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A SOCIO-TECHNICAL APPROACH TO SUSTAINABILITY IN ORGANIZATIONS: AN EXPLORATORY STUDY

Research in Progress

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Abstract

Research has shown that sustainability is a critical issue for organizations. There are many dimensions to this concept, notably economic, social and environmental sustainability. When considering development of Information Systems, it is necessary to take these factors into account. However, although developers wish to deliver a package of sustainable benefits, the values that these benefits represent to different stakeholder groups will vary. Approaches will be needed that can provide support to resolve divergent and conflicting requirements within a transformation process, and help to surface contextual understandings of sustainable performance. Poorly-designed systems lead to work activity that is less than optimal, and thus fails to achieve a level of excellence in performance that is a significant prerequisite for competitiveness and economic sustainability. This paper introduces an investigation into understanding of a socio-technical systems framework that could function as a trigger for sustainability development where a suitable agenda already exists within an organization. Preliminary results, and their limitations, are discussed and a tentative agenda for further research is presented.

Keywords: Socio-technical systems, Sustainability, Organizational Information Systems, Stakeholder engagement, Exploratory study.

1 Introduction

Research has acknowledged that it is critical for companies to address sustainability issues if they are to survive and thrive in the long-term (Checkland, 2004; Porter and Kramer, 2006; Martens and Carvalho, 2016). The term ‘sustainability’ is often associated in public consciousness with policies to conserve the Earth’s resources and avoid polluting the physical environment. Indeed, a number of regulations addressing environmental sustainability do exist to constrain what businesses can do or must do (Haigh and Griffiths, 2008; Stowell, 2013). However, it is important in an organizational context to go beyond narrow views and embrace wider dimensions of sustainability.

For many stakeholders, the most important of these dimensions is economic. When an organization draws up its accounts and balances receipts from its activities against payments made, a positive balance is needed at least in the long-term. Without this, the survival of the organization is threatened, as are the incomes of most of its various stakeholders. It is for this reason that traditional business reporting systems have been restricted to financial statements. However, interest has grown in promoting a wider brief for reporting mechanisms. For example, Elkington (1998) pointed out that conventional accounting systems report only on the financial health of organizations and suggested that evaluation of sustainability requires a wider framework, encompassing three dimensions that he labelled the ‘Triple Bottom Line’ of social, environmental (or ecological) and financial factors. Magee *et al.*, (2013), going further, suggest an engaged approach to sustainability assessment, encompassing domains of economics, ecology, politics and culture. According to Perrini and Tencati (2006), a sustainability-oriented company is fully aware of its responsibilities towards different stakeholder groups, and adopts methods and tools that allow it to improve its social and ecological performance. The statutory bases

of Corporate Governance have also begun to give greater emphasis to social responsibility, e.g. in the UK, the Companies Act 2006 was supplemented with 2013 requirements for quoted companies to report on environmental matters (including the impact of the company's business on the environment, company employees, and social and community issues (Dept. Business, Innovation & Skills, 2012).

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. In the context of Information Systems Development, designers, 'users' and managers may hold different perspectives on sustainability and/or assessments of its relevance (Baskerville, et al, 2016). One possible way to manage the multiplicity of stakeholders' views is supported by a socio-technical systems (STS) approach, focusing on reciprocal relationships between human actors and the technologies with which they engage in the workplace. STS approaches are concerned with harnessing human and technical aspects of organizational structures/processes in order to achieve a holistic optimization (Emery, 1982; Mumford, 2003; Welch *et al.*, 2016).

Early work in STS research focused on finding ways to improve the experience of workers, allowing them more autonomy and focusing on work design. A set of ST principles were developed from multidisciplinary sources by members of the Tavistock Institute (Cherns, 1987; Emery, 2000). These included design of work tasks to be meaningful to those who performed them, and formation of working groups with responsible autonomy over their actions. In more recent times, however, greater emphasis has been placed on achievement of operational excellence through design of harmonious, self-healing processes (Duggan, 2011). Mohr and van Amelsvoort (2016, p.2) define contemporary ST theory 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 ...'*. STS theory recognizes that organizations can be viewed as dynamic, open systems interacting across their boundaries within wider environments or contexts. In this sense, society itself, and most of its sub-structures, constitute intricate ST systems, comprised of interactions among people finding usefulness in artefacts (Bednar and Welch, 2007).

