

The impact of teaching interventions in education for sustainable development – an experimental case study

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Received: 11.08.2022, Revised: 23.09.2022, Accepted: 23.09.2022

doi: <https://dx.doi.org/10.29015/cerem.957>

Aim: Questionnaire research can be used as a teaching instrument and to measure the impacts of education for sustainable development. This paper presents a case study of a teaching intervention regarding students' perception of operations and (supply) management fragilities, such as dependency on few customers or suppliers; difficult to find employees; and low probability, high impact events for business sustainability. The teaching intervention focused on side effects of innovations, leading to vulnerabilities that can threaten the existence of an enterprise. This research was carried out in the context of the capacity for creating an Early Warning System for small probability, high impact events. The following issues are addressed in the paper: 1). The impact of the teaching intervention on students' perceptions; 2). Differences in perception between non-attending (N = 128) and attending students (pre-test N = 139; post-test N = 119).

Design / Research methods: This paper discusses whether teaching interventions can influence the awareness of fragility issues as well as low probability, high impact events. The case-study is based on an experiment in a marketing course for management students of a large private business school in Wrocław (Poland) in April–May 2019. Before start of classes students filled out a questionnaire (Attending Students). A teaching intervention slide was used in every lecture. At the end of the course, all students (also the students absent during the first classes) filled out the repeat questionnaire. Statistical analysis was carried out whether there were differences between Attending Students filling out both questionnaires, and students only filling out the repeat questionnaire (Non Attending Students).

Conclusions / findings: The findings show that students struggle to grasp the complexities and uncertainties surrounding sustainability and fragility issues in relation to the business context. The teaching interventions had limited impact on the ability of students to engage in these issues, albeit significant differences between attending and non-attending students were observed. A limitation of the results is that this study only concerned a case study of a specific group of students. An implication requiring deeper research is that while teachers can do in-depth exercises and provide lectures, a part of the students, being less motivated to obtain knowledge, is unlikely to grasp sustainability issues, when not included in assignments, examination preparation, or compulsory rather than elective courses.

Keywords: education for sustainable development, fragilities, Black Swans, innovation for sustainable development

JEL: I21, O31, Q01

1. Introduction – the importance of teaching interventions in education for sustainable development

In recent decades, Higher Education Institutions worldwide have been called to contribute to education for sustainable development (Lozano et al. 2013), as well as fostering knowledge which can support innovations for sustainable development (Wright 2007; Novo-Corti et al. 2018). However, education as well as innovations for sustainable development may not always be in line with the students' aims and motivations, as well as short term, profit-oriented goals in business. Increasingly, higher education is criticized for its focus on economic objectives, influenced by neoliberalism (Bessant et al. 2015; Nussbaum 2010). As a result, students focus on obtaining a diploma to enter or stay in the labour market (Molho 1997), rather than a broad learning process which enables them to lead meaningful lives (Lambrechts et al. 2018a; Nussbaum 2010). This also contradicts the Sustainable Development Goals (SDGs), as these long-term goals may conflict with short-term, myopic goals of students and companies (Alvesson, Spicer 2012). In the line of Lambrechts et al. (2018a), education for sustainable development aims at “preparing students for wicked problems (Rittel, Webber 1973; Levin et al. 2012) featured by complexity and uncertainty (Lambrechts, Van Petegem 2016), and preparing students to deal with limits to knowledge as well as with the existence of unseen evidence, threatening sustainability in a complex and uncertain world (Kahneman 2011; Taleb 2012).” (quote from Platje et al. 2019).

However, while sustainability is becoming increasingly important in business, traditional business studies focus on neo-liberal paradigms, where ecosystems are considered to be resilient, and growth, technology and innovations are supposed to solve different types of challenges to sustainable development in general, and sustainable business in particular (Gladwin et al. 1995; Carson 2002). This has been outlined by Elkington (2018), who criticized limited approaches of his Triple Bottom Line (TBL), in which the economic dimension overshadow the social and environmental dimensions. Instead, more holistic and systemic interpretations are called upon, that critically question the growth-oriented economic systems (Mitchell et al. 2020). It is hardly considered that markets and the business environment are more random and volatile than is often presented in mainstream business approaches (Mandelbrot, Hudson 2008), while the solution to a certain problem of challenge (e.g., an innovation), through dynamic effects are likely to cause new challenges to the sustainability of business (Sterman 2000; Taleb 2012). In particular when fragilities appear, as focused upon in the teaching experiment presented in this paper, the company becomes more vulnerable to random events, in turn increasing the importance of managing small probability, irreversible high impact events (Taleb 2012; Taleb et al. 2014). Awareness of this issue is a pre-condition for dealing with potential threats, and eventually applying the precautionary principle (Rao 2000).

