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Methodology for Sustainable Resource Management measurement at a company level - case study

Monika Kosacka^{a*}, Karolina Werner-Lewandowska^a

^a*Poznan University of Technology, Faculty of Engineering Management, Strzelecka 11, Poznan 60-965, Poland*

Abstract

The greatest challenge is to translate the theoretical goal of sustainable development into practical usage at different levels of application, including the company level. Sustainability should be managed, what requires appropriate measurement. Consequently, authors define in the paper a concept of the Sustainable Resource Management (SRM) as translation of the sustainability at the company level from the perspective of resources remaining at the company's disposal. The publication presents an universal methodology for measurement of SRM, which was presented in details for polish vehicle recycling company in Poland.

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1. Introduction

The resource context is present for a long time in business management as it is proofed by both - definitions of management (e.g. [1,2]) as well as The Resource-based View (RBV) theory, which examines how resources can drive a competitive advantage. Considering that, authors perceived company by its resources, that are used with the

* Corresponding author. Tel.: +48 61-665-34-14; fax: +48 61-665-33-75
E-mail address: monika.kosacka@put.poznan.pl

aim of achieving organizational goals in an efficient and effective manner, defined and implemented by appropriate management.

Taking into consideration the practical approach to management in the resource based context, it was claimed that one of the major contemporary challenges for the management is Sustainable Development (hereafter: SD). It was assumed that SD is a source of competitive advantage. Therefore, SD should be treated as one of the enterprise's purposes what was presented in the Fig. 1.

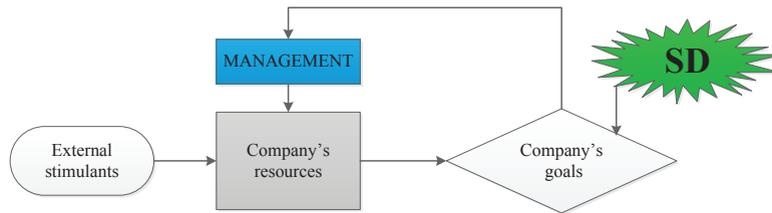


Fig. 1 SD as company's objective [1]

According to the idea presented in the Fig.1, resources are managed in order to achieve established company's goals. Resources are stimulated by some external factors (including politics, economy, competitors, etc.) but also they interact with themselves. Sustainability becomes a hot issue among academics and industry, expected to be introduced in business practice, particularly in company's objectives, as the leading one.

SD is a worldwide concept, which requires activities from bottom to the top, what, in authors opinion should be started at company level (levels of SD application were described in previous work [3]). Nowadays, implementing SD is a necessity, resulting from the law, as well as the effect of increasing people's awareness [4]. Although sustainability is perceived as a source of the competitive advantage for companies [5], authors claimed, that it is mostly considered in the category of global problems (e.g. access to water [6], poverty, quality of soil, air, climate change [7]), which are difficult to refer them to company level. Despite the fact that there is a common approval for SD, there are many problems with the SD term. The most known definition from Brundtland Report [8] is not sufficient, particularly it is worthless in the context of implementation in the business practice [9, p.59-60].

Considering mentioned discomfort associated with SD, authors have made an attempt to translate theoretical assumptions on SD policy realization into practical usage at the company level from the perspective of the owned resources. The research questions are defined as:

- Q1: How to define SD at the company level from the perspective of resources?
- Q2: How to measure SRM?
- Q3: How to improve SRM?

In order to answer the 1st research question the concept of Sustainable Resource Management (hereafter: SRM) was developed. SRM becomes representation of specific approach to all resources promoting SD at the company level (Section 2). As a result of literature review it was discovered that there is a research gap in the field of practical implementation of the SD considering company's resources framework. All works related to the *sustainable resource management* issue are about natural resources e.g. water [10], flora [11], etc., but they do not cover the problem of company's resources management. In order to answer the second and the third research questions, authors propose a methodology of SRM measurement described in Section 3. The originality of the recommended procedure relies on the practical application of sustainability at the company level from the perspective of the resources, what meets the research gap. Authors explain how to determine suitable set of indicators and how to improve obtained results of the SRM ratings.