Some researchers have suggested that an STS approach requires attention to a technical sub-system and a social sub-system, and the interactions between them (Bostram *et al.*, 2009). A focus on separation of social or technical factors is problematic, however. Contextual dependencies inherent in a ST system mean that interactions among all elements within that system contribute to shaping the whole, just as the system is changed by any element changing or leaving it. The whole forms, in effect, a Purposeful Activity System (Checkland, 1999). If we isolate sub-systems for analysis, e.g. task-structure-people-technology (Leavitt, 1965, cited in Seidel *et al.*, 2013) we risk failing to recognize the dynamic of interactions among these factors which creates the conditions for (un)successful organizational performance. Overlooking this dynamic, and focusing on the optimization of social or technical aspects of a system in isolation, can increase not only the number of unpredictable, unintended consequences and relationships, but the extent to which those relationships are destructive for the performance of the system (Mumford, 2006). For these reasons, contemporary STS theory emphasises an open-systems approach as more appropriate. STS theory thus extends ST theory.

As capability is embedded in people, it follows that an effective work system will be one designed as a ST whole, in which employees are expected to employ their skills and make efforts to explore and solve problems. When staff members commit to pursuing work excellence, then it is an important corollary that organizations provide favourable working conditions to recognize this, and enable employees to derive satisfaction from their engagement. It follows that human sustainability is dependent on social sustainability within a Purposeful Activity System. To be able to survive and thrive in a social and cultural space, an organized human activity system must also have economic sustainability. This, in turn, is intertwined with its wider social environment, and in harmony with the physical environment, which must be organized to promote environmental sustainability. Application of STS principles, while necessary, is insufficient in itself to promote development of economic, social or environmental sustainability. In order to produce a system that is experienced as useful by organizational ac-

tors, we argue that it is necessary to promote a process of co-creation for and by the actors themselves, supported by ST tools and techniques (Bednar and Welch, 2008; Bednar, *et al.*, 2014). In this way, unique, tacit understandings of contextual dependencies can be helped to surface and made available to inform sustainable design.

In this paper, we discuss an investigation into the potential of STS-based techniques to act as a trigger for sustainable development, where such an agenda already exists within a company. We report some results of an exploratory study using a set of socio-technical tools and techniques (Bednar and Sadok, 2015) to investigate how companies approach sustainability. Based on this study, we then discuss a potential research agenda aimed at developing a ST framework for sustainability that will integrate relevant metrics for implementation of sustainable work practices in an organization.

In the next section of the paper, we discuss aspects of sustainability in IS research, in order to clarify our aims. We then consider organizations as Purposeful Human Activity Systems, and suggest ST approaches to address sustainability. The paper then goes on to report some results from our exploratory study involving 34 companies in the UK, in order to identify sustainability issues. In the final section, limitations of the study are discussed, together with plans to set up a future research agenda.

2 Dimensions of sustainability in an IS context

In relation to environmental sustainability, there has been a focus on the potential of IS to empower environmental initiatives, such as energy efficiency (Watson, *et al.*, 2010) and management of compliance with normative, cultural-cognitive, and legislative pressures (Butler, 2011). Elliot (2011) suggests that the imperatives of an environmental agenda require IT-enabled, business transformation to address ongoing uncertainties. Ereik *et al.*, (2009) explore the environmental impact of IS activities and progress towards sustainability through interviews with a number of senior managers, in an effort to establish scope for further research. However, sustainability is a broader issue than this, covering a range of dimensions that leaders need to consider. A need for IS evaluation to incorporate social and environmental, as well as economic factors has been supported by Piotrowicz and Cuthbertson (2009). Meppem and Bourke (1999) suggest that there is a need for researchers to reconsider the way in which sustainability is conceptualised, since much of the discourse to date had focused on discipline-based exercises, fragmented and insulated from the real-world complexity of problems. They call for a communicative turn in which more pragmatic change strategies might be developed.

The contribution of IS to development and implementation of sustainability principles could be a fertile area for IS researchers, since few papers have so far addressed this topic (Melville 2010). In particular, Baskerville *et al.*, (2016) have highlighted problems with the current conception of Green IS research, and have suggested new design principles to guide the development of an IS for environmental sustainability. They argue, for example, that identification of relevant stakeholders and understanding of their interactions with an artefact are crucial to match IS designs to the constraints and affordances of their environment. Seidel *et al.*, (2013) have identified four functional affordances created through IS that are required to perform environmentally sustainable work practices. Two of these they term *reflective disclosure* and *information democratization*. These require a sensemaking process (see Weick *et al.*, 2005) that enables active participation of individuals across different levels of an organization in identification, understanding and assessment of sustainability issues and their potential impact on work practices. Opening up such functional affordances could provide a vehicle for open discussion and inclusive dialog about sustainability themes (Seidel *et al.*, 2013).

