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Socio-Technical Perspectives on Smart Working: Creating Meaningful and Sustainable Systems

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Abstract
Technological advances have made possible industrial and commercial applications of artificial intelligence, virtual reality and highly integrated manufacturing systems. It has also freed business activity from a focus on place, as both work activities and markets have been able to harness information and communication technologies in order to operate remotely. As a result, researchers have highlighted a phenomenon of 'smart' working. Some have pointed to a fourth Industrial Revolution (Industry 4.0) in which 'smart' factories use robotics to achieve high performance. There is now a suggestion of progress towards Industry 5.0, in which technological and social systems work in harmony to deliver personalised mass customization of products and services. This paper examines these developments from the perspective of unique, individual understandings of work roles and sustainability, posing the questions 'Smart' from whose point of view? Do smart systems promote sustainable organizations? How should design of smart systems be approached? It suggests that contemporary socio-technical systems approaches to organizational analysis are the best way to support harnessing of smart technologies in organizations.

Keywords Smart working · Industry 4.0 · Industry 5.0 · Socio-technical approaches · Open systems · Emergence

1 Introduction

The term 'smart working' has been used to describe an evolutionary change taking place over a number of different dimensions in the world of work (Boorsma and Mitchell 2011). These authors highlight '*changes in approaches to work, work cultures, business architectures, premises, decision making, communications, and collaboration*' (2011, p.2). There has been a decline in the importance of *place* in work activities; greater scope for collaboration; employee autonomy and talent management; and an emphasis on innovation (Hamel 2007). Lake (2013) highlights flexibility as a key feature of new, smart working practices. However, flexibility and disappearance of place are only one feature of smart work. McEwan (2013) offers the following definition, '*Smart working practices are agile, dynamic and emergent. They are the outcomes of designing organizational systems that facilitate customer-focused, value-creating relationships that are good for business and good for people*'. She cites reports by the Chartered Institute for Personnel and Development, which categorize 'smart' work systems as '*managing and optimising both the physical and philosophical work environments to release energy that drives business performance*.' They go on to suggest that a focus on core beliefs and culture is key to defining an organization as 'smart', and highlight a framework of 'multiplicative relationships' – interacting sub-systems encompassing management values, high-performance systems, enabling technologies and working environments. In the view of the CIPD, these interacting factors are more likely to lead to effectiveness for an organization if they are designed so as to promote self-determination and choice for those engaged with them. It will be argued that a socio-technical perspective and socio-technical design tools are needed in order to explore and support these 'multiplicative relationships'. In this paper, it is intended to explore the nature and implications of smart working, asking the questions: Smart from whose point of view? Do smart systems promote sustainable organizations? How should design of smart systems be approached?

Advantages put forward for smart working include a better work-life balance, less time and money spent on travel, lower

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rents and running costs for organizations, attraction of new talent into the workforce and increased productivity (Gastaldi et al. 2014; HM Government UK 2015; Dominguez 2017). At the same time, it has been acknowledged that Smart working requires very careful planning and can involve a shift of costs from employer to employee. Whilst acknowledging that employees may experience increased isolation, proponents of Smart working suggest that use of collaborative and mobile technologies provide better support for team-working and innovation. Much of the discussion around the concept of 'smart' working is focused on work traditionally performed in offices – administrative and managerial tasks. However, the agenda can be linked to the advent of Industry 4.0 and integrated manufacturing systems (Lee et al. 2015), as well as supply of services (Barile and Polese 2010).

Smart working practices are said to be dependent upon utilisation of advanced technological developments, supporting communication, business intelligence and production/service delivery. Smart factory systems are associated with the term Industry 4.0. This has been heralded as a new industrial revolution focusing around achievement of competitiveness in industry through integration of 'cyberphysical' systems into production (Lee et al. 2015; PWC 2016). By harnessing the Internet-of-Things, Artificial Intelligence and robotics in manufacturing, considerable enhancements to productivity could be made. It is easy to understand the attraction of such systems – robots do not need sleep, do not require holidays and are readily switchable from one form of output to another. Digitally controlled tools and production lines are more reliable and accurate in output. Their use has enabled a shift from economies of scale (as achieved through specialisation and standard work) to economies of scope, whereby detailed differences in customer preferences can be catered for at little or no extra cost. However, some enterprises have hesitated to proceed with such initiatives, fearing that they may become dependent upon technologies that are understood imperfectly by managers; and there has been anxiety in society more widely at the possibility of mass destruction of traditional employment opportunities. In service industries, such as banking for instance, there are examples of whole processes becoming automated through use of intelligent agents that can read and assimilate text rapidly and can also observe human-customer interactions in order to learn by experience. This, managers and system designers claim, frees human staff members to deal with the more complex issues needing experience and discretion to solve (Flinders 2016; Haaramo 2017). However, a question arises how in future human agents will acquire the necessary deep knowledge of task performance to enable them to exercise discretion and/or promote innovation (Bednar and Welch 2017b).

Technological changes would be expected to be accompanied by changes in relations among organizational stakeholders to reflect new thinking and to deliver the suggested benefits. There have been many 'new' perspectives on change in the past that promised much but were later abandoned, e.g. Business Process Re-engineering. If it is genuinely desired by decision-makers in an organization to promote 'smart' working, by what means could this be accomplished? A search for examples of current 'smart working practice' yielded rather disappointing results. The UK Government (HMGUK 2015) has set out a set of principles of 'best practice for Smart working'. The UK Government is too large to be homogenous in culture. However, it is possible to perceive a paradox here, between publication of 'best practice' for benchmarking on the one hand, and a statement of intent to promote flexibility, empowerment and freedom to innovate on the other. How far do people feel genuinely empowered, or this this an example of empty rhetoric (Alvesson 2014)? Purposeful leadership in context may be a key issue here (Bailey and Shantz 2017).

In the next section of the paper, the nature of smart work systems, and the concerns they give rise to, are examined. The paper goes on to discuss individual experience of working environments and the role of management, before considering developments in the field. Finally, the paper considers the need for socio-technical, systemic approaches to organizational transformation, before attempting to draw some conclusions.

2 Smart Working

2.1 Concerns

The advent of Industry 4.0 has given rise to advances in productivity but has also generated concerns among stakeholders and wider society. Many organizations have yet to embrace the potential of cyber-physical production, fearing that they will become over-dependent upon systems that are vulnerable to power failure, cyber-attack or embedded error. In smaller organizations, the necessary expertise to bring about transformation to Industry 4.0 may not exist, or existing managers may fear loss of control over systems that they understand imperfectly (Schröder 2016). Employees also have issues of concern, not least that they will be rendered redundant by application of robotics in production or service delivery. According to the CIPD (2008, p.20), the top barrier to implementing new practices is the operational pressure that absorbs time necessary to develop and trial different ways of working. Indeed, it is clear that the advent of smart technologies has increased the challenge and range of cyber security issues (Flatt et al. 2016; Riel et al. 2017). Unlike previous generations of technological development, these challenges go beyond the sphere of control of manufacturers and suppliers. The advent of the Internet-of-Things means that every consumer must now be concerned with cybersecurity and privacy, and needs to have confidence in manufacturing

and business processes leading up to supply and customer care (He et al. 2016). Approaches to risk and security management clearly require that analysis goes beyond the purely technical to address activities of people in relation to systems with which they interact, or seek to influence (Sadok and Spagnoletti 2011).

Two examples show that implementation of smart systems is not always seen in the terms of multiplicity suggested by CIPD, but rather as a means to utilise technology in order to make efficiency gains. The first shows the potential for electronic devices and AI to be used in a coercive manner. Take for example the bracelet issued to staff working in Amazon's warehouses (Solon 2018). This uses ultrasonic tracking to identify the precise location of each worker's hands. A buzzing sensation against the hand alerts the wearer when moving away from the target warehouse bin. It is intended to speed up the picking process against set performance measures. In public statements, the company asserts that this technology will be helpful to employees – saving them time and freeing their hands from scanners and their eyes from screens. Suggestions that performance monitoring is the real purpose of the wristband is dismissed by the company as 'misguided speculation'. Interestingly, however, examination of the actual registered US patent reveals that the purpose of the device is described as '*radio frequency-based tracking of a worker's hands to monitor performance of inventory tasks*' (US Patent Office 2018).