2. Sustainability at the company level - concept of the Sustainable Resource Management

In order to translate SD concept on the company’s level, considering resources framework, the SRM concept was determined (Fig.2).

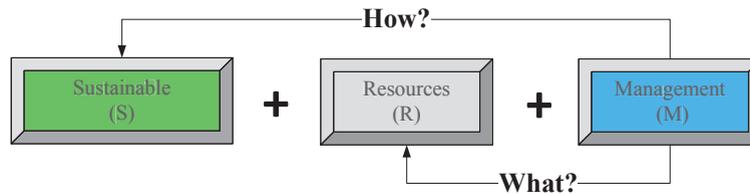


Fig. 2 Idea of the SRM concept

According to the Fig.2, in the center of the SRM concept are resources. With reference to the RBV theory, resources are essential for competitive advantage. Moreover for some type of industries and types of companies (e.g. SMEs) they are limited what makes them crucial. Authors assumed that, resources are *all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness* [12, p. 101].

Table 1: Resources classification [1,12,13]

Natural (N)		Financial (\$)		Physical (P)		Human (H)		Organizational (O)		Relations (with) (R)	
Water	N1	Credit	\$1	Technical	P1	Employees number	H1	Organization culture	O1	Customers	R1
Energy	N2	Cash	\$2					Reputation	O2	Employees	R2
Land	N3	Stocks	\$3	Inventory	P2	Features	H2	Image	O3	Competitors	R3
								Know - how	O4	Government	R4
Animals, plants	N4	Bonds	\$4	Buildings and parcels	P3	Competences	H3	Patents	O5	Local community	R5
Air	N5	Donations	\$5					Organizational structure	O6		
				Technology	O8	Suppliers	R6				
								Trademark	O9		

From the perspective of proposed SRM concept, recognition of resources is required to have a knowledge about the object of management (answer for the question *what to manage?*). Authors have prepared universal resources’ classification for the SRM, considering available approaches, presented in the Table 1.

Authors have identified six general categories of resources (N, \$, P, H, O, R), which were divided into particular types of resources, what was presented in the Table 1. Traditional approach to production factors (including land, labor and capital) was extended with additional resources types, particularly intangible, however all types of resources are equally important and they require proper management. In authors’ opinion proposed resources’ categorization is universal and sufficient for each company in context of SRM. Moreover it becomes a compromise for a number of available approaches to resources.

On the basis of the resources significance, it was claimed that resources are managed (object of management process), as company is managed. The management process should include SD issues with reference to Fig.1, what corresponds with way of the management (answer for the question *how to manage?*).

In authors opinion, adaptation of SD strategy at the enterprise level is a complicated task, but at the same time it is desired. Assuming that resources are used to achieve the established goals, while the realization of the SD concept is

the overriding goal, companies should take some actions which will support implementation of the SD at that level. It refers taking some actions directed to the resources for supporting SD policy realization.

Taking into account all previous consideration, there was prepared the following definition of SRM:

SRM had been adopted as such resource management, that allows company to achieve simultaneously the following objectives (O1 –O3) in a non-confrontational way:

- O1 - improving economic performance,
- O2 - reducing the negative impact on the Environment, in terms of used technologies/manufactured products/provided services, guaranteeing access to the Environment capital for future generations,
- O3 - improve relations (internal and external).

In the SRM concept, there was assumed, that all taken actions will be acceptable by company's stakeholders, what will also comply with the law.

To sum up, traditionally, the leading aim of the company was profit's maximization, affecting all company's activities. Authors proposes replacing the maximization of profit to maximize the SRM rating in order to ensure SD implementation at the company level. Consequently in this section the first research question was answered.

