SUSTAINABILITY INDICATORS AT THE COMPANY LEVEL: FRAMEWORK AND METHODOLOGY

KOSACKA Monika[1], WERNER-LEWANDOWSKA Karolina[1]

[1]*Poznan University of Technology, Faculty of Engineering Management, Poznan, Poland, EU*

Abstract

Sustainability is a hot issue, implemented at different levels, including whole world, regions, countries, cities / villages and companies. In the presented paper authors are focused on sustainability at the company level, which may be seen as a source of the competitiveness. Running a sustainable business requires appropriate system of measurement, supplying useful information for the decision-makers. Authors choose indicators as a tool for sustainability measurement. In the study, there is presented the method of sustainability indicators system determination at the company level, considering theoretical background of sustainability indicators as well as experts' knowledge.

Keywords: Sustainability indicator, sustainability measurement, sustainable development

1.   INTRODUCTION

Sustainability has become recently an essential topic in many areas. It results in making an effort in translating the theoretical goal of sustainable development (hereafter: SD) raised from Brundtland Report into practical usage at different levels of application. In accordance to the literature review, authors claim that SD has been introduced at five different levels, depending on the scope of impact (**Figure 1**).
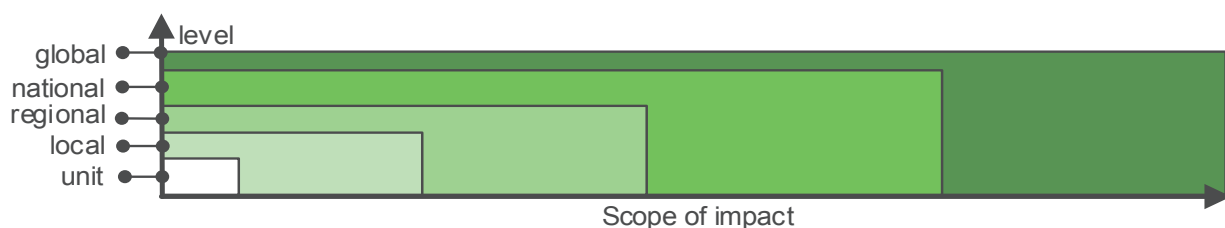

Figure 1 Levels of SD policy application

There are close relationships between levels from the **Figure 1.**The top-level of SD introduction is the global one. All goals defined at this level should be treated as a guide to the activities undertaken at lower levels, in order to meet needs of humanity (material and immaterial) with the use of environmentally friendly technologies what will not stop the development. The first source of guidance in the implementation of SD on a global level was a program document established during the United Nations Conference in 1992, Rio de Janeiro, called Agenda 21. It was intended to involve actions at international, national, regional and local levels, what corresponds with the proposed levels in the **Figure 1.** At the national level, in Poland the SD become included into constitution, gaining the valuable significance. Considering Agenda 21, authors addedd the unit level. It includes company's dimension of SD implementation. According to the literature review, authors claim that researches spent significant effort on the SD issues from the macro-perspective, focusing on the global, national or regional level. Moreover in the global debate on the SD, the universal perspective is dominating,

what results in universal measurement systems for SD assessment designed for countries / regions, without considering the diversity in the field of economic development, the socio-cultural or political conditions. At the same moment it can be observed a positive relationship between company's sustainability and competitiveness of the same enterprise. Sustainability is not a possibility to be more competitive, it becomes a requirement of competitiveness, what is a result of greater awareness of customers and entrepreneurs. Taking that into consideration, authors suggest to start thinking about SD and implementing appropriate activities at the company's level. What is more it should correspond with local, regional and national solutions in order to fulfill global requirements. Nowadays, business success is no longer measured by traditional economy indicators, but sustainability indicators which consider people, economy and ecology aspects of running a business [9, p.132]. With appropriate indicators set, company is able to improve the sustainability. However at first, there should be established set of indicators which allow company to answer the following questions: *What is the actual state? Have we achieved established goals? How do we compare to other companies in the sector?* Selection of the right indicators for sustainability measurement is relevant, because it is better to measure right things approximately than the wrong ones with great accuracy and precision [12].

