, have more stops and starts, are more context-dependent in that strategic considerations can accelerate, retard, or terminate progress, and more often include cross-functional and or cross-unit team-work in comparison with incremental innovations (McDermott & O'Connor, 2002). Taleb (2010) uses the concept of Black Swans, which are very low probability and high impact events which we are essentially incapable of foreseeing. He argues that since we lack the ability to predict Black Swans, we should instead build our institutions to be Black Swan-proof, making them resistant and resilient to shocks, and minimising the incentives to build hard-to-unwind and hard-to-rebuild assets. Often, the ingredients for a radical innovation might be there but the legacy systems or conventional designs dominate, so there is no space for a radical innovation.

Radical innovation is a risky business. The revenues can be huge but highly uncertain, while the hit rates are low and the costs of failure often very high (Cooper, 1993). Risk awareness is a capability of the organisation to recognise risks before they threaten, mitigate them when they arise, and recover from the damages they may cause. Proactive risk management is needed (Wheelwright & Clark, 1992).

Radical innovations are multidimensional. Leifer et al. (2000) have defined four major dimensions of uncertainty that are relevant for all radical innovation development projects: technological, market, organisational, and resource uncertainties. The leadership challenge of multiple dimensions of uncertainty is complicated by the fact that the uncertainties interact with each other, in the sense that there are complex correlations. Further complexity is brought by the long-time span of the process during which major disruptive changes may happen in technology, markets, and competition having major influence (either positive or negative) on the business potential of the innovation.

Radical innovations are new combinations and represent serendipity. Radical innovations prompt significant subsequent technological development and exhibit novelty and 'architectural' innovation, i.e. rearranging the way design elements are put together in a system. This requires a transdisciplinary approach. Radical innovations are seen to involve significant conceptual breakthroughs, through either luck or genius. Radical and incremental innovation projects differ on different project dimensions. Incremental projects are more linear and predictable, with fewer resource uncertainties, including simpler collaboration relationships.

2 Applicability to workplace studies

Radical innovations often serve as the foundation for new technological systems, industries, or domains. Radical innovation theory focuses either on the process of product development or typologies of innovations. The design-science paradigm seeks to extend the boundaries of human and organisational capabilities by creating new and innovative artefacts (Hevner et al., 2004).

In workplace research the transformation of workplaces as digital and physical entities describes the evolution towards innovations; however, the disruptive or radical innovations are scarce.

The technological systems have a significant role in the workplace transformation. Workplace research has focused on digital and physical entities for a long time; e.g. Joroff (2002) stated that digital technologies allow people to change the workplace in a fundamental way. The connectivity enabled by these technologies has opened new opportunities for how, when, and where people work. Levin (2005) states that while organisations continue to build facilities that range from newer adaptations of their previous model to what some may deem radical departures with the goal of creating new ways of working, the selection of what course of planning direction to take is still often left to a methodology that is removed from the long-term strategic objectives of the organisation. Hardy et al. (2008) discuss the distributed workplace model by identifying the public, privileged, and private virtual environments aligned with characteristics of physical working environments.

According to Mobach et al. (2015), an important toolkit for innovation in facilities management is the holistic orchestration of organisation, architecture, technology, and nature; the outcome for organisations is in behaviour, mood, and health of users. The new knowledge to advance an integral approach of infrastructure, space, people, and organisation by taking a cross-disciplinary design perspective is needed. This integration must remain action focused and problem oriented, as it is directed at improved actions of the facility manager and the organisation he or she works for. Given the specific practical and/or societal problems, the improved actions to be developed by a consortium of practitioners and scientists should, in turn, lead to a proven better organisation performance and benefit for the end user.

Technological innovation is transforming continuously, and now ubiquitous computing is beginning to transform the workplace. Ubiquitous, mobile workers are not only present in one physical workspace (e.g. in the main office or with a laptop in the park), but also within a combination of the other spaces. This would mean that although a worker is physically working in his living room at home (physical workspace), in his or her thoughts and current mental state, the worker might be in his or her main office at the company premises (mental space). Ubiquitous workplaces change the work system, workplace democracy, high-tech application, workplace boundaries, workspaces, people practice, workplace experience, and workplace culture (Cascio & Montealegre, 2016). The role of technology and potential to even greater radical innovation is increasing.