3. Sustainable Resource Management measurement - methodology

The focus of the presented paper is on sustainability application at the company level. Authors claim, that decision makers in the company need information about the current SRM rating in order to take some actions aimed at resources focused on improving obtained assessment results. To get the knowledge about the current SRM rating as well as areas for improvement, the performance measurement system is required. To meet the identified requirement, authors propose a methodology for determination a Sustainable Resource Management measurement, which consists of three main stages (Fig.3):

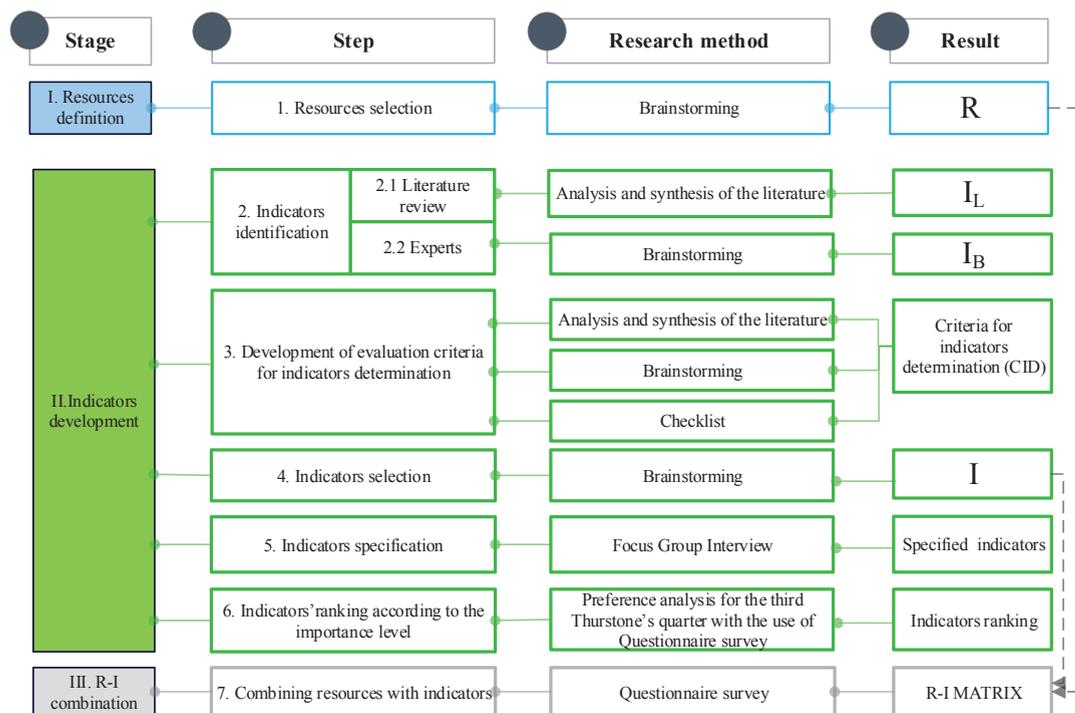


Fig. 3 Approach used for determination SRM measurement

Firstly, the basic set of measured resources is defined. Secondly, the indicators required for the resources assessment are identified. Finally, a SRM performance evaluation matrix is developed, where indicators and resources are brought together in order to define directions of improvement actions. The details of all stages are presented in the following subsections (3.1-3.3).

3.1. Resources definition

In the first stage and the first step of the methodology, there should be established set of resources which will be object of the measurement in the SRM context, using classification of resources developed in the Table 1. Authors recommend to use a brainstorming session including experts from industry and academic to define a set of resources appropriate for the analyzed industry considering type of the company under assessment, and importance of the selected resources in the context of management process.

In the result, the set of the resources (hereafter: R) is defined, which will affect second stage of the proposed methodology.

3.2. Indicators development

Authors recommend indicators use as a measurement tool considering the following arguments [3]:

- Indicators possibilities: tracking progress over time, identification of problems, planning future improvements,
- Guidelines included in Agenda 21 (considered as a program document of SD),
- Importance of the SRM concept, what correspond with the Meadows statement, that *Indicators arise from values and they create values* [14, p.2].

The most important issue at that stage is to define a set of indicators dedicated for the company representing specific industry. It means, that indicators should be *fit for purpose* [15]. As a result of the previous work, authors stated that there are examples of indicators for sustainability measurement, dedicated for specified industry/type of company (e.g. [16,17] etc.), however there was not identified any solution which would consider sustainability measurement at the company level from the perspective of resources (indicators dedicated to company's resources measurement in the context of SD).