The second example relates to the development of 'smart' energy grids in India. Commenting upon this, Kumar (2019) reflects that policymakers and developers appear to perceive them entirely as a technological initiative, ignoring all other dimensions of 'smartness'. However, as he points out, *'a number of social, financial and governmental interventions can also make grids smart,* i.e.*, more efficient, more responsive, more inclusive and more robust*.' In his view, there would be greater benefit in considering 'smartness' as a socio-technical phenomenon.

2.2 Sustainability

In any organization, there will be a strategic balance to be achieved between short-term and longer-term desires, espoused values and policies, and the interests of differing stakeholder groups. Clearly, an organization must be sustainable in many dimensions – financial, ecological and (socio-)technical. Pursuit of effectiveness in delivering products and services is, of course, dependent upon the financial viability of the processes involved, at least in the short-term. For many stakeholders, economic sustainability appears to be paramount. When an organization draws up its accounts, there must be a positive balance at least over the long-term or the organization's very existence is threatened. However, traditional business reporting systems have been criticised for a narrow, financial view that is only one dimension of organizational sustainability (Elkington 1999; Willard 2012). A wider framework could embrace the 'Triple Bottom Line' of social, environmental (or ecological) and financial factors, or go even further towards an engaged approach extending to politics and culture (Magee et al. 2013). Perrini and Tencati (2006) describe a sustainability-oriented company as one that is fully aware of its responsibilities towards different stakeholder groups. Such an organization takes purposeful action to improve its social and ecological performance, giving consideration to socio-technical issues.

In a competitive business environment, an organization must innovate in order to generate new business through new products and services, or at least to challenge and replicate those of its competitors. It has been pointed out that excellence, and the competitive advantages that may flow from it, cannot be gained once and for all. "… *excellence is relative and can shift over time. What looks like excellence today, may not be tomorrow. Best-in-class competitors, technology, and management paradigms all evolve*" (Wilson Perumal and Company 2013: n.p.). While it is not suggested that employees spend the whole of their time in experimental, creative endeavour, the ability to engage in reflection over context and (re-)imagine future practice is clearly a positive feature of resilient organizations (Weick and Sutcliffe 2015).

In business, any innovative development will be undertaken with a view to delivering a package of benefits to the company. However, the values that these benefits represent to different stakeholder groups will vary. It can be challenging to resolve divergent and conflicting requirements within a transformation process towards more sustainable business practices. Take the example of the Automobile Association. Some years ago, the AA adopted a new strategy to deliver a 'more flexible' service by buying in services from local garages via networked communications, rather than maintaining a fleet of dedicated patrolmen. This had the benefit of delivering efficiency gains yielding higher profits for investors, but both customers and employees became dissatisfied, service quality deteriorated and thus revenue streams for the future were threatened. Thus, utilisation of disruptive, more advanced technologies requires consideration from multiple perspectives taking into account the longer-term as well as potential short-term gains. Barber and Campbell (2001) point out that '*The value of today's technology-based businesses is driven by their intellectual capital, the quality of their service, and their ability to attract and retain the most productive employees … Knowing how to quantify the impact of people is essential to managing a successful technology business. It will become even more essential in the future*' (2001, n.p.).

Investment in digital technologies is clearly associated with risk. Kane et al. (2016) refer to a need for *digital congruence*— culture, people, structure, and tasks aligned with each other, company strategy, and the challenges of a constantly changing digital landscape. Li et al. (2015) refer

to a survey of managers' attitudes to deployment of the Internet of Things, in which organizational issues, including lack of agility and cultural complacency, emerged as even greater areas of concern than technical or security matters. However, as Yoo, Henfridsson and Lyytinen warn, the field of smart work systems is still emerging and much research will be needed to comprehend wherein the greatest risks lie. As these authors comment: '*We now create digitized products with loose couplings across devices, networks, services, and contents in an irrevocable way. Thus far, we have only seen the early forms of such digitized products and therefore can only dimly observe the forms of the emerging organizing logic of digital innovation*' (2010, p.734).

Smart working requires an optimal balance of skills, engagement and supporting technologies and requires professional education and commitment from staff. It is easy to recognize how benefits may emerge in such examples. Whether they will emerge, however, depends crucially upon the perceptions and perspectives of the engaged actors, and the extent to which they have an opportunity to explore and express them. Social networks can be viewed as entwined aspects of cultural behaviour (Fuhse 2015). As Checkland (1999) pointed out, when contemplating purposeful change in a system it is necessary to look for opportunities that are both systemically desirable and culturally feasible. Proposed change that is not culturally feasible within particular socio-technical environments will be difficult to implement, and therefore unlikely to deliver sustainable advantages (Bednar 2000; Bednar and Welch 2016b).

An important point that must be recognized when considering pursuit of benefits from smart working is that every engaged stakeholder (customer, investor or employee) will have a personal, unique view of what is desired in context, and this also will be subject to redefinition and change over time. Desire by individuals to participate in, and facilitate change in pursuit of excellence must be a key to genuinely smart work systems that deliver benefits to all (Bednar and Welch 2006, 2009a).

In the next section, human sense-making process in relation to work and work roles is considered.

3 Individual Uniqueness, Contextual Dependencies and Sense-Making

As sentient beings, human beings have no choice but to think. From the cradle, each of us engages in efforts to make sense of the environments in which we find ourselves and our relations with other human individuals. Human beings communicate with intention that is context-dependent (see Habermas 1984). Our interpretations of context are individually-unique and continually changing over time. Constant change of interpretation, and consequently of perceived meaning, constitute 'information' for each individual, which will never be precisely the same as that of her/his neighbour (Dahlbom 1995). Here we are engaging with phenomenology and hermeneutics – human consciousness. As Husserl (1954) emphasises, structured organizing human consciousness cannot be explained in terms of generalizations learned *from* experience, but are presumed *by* experience, forming the basis of an individual's 'life-world'. Gadamer (1987) developed this concept of life-world to point to individuals' submergence in the constantly changing context of their experiences. Individuals are embedded within their historical culture through the inter-dependence of language and context which cannot be transcended. According to Gadamer we interpret our world through language, which is at the same time a part of our life world. From a sociological perspective, Berger and Luckmann (1967) suggest that individuals construct their own views of 'reality' through interpretation of on-going experiences. From a perspective of Hermeneutic Dialectics, sense-making is an act of creation not just interpretation (Radnitzky 1970). There is a continual exchange/interchange between an individual's pre-understanding and experience. A dialectic emerges in such interactions because each individual is concurrently interacting with others.

In order to take into account unique individual sense-making processes within an organizational problem arena, there is a need for analysts to explore multiple levels of contextual dependencies. Every observation is made from the point of view of a particular observer (Radnitzky 1970). Since it is not possible to observe problem spaces from any point of view but one's own, it follows that individuals within given contexts must be supported to explore and interpret their own sense-making. When a phenomenon is observed through a systems lens, observers notice properties that emerge from interaction among elements, i.e. that a system is something greater than just the sum of its parts (von Bertalanffy 1966). Thus, an organizational system may be seen as an emergent property of unique, individual sense-making processes and interactions among those people and technologies who are its members (Bednar 2007). Drawing of particular boundaries around organizational systems will vary with the perceptions of particular individuals, and even the same individual at different times and for different purposes. This can be readily appreciated when considering that customers, nowadays, are often perceived to be included within an organization's boundaries for some purposes, such as product development (see, e.g. Patora-Wysocka 2016) and not for others, e.g. accountability. It is, indeed, possible to perceive individuals themselves to have emergent properties of their own, which can be larger than (or outside of) those of a particular organizational system of which they may appear to be part, drawing in properties relating to other aspects of their lifeworlds (Bednar 2007, 2009).

