

We can't get here from there

Sustainability from complexity vs. conventional perspectives

February 6, 2018 · Practitioner

Dr. Terry Porter¹, Randall Reischer

¹ University of Maine

Porter T, Reischer R. We can't get here from there: Sustainability from complexity vs. conventional perspectives. *Emergence: Complexity and Organization*. 2018 Feb 6 [last modified: 2018 Mar 19]. Edition 1. doi:

10.emerg/10.17357.0d3dd494df633eb4018f6abde38fd3ee.

Abstract

Sustainability problems are today becoming more prevalent, more systemic and more serious than ever before. And they are expanding, from operational inconveniences that could largely be addressed through line-level fixes, to boardroom enigmas and political groundswells that defy traditional boundaries. This paper argues that these shifts in the nature of sustainability problems are highly significant for researchers as well. They indicate that the ontology of sustainability issues is also shifting: it is growing increasingly complex. We can no longer speak meaningfully about social, environmental and economic sustainability issues as isolated, independent incidents. With growing acceptance that “everything is connected to everything else”,¹ we recognize that we must progress beyond sole use of conventional reductionist epistemologies. Growing complexity is not a descriptive term, but rather an ontological watershed between classical Newtonian assumptions of linearity, stability, and reductionistic inquiry on the one hand, and nonlinear, self-organizing, and emergent complexity theory on the other. While readers of this journal are likely to be well aware of these changes, there is value in a careful examination of this apparent shift toward complexity-based inquiry in sustainability research. Indeed, there are dangers in not doing so: not only is conventional research growing more limited for revealing the nonlinear nuances that increasingly make up sustainability problems, but further, it may obscure the actual dynamics and dynamic elements in play in a given situation.² Hence, there is a need to both distinguish the two approaches from each other, and to highlight how each may be better suited to address particular problemscapes, or economic-social-environmental systems situated in space and time.³ This paper attempts to address the above situation in three ways. First, in a brief review of current literature, it finds several types of confusion in conventional research and research calls. Second, it offers a distinguishing framework that clearly differentiates complexity-based sustainability from conventional views, and shows how both are valuable but each is incommensurable. Third, it presents an original, longitudinal and quantitative case study of a sustainability initiative in a UK organization, using competing hypotheses from each perspective. Results are unexpected and anomalous from a conventional perspective, but these “negative” findings may be interpreted as consistent with a complexity perspective on the organization and initiative. In sum, the neoclassical, positivist, and reductionist model of sustainability is certainly not the only, and may not be the best way to study internal organizational shifts towards sustainability. From literature to theory, and theory to practice, it appears that complexity perspectives are fast becoming the “there” needed in sustainability inquiry in order to get to the “here” of today’s sustainability issues and problems.

Literature Review

The research field on sustainability and its close relative, corporate social responsibility, has grown much too large to be addressed in even a birds-eye overview. This paper focuses on one small aspect of this literature, namely calls for new research directions that stem from stated limitations in the findings of conventional positivist research. As suggested in the brief review that follows, there are many records of issues and problems with linear reductionist epistemologies and in explaining and understanding sustainability in organizations. We argue that, in sum, these calls add up to a clamoring for transcendence of the Newtonian perspective, though without specific recommendations as to what this might precisely entail. A close examination of these calls is worthwhile because it leads us to clearly differentiate between conventional linear research and complexity-based inquiry. The following review respects each approach separately, valuing positivist calls on their own merit while also interpreting these same calls from the lens of complexity thinking.

Outcome studies. The sustainability challenge in organizations has been defined as how to meet societal, environmental and economic needs in the present without compromising the ability to meet these needs in the future⁴ This definition supersedes shareholder wealth maximization in both scope and time, in that it encompasses eco-socio dimensions as well as care for unborn generations. Corporate social responsibility is a narrower, firm-specific term that refers to activities that aim to advance a social or environmental agenda beyond the interest of the firm and beyond legal requirements⁵ From these basic definitions we note that sustainability and CSR intrinsically involve multiple aspects and interests, multiple levels of analysis, and multiple time horizons.