This paper intends to construct a comprehensive, compact and practical indicator framework for sustainability assessment addressed for company. The objectives are: (1) to identify existing indicator frameworks for companies (2) to define guidelines for company's sustainability indicators development and (3) to establish an indicator selection method for companies.

The remaining part of this paper is structured in the following way. In Section 2 a review on existing sustainability indicator frameworks is introduced. Based on that review, the guidelines for company's sustainability indicators development are proposed in Section 3. Section 4 introduces the recommended method of sustainability indicators determination. The last section summarizes findings and suggests future research directions.

2.   EXISTING SUSTAINABILITY INDICATOR FRAMEWORKS

2.1.   Indicators importance for sustainability measurement

The growing interest in sustainability worldwide during the last two decades, has resulted in a parallel growth in measures of sustainability, usually expressed as sustainability indicators, ratings and indices. Authors reccommend to use iindicators. First of all, they were identified in Agenda 21 as one of the guidelines to measure progress towards achieving sustainability targets and inform decision-makers as well as the public about the current state of sustainability state in a suitable and policy-relevant manner. Secondly, Meadows stated that "*Indicators arise from values and they create values*", what fits well to the SD, the most significant issue worldwide, in authors opinion [7, p. 2]. The meaning of indicators is a result of their possibilities: tracking progress over time, identification of problems, planning future improvements, etc. As it was mentioned in the Section 1 it is problematic to provide a practical dimension to SD concept, although measurement of the sustainability is a great chance for that.

2.2.   Review of existing indicator frameworks

In order to recognize existing indicator frameworks, authors have made the literature review with the use of scientific database - Web of Science Core Collection. The keywords used in the search were subject to the following logic sentence: („sustainability indicator" OR „sustainability assessment"), the search was performed over the title of all publications in the database. Through this search 2033 articles published between till 2016 were found (state on 21.10.2016). Summary of the literature review is presented in the **Figure 2** as a classification scheme for papers regarding sustainability assessment**,** including 3 levels.
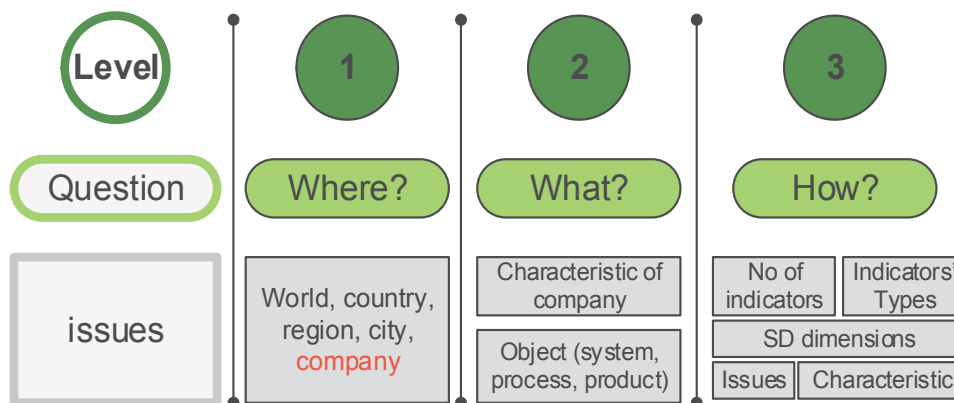
Figure 2 Classification scheme for papers regarding sustainability assessment

The first level in the **Figure 2** is related to the position of the SD policy application (answer for the question: *where*?), what corresponds with **Figure 1.** In order to achieve the goals of this article, obtained publications, were filtered according to their relevance to the sustainability assessment at the company level. Consequently, the second level in the **Figure 2** concerns object of the assessment at the company level (*what?*) including company's characteristic determined by size, sector and type of the company. There are various objects of the assessment, including systems (whole company e.g. [1]), processes (e.g. [3]) and products (e.g. [8]). Considering availavle solutions, they are e.g. dedicated for Small and Medium Size Companies (e.g. [2, 9]), or for companies representing particular economy sector e.g. printing industry [5] mining industry [1], steel industry [6]. According to the **Figure 2**, at the third level, it was time to obtain the answer for question: *How?* That question is related to the following issues related to the indicators: total number of indicators, type, characteristic, issues which they should measure, coverage of SD dimensions (ecological, social, economic).