The focus in this paper is on whether teaching can influence the awareness of fragility issues as well as low probability, high impact events, by means of an experiment in a marketing course for management students of a large private business school in Wrocław (Poland) in April–May 2019. Business students have been described in the literature as being strongly focused on economic gain and bottom line thinking, yet recent studies added nuance to the debate, describing different segments when it comes to perceptions regarding sustainability (Lambrechts et al. 2018b) and pro-environmental behavior (Caniëls et al. 2021).

The following issues are addressed in the paper: 1). The impact of the teaching intervention on students' perceptions; 2). Differences in perception between non-attending (N = 128) and attending students (pre-test N = 139; post-test N = 119); 3). The acceptance of increased fragilities in the company due to innovations, and the implication for innovation for sustainable development.

2. Theoretical framework

The sustainability of many systems, including industries and business, is challenged by increased interconnectiveness in the global economy (Taleb 2012). Also, social and ecological systems are more interconnected due to increased trade flows, increased travel opportunities, etc. (Harari 2015). This process adds to the complexity of global supply chains, and increases the importance of unexpected events appearing (Casti 2013; Taleb 2012), which may threaten business sustainability in case of existing vulnerabilities or fragilities. While research on these issues has been presented in the last decade, the COVID-19 pandemic was a clear example and reminder of how fragile global economic systems are, pointing towards the importance of resilient supply chains (Linton, Vakil 2020). As a consequence, the identification of such fragilities or vulnerabilities becomes more and more important. Thus, it becomes important to prevent or reduce ignorance of potential low probability threats that can threaten the viability and sustainability of enterprise (Amoyette et al. 2014). This can be expressed by the level of functional stupidity (Alvesson, Spicer 2012), which, together with awareness of fragilities, worldviews (paradigms, mental models) and trust is a determinant of the capacity to create a so-called Early Warning System (EWS), a kind of “smoke detector” that catches weak signals indicating a potential disaster (Bertoncel et al. 2018). “Early warning systems serve as a key management tool for anticipating potential disasters or other negative events” (Trzeciak, Rivers 2003, cited in Bertoncel et al. 2018: 407).

In order to be able to design, create, implement and use an EWS for unexpected events that may cause irreversible damage, four determinants have been identified (see Platje et al. 2019): Awareness of vulnerability and fragility (Mandelbrot, Hudson 2008; Taleb 2008), functional stupidity (Alvesson, Spicer 2012), general trust (Raiser 1997, 1999) and worldviews (Meadows 1999) expressed by adherence to technocentric paradigm (Gladwin et al. 1995). These determinants are presented in Table 1, together with the effects as well as the questions asked in the questionnaire. The teaching intervention concerned a) awareness of fragility issues, and b) low probability and high impact events as an element of (lack of) functional stupidity, as

this fits in the existing curriculum of the course. Worldviews are not dealt with in this paper.

Table 1. Determinants of the capacity to create an Early Warning System (EWS)