An early thrust in sustainability research is that of “outcome studies”,⁶ meaning conventional linear studies of links between CSR/sustainability and a variety of variables. Of greatest interest is firm financial performance, and indeed, several meta-analyses do find a small but positive effect of CSR programs on profitability. For example, Aguinas and Glavas⁷ review of 588

articles and 102 books and book chapters, and Wang *et al.*'s⁶ review of 87 articles “over six decades” of the *Academy of Management Journal* both reached this conclusion. And yet, Pelozo⁸ found 36 different metrics used to assess CSR, and 39 different measures used to measure financial performance, a finding which jeopardizes any claim to inter-study comparability. A further qualification of this genre is that the datasets are firm-level and cross sectional, using large samples of company data to compare predefined antecedents and outcomes.⁶

The linear models and hypothesized relationships inherent in outcome studies are only capable of finding their own presumptions to be supported or not supported; anything outside such models is defined away as “noise” or “externalities.” Yet to the complexity mindset, it is precisely this “noise” that is of the greatest interest. It hints at recursive feedback, nonlinear relationships, processes and influences that make up the very jist of sustainability but that are epistemologically invisible from conventional Newtonian assumptions of linearity, stability, and reductionistic inquiry.

More Complicated Outcome Studies. Outcome-focused research can indicate broad trends in high-level data, a contribution that can potentially help situate more nuanced investigations. But its limits have been aptly captured from within its own perspective:

It's often difficult to observe the effectiveness of CSR efforts, especially in the short term [i.e. cross section]... CSR by nature involves multiple stakeholders and perspectives, which leads to lots of conflict of interest and difficulty for managers in balancing⁶ [comment added].

From within the positivist project, the answer to confusion is often to pursue more of the same. For instance, there are calls to identify mediators and moderators that may be based on personal relationships, values and ethics, mission, motives, location, cost, or context.⁶ Thus, documented evidence has suggested that sustainability is associated with enhanced legitimacy and image, product quality, operational efficiencies, decreased risk, and attractiveness to investors.⁷ At the employee level, it has been found that both personal wellbeing and willingness to invest “discretionary effort” increase when greater attention and effort is put into CSR.⁹

Based on this approach, the search is on for a comprehensive cause-and-effect model that would comprise “*the emerging integrative view of corporate sustainability*”¹⁰ (italics added). This would be a super-contingency model, certainly highly complicated but remaining decidedly linear, reductionist, and rationalistic. For example, Hahn *et al.*¹⁰ propose a massively complicated 3x3x2x2x3 model of contingency dimensions for corporate sustainability activities. At some point, however, contingencies become unwieldy, particularly in an environment of mismatched empirical variables. From this vantage point, complexity thinking may see the contingency project as not only more limited for revealing the nonlinear nuances that increasingly make up sustainability problems, but further, it may obscure the actual dynamics and dynamic elements in play in a given situation.² A further step would be towards more explicitly process-centric approaches, which is barely evident in conventional research: in their massive review Aquinas and Glavas⁷ found this type of approach reflected in only 4% of the papers reviewed.

Beyond Outcome Studies. Among the most interesting aspects of positivist research into organizations and sustainability are calls from within its own boundaries to exceed these boundaries entirely. Some of these calls seek to embed new vistas into conventional approaches, while others suggest leaving linear constrictions completely. There seems to be considerable confusion but on the whole at least a covert recognition of limitations to Newtonian approaches to the complex dynamics of today's sustainability challenges. As articulated by two well-versed authors:

theoretical development in sustainability has yet to yield a model that fully acknowledges...the changing organization-and-environment field and its implications in the long term; the interdependence and integration of relationships of humans, organizations, and society; and the paradoxical demands inherent in a dynamic society.¹¹