Economic sustainability appears to be a straightforward target, at least within a business agenda. However, questions arise regarding the conflicting interests of differing stakeholder groups and the means by which these are to be resolved in order to promote sustainable prosperity (Lindblom, 1959). The question of how to promote social sustainability remains more problematic. It has been suggested that organizational, social sustainability focuses on employees and includes a favourable working environment that promotes equal opportunities and provides democratic processes and responsible govern-

ance structures (Elkington, 1998). We suggest that economic sustainability, in the long-term, will depend upon achievement of social sustainability so that the contextual understandings of all engaged actors within the organizational system can be surfaced and harnessed for the benefit of all.

Taking these considerations into account, the task of designing, managing and maintaining an effective business IS with regard to the three sustainability dimensions can be seen to be challenging one. Sustainability is a complex issue with many dimensions and perspectives, reflecting interests of stakeholders. Such complexity induces a lack of common understanding of how sustainability is defined or what metrics are relevant to assess sustainability initiatives. There is, therefore, a need to search for approaches that recognise and address multiple stakeholders and their dynamic relationships within an organisational problem space. We argue in this paper that ST paradigm offers a set of tools and techniques to support engaged stockholders in their creation of a useful and sustainable work systems.

3 A socio-technical approach

Sustainability is a complex and multidimensional concept involving different stakeholders' perspectives. One of the many challenges associated with sustainability assessment is the relevance of metrics. Taking a socio-technical systems (STS) approach as theoretical underpinning, we propose to develop a framework to address and assess sustainability practices within business organizations. Such a framework could support in-depth analyses of relationships between business competitiveness or/and survival and sustainability practices. Additionally, it could provide support for companies to explore potential to incorporate future sustainability practices, involving changes in work systems design.

It is widely recognised that IS are complex ST systems (Lyytinen and Newman 2008; Mumford 2000; De Michelis, 2016) and that ST change perspectives are beneficial in supporting design of useful and usable work systems (Mumford, 2006; Welch and Sadok, 2016). Clearly, when we look at IS as organized activity involving interaction between individual human beings, we can view these from a holistic perspective as Purposeful Activity Systems (Checkland, 1999). The application of systems approaches has potential to evaluate sustainability outcomes from an organizational perspective (Melville, 2010). If we want a system to continue, survive and even thrive it needs to have human sustainability. If people are to volunteer their efforts to explore and solve problems and to want to pursue work excellence, they also need to be able to maintain their health, enjoy their work and get satisfaction of their efforts. As we are talking about 'organized activity' the human dimension is dependent on social sustainability. To survive in a social and cultural space, organized human activity must also have economic sustainability. This in turn is intertwined with the physical environment, which need to have environmental sustainability. If IS evaluation requires attention to all these dimensions, then it is vital that approaches to IS (co)creation should reflect them too. Recognition of these imperatives can be found in the ST theory, which puts forward evidence of the relevance of contextual analysis. Thus, emphasis is placed on human and technical dependencies in the context of an evolving organizational environment.

A wide range of ST methods have been developed and implemented (Avison and Fitzgerald, 2006). Particularly, In Effective Technical and Human Implementation of Computer-supported Systems (ETHICS) analysts have support mechanisms and descriptions with advice, comments and examples for over twenty different but related analyses (Mumford, 2003). ETHICS has been applied in many companies in Europe and the United States to provide support to problem solving and change process management. A major contribution of ETHICS is that it incorporates several stakeholder analyses and also explores different types of participation and empowerment, which allows reflection over engagement and involves stakeholders in their own definition of desirable change practices and system boundaries. The Soft System Methodology (SSM) by Checkland (1999) is used for modelling Purposeful Human Activity Systems through exploration, sensemaking and definition of multiple views of problem situations. The SSM is supported by multitude of concepts and techniques such as CAT-WOE technique (Customers, Actors, Transformation process, Worldview, Owners, Environmental constraints), mind mapping and rich pictures to engage in a deep understanding of how a particular

actors attribute meanings to their perceived world and how the purposes assigned to the IS are perceived to be “truly” relevant within this world (Checkland and Poulter, 2006). These techniques are deployed to support the participation of all stakeholders in complex problem situations such as identification of relationships in the network subject of change and exploration of the impact of change on existing relationships according to multiple perspectives. Baxter and Sommerville (2011) propose a framework for ST systems engineering. This combines ST systems design approaches to systems engineering and improves the communication and interaction between system development and organizational change teams by means of two types of activities: sensitization and awareness and constructive engagement. The former activities aim to enhance awareness of system stakeholders about ST issues that have the potential to influence significantly the design and use of the system. The latter activity deals with the application of ST system design methods to problem definition, solution construction and evaluation of the deployed system.