It has been recognized for many years that effective inquiry into the fit between technologies and business processes in a specific organization can make or break a business (Fincham 2002; Markus and Robey 2004). The scope and complexity of automation made possible in Industry 4.0 should not blind us to the importance of effective organizational analysis, especially as we recognize the political and social dimensions involved. If these inquiries are confined to a superficial examination of goals, tasks and decisions, the results may be very unsatisfactory. Inquiry into opinions and sense-making processes, relating to a multitude of issues in the organizational arena forming the context of development, will be crucial. As pressure grows for faster exploitation of technologies, this will place further demands on organizational and business planning processes. Tools to support mutual exploration of differing, individual and group perspectives could help to build a platform for understanding and demand for sustainability, providing a layer of mutual communication between all stakeholder groups (Bednar 2000). Managing stakeholder relationships and interactions will bring a whole new impetus to strategic planning, decision making and management of 'knowledge'. In an age where personalisation is ever more important to producers and consumers, and customers are viewed as co-creators of value (see discussion below), it is vital to recognize individual uniqueness and the ways in which perception of multiple levels of contextual dependencies influence our worldviews.

Thus, an important point that must be recognized when considering pursuit of benefits from smart working is that every engaged stakeholder (customer, investor or employee) will have a personal, unique view of what is desired in context, and this also will be subject to redefinition and change over time. Desire by individuals to participate in, and facilitate change in pursuit of excellence must be a key to genuinely smart work systems that deliver benefits to all (Bednar and Welch 2006, 2009b). While human life has always involved making sense of complex experience, in the twenty-first Century the pace of technological change has accelerated so that individuals cannot fail to experience uncertainties and fresh challenges on an on-going basis. Senge (1990) suggested that '*systems thinking is needed more than ever because we are becoming overwhelmed by complexity. Perhaps for the first time in history, humankind has the capacity to create far more information than anyone can absorb, to foster far greater interdependency than anyone can manage, and to accelerate change far faster than anyone's ability to keep pace....organizations break down, despite individual brilliance and innovative products, because they are unable to pull their diverse functions and talents into a productive whole'* (Senge 1990, p.69).

Much research attention has focused on acceptance of new technological applications by participants, e.g. via the Technology Acceptance Model (Rogers 2003). The limitations of this model have been explored elsewhere (Bednar and Welch 2017b) and it is recognized that other researchers have tried to go beyond Rogers' agenda (see, e.g. Wamba et al. 2017). However, if engaged actors are to collaborate and exercise their creativity to co-create new ideas and practice, it is necessary that they go beyond mere acceptance and embrace a forward trajectory for innovation.

Changing views on the role of managers is discussed in the section which follows.

4 Management

There have been many definitions of manager since the days of Fayol (1917), who suggested their role to comprise planning, directing and controlling. While these roles are still needed (and there are still undoubtedly organizations whose structures and culture operate on the basis of 'command-and-control') they are increasingly carried out in conjunction with wider groups of stakeholders and intelligent agents. A more recent suggested definition may be preferable - managers as 'architects of context' (Wrzesniewski and Dutton 2001, p.195). This seems a useful way to conceptualise management activities of the future.

Others have suggested a need for more purposeful leadership, reflecting the cultural values that organizations purport to espouse. Too often, business websites contain bold vision statements about ethical values that are not borne out in practice. The most extreme cases make news headlines, such as the case when Wolkswagen were found to have introduced fraudulent software into their vehicles that gave false readings about harmful emissions (Tabuchi et al. 2017). The CIPD in the UK recently surveyed organizations to establish how more purposeful leadership might come about (Bailey and Shantz 2017). They consider the parameters for establishment of purposeful leadership and conclude that '*For employees to have positive outcomes in terms of job satisfaction, meaningfulness of work, organisational commitment and lower intentions to quit, it is important that they are ethically aligned – that is, see that their leader behaves ethically and also feel that their own values fit with that of their organisation'* (2017, n.p.). It is clearly a necessary quality in the context of Industry 5.0 and smart systems, where concerns remain about a range of inherent challenges (Rada 2018), including lack of transparency, use of tools for nefarious purposes, and issues that may arise through lack of balance between technological, social and business imperatives.

Organizational discourse in recent years has tended to emphasise leadership roles over 'management'. In particular, the concept of transformational leadership has been associated with successful change (Khalili 2016). The idea of the charismatic leader, who inspires employees with a shared vision and desire to embrace change is an attractive one, and may be

preferred over 'management' in organizational discourse. A leader can be seen as an approachable figure, who coaxes, rather than coerces, compliance. Alvesson (2012, 2014), having undertaken in-depth case studies in the field, is more sceptical regarding the impact of leadership. He notes that the day-to-day imperatives of getting 'stuff' done require a measure of directing and monitoring. Thus, transformational leadership may be one of the espoused theories underpinning organizational practice that does not translate fully into theory in action (Argyris and Schön 1974). It may be that the concept of leadership is sometimes used as an excuse not to take unpopular, coercive action. It may also have the effect of taking the credit away from professionals, who are attempting to achieve excellence in their craft – since positive change is regarded as an achievement of good leadership.

What is clear, however, is that leadership has a role to play in deriving maximum benefit from the professional competence, contextual-knowledge and creative energy of employees. Innovation is needed in order to promote sustainability over the life of the organization. Leaders/managers as the architects of context have a vital role in resourcing and empowering professionals to experiment and collaborate to generate new ideas (Hung et al. 2010). An element of risk is inherent in creativity and leaders/managers can provide legitimacy for risk-taking by those who might otherwise feel vulnerable to criticism. Many ideas will be generated that will not lead to practical innovations. It may be a role for leaders and managers to identify those that have promise and justify further investigation.

As suggested above, individuals form unique perspectives on their workplace and roles (or their interactions with a value web in other forms). These perspectives are co-created through ongoing interpretations over time of their experiences of contextual dependencies. As human beings engage in sense-making, they seek for meaning in their interactions and the roles they perform, underpinning their uniquely-formed identities as productive beings.

Wrzesniewski and Dutton (2001) suggest that individuals seek to 'craft' the jobs they perform by '*changing cognitive, task and/or relational boundaries to shape interactions and relationships with others at work. These altered task and relational configurations change the design and social environment of the job, which, in turn, alters work meanings and work identity*' (2001, p.179). The meaning of work, and our identities at work, are not pre-determined but constructed by individuals and groups as they interact, exercising professional skills and pursuing individual and collective values (Ghoshal and Bartlett 1994; Sandberg and Targama 2007).

Job crafting enables employees to exercise some control over their experience of worklife, perhaps in order to escape from alienation, to create a positive self-image or to engage in social interaction (Braverman 1974; Baumeister and Leary 1995; Wrzesniewski and Dutton 2001; Ko 2011). Job crafters effectively manipulate the boundaries they perceive around tasks, task contexts and interactions with co-workers, managers and clients/customers. Wrzesrnewski and Dutton point to two (contradictory) trends that impact upon possibilities for job crafting. On the one hand, technologies associated with Industry 4.0 have enabled greater scope for tight control over worker's activities (as seen in the example of the Amazon bracelet that monitors staff movements). On the other hand, we have seen cultural shifts in industry and commerce over the past few decades towards flatter, more democratic and less restrictive organizations and workplaces.

We suggest that greater freedom to interpret and manipulate work boundaries, crafting different views of work roles, is essential to promote creativity and thus vital to the interests of modern organizations that depend upon innovation for future prosperity. Thus, the role of a manager as an architect of context is a crucial one. The possibility exists that staff members pursuing individual interpretations of the work environment may be seen to be pursuing their own goals, which may be in conflict with the overall vision of the organization. This has been termed 'sub-optimality' (Bertalanffy 1969). However, it is increasingly recognized that employees in twenty-first century organizations need encouragement to be more free to exercise their creativity, form meaningful interactions with one another and especially with clients and customers – *'not ... passive recipients of job characteristics, but as active participants in the construction of the meaning of their work and themselves'* (Wrzesniewski et al. 2013). This, we consider, is vital to progress towards smart working. Organizations must innovate in order to thrive in competitive markets, and they depend upon the resourcefulness and creativity of individuals and groups at work in order to do so. Collaboration, often the key to successful innovation, extends to customers and clients.