This statement locates the current “here” of sustainability issues in “interdependence,” “integration,” and “paradoxical demands,”—all of which herald complexity theory—yet its stated desire for “a model” (italics added) is ontologically impossible from a complexity perspective. Similarly ambiguous is the call to integrate conceptual streams, understand underlying mechanisms, conduct more individual-level studies, move beyond cross-sectional sampling, include more qualitative studies, pursue “microfoundations” research, and study underlying processes.⁷ This extensive call aims for a full recipe of remedies. One interpretation is that it is similar to the mega-contingency solutions, adding further complications to the linear approach, but another is that it hints at nonlinear processes. Whilst surpassing cross-sections and studying underlying processes are not necessarily nonlinear directives in themselves, pursuing them in depth could lead to breaking the strictures of linear cause-and-effect. Likewise, the call to take a temporal perspective and examine the evolutionary interplay of social issues and corporate response” points directly towards complex adaptive systems approaches without naming them as such⁶

Beyond ambiguous references to add complexity dimensions to conventional sustainability research are explicit urgings to step out of conventional standpoints altogether. Smith¹² refers to a need to “change industrial-age mindsets”,¹² and Margolis and Walsh's¹³ call to transcend neoclassical organization and economic theory in CSR research stands as a beacon for complexity

theory today. Starik and Kanashiro¹¹ call for a more circular, evolutionary, dynamic and systemic approach to conceptualization of CSR, none of which is possible in a conventional mindset. And Hull and Rothenberg¹⁴ note in their discussion of limitations and calls beyond their study that their research “doesn’t allow researchers access to the perceptions and other subjective factors that influence managerial decisions”.¹⁴

The issue that seems to be misunderstood in all this research is that Complexity theory assumptions are incommensurable with those of Conventional systems research. The two theories cannot be selectively spliced onto one another. This, because CAS are non-linear, self-organizing, and highly unpredictable. They are continually created in the moment by many types of actors whose directed self-interest brings them into contact with many other actors. The resultant melee is uncontrollable, but regularities do emerge over time through coevolution and emergence.¹⁵ Each system and context is unique, such that generalizing across organizations, geographies, and cultures is not warranted.¹⁶ Most other S management theories are based in just a few disciplines, where clearly the need is for broader-based theorizing that can take in the “multifaceted longterm quality of life aspects” of our wicked problems today.¹¹

Conceptual framework

The brief review above has demonstrated the self-stated limits of sustainability research from conventional linear perspectives. Incompatibility in methods and variables, stubborn searches for the one best contingency model, a lack of closure in static attributions of cause-and-effect, and impossible calls to insert complexity principles into linear epistemologies—all are indicators that the “there” of reductionistic research methodologies has not kept pace with rapid changes to the “here” of sustainability in actual practice. “We can’t get here from there” suggests that we cannot begin to comprehend the “messy” and intertwined realities of sustainability “wicked problems” today with standard boxes-and-arrows thinking. To wit, “...existing management theories may be too simplistic and static to fully explain the complexity (*sic*) of the paradoxical demands inherent in the management of sustainability.”¹¹ (*italics added*). In short, the deterministic project of explaining and predicting consistencies in sustainability outcomes is receding, gradually being subsumed in the conceptual tectonics of complex systems theory, which is nonlinear, spontaneously multidimensional, and coevolutionary.

Elaborate linear models¹⁰ are still linear models, presuming as they do that top down management is possible and feasible with the right input of information. In contrast, Stead and Stead¹⁷ and Smith¹² advance representations of sustainability issues as complex adaptive systems. Figure 1 portrays their ideas as a fluid, ever-evolving system of multilevel, unplanned and unplannable influences ranging from the widest biosphere to the most micro-personal.