It follows that the implementation of ST principles is expected to create the conditions for job enrichment, to support development of goodwill from the different communities of practice. Thus, constructive conversation and interaction between different stakeholders provides opportunities to promote high levels of effectiveness and performance. Such principles provide a propitious background to implement or change work practices that improve sustainability. However, participation at all levels in work system design is an important ST principle that is not always realised (or realisable) in practice (Mumford and Henshall, 1979). The use of ST methods in professional practice continues to pose a number of challenges and is not always adequately supported. Limitations to participation may be damaging to the usefulness of any designed system, because the contextually-dependent understandings of unique individuals will be lost in the design process. Individuals must be empowered to join in co-creation of their system, surfacing their contextual understandings and participating fully in ownership and control of their project (Friis, 1991; Bednar, 2000).

4 An exploratory study

The focus of our main study will be to explore current practices relating to social, economic and environmental sustainability from a STS perspective, in order to provide valuable data for reflection in this research. In this exploratory study, we have conducted a preliminary survey that will serve to classify companies according to a ST framework for sustainability. Such a framework could be used to test the main premise set up in this paper, which is that the adoption of an STS approach could function as a trigger for development of sustainability practices, where such an agenda exists among stakeholders in the company.

This preliminary survey was designed to address some aspects of the background to organizational sustainability practice. An in-depth investigation of actual practice will form the focus of later stages in our research. The current survey was conducted via structured interviews based on a common questionnaire. The survey population consisted of small to medium-sized businesses (SMEs) in the Portsmouth locality. The 34 companies who responded were drawn from a variety of sectors, including manufacturing industry, services and retail. Company size varied from 7 to 215 employees. The research took place during the first half of 2016. In total, we collected and analysed 98 questionnaires (3 employees interviewed in each of 32 companies and only one employee in the remaining two). In some companies the interviewees were junior, senior, or experienced managers or officers, while in other companies it might be the business owner. The questionnaire included three sections to assess existing sustainability practices. This material provides a vehicle for reflection and dialogue in this research, to discuss potential for future sustainability practices.

The first topic of our exploration is related to *economic* sustainability. In particular, the questions investigate the possibilities of taking initiatives or making financial decisions, as well as flexibility in using resources. In fact, the complexity of the real world means that from day to day an employee needs to deal with exception handling to overcome contextual deviations. This is why engaged actors

need professional skills, ability, willingness and empowerment to make appropriate decisions as part of their job activities (Brown and Duguid, 1991; Duggan, 2011; Bednar and Welch, 2016). However, it is not always the case that organizational practices allow or support contextual adaptation and flexibility by managerial delegation of professional decision making. Without adaptation to context, any work activity will become less than optimal, and thus fail to achieve that level of excellence that is a significant prerequisite for competitiveness and economic sustainability (Welch, *et al.*, 2016).

Regarding *social sustainability*, the survey contained questions dealing with the ways in which work practices support development of competences. This could be through formal training, or by other means such as collaboration with local communities and neighboring businesses. These dimensions are necessary to retain employees long-term, to support loyalty and development of high quality performance and excellence in work practices. The last topic of the questionnaire explores the contribution that daily work practices make towards environmental sustainability. In other words, the extent to which environmental sustainability is integrated into work practices, or what tasks and responsibilities are directly related to the sustainability?

Our findings reveal three main trends related to the three areas of sustainability. First, there is a lack of empowerment of individuals when it comes to financial decisions and resources management. As noted in figure 1, although involvement in financial decisions is significant, there is little scope for initiative in managing an individual budget.