Determinants of EWS and possible effects	Questions asked in questionnaire
<p>a. Awareness of fragility issues, a vulnerability that may lead to a serious crisis or (irreversible) collapse scenarios.</p> <p>Awareness of a problem is a part of the solution (Taleb 2012), and supports the development of an EWS for unexpected high impact, irreversible events (Black Swans – Taleb 2007).</p>	<p>A1. It is no problem for a company when it is dependent on one or a few main suppliers.</p> <p>A2. It is no problem for a company when it is dependent on one or a few customers.</p> <p>A3. It is no problem when the innovations of a company make the management more complex.</p> <p>A4. It is no problem when innovations of a company increase the reliance on high skilled, difficult to find employees.</p> <p>A5. It is no problem when the innovations of a company make it reliant on one or two suppliers.</p> <p>A6. It is no problem when the innovations of a company make it reliant on one or a few customers.</p> <p>A7. It is no problem when a company depends on high skilled, difficult to find employees.</p>
<p>b. Functional stupidity.</p> <p>If the lack of capacity or willingness to use and apply knowledge (Alvesson, Spicer 2012) and to deal with uncertainty as well as small probability, high impact events in decision making.</p> <p>Functional stupidity means „an absence of reflexivity, a refusal to use intellectual capacities in other than myopic ways, and avoidance of justifications” (Alvesson, Spicer 2012: 1188).</p> <p>Mistakes are not a source of knowledge, and may accumulate into different kinds of vulnerabilities / fragilities unnoticed by the management, The higher the level of Functional Stupidity, to lower the capacity to create an EWS.</p>	<p>B1. It is no problem when a company ignores threats to its existence which are difficult to quantify.</p> <p>B2. It is no problem when a company ignores low probability threats</p> <p>B3. A company should take unlikely disasters into consideration in crisis management.</p> <p>B4. Companies can neglect low probability threats in their risk management.</p>

Table 1. Cont.

<p>c. General trust and process based trust. General trust exists when we trust unknown people or institutions. Process-based trust relates to trust appearing through repeated contact with people we know directly (Raiser 1997, 1999). A high level of general trust increases the ability to react to unexpected events, as well as the absorption of information and knowledge. Process-based trust can lead to the development of groups and networks closed to new ideas from outside (Raiser 1997, 1999), increasing the transaction costs of finding solutions in case of a crisis.</p>	<p>General trust: C1. In general, people can be trusted. Process-based trust: C2. In general, lecturers at our university can be trusted. C3. In general, students at our university can be trusted. C4. In general, my class mates can be trusted. C5. In general, businessmen can be trusted.</p>
<p>d. Adherence to the technocentric paradigm. Technology and economic growth are supposed to enable solutions for all types of challenges and crises (Gladwin et al. 1995). As low probability, high impact events are considered to be irrelevant or non-existent, they are likely to be ignored and an EWS may be considered unnecessary.</p>	<p>D1. Technology will solve eventual problems with energy supply in the future. D2. Innovations and development of technology will solve problems with environmental pollution and overuse of natural resources.</p>

Source: adapted from Platje (2019); Platje, Zepeda (2019); Platje et al. (2019), based on Alvesson, Spicer (2012); Gladwin et al. (1995); Taleb (2012); Mandelbrot, Hudson (2008).

3. Methodology and hypothesis regarding the teaching intervention

One element of this research is the issue of non-attending students. In theory, students should be eager to obtain knowledge, and be motivated to obtain skills and abilities for dealing with issues of sustainable development. However, there may be different problems with this. While the student may, for example, be motivated to obtain skills and knowledge, the priority may be income and opportunities in the labour market (e.g. Becker 2009). While not all teachers and scientists are interested in developing knowledge, but just doing a job which gives them income (e.g. Smith [1776] 1998), also students may have weak motivation in obtaining knowledge, and rather focus on passing exams in order to obtain a diploma (e.g. Molho 1997). In the experiment this is addressed by researching students attending and students not attending classes, but taking part in the final examination. For the aim of the research, the following hypotheses have been formulated:

Hypotheses 1. There is no impact of the teaching intervention on the students' perception.

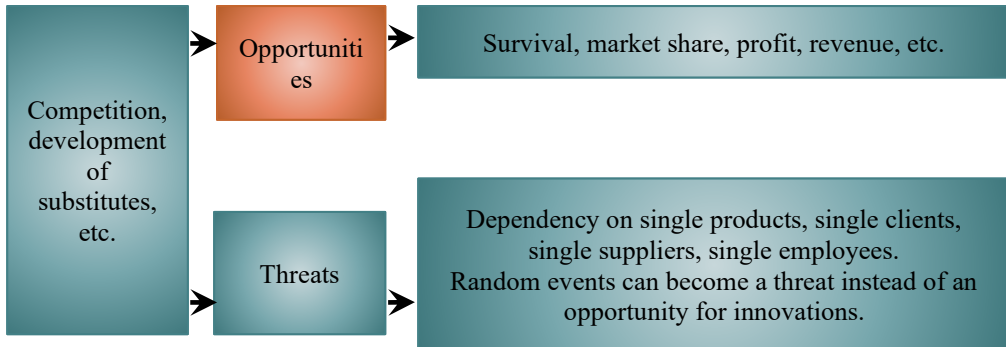
Hypothesis 2. Attending Students perceive fragilities and low probability, high impact events as more problematic than Non Attending Students (NAS).