Many scholars have classified the processes of radical innovation from the user-centred or human–centred design (HCD) approach e.g. (Norman, 1998). The behavioural-science paradigm in research in the information systems discipline seeks to develop and verify theories that explain or predict human or organisational behaviour (Hevner et al., 2004). The usability of workplace research has the same focus. Usability is a concept like functionality, but usability depends on subjective view of users, context, culture, situation, and experience. Understanding usability is achieved by involving users (Fronczek-Munter, 2016). Work by Voss (2004) has highlighted the importance of users in the design of 'experience innovation' whilst German research on a number of service sectors stresses the importance of customising and tailoring the experience via forms of co-creation (Reichwald et al., 2008).

Blakstad and Knudsen (2008) has studied the relation between organisations and the physical environment. They have explored how buildings support organisational goals using output from descriptive methods as input to participatory processes. Some design methods are targeted at frame breaking – creative problem solving, imagination, etc. – whilst others are about understanding users and bringing their perspective into the articulation – anthropology, empathic design, construct elicitation, etc. (Schrage, 2000; Thomke, 2003). Additionally, in the tradition

of computer science research, understanding user behaviour is common; for example, the individual's acceptance of information systems in the Technology Acceptance Model (TAM) (Davis, 1989). TAM considers that an individual's intention to use a system will be verified by perceived usefulness and perceived ease of use of that system.

Innovation typologies have been developed from various perspectives to identify differences between innovations. As one example of product development components, Henderson and Clark's (1990) Innovation Model proposes four categories of innovation, which describe whether the innovation relates to a product's architecture, components, or both. Radical innovation happens when both factors are affected. Verganti (2008) propose a framework, which connects the two dimensions of innovation (technology and meaning). This theoretical framework distinguishes the procedures of incremental and radical innovation to address the fundamental activities of innovation.

The framework provides four different innovation clusters with three drivers: technology, design, and users. Four different clusters provide potential for four different workplace realities (WPR), Figure 14.1.

1   Technology-push innovation comes from radical changes in technology without any change in the meaning of the products. Technology push innovation is the result of dynamics of technological research. In workplace transformation, the functionality of technology creates radical improvement but is achieved without affecting the meaning. Such functionality can be opening the digital bridge from one site to another site, extending, e.g., the dimensions of a breakout room with technology. This improvement increases informal collaboration between people; they are digitally co-located but physically in different places.

2   The overlap between technology push and design-driven innovation highlights that breakthrough technological changes are often associated with radical changes in product meanings, i.e. that shifts in technological paradigms are often coupled by shifts in socio-cultural regimes. In workplace transformation, it means that radically improved technology is adding sources to the existing, related, and potential meanings of the new reality and cross-fertilises both the physical and digital entity. This can be, for example, an experience of
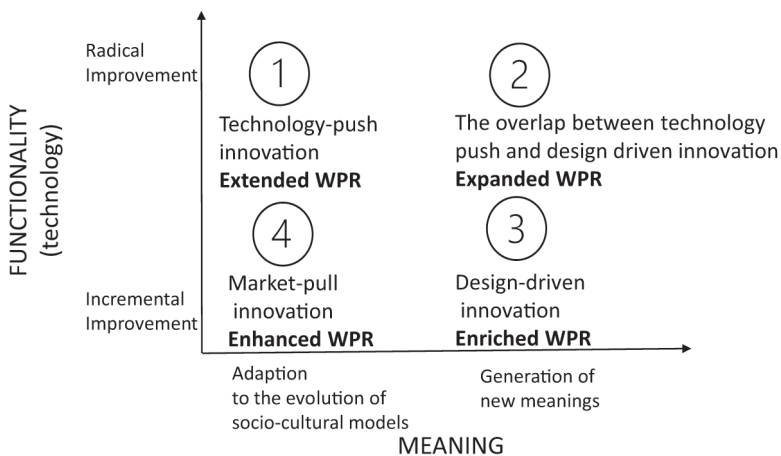

Figure 14.1   Four different workplace realities (WPR) applied from innovation framework by Verganti (2008)

three-dimensional remote presence, creating new meanings for users. New socio-digital functions set requirements for the physical environment, which is serving the expanded reality. Technology can also be a co-worker, assisting with the tasks which used to be done by individuals. The digital and physical layers of workplaces form an integrated platform for shared reality.

3   In design-driven innovation, the innovation starts from the comprehension of subtle and unspoken dynamics in socio-cultural models and results in proposing radically new meanings that often imply a change in socio-cultural regimes. In workplace transformation, incremental improvements in technology support the generation of new meanings. This transformation is experienced at a large scale during the working-from-home period caused by regulations of social distancing and lockdowns in the pandemic year 2020: incremental technology provided possibilities to transform homes for living to places for working, while digital reality provided tools from large digital collaboration platforms to digital group work rooms and individual working. This created new meanings for working from home.