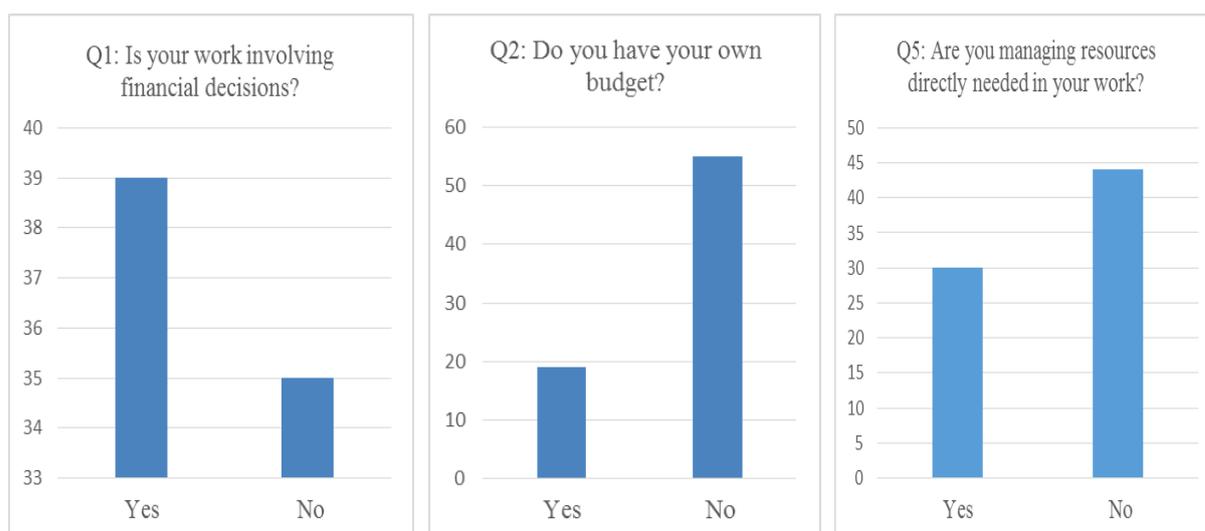


Figure 1. Questions relating to economic sustainability.

It was clear from the interviews that the vast majority of staff did not experience much managerial enthusiasm for supporting employees to make decisions and to use their own judgment. This result is coherent with previous management studies stipulating that financial decisions are among the most centralized decisions in organizations.

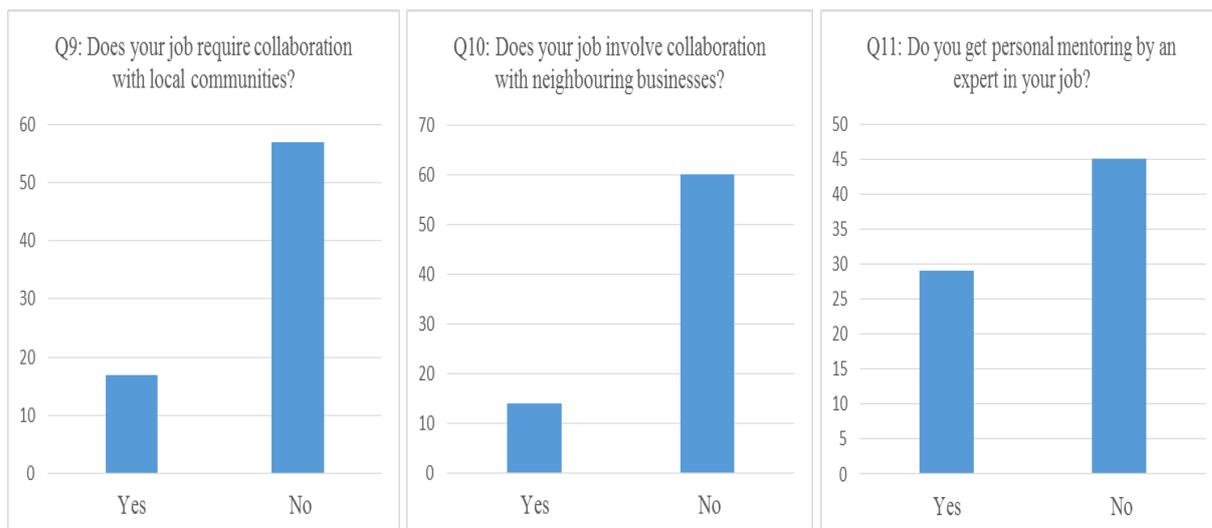


Figure 2. Questions relating to social sustainability.

Secondly, there is a lack of sustained investment in developing competencies required to enable an organization to exploit its available resources effectively. The mentoring and training effort in the interviewed companies is limited to informing employees or providing guidelines and procedures about how to execute the job. Interestingly, most of our interviewees said that their jobs did not provide them with opportunities to develop awareness and understanding of the relationships between their company and its local environment. In order for a company to thrive, it is important that it should have positive relationships with local communities and businesses. Moreover, this form of isolation from the local environment hinders a deep and systemic understanding of how to sustain a business in the longer term, and how it is to cope in an evolving economic and social climate.