In order to define an appropriate set of indicators authors recommend to combine:

- a) sustainability indicators from the literature appropriate for assessment at the company level, particularly in the specific sector which company is representing (hereafter: I_L) – step no 2.1,
- b) indicators determined by academic and industry experts as a result of brainstorming (hereafter: I_B) – step no 2.2.

The final set of indicators should consider achievement of the science as well as practical requirements.

In order to limit the number of used indicators as well as to ensure appropriate indicators' set, authors recommend to define evaluation criteria for indicators in the third step (hereafter: CID), with the use of available solutions (e.g. SMART) as well as experts insight on that issue (brainstorming). The basic requirement was to ensure indicators fit for resources measurement (R). Other guidelines should consider specific of the industry and type of the company (e.g. size). Selected evaluation criteria should be set up in the form of checklist for supporting additional steps in the procedure.

The fourth step's effect was final set of indicators used for SRM measurement (hereafter: I) obtained as a result of brainstorming with the use of CID tool. Authors recommend to limit the total number of selected indicators, because the bigger number of used indicators, the more time-consumed measurement is. Moreover to ensure practical application of the methodology, there cannot be many indicators used. Adopting Veleva and Ellenbecker approach [18, p. 523], authors recommend to use from 10 to 20 indicators.

After indicators selection, the specification of each indicator should be made, considering the following factors [19,p 150]: name, definition, formula/assessment base, unit, reference value, required data. It was proposed to use Focus Group Interview (FGI) to prepare it.

Authors assumed that indicators obtained at previous steps of the procedure, may be characterized by various importance level from the perspective of the SRM measurement. There are variety of possibilities of establishing importance level of each indicator – e.g., the weighted average method, the third quarter preferential Thurstone’s method [20] or the Analytic Hierarchy Process (AHP) [21]. In the presented methodology authors postulate to use the third quarter preferential Thurstone’s method, because of the short time of assessment and low requirements in accordance to the experts number (at least 5 experts). In the result there was prepared indicators ranking, useful in the case of improvement actions’ application in the company directed at increasing the SRM rating. The higher weight of the indicator, the higher priority of the improvement actions is.

High frequency of use brainstorming method in the second stage of the proposed methodology, can be justified by a large number of potential obtained results, however there should participate experts from the industry as well as academic to consider different aspects of the measurement.

3.3. Combining resources with indicators

Information about indicators ranking are important to designate direction of improvement actions, however they are not sufficient from the perspective of the SRM definition presented in the Section 2. In response to that, authors recommend to prepare R-I matrix, where there are indicated connections between resources and indicators used in the SRM, according to the template presented in the Table 2.

Table 2. R-I matrix template

Resource	Indicator			
	I ₁	I ₂	...	I _n
R ₁	0	1	0	0
R ₂	1	0	0	0
...	0	1	1	0
R _n	1	0	0	0

At the crossing of particular row and column there is insert information of the influence of analyzed resource on selected indicator (e.g. R₁ affecting I₂, what was presented by value “1” in an indicated cell in the Table 2). One resource may affect many indicators, one indicator may be influenced by many resources.

In order to define connection between resources and indicators, authors recommend to use questionnaire with the use of traditional binary sets, conducted among experts from industry and academia. The connection should be established in the case of min. 50% of answers for one of possible options (0 – lack of connection, 1 – connection).

In the result of the presented methodology, decision-makers will get the information about direction of their future improvement actions in context of the resources at company’s disposal. It creates a possibility of global improvement of sustainability. As it was mentioned in the introduction it is important issue as sustainability is considered as a source of competitive advantage.

Taking into consideration prepared procedure, in the next section there was presented application in polish disassembling facility as a representative of vehicle recycling sector.

4. SRM application for companies from vehicle recycling sector in Poland – partial results

On the basis of realized project: “Development of indicator sustainability assessment method for recycling company (Project ID: 503226/11/140/DSMK/41)”, authors introduced proposed approach, in the company from vehicle recycling sector in Poland, what was visualized in the Fig. 4.