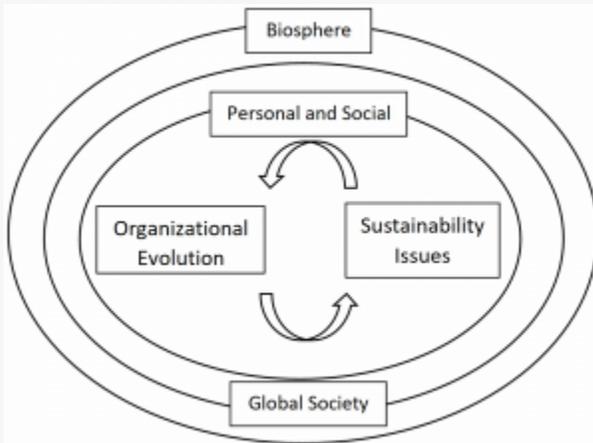


Fig. 1: Sustainability from a complexity theory perspective

Based on Stead and Stead¹⁷ and Smith.¹²

Complexity thinking” has arisen as a descriptor for this new vision of organizational phenomena.¹⁸ Far from a monolithic theory, it is “a particular attitude towards our ideas about the world and the world itself, not a particular tool/method, or even a particular language...rather more sensitive to the complexities that are inherent in daily experience”¹⁸ “Sustainability Thinking”¹⁹ is an extension of complexity thinking that applies this approach to sustainability in organizations. Table 1 is drawn from Porter & Derry’s¹⁹ synthesis of complexity thinking and its application to sustainability.

Table 1

Complexity and sustainability thinking: Principles and research guidelines. ¹⁹	
Complexity Principle	Sustainability Application
Systems. Complex adaptive systems are holistic, nonlinear, overlapping wholes. They are continually in flux, continually becoming. Change is ubiquitous and unpredictable.	Sustainability thinking is dynamic, not static. Longitudinal models and multiple methods are favored, including those of different disciplines. Cross-sections oversimplify, but do provide sometimes-useful snapshot reductions.
Agents. Agents in networks are the unit of analysis, often social and informal. 'Agents' are independent actors who act in self-interest based on local conditions. They may also be non-human.	'Subjects,' 'meanings,' and 'events' are not self-evident, universal, or permanent. Search for and investigate interdependencies and social co-construction of reality.
Self-organization. Nonlinear feedback leads to spontaneous patterning of interaction and organization. Change is unpredictable and may originate anywhere.	Resist oversimplifying models of feedback. Expect the unexpected where it's least expected. Develop tools to identify early markers of transformative sustainability innovation.
Edge of Chaos. Local, unpredictable sites where tensions, conflict, and agitation may be greatest. Network activity is heightened at such loci, spurring active coevolution.	Understand that sustainability adaptations are more likely in sites of heightened stimulation, agitation, and often tension and conflict. Take tensions as a starting point. Seek ongoing processes rather than temporary and transient outcomes.
Co-evolution. Change emerges over time as interacting agents and networks adapt in relation to the perceived adaptations of proximal agents and networks.	Recognize that sustainability adaptations are unplannable because they are not under top down control. Look for anomalous micro-interactions and processes, and observe connections with broader systemic change.
Emergence describes this bottom up process of adaptation and development.	Sustainability cannot be actively "managed" in a conventional sense, but must be allowed for, supported, and generously resourced.

Table 1 makes clear that complexity principles are incompatible with conventional neoclassical thinking and research. In complex adaptive systems, 'externalities' and 'errors' often turn out to be critical components of system functioning, rather than non-factors to be expediently dismissed. They may indicate nonlinear aspects and effects that do not fit a predetermined model but may nonetheless be important to dynamic coevolution, self-organization, and emergent change. Table 1 also indicates how our research approaches are adapting, with many exemplars in the present journal, to gain the ability to see and highlight nonlinear dynamics. As such, we note that conventional systems thinking is often highly complicated, as with detailed contingency modeling, but it is never complex. When complexity is understood as a noun, not an adjective, we come to understand that complexity thinking and conventional hypothesizing can never mix. In the following section we present an empirical example where we attempted to test our arguments.

Case study

The case study for this paper is part of a larger exploratory study of sustainability initiatives in a Welsh public sector organization, made possible by a grant from the US Fulbright Association. Our interest was in employee responses to an internal sustainability initiative that was designed to both enhance employee wellbeing and contribute to societal social sustainability. Given a previous meta-analysis that found a noteworthy scarcity of process-based studies at the employee level of analysis,⁷ we wished to explore potential links between self-reported employee attitudes and sustainability initiatives promoted by the organization.