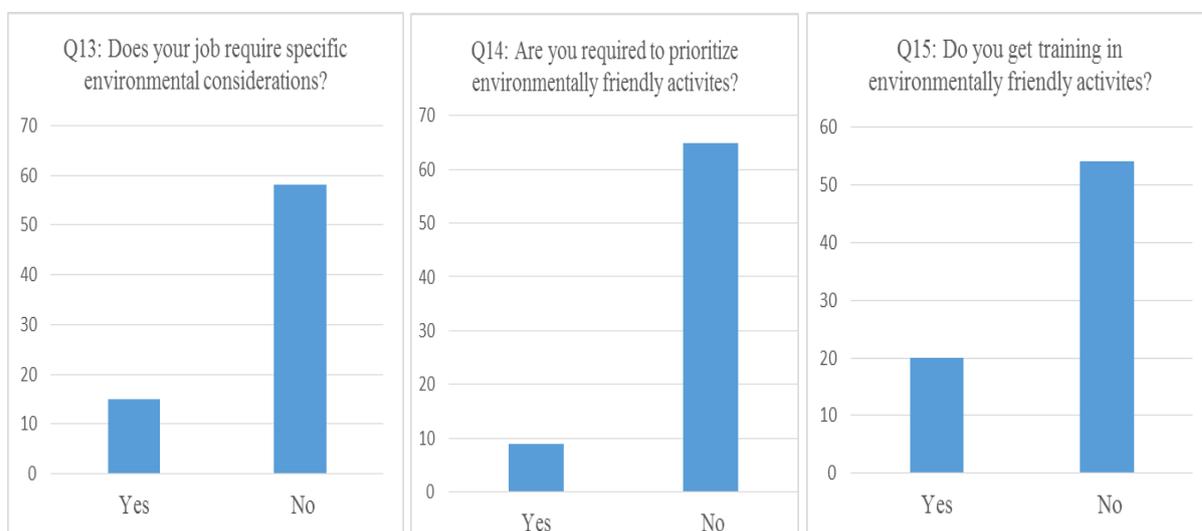


Figure 3. Questions relating to environmental sustainability.

Thirdly, there appears to be a lack of support for development of environmentally sustainable everyday work practices within the sample surveyed. Environmental sustainability activities are rather seen as an add-on to work practices than an intertwined aspect of their design. In Figure 3, almost 80% of the respondents said that doing their job does not require specific environmental requirements. This explains why more than 87% of our interviewees said that they are not required to prioritise environmentally- friendly activities. Another aspect of environmental sustainability relates to providing train-

ing and enhancing awareness to understand and discuss ecological issues and impact of business activities. Almost three-quarters of subjects answered that they do not get any form of support in this respect. For those who answered positively to environmental sustainability questions, we noticed that they were describing simple activities of recycling and energy-saving, rather than considering environmental impact as an integrated, core part of work system design. Those activities mentioned tend to be those encouraged by regulative pressures and standardisation organizations.

5 Agenda for Further Research

Our tentative research agenda focuses on informing design of ST systems for sustainable development and includes perspectives on methods and reasoning about the sustainable impact of designed work systems. The exploratory study in this research has generated valuable experience and feedback on usefulness of STS perspectives to address and incorporate sustainability principles into work systems. Preliminary results suggest that there may be potential for SME's to derive benefit by incorporating STS principles more pro-actively within their sustainable development practices. We believe that adoption of STS principles can create and enact the conditions for effective design and management of sustainable work systems, of which IS are one essential aspect. However, it will be important to enlarge the sample of companies to provide better ground in which to test the validity of the main premise of this research.

One of the main limitations of this study is the lack of specific metrics on sustainability practice and it is difficult to devise a survey instrument to cover all aspects. A further interpretation of collected data according to company size or activity sector is also desirable. We propose to expand upon the questions explored in our preliminary work, and to embark on a series of in-depth interviews with selected respondents in order to explore their practices. The research agenda will then be pursued via case study work, to explore the potential impact of STS tools on sustainability practice in firms where such an agenda is already embraced.