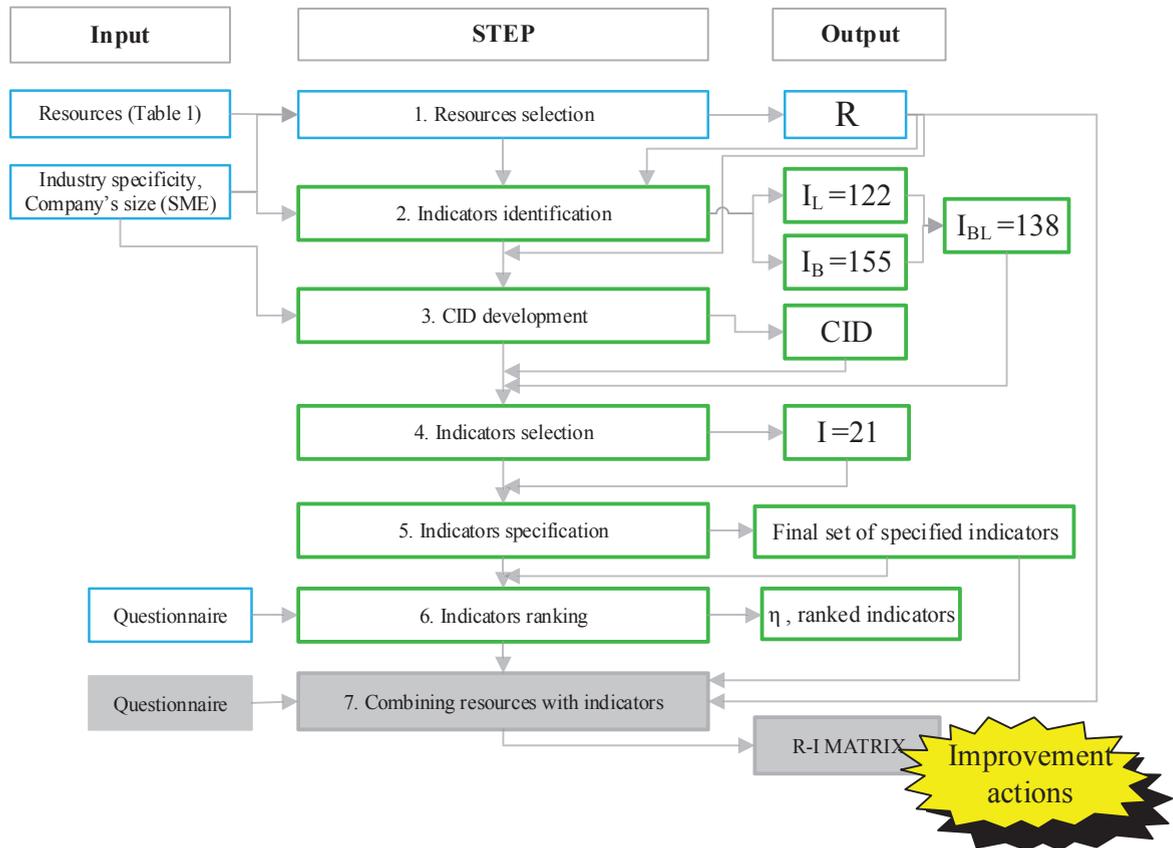


Fig. 4 Determination SRM measurement for vehicle recycling company in Poland

In accordance to the Fig. 4, firstly the set of measured resources was established including: natural resources (N1, N2, N5), physical (P1-P3), human (H1, H3), organizational (O1,O2,O3,O4,O6,O8) and relations (R1-R6). It was a result of brainstorming of 10 experts, from academia and industry discussing all resources types pointed out in the Table 1. The resources N3 and N4 were excluded as a result of law requirements in Poland. All financial resources (\$1-\$5) were not analyzed because experts assumed them as confidential data. Moreover, experts excluded resource H2 as it was assumed that in the methodology there are measured all resources affected by the company. In the context of the organizational resources, experts recognized vehicle recycling sector in Poland deprived of resources O5 and O9. What is more, because of the sector’s specification, it was adopted simplified approach of treating the following resources together: O1&O6 (as O26), O4&O8 (as O48) and O2,O3,O7 (as O237). Consequently, a set of measured resources adequate for the specific industry/sector was defined.