The research was carried out in 2018 during a marketing course for first year management students at a large private university in Poland. The research was conducted as follows. At the beginning of the course, all attending students filled out the questionnaire. The questionnaire contained 44 statements, of which 19 were relevant for the teaching experiment. Each student received an individual anonymous code, which should be used when filling out the repeat questionnaire at the end of the course. Some credit points could be earned for delivering the repeat questionnaire, also for those who did not fill out the questionnaire at the beginning of the course (the absentee group). As all students attending during the last meeting obtained some credits, and the questionnaire was collected in bulk, anonymity was assured.

Two groups were considered for analysis: Attending students (AS) and non-attending students (NAS). The students who filled out the initial questionnaire and the repeat questionnaire were assumed to be the attending students, while those who only filled out the repeat questionnaire were assumed to be rather non-attending students. The explanation for this is that there were only 3 lectures, each 90 minutes, as a general introduction to more in-depth exercise groups. In each lecture, a teaching intervention was conducted by one of the co-authors, using the slide presented in Figure 1. Focus was on innovations and innovation management, and the potential advantages and threats of such innovations for sustainable development. This issue fit in the curriculum of the course.

The main line of thought in this study is whether students can imagine that innovations and solutions for existing problems may lead to new problems, potentially threatening business sustainability and survival? In other words, do they consider the appearance of fragilities, making a company more vulnerable to random events, causing potential non-linear, irreversible damage? (Platje et al. 2019; Taleb 2012).

Figure 1. Slide used for teaching intervention – topic Innovation Management



Source: prepared by Johannes Platje and Markus Will.

The reason the topic of innovation management was focused upon, is that it is not only an important element of the large majority of business studies, but also supposed to be important in achieving sustainable development as Goal 9 of the Sustainable Development Goals (SDG) is: “Build resilient infrastructure, promote sustainable industrialization and foster innovation.”¹ It is stated that: “Technological progress is the foundation of efforts to achieve environmental objectives, such as increased resource and energy-efficiency. Without technology and innovation, industrialization will not happen, and without industrialization, development will not happen.”² It seems that innovation and technological progress is considered to be a precondition for sustainable development, as they allow for industrialization, which is a precondition for achieving economic growth (Schumpeter 1942; Jacobs 1986), and in turn social and economic goals of sustainable development. This seems to be in accordance with the techno-centric paradigm (Gladwin et al. 1995), where growth and technological progress are assumed to solve all kinds of environmental problems.

While innovation is important for the viability of business (the opportunities shown in Figure 1 focus on this issue), the presented threats go beyond standard risk of failure. Even when innovations seem to be successful, different, often unexpected,

¹ <https://www.un.org/sustainabledevelopment/infrastructure-industrialization/> Goal 9: Build resilient infrastructure, UN Sustainable Development Goals: Goal 9 – promote sustainable industrialization and foster innovation [14.09.2019].

² Ibid.

side effects may appear (Jevons 1906; Sterman 2000; Taleb 2012). First of all, different fragilities may appear, like increasing reliance on a few suppliers, customers or employees. At this moment, random events in the external environment may lead to a threat for the company (Taleb 2012). Innovation seems to be a kind of “mantra”, a solution to all types of problems. This was expressed in the questionnaire research by questions whether innovation and technology can solve problems with energy supply in the future, and can solve appearing environmental problems as well as overuse of natural resources. This raises the question, in case of existing fragilities in a system (e.g., dependency on a specific energy source), what would happen when new technology appears too late. This line of thinking concerns scenario thinking, according to the question “What’s the worst that could happen” (Craven 2010). Besides fragilities, another issue is whether a technological fix for a certain problem creates another problem, whether this problem is manageable, or can create a threat to the existence of a system or an organization.