Based on previous findings using conventional linear modeling, received knowledge suggests that employee attitudes will improve when both inward-facing and outward-facing social sustainability is promoted.^{14,20,21} Hence, competing hypotheses were developed from conventional and complexity perspectives, which enabled us to compare theoretical predictions in a live setting. Our method was to survey employees at three time points relative to the initiative's rollout: as it was beginning (t1), as the rollout ended six weeks later (t2), and one year later (t3). This design is thoroughly situated within conventional linear perspective, but it aims to examine not only whether predicted relationships are supported, but also whether results might suggest an extra-perspective explanation in complexity thinking. Therefore a note of caution is in order: having argued that conventional epistemologies cannot "see" complexity dynamics, we recognize that any potential findings from this study cannot be "verified," but only suggested, from a complexity point of view.

We first queried employees on eight global dimensions of attitudes at work, namely creativity, productivity, collegiality, collaboration, job satisfaction, autonomy, engagement, and positive morale (these numbered 1-8 in sequence). Based on a 5-point Likert scale, employees reported on these attitudes at t1, t2, and t3. Hypotheses were as follows:

Hypothesis 1a: Global attitudes towards work will show consistent linear improvement following a social sustainability initiative.

Hypothesis 1b: Global attitudes towards work will not show consistent linear improvement following a social sustainability initiative.

Secondly, we selected a number of constructs and survey items previously shown to be related to sustainability improvement and asked employees to respond to them on a 4-point Likert scale at t2 and t3. We hypothesized:

Hypothesis 2a: Specific beliefs about work will show improvement following a social sustainability initiative.

Hypothesis 2b: Global beliefs about work will not improve following a social sustainability initiative.

Results. Hypotheses 1 was tested using the chi square test of association. A non-parametric approach was called for due to the small and unequal sample sizes (n=13 @ t1; n=16 @ t2; n=36 @ t3) and the ordinal nature of the data. Results are shown in Figure 2.

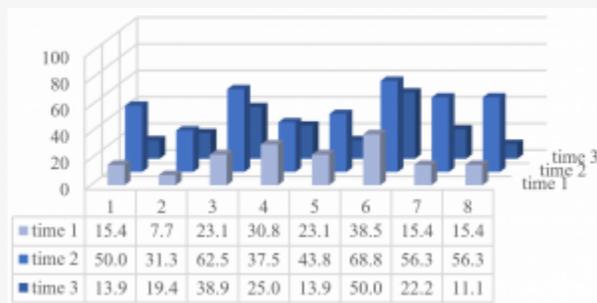


Fig. 2: Bar chart showing global attitudes at work at t1, t2, and t3

These results show that while there was a consistent rise in employee attitudes from t1 to t2, there was no continuing rise from t2 to t3. In fact, between t2 and t3 there was a consistent decrease in employee attitudes toward the workplace. Chi square results show that these changes were significantly different than those which would be expected by chance for five of the eight attitudes assessed: creativity, productivity, job satisfaction, engagement, and morale.

Hypothesis 2 was also analyzed with the Chi Square test, again due to the small and variable sample and the use of an ordinal scale. Table 2 shows the selected constructs and items in the survey. Chi Square results indicate that only two of the 12 items rose significantly between t2 and t3: "If I make plans, I generally succeed in executing them" (#9), and "I do get enough resources to be effective in my job" (after reverse scoring) (#10). The remainder of the items did not show any significant rise or decrease between t2 and t3, which were one year apart.