Secondly, there were identified indicators which could be potentially indicators used for SRM measurement (two indicators’ sets: I_B, I_L). During a literature review, which was made at the beginning (described in details in previous work [3]), there were excluded all indicators, which were not adjusted to the specific business, size of the company what was directly related to the evaluated resources selected in the first step. In the result the set of indicators obtained from the literature was partially filtered. The final number of indicators was 122 items.

In order to ensure practical dimension of the proposed methodology, after the literature review of existing sustainability indicators frameworks, there was carried out brainstorming among 10 experts from academia (Poznan University of Technology from various departments) and recycling industry in Poland. The meeting resulted in 155 indicators dedicated for the specified company. At the end of described step, all sets of results (I_B, I_L) were

summarized together into set marked as I_{BL} , obtained as a result of repetitions' elimination (it consisted of 138 various indicators).

In the third step there were defined CID in order to limit the number of used indicators. Authors have made a literature review and brainstorming among the same experts from the last step, to prepare CID. It was determined in the form of checklist with the use of MS EXCEL spreadsheet. The purpose of the tool was to support experts at the next step, to filter results. There were identified following criteria (CID): comparability, simplicity, usability (for decision-makers), dedication for polish vehicle recycling company, using non-confidential data.

In the next step, the final indicators set was selected (I), considering indicators (I_{BL}) and evaluation criteria (CID) with the use of the same experts as before. Because of the large number of verified items, authors have made first selection with the use of prepared tool (CID). During the meeting results of that selection were presented to other experts with discussion. In the result there was obtained final set counted 21 indicators, including e.g. disassembling quality, harmfulness of the End-of-Life vehicle, recycling rate, Employee creativity level, relations with local community, etc.

After a break, experts had a last meeting oriented on determination the specification of each indicator, where they had to decide about the type of indicator (qualitative or quantitative), scale of measurement or assessment formula, reference value, etc. It was deciding for the SRM measurement. There were many discussions, particularly for qualitative indicators related to the scale's definition. At the end there was established compromise, resulting in the final set of defined indicators.

As it was described in the subsection 3.3, in the next step there were prepared questionnaires included list of indicators with descriptions, in order to determine weight of each indicator in the SRM context. However, in the proposed method the total number of obtained questionnaires sufficient for good final result is five, authors assumed that they should have minimum 20 results. The questionnaire was sent via e-mail to 100 experts from academia and industry. In the result there were obtained 22 questionnaires although 20 were correct, and they were object of further analysis. After additional analysis there were obtained weights of indicators which indicates the importance level of each item in the context of SRM measurement, what makes possible to rank indicators from the most important to the less important one. The ranking is pointing out direction of further actions in order to improve value of SRM indicators.

At this moment authors have prepared questionnaire for the last step which is combination of resources and indicators (all white activities in the Fig.4 are ended). It is planned to send it to 100 experts via e-mail in order to prepare R-I matrix. In the future authors plan to determine list of improvement actions which will improve utilization of specified resources in vehicle recycling company.

5. Conclusion

The paper presents the practical application of SD policy at the company level, what might help companies to analyze their situation and to make decisions on how to improve their operations in order to fulfill global requirements of the sustainable policy. The authors discuss the sustainability measurement at the company level by introducing methodology of indicators selection that is meant to be easy to use for practitioners. In order to better understand the methodology, there was presented application in polish vehicle recycling company.

Although in the presented methodology decision-makers get information about resources which require some improvement actions in order to increase value of SRM indicators, there is lack of directions for particular resources activities. It is a result of purpose fitting solution (indicators and resources), what means that firstly, there should be made the performance measurement for SRM for the specific industry, then it would be possible to prepare list of improvement actions dedicated for the particular resources, what is direction for further researches for authors. Authors have chosen vehicle recycling companies as an example for methodology verification because they represent a big market in Poland (country of original to the authors) and which are important manufacturers of automotive parts and accessories in the European Union, as Grzybowska and Kostrzewski [22] claim. Moreover those companies affects people and planet, generating profit.

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