4. Results and discussion

Having a picture of the student’s profile can be useful for preparing classes, in order to find a focus for in class discussion. When knowing the perceptions of the students, information is available about which issues may be controversial, and which issues may need special attention. The students in our sample were first year students of management of a large private business university in Poland, who have a (often full time) job and study during the weekend. Compared to a group of logistics students, where a teaching intervention on sustainable transport systems was carried out in 2018 (Platje et al. 2019), the students show a different profile. Analysis of questions on elements of functional stupidity (not further discussed in this paper, but relevant for future teaching interventions) shows that reflexivity (the possibility to doubt and criticize management decisions in a company; openly discussing changes in the rules in a company) and justification (management explaining their decisions; providing feedback) (Alvesson, Spicer 2012) are perceived to be more important for management students than for logistics students. While in both groups the lack of

reflexivity and justification is seen as problematic, the issue may require more attention for the logistics students when dealing with management of innovations for sustainable development.

Analysis of the Attending Students (AS) and Non-Attending Students (NAS) of the experiment discussed in this paper, indicates that the groups differ. However, this difference is only significant regarding the need to provide feedback. On a Likert-item scale from 1-5, where the statement was assessed whether something is not a problem (1 – totally disagree, 5 – totally agree), the mean for NAS was 1.82, and for NA 1.39 in the pre-test and 1.51 in the post-test, both showing a significant difference with the mean for NAS.

The level of trust was measured in the pre- and post-test. No significant difference was observed neither between the pre- and post-test for AS, nor between AS and NAS (Table 2). General trust is low, as can be expected as Poland is rather a low-trust society (see, e.g. Kochanowicz 2004). On a scale from completely disagree (1) to 5 (completely agree) to the statement “In general, people can be trusted”, the mean for the three groups ranges from 2.51 to 2.69 (Table 2). No significant difference was observed. General trust is correlated for all three groups with other types of rather process-based trust in lecturers (correlation coefficient (Kendall’s Tau) ranging from 0.226 to 0.436), students at the university (correlation coefficient ranging from 0.290 to 0.399) and class mates (correlation coefficient ranging from 0.274 to 0.340) at a significance level ($p < 0.001$). Trust in lecturers (mean ranging from 3.65 to 3.75) and class mates (mean ranging from 3.62 to 3.66) is medium high, while students at the university are a bit trusted. Trust in Businessmen is rather low (mean ranging from 2.35 to 2.67). Regarding AS-pre and AS-post as well as NAS, no significant differences were observed between the means at $p < 0.001$

A possible implication is that the relatively high trust in lecturers and classmates is a factor supporting the educational process. The low general trust and trust in businessmen can be a factor hampering the process of innovation for sustainable development, as this may hamper cooperation and information flows. These issues can be a good topic for discussion in class on managing innovations for sustainability.

Table 2. Trust – means and standard deviations

	AS pre	Standard Deviation	AS post	Standard Deviation	NAS	Standard Deviation
C1. In general, people can be trusted.	2.51	1.11	2.69	1.09	2.62	1.05
C2. In general, lecturers at our university can be trusted.	3.75	0.764	3.73	0.685	3.65	0.947
C3. In general, students at our university can be trusted.	3.24	0.879	3.32	0.834	3.36	0.990
C4. In general, my class mates can be trusted.	3.66	0.856	3.63	0.809	3.62	0.980
C5. In general, businessmen can be trusted.	2.35	0.847	2.49	0.859	2.67	0.952

Source: authors’ own research.

AS pre = Attending Students pre-test; AS post = Attending Students post test; NAS = Non Attending Students

As innovations tend to produce side effects, the following statement was formulated “The world increases in complexity so fast, that increase in knowledge cannot keep up.” The means ranged from 3.02 for NAS to 3.16 for AS-pre and 3.36 for AS-post, i.e., neither agree, nor disagree. While there is no significant change between the pre- and post-repeat groups, after finishing the course, the repeat group shows a significant higher agreement with the increasing complexity-knowledge gap than the non-repeat group. This brings forward a hypothesis to be tested in future research: class attendance leads to recognition of an increasing complexity-knowledge gap. However, no significant correlation with other statements were observed.