3.   GUIDELINES FOR COMPANY'S SUSTAINABILITY INDICATORS DEVELOPMENT

Based on conducted literature reseach in **Section 2**, authors defined following guidelines for development of sustainability indicators at the company level:

- *G1:Indicators should be dedicated for the company representing particular sector of a certain size and type, considering aspect of socio-economic terms in the region / country;*

- *G2:Compatibility with requirements of higher levels in application of SD policy;*

- *G3:Limitation of indicators' number ensuring comprehensive approach of all SD dimensions and stakeholders of business;*

- *G4:Indicators'diversification according to the type (quantitative, qualitative).*

- *G5:Use of expert judgement as well as theoretical achievements in the context of sustainability indicators.*

Guidelines no G1 and G2 are related to the issues described in the **Section 1**. Authors pointed out that the number of used indicators should be limited and at the same time it should make possible to ensure comprehensive approach to all SD dimensions considering ale business stakeholders. According to the studied papers, if a set of indicators consists of large number items, there are a lot of confiusions regarding the importance of the indicators as well as the assessment becomes time-consuming. Consequently, enetrpreneurs are not willing to make the assessment. Taking into consideration opinion of Veleva i Ellenbecker [11,p. 523], authors reccomend to use 10-20 indicators. Examining guideline G4, it is suggested to diversify types of indicators in order to make it possible to use in varius conditions. The last recommendation

(G5) is associated with use of experts' insights on indicators because each system is specific as well as indicators available in the literature. In authors opinion, the most well-known and used by researches indicators sets are: Dow Jones Sustainability Index, Icheme Sustainability Metrix, ITT Flygt Sustainability Index, Global Reporting Initiative (GRI), Barometer of Sustainability, Ford Product Sustainability Index (FPSI), etc. They are briefly described and compared in [2, 3, 4 ,6, 9]. Consequently, authors have developed a catalogue of sustainability issues (hereafter: CSI) (**Table 1**):

Table 1 Catalogue of sustainability issues (CSI)

People	Environment	Economy
Working conditions (health and safety, comfort at the workplace, Employee's training and development, equal opportunities);	Materials (use, use of hazardous substances, recycling / direct reuse of products / raw materials);	Company's equipment (accommodation, machinery, tools)
Customer satisfaction	Emissions (CO_2, sewage);	Employment
Employees' participation in decision-making process	Energy (consumption, use of renewable energy sources);	Investments (in technology, Employees, community development)
Support for the local community	Waste (3R scenarios, toxicity);	Quality (defects, customer service);
SD awareness	Water (consumption, re-use)	Economic results (income, expenses)

In the **Table 1** there were presented all sustainability issues which should be covered by indicators used to assess sustainability at the company level, considering all dimensions of SD.

In the presence of the large number of sustainability indicators proposed in the literature, many authors have noted that there is lack of guidance on correct selection of indicators [10]. In order to complete consideration of guideline G5 and to meet mentioned requirement, authors have proposed the following criteria for indicators' selection (Hereafter: CIS), which are creating indicators' characteristic:

- *C1:Accessibility of required data for indicator (easy to identify, without creating demand on additional data)*

- *C2:Comparability of the indicator's results over time (trends) enabling benchamrking*

- *C3:Reliability of supplied trusted and useful information about sustainability state-of-art for decision-makers.*

- *C4:Simplicity in the construction and interpretation of indicator to enable a non-expert the understanding and interpreting it for future decisions*

- *C5:Relevance - indicator is related to an aspect of sustainability that is significant for stakeholders and purposeful for the company with a particular specyfic.*

- *C6:Resistance against confidential data - indicator should not concern data considered as confidential.*