Table 2

Attitude survey constructs and items previously related to sustainability. ¹⁵ (r) denotes reverse scoring.		
#	Attitude Construct	Item
1	Organizational Identification	I am proud to be an employee of this company.
2		In general, this company's goals are similar to my own.
3		I find that my values and the values of this company are very similar.
4	Sustainability Attitude	I am a person who cares about sustainability.
5		Let future generations solve their own problems. (r)
6		The positive benefits of economic growth outweigh any negative environmental or social impact. (r)
7	Work Stress	I feel there is never enough time to get things done. (r)
8		My work role tends to interfere with my personal life. (r)
9		I do not get enough resources to be effective in my job. (r)
10	Self-efficacy	If I make plans, I generally succeed in executing them.
11		If I have a failure the first time, I keep working at it until it is going better.
12		I am usually able to solve problems well in my life.

As we move on to discussion of these findings we note that space limitations precluded us from presenting the complete study. Fuller details may be obtained from the primary author.

Conclusions and future research

Results of the quantitative case study are mixed. In the first survey and hypothesis, the initial increase in attitudes was indeed expected from the linear viewpoint, but the subsequent and universal decline in attitudes one year later (at t3) was not. It appears there may be some statistically relevant regularity in play that was not captured in our linear model. This “non-result” is interesting from both empirical perspectives: it suggests a further dive into contingency modeling for conventional researchers, but it also suggests that many unclear and dynamic influences may be affecting the relationship between employee attitudes and sustainability initiatives. In other words, findings motivate a totally different inquiry, one that requires more narrow and deeper study of the co-construction of sustainability outcomes amongst individuals, organization, and environment (see Figure 1).

The findings of survey and hypothesis 2 are difficult to interpret. Only two of the 12 attitudes previously linked with sustainability improvement showed a significant increase from t2 to t3. While low power due to small sample size may be involved, we can again imagine that the universe of employee attitudes is much greater and more complex than what can be captured in a small study. These results, while possibly discouraging to the conventional worldview's project of thoroughly mapping the causes-and-effects in sustainability shifts, are eye-opening and beckoning from a complexity perspective. Complexity researchers may take the present study as a tiny snapshot of a complex adaptive system, perhaps suggesting that fruitful further inquiry might begin in the arena of resource provision and employee self-efficacy.

In conclusion, we propose that conventional and complexity approaches are distinct, incommensurable modes of sustainability research. The conventional approach is ideally suited to operations- and firm-level CSR objectives such as resource optimization, initiative implementation, and achievement of tangible objectives. The complexity approach is a window into

intangible but no-less-real relationships in ever-shifting networks. What were once considered isolated problems are now becoming components of complex “problemscapes”;³ static outcomes are becoming pieces of ongoing resilience;²³ and positivist determinism is becoming a limited aspect of complex “sustainability thinking”.¹⁹

Future research. The project for future research from conventional perspectives is to tease out finer and finer antecedents, moderators, mediators, etc. in the search for a one best model. Yet singular use of this approach is useful in achieving temporary outcomes, but is unlikely to lead to new visions and breakthroughs. Complexity researchers, looking ahead, should be inspired by “non-results” in linear research, pointing as they do to the need to dig deeper into the “black box” of subjective, agent-based coevolutionary dynamics. It is important to accept the value of each approach and embrace the tensions between them as a natural starting point. Together they may be considered simultaneously for informative insights and ideas²⁴ In this way, sustainability researchers may gain insights into the new “here” of sustainability issues from a revised and expanded “there” of research perspectives.