An issue is whether increasing complexity due to innovation is considered to be problematic (question A3). While the mean respondent tends to see this as neither problematic, nor unproblematic, increasing complexity is considered to be more problematic by the post-repeat group after the teaching intervention. In order to assess whether innovation leads to higher acceptance of increasing fragilities questions were

asked whether dependency of a few suppliers, customers and high skilled, difficult to find employees is problematic. Additionally, it was asked whether increase in such dependency is problematic. The results are presented in Table 3. The teaching intervention does not show a significant impact at a level of significance of $p < 0.01$. However, except for dependency on suppliers (A1 and A5), the AS group perceives increasing management complexity and dependency on a few customers or employees as more problematical than NAS.

Another issue researched was the awareness of so-called Black Swans, i.e., low probability, high impact events (Taleb 2007). A distinction was made between difficult to quantify threats (B1) and low probability threats (B2, B3 and B4). While questions B1 and B2 focus on ignorance of threats, questions B3 and B4 concern the inclusion of threats into risk and crisis management. The following results were obtained:

- Both AS and NAS consider ignorance of Black Swans as problematic. No significant difference was observed at $p < 0.01$.
- Both AS and NAS think Black Swans should be included in crisis and risk management.
- The teaching intervention only had a significant impact on question B2 (a significant difference between AS pre and AS post at $p = 0.002$; a significant difference between AS post and NAS at $p = 0.022$).
- The notion “crisis management” in question B3 seems to increase the willingness to include low probability threats in crisis management, compared to risk management mentioned in question B4. This may imply that framing Black Swans properly may be of importance in order to have it considered in company management.

Table 3. Fragilities – means and standard deviation

	AS pre	Standard Deviation	AS post	Standard Deviation	NAS	Standard Deviation
A1. It is no problem for a company when it is dependent on one or a few main suppliers.	2.28	1.04	2.03	0.872	2.50	1.09
A2. It is no problem for a company when it is dependent on one or a few customers.	2.05	0.942	1.95	0.889	2.50	1.17
A3. It is no problem when the innovations of a company make the management more complex.	2.84	1.15	2.46	1.08	2.86	1.18
A4. It is no problem when innovations of a company increase the reliance on high skilled, difficult to find employees.	2.77	1.07	2.55	0.883	2.71	0.951
A5. It is no problem when the innovations of a company make it reliant on one or two suppliers.	2.29	0.934	2.27	0.885	2.74	0.970
A6. It is no problem when the innovations of a company make it reliant on one or a few customers.	2.29	0.900	2.25	0.885	2.82	1.00
A7. It is no problem when a company depends on high skilled, difficult to find employees.	2.41	0.938	2.41	0.994	2.78	0.997

Source: authors' own research.

AS pre = Attending Students pre-test; AS post = Attending Students post test; NAS = Non Attending Students

Table 4. Awareness of Black Swans

	AS pre	Standard Deviation	AS post	Standard Deviation	NAS	Standard Deviation
B1. It is no problem when a company ignores threats to its existence which are difficult to quantify.	1.84	0.738	1.84	0.830	1.97	0.894
B2. It is no problem when a company ignores low probability threats	2.45	0.973	2.14	0.887	2.45	1.08
B3. A company should take unlikely disasters into consideration in crisis management.	3.62	0.856	3.50	0.857	3.40	1.02
B4. Companies can neglect low probability threats in their risk management.	2.67	1.00	2.68	1.08	2.85	1.03

Source: authors' own research

AS pre = Attending Students pre-test; AS post = Attending Students post test; NAS = Non Attending Students

5. Conclusion

The research focuses on 1) the impact of the teaching intervention on students' perceptions, and 2) Differences in perception between non-attending (N = 128) and attending students (pre-test N = 139; post-test N = 119). Hypothesis 1 was confirmed, as hardly any significant teaching effect has been observed. This may imply that in-depth assignments and system approaches are rather necessary for a change in perceptions (Platje et al. 2019; Ng, Burke 2010; Beck 2017), and messages have to be repeated in order to be understood.