- *C7:Support for application of SD policy in region / country.*

4. SUSTIANABILITY INDICATOR SELECTION METHOD FOR COMPANIES

Considering results of the Section 2 and Section 3, authors have proposed an universal methodology of sustainability indicators determination at the company level (**Figure 3**).
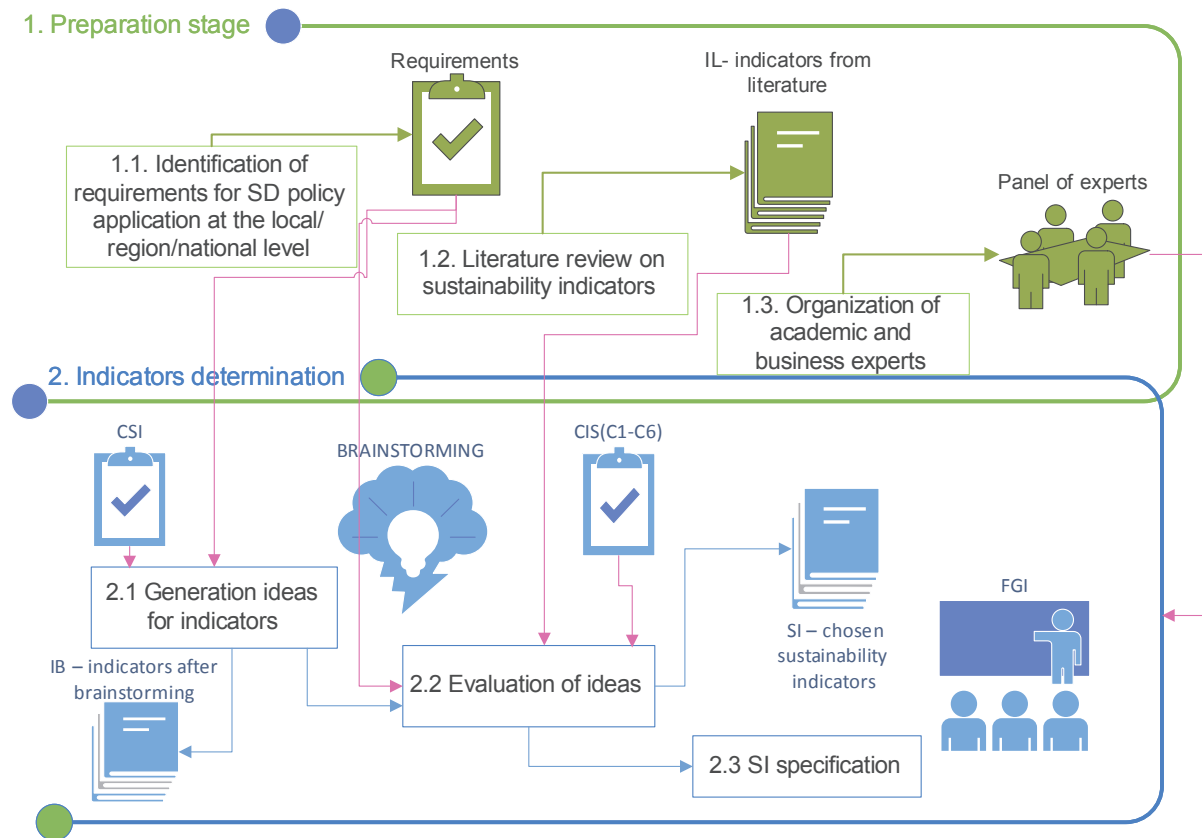
Figure 3 Systematic indicator selection method for companies

Authors recommend in the **Figure 3**, the method of sustainability indicators determination dedicated for a company representing a particular specyfic, in accordance to guideline G1 from Section 3. The method consists of two stages: preparation (1) and indicators determination (2). Introduction of the guideline G5 is manifested by use of set of indicators from the literature (**IL**) as well as indicators obtained from brainstorming session **(IB)** with academic and business experts (2.1) (minimum 10 experts). The key step in the procedure is 2.2, where all ideas of indicators (from literature (1.2) and from creativity phase of brainstorming (2.1)) are evaluated with the use of: requirements expressing adaptation of SD policy application at higher level (region / country) and criteria for sustainability indicators (CSI). Positively verified indicators are creating the set of recommended SI, which should be specified with the following data: formula (quantitative indicator) or assessment base (qualitative indicator), unit, reference value and range of values. Authors suggest to use a Focus group interview (FGI) in order to determine those characteristics of selected indicators. As a result there should be obtained a set of 10-20 indicators appropriate for the company's type, size and sector supporting SD policy application in the region / country.