Dahlander and Gann (2010) highlighted the permeability of organizational boundaries to external ideas, resources and individuals flowing in and out'. Thus, an era of open innovation is suggested, i.e. '*a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as firms look to advance their technology*' (Chesbrough 2003). This is an area for on-going research (Van de et al. (2009) but Baldwin and Von Hippel (2011), looking at Open Innovation in SMEs, note that there remain substantial barriers to be overcome, including include '*cognitive, organizational, cultural and institutional differences between collaboration partners, implying that potential problems may arise due to insufficient knowledge, cultures or modes of organization, or bureaucratic elements*' (2011, p. 427). Yoo et al. (2010) highlight a need for new tools to support knowledge management and virtual teams, which can handle heterogeneity and discontinuity in knowledge.

Patora-Wysocka (2016) suggests that value co-creation is centred around reciprocal interactions between customers and members of an organization. She relates details of a study set in a fashion company (labelled as Alfa). '*The partners undertook to cooperate within a clear context of interaction and direct involvement in the product development process with the customer. The owner of Alfa emphasizes that as a result of this the company gained a number of new skills. It is possible to state that in this case value is close to the concept of value in-use in the realm of everyday activities …This use gains a new meaning as it cannot be related to the use of a product or a service by the customer, but to the processual context of work on the service, as a result of which the service co-creator acquires new skills that are crucial in everyday practice. There is value-in-action emerging*' (2016, p.122).

Rationalist perspectives on management tend to emphasise intervention – a visionary (outside the group) knows best what is to be done and members of the organization are to be coaxed or coerced to 'buy-in' to innovative practices (Bednar and Welch 2005). Aspects of organizational behaviour, such as tasks, skills and competences, are externalised and defined so that staff can be fitted to work like pegs into appropriately shaped holes. Sandberg and Targama (2007) point out that such attempts at 'fit' often fail to yield satisfactory results. They suggest that managers should instead recognise that it is the understandings of participants in context that determine how they will behave and therefore what can be achieved. As they suggest '*while it is regarded as important to figure out what effects changed conditions have on human behaviour, how people understand the changed conditions is typically treated as a black box*' (2007, p.33).

Managers are, of course, those who are charged with the responsibility to detect success/failure in organizational activities and to report to key stakeholders on results. However, it may be better to replace traditional views of management or leadership roles and to focus instead upon influences. The architects of context are in a position to influence internal behaviour by facilitating discussion and providing appropriate resources (Bednar 2000). A key factor here may be their ability to garner contextual understandings from professionals who are carrying out their work, interacting with customers and engaging in collaborative experimentation and creativity. Thus, managers, employees and customers are co-influencers on the architecture of context. Weick and Sutcliffe (2015) point out that the most resilient organizations tend to be those that are able to notice small changes as they occur. They suggest that organizations practicing mindfulness, i.e. openness and tolerance of mistakes, are those most likely to do this. Such organizations can harness contextual knowledge-in-action to identify weak signals of change in business and respond with vigorous action before change becomes a problem. It is important here that practice is tolerant of uncertainty. While management has traditionally been concerned with promoting greater certainty, smart working requires a different approach. As Poerksen (2004), suggests that '[individuals] …*must assume self-responsibility, endure insecurity, consider change as something natural, and say farewell to the idea that the true essence of the world can be known unconditionally*' (2004, p.190).

Management is essentially bound up with decision-making, and good decisions at all levels are dependent upon individuals and groups being able to surface their contextual understandings and inform themselves about relevant parameters. Informing activities include observation, exchange and interpretation of messages, interpretation of data sources, and collaborative activities with colleagues, customers and possibly intelligent agents and robots (termed cobotics) (Claverie et al. 2013). People have used artefacts to facilitate tasks of informing themselves or helping others to do so since long before the advent of computers or automated systems (Nissen et al. 2007). When new artefacts are devised, they may incorporate both redesign of earlier versions and/or some new affordances of their own. However, for people who desire to use them (or are obliged by others to do so) they demand a lot of unlearning and learning over time. It has been suggested (Bednar and Welch 2007) that there is an on-going dialectic between use of an artefact and reflection-upon-use, which leads to innovation. As reflection triggers change in use, and such change triggers further reflection, a positive spiral of change and development comes about. 'Use' is a contextually-dependent phenomenon, and deep understandings of context are only available to those actors who are immersed in it. It is for this reason that engaged actors need to own and control the process of innovation for themselves, and collaborate with managers as 'architects of context' to bring about beneficial change. This includes both internal and external clients of artefacts in question. Such ownership is expressed in the form of mindful management practices (Weick and Sutcliffe 2015), in which mistakes are tolerated as opportunities for learning and people are permitted to express 'off-the-wall' ideas that may arise from their engaged experience. This is in contrast to some organizational situations that can lead to negative spirals of 'organizational defenses' (Argyris 2004) that are likely to dampen scope for innovation. The definitions of 'smart' working discussed in the Introduction, above, clearly include the possibility for people to inform themselves about circumstances relevant to the situation in which they are engaged. However, it is not always easy for people to judge the quality of the sources they draw upon. Business intelligence increasingly draws upon 'Big Data', i.e. large repositories of highly aggregated data to be used in conjunction with complex algorithms for interpretation. There is much current rhetoric about the potential of such aggregated data to benefit business, but organizations may experience difficulty in harnessing these benefits due to lack of readiness, i.e. poor understanding of the alignment of

intelligence with core business activities. Klievink et al. (2017) point out '*the mere fact that Big Data and the tools to analyse it are available does not in itself constitute a value proposition'*. Popovič et al. (2018) point out that Big Data Analytics (BDA) can be integrated into organizations in such a way as to augment management capabilities, providing there is sufficient attention to readiness factors such as resourcing, senior management support and employee engagement.

While such aggregates have potential to support greater accuracy and more focused decision-making, individuals have little power to influence how it is gathered or for what purposes. Many instances of 'fake news' have been exposed in recent years, and not just in the political arena. However, it is important to realise that sources of information require careful interpretation even when they have been compiled with integrity. Those taking part in inquiry, or making efforts to communicate, may intend to take a neutral or objective stance, but still find themselves entrapped in processes of misinforming (Bednar and Welch 2008). As people collaborate in groups or across organizational boundaries, the scope for misinformation clearly become greater. Individuals require opportunities to construct forms of inquiry to suit their own individual needs, and to be aware that there are no neutral 'facts' to be gathered, but that informing is an active process of inquiry, interpretation and evaluation.

Advanced technological and socio-technical developments are expanding the possibilities for informing activities, collaborations and smart working. These advances are discussed in the next section.

5 Developments in Smart Working

5.1 Industry 4.0

Industry 4.0 has been enabled by simultaneous advances in many fields over the past decade, including artificial intelligence, machine learning, robotics, Internet-of-Things, autonomous vehicles and self-driving cars, 3D printing, virtual and augmented reality, wearables, additive manufacturing, nanotechnology, biotechnology, energy storage and quantum computing are blurring traditional boundaries and creating new business models (Vollmer 2018). These and other technologies have had a disruptive impact on both personal and working lives. The term 'Industry 4.0' is potentially misleading. Indeed, the suggestion that this is a fourth Industrial Revolution has been disputed, e.g. by Garbee (2016), who points out that the term has been applied to many other technological breakthroughs since the 1940s. Many large organizations have already taken advantage of the opportunities these developments afford, but many others, especially SMEs, have yet to do so due to the concerns outlined above. Schröder (2016) suggests that '*While many large companies are already attempting to anticipate the potential and risks of digitalisation for their respective business models and have introduced innovation processes, small and medium-sized enterprises appear to be making heavy weather of it*' (2016, p.3). The structures of industries and markets have been transformed and new products and services never before contemplated have come into being. This wave of industrial transformation has enabled mass customisation of products, so that a customer's exact personal requirements for a product can be met at little or no additional cost to the producer. Mass customisation may be very pleasing to customers, but the impact of this transformation on both producers and employees may be more detrimental, removing a need for management intervention and often requiring residual employees to act as if they were indeed robots. It must be remembered that reducing labour costs can also mean a loss of income to potential customers. At societal level, the logic of Industry 4.0 to produce productive efficiencies could be self-limiting if it is not accompanied by opportunities for retraining and emergence of new occupations.