However, significant differences were observed between attending students and non-attending students. While this result should be treated with care, as it only concerns one case study of a specific group of students. It may imply that while teachers can do in-depth exercises and provide lectures, a part of the students is

unlikely to grasp sustainability issues, when not included in assignments, examination preparation, or compulsory rather than elective courses. In other words, the success of a teaching approach is likely depending on the approach in the course/curriculum, as well as the motivation of students (compare Molho 1997), an issue which needs more attention and deeper research.

References

Amyotte P., Margeson A., Chiasson A., Khan F. (2014), There is no such a thing as a Black Swan process incident, Hazards 24 Institution of Chemical Engineers Symposium Series, 7–9 May 2014, Edinburgh, pp. 12–21 [non refereed conference paper].

Alvesson M., Spicer A. (2012), A stupidity-based theory of organizations, “Journal of Management Studies”, vol. 49 no. 7, pp. 1186–1220.

Beck H. (2017), *Irren ist nützlich*, Carl Hausner Verlag, München.

Becker G.S. (2009), *Human capital: a theoretical and empirical analysis, with special reference to education*, University of Chicago Press, Chicago.

Bertoncel T., Erenda I., Pejić Bach M., Roblek V., Meško M. (2018), A managerial early warning system at a smart factory: an intuitive decision-making perspective, “Systems Research and Behavioral Sciences”, vol. 35 no. 4, pp. 406–416.

Bessant S.E., Robinson Z.P., Ormerod R.M. (2015), Neoliberalism, new public management and the sustainable development agenda of higher education: history, contradictions and synergies, “Environmental Education Research”, vol. 21 no. 3, pp. 417–432.

Caniëls M.C., Lambrechts W., Platje J., Motylska-Kuźma A., Fortuński B. (2021), 50 shades of green: insights into personal values and worldviews as drivers of green purchasing intention, behaviour, and experience, “Sustainability”, vol. 13 no. 8, art. 4140.

Carson K. (2002), *The Iron Fist behind the Invisible Hand: corporate capitalism as a system of state-guaranteed privilege*, Red Lion Press, Nanaimo, BC.

Casti J.L. (2013), *X-Events – complexity overload and the collapse of everything*, Harper Collins Publishers, New York.

Craven G. (2010), *What’s the worst that could happen? A rational response to the climate change debate*, Perigee Book by Penguin Group, New York.

Elkington J. (2018), 25 years ago I coined the phrase “triple bottom line”. Here’s why it’s time to rethink it, *Harvard Business Review*, vol. 25, pp. 2–5.

Gladwin T.N., Kennelly J.J., Krause T.S. (1995), Shifting paradigms for sustainable development: implementations for management theory and research, “*Academy of Management Review*”, vol. 20 no. 4, pp. 874–907.

Harari Y.N. (2015), *Sapiens: a brief history of humankind*, Harper, New York.

Jacobs J. (1986), *Cities and the Wealth of Nations – principles of economic life*, Pelican Books, New York.

Jevons W.S. (1906), *The coal question: an inquiry concerning the progress of the nation, and the probable exhaustion of our coal-mines*, Macmillan, London.

Kahneman D. (2011), *Thinking, fast and slow*, Penguin Books, London.

Kochanowicz J. (2004), Trust, confidence, and social capital in Poland: a historical perspective, in: *Trust and democratic transition in post-communist Europe*, Markova I. (ed.), British Academy, Oxford, pp. 63–84.

Lambrechts W., Van Petegem P. (2016), The interrelations between competences for sustainable development and research competences, “*International Journal of Sustainability in Higher Education*”, vol. 17 no. 6, pp. 776–795.

Lambrechts W., Van Liedekerke L., Van Petegem P. (2018a), Higher education for sustainable development in Flanders: balancing between normative and transformative approaches, “*Environmental Education Research*”, vol. 24 no. 9, pp. 1284–1300.

Lambrechts W., Ghijsen P.W.T., Jacques A., Walravens H., Van Liedekerke L., Van Petegem P. (2018b), Sustainability segmentation of business students: toward self-regulated development of critical and interpretational competences in a post-truth era, “*Journal of Cleaner Production*”, vol. 202, pp. 561–570.

Levin K., Cashore B., Bernstein S., Auld G. (2012), Overcoming the tragedy of super wicked problems: constraining our future selves to ameliorate global climate change, “*Policy Sciences*”, vol. 45 no. 2, pp. 123–152.