5. CONCLUSION

To conclude, this paper presented a method for determination sustainability indicators for companies, which provides clear and effective decision-support for sustainability assessment, supporting SD policy application in wide scope of impact. Authors recommend the use of following methods and techniques, including: literature analysis, brainstorming and FGI, although there are no contraindications for use of different experts methods. The most important is to combine theoretic background with experts knowledge and business requirements to make the set of indicator and whole method not only useable but useful. Research will be continued by applying the method of determination sustainability indicators for polish recycling companies. In the next step authors are going to develop a procedure of aggregation indicators into index of sustainability presenting the level of

sustainability of the company. Searching for compromise solution in the proposed method it is also considered an application of stochastic multiple criteria decision aiding procedures (Sawicka [9], Sawicki and Sawicka [10]) as an exemplary application in the field of logistics.

ACKNOWLEDGEMENTS

REFERENCES

[1]   AZAPAGIC A. Developing a framework for sustainable development indicators for the mining and minerals industry. Journal of cleaner production,12(6), 2004, pp. 639-662.

[2]   CHEN D., SCHUDELEIT T., POSSELT G., THIEDE, S. A state-of-the-art review and evaluation of tools for factory sustainability assessment. Procedia CIRP, No 9,2013, pp. 85-90.

[3]   CHEN D., THIEDE S., SCHUDELEIT T., HERRMANN C. A holistic and rapid sustainability assessment tool for manufacturing SMEs.CIRP Annals-Manufacturing Technology, 63 (1), 2014, pp.437-440.

[4]   JOUNG C. B., CARRELL J., SARKAR P., FENG S. C. Categorization of indicators for sustainable manufacturing. Ecological Indicators, No 24, 2013, pp.148-157.

[5]   KINDERYTĖ, L. Methodology of sustainability indicators determination for enterprise assessment. Environmental Research, Engineering and Management, 52(2), 2010, pp.25-31.

[6]   LONG Y., PAN J., FAROOQ S., BOER H. A sustainability assessment system for Chinese iron and steel firms. Journal of Cleaner Production, No 125, 2016, pp. 133-144.

[7]   MEADOWS D.H. Indicators and information Systems for Sustainable Development. Sustainability Institute Hartland, 1998.

[8]   PRODUCT SUSTAINABILITY INDEX, https://corporate.ford.com/microsites/sustainability-report-2013-14/doc/sr13-ford-psi.pdf (13.10.2016).

[9]   SAWICKA H. Artificial Intelligence in Stochastic Multiple Criteria Decision Making. In: Trivedi S.K., Dey S., Kumar A., Panda T.K., (eds.): Handbook of Research on Advanced Data Mining Techniques and Applications for Business Intelligence. IGI Global, 2017, Chapter 19, 25 pages, ISBN: 9781522520313.

[10]   SAWICKI P., SAWICKA H. Logistics Process Improvement Using Simulation and Stochastic Multiple Criteria Decision Aiding. Procedia - Social and Behavioral Sciences, 2014, Vol. 111, No. 5, pp.1142-1154.

[11]   TAN H. X., YEO Z., NG R., TJANDRA T. B., SONG B. A sustainability indicator framework for Singapore small and medium-sized manufacturing enterprises. Procedia CIRP, No 29, 2015, pp.132-137.

[12]   VELEVA V., ELLENBECKER M. A proposal for measuring business sustainability. Greener Management International, Issue 31, 2000, pp. 101-120.

[13]   VELEVA V., ELLENBECKER M. Indicators of sustainable production: framework and methodology. Journal of cleaner production, 9(6), 2001, pp. 519-549.

[14]   VOLLMANN, T. E. The transformation imperative: achieving market dominance through radical change. Harvard Business Press,1996.