However, even while this industrial and commercial revolution has been in progress, it has been overtaken by a further development termed Industry 5.0. It has been pointed out that customers have not been satisfied with the potential of mass customisation, but now demand mass *personalisation* (Østergaard 2018). Producers are therefore obliged to consider how a more personal experience may be delivered to customers, and thus move towards more collaborative business models. Technologies have emerged that support on-going interaction between consumer, supplier, and indeed ecosystems for use, supply and maintenance of diverse products – from fridges to intelligent running shoes. Continuous, detailed feedback from consumer to supplier becomes possible via digital networks, as does interaction among users. The customer is effectively integrated into the web of production as a co-creator of value. Skobelev and Borovik (2017) go further to suggest that the concept of industry is becoming redundant, as we move towards Society 5.0. Certainly, reflection upon system boundaries will be needed at all levels as citizens seek to reap the benefits offered by digitally-enabled integration, whilst avoiding its pitfalls.

5.2 Moving to Industry 5.0

While Industry 4.0 has been concerned with creation of 'smart factories' through application of robotics and virtualisation in production systems, Industry 5.0 is more concerned with synergistic relationships between such systems and people, including socio-democratic and ethical considerations (Özdemir and Hekim 2018). It is suggested that Industry 5.0 will be characterised by human intelligence working in tandem with cognitive computing to produce more value-added products and goods. Current systems have the potential to

waste human capacity for creativity and problem-solving as layers of management disappear and human workforces are engaged in programmable tasks (McEwan 2013). Organizations embracing the scope of Industry 5.0 will again harness these unique human qualities.

McDonnell (2018) sets out a vision for an Industry 5.0 manufacturing environment in which humans and AI artefacts interact continuously in order to manage processes effectively. She highlights how digital assistants (similar to the now-familiar Amazon Alexa) will support monitoring and management of complex systems in dialogue with human managers, using AI to give expert advice to optimise production. Virtual and augmented reality systems (AR and VR) will support modelling and envisioning the state of systems for effective control. Moving beyond coercive uses of artefacts such as Amazon's bracelet (see above), intelligent fabrics will enable people to manipulate their environment simply by moving a hand or arm. A manager can tour a factory and see real-time information about its status and activities through AR glasses. Many of the applications and possibilities still feel like science fiction as the domain is developing rapidly but, undoubtedly, Industry 5.0 can support new, creative endeavours and business models as time goes by.

Cobotics is one such endeavour that characterises the move towards smarter working systems. The term 'cobotics' has been in use for some years, and refers to use of workstations at which human and robot actors collaborate in a particular process. Thus, a *cobot* is a robot that has been designed specifically for the purpose of collaborating with human co-worker(s). Those who are designing and building cobotic systems require a deep understanding of the possible behaviours of each element separately, together with their constraints, and additionally, the emergent properties that arise through their collaboration that may impact upon the behaviour of the system (Moulières-Seban et al. 2017). It is important to remember here that robots are designed in many different forms for different purposes, and are not necessarily android. It is clear that cobotics cannot be viewed as an entirely technological concern. Its deployment requires a socio-technical perspective in which inter-human and inter-system interactions are considered carefully in conjunction with contextual dependencies, going beyond first-order cybernetic considerations. Özdemir and Hekim (2018) point out a need for careful design in order to secure this: '*Industry 5.0 is poised to harness extreme automation and Big Data with safety, innovative technology policy, and responsible implementation science, enabled by 3D symmetry in innovation ecosystem design*' (2018, p.65).

Undoubtedly, however, these developments will create new challenges for enterprises and service providers, leading to a greater focus on interactions among stakeholders and between stakeholders and intelligent, integrated systems.. It is now apparent that a socio-technical perspective is needed when organizations embark on 'smart' initiatives. Only in this way can opportunities be pursued in a way that balances the needs and desires of different stakeholder groups and ensures that the full potential of intelligent technologies is harnesses for the benefit of all.

Socio-technical perspectives are considered in the next section.

6 The Need for a Socio-Technical Systems Perspective

6.1 Why Socio-Technical?

Effectiveness in any purposeful activity is a socio-technical phenomenon. People use tools in order to be productive. Tools are designed for use. Systems for the effective use of tools by people, to bring about desired outcomes, requires social and technical elements to be considered together. Thus, a contemporary, socio-technical approach does not pursue two separate (social and technical) strands for examination, but one, integrated whole. Mohr and van Amelsvoort 2016) have defined a contemporary socio-technical approach to comprise: '*The participative, multidisciplinary study and improvement of how jobs, single organizations, networks, and ecosystems function internally and in relation to their environmental context, with a special focus on the mutual interactions of the entity's … value-creation processes*' (Mohr and van Amelsvoort 2016, p.2). This definition is not entirely satisfactory, however, since it tends to ignore the participation of real human beings, whose contextual understandings, skills and desires are crucial to the achievement of such value-creation processes.

Any effort to bring about change in an organization in order to develop smart working practices must be considered from a socio-technical perspective. A relevant question to pose is how far traditional ideas of 'organization' can be useful in an age of smart living and working. Much of the business literature suggests that an 'organization' was identifiable by its corporate status, brand, distinctive culture and carefully managed activities. Organizations were associated with formally-defined missions, such as profit-making or religious observance, and tended to be associated with place – land and buildings. Any given organizations will have unique characteristics making it distinctive. As other organizations attempt benchmarking and copying 'best practice', they will probably acquire some of that organization's market share or reputation assets; but those organizations that achieve sustained success are likely to do so through continuous innovation. As has famously been pointed out (Davenport and Prusak 2000, p.15), the only sustainable source of competitive advantage for organizations in the long-run is the 'know-how' of those who work in them. Thus, organizations perceived to be successful are those within which employee enthusiasm,

creativity and team working are continually engaged. A journey of co-creation is undertaken by engaged professionals seeking to achieve excellence in their practice, supported and facilitated by leaders. To what extent is the concept of 'smart working' relevant to such a journey?

Business activities can be considered to form webs of value, often generated through a loose-knit collection of partner companies and individuals who come together to source, produce and/or deliver a collection of benefits perceived as a product/service. As Za et al. (2014) suggest, gradual blurring of organizational, social and temporal boundaries has been supported by evolution of new 'digital ecosystems', allowing new products and services across multi-connected, transformative systems of collaboration, co-operation and learning (Za et al. 2014). Joint ventures, collaborations and outsourced activities are increasingly the norm.

It becomes increasingly difficult to express organizational boundaries with clarity – when someone logs into a social networking site (such as Facebook or LinkedIn) are they engaging in business or social activity? Or a combination of both? Only an engaged individual can tell where such boundaries lie, for them and from moment-to-moment. What sort of 'organization' is Airbnb, for instance? Who are its members – renters, owners, facilitators? When people engage in purposeful activity, they often desire to become 'organized' so that activities are not missed or duplicated, methods and channels are chosen, and so on. Does this mean that 'an organization' has come into being? Possibilities for smart working and living have created an environment in which many things become possible at short notice, with little capital outlay and collaboration can be supported over wide distances. 'Organization' becomes an increasingly temporary and informal concept. Pop-up restaurants, festivals and galleries are common examples of ephemeral 'organization'. Community life may be enhanced within smart cities, that enable factors such as government services, transport and leisure to be 'organized' as integrated socio-technical systems. Personal life can be enhanced through smart homes that support advanced communication with devices via an Internet-of-Things (Carillo et al. 2017). Where is the boundary between personal and professional life to be drawn? It may be that the mental model of 'an organization' is less helpful than an alternative view of 'work systems' in which actors collaborate, communicate and use available technologies for particular purposes (Alter 2013).