4   Market-pull innovation starts from the analysis of user needs and subsequently searches for the technologies and meanings that can satisfy them and identifies directly or indirectly directions for innovation. Although the user-centred approach is more advanced and sophisticated, as its methodologies allow us to better understand why and how people give meaning to existing things, which can lead to more innovative concepts compared to traditional market-pull processes. It still operates within existing socio-cultural regimes. In the context of workplace transformation, incremental technology enriches the adaption to socio-cultural models. This is the workplace where technology is embedded to offices supporting e.g. meetings online. The technology can be smart and intuitive to use, making it easy to accept for use.

To summarise, the framework helps to identify four different types of workplace realities:

1   Extended workplace reality
2   Expanded workplace reality
3   Enriched workplace reality
4   Enhanced workplace reality

Each reality can use technological innovation in a different manner, either adopting or regenerating the meaning of work in digital and physical reality.

3   Methodology/research approach

The methodologies used in innovations research in general are based on the long tradition of using design tools in innovation, exemplified in a variety of handbooks and also in the insights gained from key design practitioners like IDEO (Bruce & Bessant, 2002; KELLEY, 2001). Work by von Hippel and colleagues has shown over many years the power of user-led approaches (Von Hippel, 2001) and case examples, such as that of Lego, testify to the growing importance of working with users in co-creation mode (Moser & Piller, 2006).

User-centred or human-centred design (HCD) methods have a common framework: an iterative cycle of investigation – usually characterised by observations, an ideation phase, and rapid prototype and testing. Each iteration builds on the lessons learned from the previous cycle, and the process terminates either when the results are appropriate or when the allotted time has run out.

Methodologies used are qualitative by their nature, with a strong focus on participatory approaches. However, some researchers also argue that the user-driven approach does not lead to radical innovations but rather to incremental innovations. Even qualitative approaches might reduce participation to objectifying users – rather than having them to co-design as equal members of the design team. The qualitative approach is still mostly an evaluative method, and there is a need for constructive approaches like design science and action research. Hevner et al. (2004) have developed a methodology for guidance and to inform on more effective design and adoption for complex information systems. The built environment and workplaces with all technical layers can be seen simultaneously as a complex system.

The following research questions should inspire workplace researchers: (1) How can the extended and expanded workplace realities be co-created by integrating the digital and physical architecture in co-design? (2) How does one support the change processes from the physical workplaces to the enhanced, enriched, extended, or expanded workplace realities? (3) How does one create the co-design methodology to improve the workplace transformation to benefit from the incremental and radical innovations?

4 Limitations

Radical innovation theory is describing something which is not happening very often. However, it is essential to understand and apply innovation design and design science thinking to integrate complex information and build environment systems. This is the only way to create inspiring ubiquitous environments where reality is stronger than place.

The applied framework helps to identify research gaps and challenges of transdisciplinary research. However, the dimension of meanings has many layers which are not discussed: individual, organisational, and societal meanings demand different research designs. The framework for understanding digitisation and digital transformation of workplaces in use is in this phase only theoretical and needs to be tested, validated, and iterated in practice.

5 Theory relevance to practice

Radical innovations are based on technological development. The use of them in the context of the workplace challenges users, organisations, and society, while hybrid working environments are more common. The research can provide keys to develop a workplace-experience-based common language and understanding for ubiquitous workplace offering. The frequently used expression 'smart environment' is not enough: smartness is about brains – we need to include heart and emotions to humanise smart solutions. By understanding the logic and transformations in technology-driven incremental and radical innovations, one can increase the competences to identify the requirements for the physical workplace. Designing, constructing, and maintaining such workplaces requires a transdisciplinary team. In practice, we have architects for physical planning and digital planning; in the future, they should sit around the same table more often.

The holistic user experience in future work environments includes more integrated digital and physical workplaces. A digital work environment consists of different realities – virtual reality, augmented reality, or mixed reality – and working within these realities still relies upon a physical reality. The requirements are set not only by the user but also by the technology. Technology is no longer only a technical solution; it shares our work and acts as a co-worker. Presented workplace realities (extended, expanded, enriched, or enhanced) can be used to identify the existing characteristics of the workplace, to set the direction for future development

and to develop new measurements for connectivity capability of different concepts. Innovations in work environments need not always be radical, but designing them should be more radical.

6 Further reading

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