References

1. Commoner, B. (1971). *The closing circle*. New York: Random House, ISBN-10: 039442350X.
2. Porter, T., & Zivanovic, A. (2014). Identities and Axes of Tension in the renewable energy industry: A case study of emergence at the edge of chaos. *Emergence: Complexity and Organization*, ISSN 1521-3250, 16(3), 31-64.
3. Seppelt, R., Fath, B., Burkhard, B., Fisher, J., & al., e. (2012). Form follows function? Proposing a blueprint for ecosystem service assessments based on reviews and case studies. *Ecological Indicators*, ISSN: 1470-160X, 21, 145-154.
4. Brundtland. (1987). Report at World Commission on Environment and Development. New York: United Nations. ISBN 3923166-16-8.
5. Jin Suh, Y. (2016). The role of relational social capital and communication in the relationship between csr and employee attitudes: A multilevel analysis. *Journal of Leadership & Organizational Studies*, ISSN: 1548-0518, DOI 1548051816637564 Online First, 1-14.
6. Wang, H., Tong, L., Takeuchi, R., & George, G. (2016). Corporate social responsibility: An overview and new research directions. *Academy of Management Journal*, ISSN: 0001-4273, 59(2), 534-544.
7. Aguinas, H., & Glavas, A. (2012). What we know and don't know about corporate social responsibility: A review and research agenda. *Journal of Management*, ISSN (printed): 0149-2063, 38(4), 932-968.
8. Pelozo, J. (2009). The challenge of measuring financial impacts from investments in corporate social performance. *Journal of Management*, ISSN (printed): 0149-2063, 35(6), 1518-1541.
9. Applebaum, E., Bailey, T., Berg, P., & Kalleberg, A. (2000). *Manufacturing advantage: Why high-performance work systems pay off*. Ithica, NY: Cornell University Press, ISBN-10: 0801486556.
10. Hahn, T., Pinske, J., Preuss, L., & Figge, F. (2015). Tensions in corporate sustainability: Towards an integrative framework. *Journal of Business Ethics*, ISSN (printed): 0167-4544, 127, 297-316.
11. Starik, M., & Kanashiro, P. (2013). Toward a theory of sustainability management: Uncovering and integrating the nearly obvious. *Organization and Environment*, ISSN: 1086-0266, 26(1), 7-30.
12. Smith, P. (2011). Elements of organizational sustainability. *The Learning Organization*, ISSN: 0969-6474, 18(1), 5-9.
13. Margolis, J., & Walsh, J. (2003). Misery loves companies: Rethinking social initiatives by business. *Administrative Science Quarterly*, ISSN: 0001-8392, 48, 268-305.
14. Hull, C., & Rothenberg, S. (2008). Firm performance: The interactions of corporate social performance with innovation and industry differentiation. *Strategic Management Journal*, 29, ISSN 0143-2095, 781-789.
15. Porter, T. (2006a). Coevolution as a research framework for organizations and the natural environment. *Organization and Environment*, ISSN 1086-0266, 19(4), 479-504.
16. Robone, S., Jones, A., & Rice, N. (2011). Contractual conditions, working conditions and their impact on health and well-being. *European Journal of Health Economics*, ISSN (printed): 1618-7598, 12(429-444).
17. Stead, W. E., & Stead, J. (2014). *Sustainable strategic management (2 ed.)*. London: M.E. Sharpe, ISBN-10: 0765635453.
18. Richardson, K. (2008). *Managing complex organizations: Complexity thinking and the science and art of management*. *Emergence*, ISSN 1521-3250, 10(2), 13-26.

19. Porter, T., & Derry, R. (2012). Sustainability and business in a complex world. *Business and Society Review*, ISSN (printed): 0045-3609, 117(1), 33-54.
20. Orlitzky, M., Schmidt, F., & Rynes, S. (2003). Corporate social and financial performance: A meta-analysis. *Organization Studies*, ISSN (printed): 0170-8406, 24(3), 403-441.
21. Sheehan, M., Garavan, T., & Carbery, R. (2014). Innovation and human resource development (HRD). *European Journal of Training and Development*, ISSN: 2046-9012, 38(1/2), 2-14.
22. Porter, T. (2006b). Inside greening: The role of middle managers' strategic processes, attitudes, and behaviors in corporate environmentalism (Ph.D. Dissertation), University of Massachusetts Amherst, Amherst, MA.
23. Walker, B., & Salt, D. (2006). Resilience thinking: Sustaining ecosystems and people in a changing world. Washington, DC: Island Press, ISBN-10: 1597260932.
24. Espinoza, A., & Porter, T. (2011). Sustainability, complexity and learning: Insights from complex systems approaches. *The Learning Organization*, ISSN: 0969-6474, 18(1), 54-72.