In contemplating design of work and/or organization, a systemic perspective is needed. Checkland (1999) discusses emergence in systems. Originally a chemist, he uses the analogy with chemical elements. The distinctive smell of the household cleaner ammonia has little to do with the properties of nitrogen and hydrogen atoms, which are involved in ammonia's chemical structure (NH3) – the whole is more than just a combination of its parts. Thus, an organization might be seen as a purposeful whole, made up of smaller, interacting elements combined in an organized way to bring about a desired transformation of some kind (see Fig. 1). Since definition depends essentially on an observer who describes a phenomenon, it follows that purposeful activity systems will be defined differently according to the perspectives (or what Checkland calls *Weltanschauungen*) of the individuals who view them. Thus, a system's emergent properties exist only as a reflection of the mind of a person who contemplates them (1999, p.671) and chooses to draw a particular boundary around a system of interest (Checkland 1983). Attempts to define a system from a particular perspective at a given moment in time can only result in a 'snapshot' view, meaningful to a particular observer only.

When a systemic lens is turned upon the nature of organization, it is possible to perceive that a higher order of complexity is involved. As Mumford (2006) points out, organizations can be perceived as dynamic and open systems – elements continually entering, interacting and/or leaving over time. Thus, an organizational system's uniqueness derives from the qualities of the individual people who create and recreate it on an on-going basis by their participation and mutual interactions. Furthermore, as Bednar (2007, 2009) suggests, individual emergence is worthy of special consideration in relation to organizational systems, since it would be naïve to regard people simply as interchangeable 'units' of labour. Uniquely of all systemic elements, human beings may exhibit emergent properties greater than those of the whole system within which they interact, since human lives transcend any particular organizational context and human life is reflexive – we recreate 'ourselves' on an ongoing basis through experience and learning. Participants' roles, relations and perspectives in organization overlay one another and subsist in a constant state of flux. An organization may be viewed, therefore, as an open, complex social-technical system, affected by aspirations, behaviour and values of individuals within it (Schein and Schein 2016). Indeed, it is the interaction among engaged actors on an on-going basis that co-creates and re-creates what is recognizable as 'organization' (Fig. 1, System View B). Schein uses the term 'organizational culture' to reflect these recognizable characteristics. All of this demonstrates the challenges involved in design of flexible, dispersed organizational systems to promote creativity and autonomous, continual innovation.

Attempts to separate technologies underpinning smart living and working from the activities of the individuals whose desires are supported seem increasingly unhelpful. Kappelman et al. (2017) point to a study carried out by the Society for Information Management, in which it is established that business-IT alignment is still the first concern of senior managers of companies around the world. Such 'alignment' has been a focus of discussion in IS circles for a generation (Henderson and Venkatraman 1993).

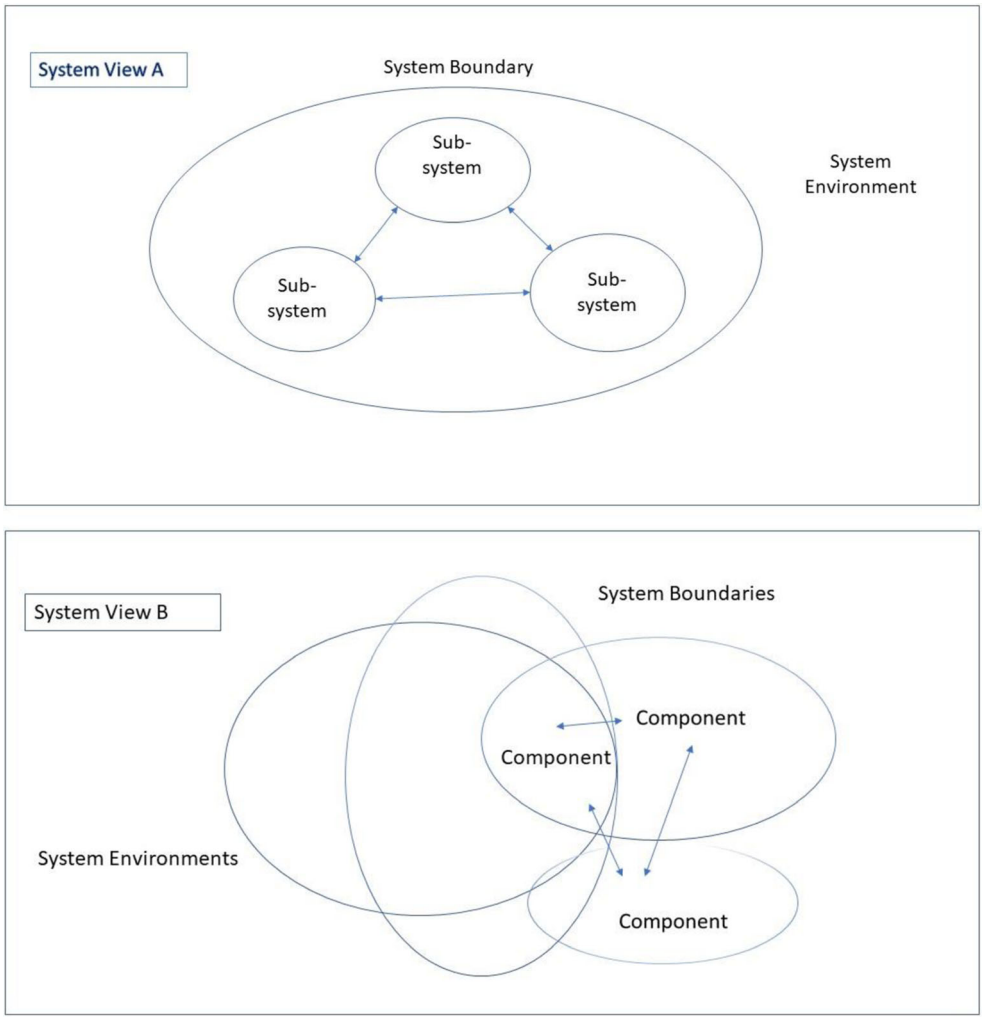

Fig. 1 System Views: A - organization as an emergent whole comprising hierarchical sub-systems (adapted from Checkland 1999), contrasted with View B – organization as an emergent property of interactions among individual actors (adapted from Bednar 2007, 2009)

However, as early as 1966, Langefors had already pointed out that a need for reporting was a crucial feature of management roles, and that it was therefore impossible to draw a meaningful distinction between Information System and organization (Dahlbom 1995) – the latter's structure being crucially influenced by the former. Since Langefors time, technological developments have gone far beyond reporting of management data, to pervade production and delivery of desired outcomes. It is suggested, therefore, that a concept of alignment between separate business and data sub-systems is not a useful construct. As long ago as 2002, Lin and Sun were suggesting that '*When an IT system is viewed as a part of the business organisation, and both the IT and business systems are designed in the same time, the gap between them can be minimised*' (2002, p.251). In the context of smart work systems, the idea is now receiving recognition that dynamic co-evolution of socio-technical elements is needed (Kahle et al. 2017; Amarilli et al. 2017). A contemporary socio-technical approach is therefore required to support an on-going journey towards smarter working and living.