References

- Avison, D. E. and G. Fitzgerald (2006). *Information Systems Development. Methodologies, Techniques and Tools*. 4th Edition. London: McGraw-Hill.
- Baskerville, R., J. Pries-Heje, and J. Recker (2016). "Principles for Re-Designing Information Systems for Environmental Sustainability", in F.J. Mata and A. Pont (Eds.): *Proceedings of WITFOR 2016*, IFIP AICT 481, pp. 14–25, 2016. DOI: 10.1007/978-3-319-44447-5_2
- Baxter, G., and I. Sommerville (2011). "Socio-technical systems: From design methods to systems engineering". *Interacting with Computers*, (23), 4-17.
- Bednar, P.M. (2000). "A Contextual Integration of Individual and Organizational Learning Perspectives as Part of IS Analysis", *Informing Science: Journal of an Emerging Transdiscipline*, 3(3), 145-157.
- Bednar, P. and Welch, C. (2007). "A Double Helix Metaphor for Use and Usefulness in Informing Systems". *Informing Science: International Journal of an Emerging Transdiscipline*, 10 (Monograph), 273-295.
- Bednar P. and C. Welch (2008). "Generating Real Business Value: Transcending the Socio-Technical Dimension". Paper 171 in Golden W., Acton T., Conboy K., van der Heijden H., Tuunainen V. (eds.), *Proceedings of 16th European Conference on Information Systems*, Galway, Ireland, June 9-11, Association of Information Systems Electronic Library, <http://aisel.aisnet.org/ecis2008/171/>.
- Bednar, P. and C. Welch (2016). "Learning for Professional Competence in an IS Context". *Proceedings of 7th Scandinavian Conference on Information Systems, SCIS 2016 and IFIP8.6 2016*,

- Ljungskile, Sweden, August 7-10. *Lecture Notes in Business Information Processing* 259, Springer, 163-175.
- Bednar, P.M., Sadok, M. and Shiderova, V. (2014). "Socio-Technical Toolbox for Business Analysis in practice", in L. Caporarello, B. Di Martino and M. Martinez (Eds), *Organizations and Smart Artifacts, Lecture Notes in Information Systems and Organisation*, NY: Springer International Publishing, pp 219-227.
- Bednar, P.M. and Sadok M. (2015). "A Socio-technical toolbox for business systems analysis and design", Proceedings of the 1st International Workshop on Socio-Technical Perspective in IS Development (STPIS'15) co-located with the 27th International Conference on Advanced Information Systems Engineering (CAiSE 2015), Stockholm, Sweden, June 9.
- Bostrom, R.P., Gupta, S. and Thomas, D. (2009). "A Meta-Theory for Understanding Information Systems Within Sociotechnical Systems". *Journal of Management Information Systems*, 26(1), 17-47.
- Brown, J.S. and Duguid, P. (1991). "Organizational Learning and Communities of Practice". *Organization Science*, 2(1)1, 40-57.
- Butler, T. (2011). "Compliance with Institutional Imperatives on Environmental Sustainability: Building Theory on the Role of Green IS". *Journal of Strategic Information Systems*, 20(1), 6-26.
- Checkland, P. (1999). *Systems Thinking, Systems Practice: a 30-year Retrospective*. Wiley: Chichester.
- Checkland, P. (2004), "Webs of significance: the work of Geoffrey Vickers" in: *Systems Research and Behavioral Science*, 22(4), 291-298.
- Checkland P. and Poulter J. (2006). *Learning for Action*. Chichester: John Wiley and Sons Ltd.
- Cherns, A. (1987). "Principles of Sociotechnical Design Revisited". *Human Relations*, 40(3), 153-161.
- Department for Business, Innovation and Skills (2012). *The Future of Narrative Reporting: A New Structure for Narrative Reporting in The UK*. October 2012. URL: <https://www.gov.uk/government/publications/the-future-of-narrative-reporting-a-new-structure-for-narrative-reporting-in-the-uk/>, accessed 11/17/2016.
- De Michelis, G. (2016). "Redefining the Mutual Positions of the Social and Technical Sides of Socio-Technical Systems", in L. Caporarello, F. Cesaroni, R. Giesecke, and M. Missikoff, *Supported Innovation A Multi-Disciplinary View on Enterprise, Public Sector and User Innovation: Lecture Notes in Information Systems and Organisation*, Vol 18, 129-140.
- Duggan, K. J. (2011). *Design for Operational Excellence: A Breakthrough Strategy for Business Growth*. New York: McGraw-Hill.
- Elkington, J. (1998). *Cannibals with forks: The triple bottom line of 21st century business*. Gabriola Island, BC: New Society Publishers.
- Elliot, S. (2011). "Transdisciplinary Perspectives on Environmental Sustainability: A Resource Base and Framework for IT-enabled Business Transformation". *MIS Quarterly*, 35(1), 197-236
- Emery, F.E. (1982). "Sociotechnical foundations for a new social order?" *Human Relations*, 35(12), 1095-1123.
- Emery, M. (2000). "The Current Version of Emery's Open Systems Theory", *Systemic Practice and Action Research* 13(5), 623-643.