Linton T., Vakil B. (2020), Coronavirus is proving we need more resilient supply chains, “*Harvard Business Review*”, 5 March 5, <https://hbr.org/2020/03/coronavirus-is-proving-that-we-need-more-resilient-supply-chains> [22.09.2022].

Watson M.K., Lozano R., Noyes C., Rodgers M. (2013), Assessing curricula contribution to sustainability more holistically: Experiences from the integration of curricula assessment and students’ perceptions at the Georgia Institute of Technology, “*Journal of Cleaner Production*”, vol. 61, pp. 106–116.

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Mandelbrot M., Hudson R.L. (2008), *The (mis)behaviour of markets*, Profile Books, London.

Mitchell A.S., Lemon M., Lambrechts W. (2020), Learning from the Anthropocene: adaptive epistemology and complexity in strategic managerial thinking, “Sustainability”, vol. 12 no. 11, art. 4427.

Molho I. (1997), *The economics of information – lying and cheating in markets and organizations*, Blackwell Publishers, Oxford.

Ng E.S., Burke R.J. (2010), Predictor of business students’ attitudes toward sustainable business practice, “Journal of Business Ethics”, vol. 95 no. 4, pp. 603–615.

Novo-Corti I., Badea L., Mihaela Tirca D., Aceleanu M.I. (2018), A pilot study on education for sustainable development in the Romanian economic higher education, “International Journal of Sustainability in Higher Education”, vol. 19 no. 4, pp. 817–838.

Meadows D. (1999), *Leverage points – places to intervene in a system*, The Sustainability Institute, Hartland.

Nussbaum M.C. (2010), *Not for profit: why democracy needs the humanities*, Princeton University Press, Princeton, NJ.

Platje J. (2019), The capacity of companies to create an early warning system for unexpected events – an explorative study, in: *Lecture notes in computer science*, Nguyen N.T. et al. (eds.), TCCI XXXIV, LNCS 11890, Springer, Heidelberg, pp. 1–16.

Platje J., Will M., Van Dam Y. (2019), A fragility approach to sustainability – researching effects of education, “International Journal of Sustainability in Higher Education”, vol. 20 no. 7, pp. 1220–1239.

Platje J., Zepeda Quintana D.S. (2019), Business sustainability and early warning systems, in: *Encyclopedia of sustainability in higher education*, Leal Filho W. (ed.), Springer Nature Switzerland.

Raiser M. (1997), *Informal institutions, social capital and economic transition: reflections on a neglected dimension*, EBRD Working Paper 25, London.

Raiser M. (1999), *Trust in transition*, EBRD Working Paper 39, London.

Rao P.K. (2000), *Sustainable development – economics and policy*, Blackwell Publishers, Oxford.

Rittel H.W.J., Webber M.M. (1973), Dilemmas in a general theory of planning, “Policy Sciences”, vol. 4, pp. 155–169.

Schumpeter J.A. (1942), *Socialism, capitalism and democracy*, Harper and Brothers, New York.

Smith A. [1776] (1998), *An inquiry into the nature and causes of the wealth of nations*, reprint edited with an introduction by Kathryn Sutherlands, Oxford University Press, Oxford.

Sterman J.D. (2000), *Business dynamics: system thinking and modelling for a complex world*, Irwin / McGraw Hill, Boston.

Taleb N.N. (2007), *The Black Swan – the impact of the highly improbable*, Penguin Books, London.

Taleb N.N. (2012), *Antifragile – things that gain from disorder*, Penguin Books, London.

Taleb N.N., Read R., Douady R., Norman J., Bar-Yam Y. (2014), *The Precautionary Principle: fragility and black swans from policy actions*, Extreme risk initiative – NYU School of Engineering Working Paper Series, <https://arxiv.org/pdf/1410.5787.pdf> [22.09.2022].

Trzeciak S., Rivers E.P. (2003), *Emergency department overcrowding in the United States: an emerging threat to patient safety and public health*, “*Emergency Medicine Journal*”, vol. 20 no. 5, pp. 402–405.

Wright T.S.A. (2007), *Developing research priorities with a cohort of higher education for sustainability experts*, “*International Journal of Sustainability in Higher Education*”, vol. 8 no. 1, pp. 34–43.