6.2 Contemporary Socio-Technical Approaches

A contemporary socio-technical perspective can be seen as a cornerstone of discussions about smart working in the context of Industry 4.0 and 5.0. Earlier applications of a socio-technical perspective, emerging from the Tavistock Institute after World War II, focused on improving the experience of work and the work environment for employees (see, e.g. Mumford 2006). Contemporary approaches build upon this to focus on achievement of excellence and sustainable systems (Bednar and Welch 2016a). Sarker et al. (2019) argue that interest in a socio-technical perspective has waned within Information Systems research community, but that it has the potential to draw together the dimensions of this '*diverse, distinctive, and yet unified discipline*' for the future. Phenomena such as human use and engagement with mobile technologies, the Internet-of-Things, or social networking are all factors that have potential to promote or inhibit major changes in organizations and in society (Bednar and Welch 2017a). These changes, however, must be designed and created. Such design must

focus on individuals and groups, according to a philosophy of human-centred design (Shin 2014), and by taking into account systemic interactions among people and technologies (Kling and Lamb 1999; Mumford 2006; Lyytinen et al. 2016. Technical systems must be recognized to be intrinsically incomplete, and therefore continually open to design and redesign in relation to human engagement (Kallinikos et al. 2013). It is possible to point to a double-helix relationship of use and reflection-upon-use in relation to IT artefacts, driving this process onwards (Nissen et al. 2007). Thus, design and re-design of socio-technical systems must be conceived as a continuous process involving innovators and recipients dealing with complex and evolving artefacts (Mumford 2006). This process cannot be decoupled from soft, social, cultural and even psychological components of individual and organizational experience (Nissen et al. 2007; Bednar and Welch 2017b). Conceptually, we can distinguish between design of a new artefact, and design of systems for use of that type of artefact in real-world contexts, by real people, pursuing their own desired activities. In practice, socio-technical systems are indivisible as they form dynamic, evolving 'wholes' through human agency (Silver and Markus 2013).

It can therefore be demonstrated that human action, and interface with changes in personal and organizational life, are driven by desire. Too often, this crucial factor has been overlooked in efforts to develop and exploit new ideas for ICT artefacts and systems (Bednar and Welch 2006). Consultation about 'requirements', followed by a phase of 'beta testing' have been considered all that was necessary as engagement with human motivation to use designed products. However, in an age of rapid technological change and virtualisation of supply chains, organizations that wish to achieve innovation in working practices must pay attention to collaborative endeavours and human desire to achieve excellence. There are motivating factors for use of mobile and smart artefacts that might be described as 'fun', e.g. to be able to keep in touch with friends via social media, play games or to stream music and film. People may be motivated by factors equally compelling in the work environment, i.e. to engage with fellow professionals in carrying out tasks effectively to achieve professional excellence (Bednar et al. 2016).

While designers may give adequate attention to the technical workings of artefacts and the ways in which they can be exploited for smart working, this is often limited to a perspective we might term *first order*, ignoring the impact of interaction and communication among engaged actors. Here, a socio-technical system, incorporating mobile devices, intelligent agents, and including human use of that system, form what is understood as a system of work. The boundary of this system is perceived as limited by the extent of artefacts, direct human use and interaction. Those who wish to support design of genuinely smart working and living environments need to find ways to encourage genuine professional commitment through collaborative endeavour and creative energy.

It is suggested that system design requires specific attention to the factor of desire - desire-for-use, including job crafting and/or pursuit of *purpose*. This can only be achieved within a *second-order* interpretation of relevant socio-technical systems. Here first-order elements are considered together with other, further, inter-human communication within a work system (or other human activity systems in social contexts such as communities and groups) (Bednar and Welch 2009a). Viewed in this way, a work system (organization) can be seen to be both ephemeral and limited only by perceived boundaries of social networks out of which it is created. Desire to engage with such a system can only arise through opportunities for human agents to create and explore these boundaries for themselves. Designers then take the role of interested and supportive 'by-standers', supporting actors to build systems that can contribute to empowerment for use (Friis 1991). If human agents are to be supported to pursue excellence in their professional environments, then they need appropriate support to create purposeful revisions of contextuality – to explore and shape the contextual dependencies inherent in their working lives (Bednar 2000), and to design innovation in working practices from a socio-technical perspective. Every aspect of socio-technical change requires a human-centred design perspective, whether work systems comprise people-to-people interactions, machine-to-machine interactions, or combinations of both (Bednar and Welch 2016a). Professionals are distinguished by their ability to reflect upon practice of a professed skill set in context, and to relate these reflections to a body of standards and values transcending their immediate job role, and to interact with other professionals in doing so. Often, this involves membership of wider 'landscapes of practice' – formal and informal (Wenger-Traynor 2015). It is these interactions, and those of professionals with other stakeholders within and outside of work environments, that continually co-(re)create 'organization'. Engaged professionals pursuing excellence will engage in extra role behaviour, e.g. experimenting, making suggestions for improvements, innovating methods or making efforts to help others in their professional roles. They are likely to bring experiences from other socio-cultural dimensions of life into their reflections upon practice. It is through such attachment to a transcendent system of values, standards and experience that we recognize professional practice (Bednar and Welch 2016b).

Even where there is a focus upon human agents as part of a socio-technical system, innovations are not always designed in such a way as to support collaborative pursuit of excellence. An example is explored in Solon's (2018) discussion of Amazon's patented a bracelet as worn by staff working in its warehouses. Leaders of organizations may seem to recognize that investment in enabling technologies must be combined with redesign of whole working systems (Gastaldi et al.

2014). However, it becomes ever more necessary to ask the question from whose point of view resultant systems may be regarded as smart, genuinely socio-technical or supportive of a journey towards professional or organizational excellence? Such initiatives often appear to be motivated by a wish to achieve cost savings, yielding quick returns for investors, rather than developing excellence in practice through smart working. It may be worthwhile here to reflect that efficiencies are often an expensive luxury in practice – achieved only by sacrifice of other, valuable assets. Too often, it appears that policies suggested to encourage innovation and smart working are not translated into effective change (Alvesson 2014). Smart working practices are not always rewarded in practice, but rather incentives are applied in such a way as to create disorder and unintended, negative consequences. We also see this in personal life as individuals become attached to smart mobile devices and social media to an extent that may amount to addiction. The intended opportunities to stay connected, access leisure facilities and eCommerce can lead to fear of 'missing out' on desired contacts and an unreasonable focus on artefact use. In organizations, people may wish *to be seen* to carry out policies promoting innovation, rather than genuinely understanding or desiring beneficial outcomes from those policies. The resultant distortions in practice may lead to the opposite of excellence.

Ciborra (2002), drawing on Heidegger, distinguishes between two types of indication discernible in organizational life and discourse. The first, he terms *illusory appearances*: the set of ideas and models that are readily espoused in the domain of organizational theories or consulting models (p.176). These can lead to taken-for-granted assumptions that are not challenged, stifling responsiveness and innovation (Alvesson and Spicer 2012). The second indication he labels *apparitions*, which belong to a space that cannot be filled by any model, surfacing in informal communication that host '*the unexpected aspects of organizational life*' (Ciborra 2002, p.177). It is only the latter that can actually illuminate investigations into the desires of engaged actors for beneficial change. Again, it is clear that those who desire the benefits of smart working within co-evolving socio-technical systems need support to engage in inquiry into contextual dependencies and thus unveil their desires and possibilities from use of innovative processes.

Efforts to assess the benefits of any particular innovation need to take into account both the positive and negative factors that may arise (Bednar and Welch 2013). However, it is possible that those who seek to bring about change that will benefit an organization will ask the question 'What are the negatives of the current system / behaviour?' in conjunction with the question 'What are the benefits to be expected from the posited future system / behaviour?' and use this as the basis to initiate action. However, in doing so they have neglected to ask the questions 'What are the negatives of the future system / behaviour?' and 'What are the positives of the current system /behaviour?' Both of these questions are relevant to consider in taking an open systems perspective, and their neglect is likely to detract from achievement of desired outcomes (Bednar 2018, p.44). Such a problem seems likely to occur when managers have published policies for 'best' practice in advance of any particular innovation in pursuit of smart working (as in the example of HM Government above).