- Erek, K., Schmidt, N-H., Zarnekow, R., and Kolbe, N.M. (2009). "Sustainability in Information Systems: Assortment of Current Practices in IS Organizations". *Proceedings of the Fifteenth Americas Conference on Information Systems*, San Francisco, California, 6-9 August 2009 AMCIS.
- Friis, S. (1991). "User Controlled Information Systems Development – problems and possibilities towards Local Design Shops". Dept of Information and Computer Science, Lund University Publications, Sweden.
- Haigh, N. and Griffiths, A. (2008). "The Environmental Sustainability of Information Systems: Considering the Impact of Operational Strategies and Practices", *International Journal of Technology Management*, 43 (1), 48-63.
- Lindblom, C.E. (1959). "The Science of Muddling Through". *Public Administration Review*. 19(2), 79-88.
- Lyytinen, K. and Newman, M. (2008). "Explaining Information Systems Change: A Punctuated Socio-Technical Change Model". *European Journal of Information Systems*, 17(6), 589-613.
- Magee, L., Scerri, A., James, P., Padgham, L., Thom, J., Deng, H., Hickmott, S. and Cahill, F. (2013). "Reframing Sustainability Reporting: Towards an Engaged Approach", *Environment, Development and Sustainability*, 15(1), 225–43.
- Martens, M.L. and M.M. Carvalho (2016). "Key factors of sustainability in project management context: A survey exploring the project managers' perspective". *International Journal of Project Management* (in press). <http://dx.doi.org/10.1016/j.ijproman.2016.04.004>
- Melville, N. P. (2010). "Information systems innovation for environmental sustainability". *MIS Quarterly*, 34(1), 1-21.
- Meppem, T. and Bourke, S. (1999). "Different ways of knowing: a communicative turn toward sustainability". *Ecological Economics*, 30(2), 389–404
- Mohr, B.J. and van Amelsvoort, P. (2016). *Co-Creating Humane and Innovative Organizations: Evolutions in the Practice of Socio-technical System Design*. Portland ME: Global STS-D Network Press.
- Mumford, E. (2000). Socio-Technical Design: An Unfulfilled Promise or a Future Opportunity? in R. Baskerville, J. Stage and J. I. DeGross (editors), *Organizational and Social Perspectives on Information Technology*. Boston: Kluwer Academic Publishers, pp. 33 – 46.
- Mumford E. (2003). *Redesigning Human Systems*. London: IRM Press.
- Mumford, E. (2006). "The story of socio-technical design: reflections in its successes, failures and potential". *Information Systems Journal*, 16(4), 317–342.
- Mumford, E. and Henshall, D. (1979). *A participative approach to computer system design*. Wiley, New York.
- Perrini, F. and Tencati, A. (2006). "Sustainability and Stakeholder Management: The Need for New Corporate Performance Evaluation and Reporting Systems", *Business Strategy and the Environment*, 15(5), 296–308.
- Piotrowicz, W. and R. Cuthbertson (2009). "Sustainability – a new dimension in information systems evaluation". *Journal of Enterprise Information Management*, 22(5), 492-503.
- Porter, M. and Kramer, M., (2006). "Strategy and society: the link between competitive advantage and corporate social responsibility". *Harvard Business Review*, 84(12), 78–92.
- Seidel, S., J. Recker, and J. van Brocke (2013). "Sensemaking and sustainable practicing: functional affordances of information systems in green transformations". *MIS Quarterly*, 37(4), 1275-1299.

- Stowell, A. (2013). "Environmental risk: The impact of the UK WEEE Regulation – an incentive to change occupational practice?" *Meiji Business Review*, 60 (4), 107-121.
- Watson, R.T., Boudreau, M-C. and Chen, A.J. (2010). "Information Systems and Environmentally Sustainable Development: Energy Informatics and New Directions for the IS Community". *MIS Quarterly*, 34(1), 23-38.
- Weick, K. E., Sutcliffe, K. M., and Obstfeld, D. (2005). "Organizing and the Process of Sensemaking". *Organization Science*, 16(4), 409-421.
- Welch, C. and Sadok, M. (2016). "Potential IS Change Analysis: A Sociotechnical Approach", in Proceedings of 24th European Conference on Information Systems, Istanbul, Turkey, paper 181, accessed 23/11/16 at http://aisel.aisnet.org/ecis2016_rp/181/.
- Welch, C., Sinha, T. and Ward, N (2016). "Pursuit of Operational Excellence: a Systemic Approach". *International Journal of Systems & Society* (in press).