In pursuit of professional effectiveness, the potential to go beyond the basic requirements of a role in order to create new boundaries involves a higher order of reflection. It becomes possible only through commitment to on-going reflection upon competence (Bateson 1972) in which the individual concerned is reflecting not only upon experience, but also upon the *process* of reflecting on exercise of judgment. This development of a learning 'spiral' may be regarded as an exercise in practical philosophy. In a socio-technical context, such a spiral must be generated through collaborative inquiry. Figure 2 provides a summary of a contemporary, socio-technical approach to design of smart working systems. It shows how individuals interact within an organizing space, each with unique experiences of inherent contextual dependencies arising around their professional roles, and bringing their unique life experiences into the space. Human actors may be engaged in collaborating with different types of intelligent agent, including cobots. These also bring their learning into the interaction, although reflection and imagination are still the exclusive sphere of human beings. This figure therefore reflects multiple boundaries drawn from the perspectives of different human actors within the space. Recognition is given to individual emergence, showing how human lives transcend the space that forms current system(s) of interest. Individuals interact within an organized working system, continually creating and recreating it. This system of interest is open and dynamic as different people, in multiple roles and with unique perspectives join, interact in and leave the system. These interactions overlap with a co-created system of inquiry into meaningful action that supports continual (re)co-creation through interaction, reflection and learning (Bednar and Welch 2009b, b).

7 Conclusions

It is clear that we are at a watershed in the progress of smart working, in which we contemplate moving forward into a digital age from Industry 4.0 to Industry 5.0. Organizations that have not yet embraced the potential of AI, VR and integration may be encouraged to discover that they are not left behind - the opportunities of Industry 5.0 are open to them. However, their hesitation may have reflected genuine concern for the experiences of the unique individuals from whose interactions the organizations have emerged. Smart working must mean more than saving on accommodation costs or fares for commuters. Collaborative systems will enable human

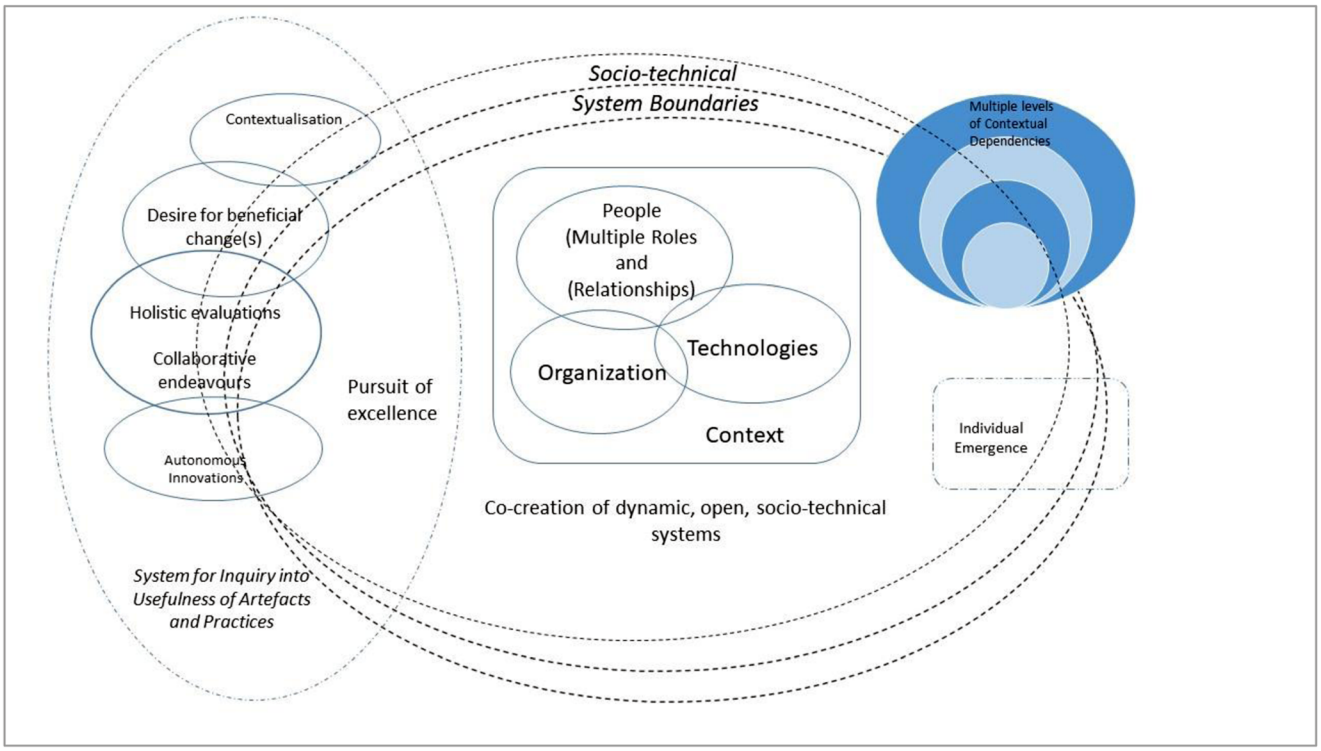

Fig. 2 A contemporary socio-technical approach to engagement with smart working

individuals to realise their full creative potential in delivering personalised goods and services to consumers, with whom they can engage in a co-creative partnership through value networks. Collaboration with intelligent agents, cobotics and use of augmented reality systems can assist staff to find greater meaning in their work roles by removing dull and monotonous tasks and automating control systems. However, great care is needed in (co-) creating the organization of the future. Never has there been a greater need to consider sustainability in all its dimensions (Magee et al. 2013). There are many challenges and concerns to be addressed if balance is to be achieved among the needs of differing stakeholder groups.

It is important to recognize the potential benefits that a shift towards smart working might realize for different stakeholder groups, but at the same time to understand that smart working strategy requires a balancing between differing interests. Benefit realization is not automatic. Desire for the benefits of smart working may genuinely exist within an organization, but inertia may mean that such aspirations are not translated into action. Where desire for smart working does exist, even the greatest advocates may inadvertently sabotage realization of these aims in practice (Argyris 2004). Such phenomena have been well documented in the past, e.g. the (1928) comment of Justice Louis Brandeis in his dissenting judgment in Olmstead v United States, on the role of governments, '*The greatest dangers to liberty lurk in the insidious encroachment by men of zeal, well-meaning but without understanding'* (Brandeis 1928, inscribed on the Capitol Building in Washington DC). People may desire to engage in smart working, resulting in demand for greater access to supportive services. How is such demand to be articulated, assessed and acted upon? Organizational leaders may be ambitious to support smart innovation. However, consideration of support for meaningful practice, and learning for meaningful practice are required in order to bring about such a transformation (Bednar and Welch 2007, 2017b; Bednar et al. 2016) and this aspect is frequently overlooked. Argyris (2004) suggests: '*It is not possible for human beings to engage de novo the full complexity of the environment in which they exist. Life would pass them by. Human beings deal with the challenge by constructing theories of action that they can use to act in concrete situations'* (2004, p.8).

It can be seen that a rational planning model to expand organizational choices involves an inherent paradox. Since any observation must, by definition, be made by a particular observer, adoption of a 'neutral' stance cannot be achieved in practice. This means that those who espouse rational planning are unaware that any data they gather about a dynamic and constantly recreated problem space is inherently misleading. It is possible to observe the practice of others, consider it in relation to our own contextual experiences and desires, and learn from it. However, attempts to copy practice from one unique context to another are unlikely to yield unsatisfactory results.

Only a human-centred stance, recognizing that organizations subsist from moment-to-moment as self-creating, dynamic and open systems, is likely to lead to success in smart innovation (see Fig. 1). Thus, if expressions of aspiration for smart working are to lead to design of socio-technical systems that are experienced as smart by professional human agents, support for professionals to explore their contextuality in pursuit of excellence must be more appropriate than policies setting out principles for supposed 'best' practice.

We suggest that contemporary, open, socio-technical systems perspectives are needed, harnessing appropriate tools and techniques to ensure that systems are created that are meaningful to all engaged actors. Not only is purposeful leadership from managers a desirable quality, but recognition is needed that transformational change will impact upon the unique experiences of all staff and customers in differing ways. Change does not simply involve technical advances, it disrupts a socio-economic ecology of work and community, which is unique to every different environment. Engaged actors require support to own and control the process of transformation, revising and recreating their understandings and interactions for the positive benefit of all concerned. It may be better to see managers not as architects of context, but as *cultivators*.

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