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DIFFERENT FIELDS, COMMON OBJECTIVES – CONNECTION BETWEEN SUSTAINABILITY AND QUALITY METHODOLOGY

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Abstract

Sustainability is a more and more important issue for humanity. The evolution of sustainability models, methods, and indicators has started in the 20th century. One can say that quality management deals with a bit less important issues, but it does so from the first half of the 20th century. However, the two fields have several common points as customers and companies start to recognize the importance of sustainability as well.

Based on these common objectives and other similarities between the two fields, this research tries to start to investigate the common understanding and the current common usage of these areas. Quality management shows how to understand and implement models, tools and nowadays its whole system is a generic, accepted part of the organizations' daily life. Quality management logic (i.e. how to choose the correct and most effective methodology and model to solve the issues; how to apply them) can be a platform to support the implementation of the sustainable development aspects.

1 Introduction

When companies begin to engage in different performance assessments, they are looking for tools to improve performance. They can use several methods depending on what the scope of that particular assessment or improvement is. These varied tools are needed because of the constant change and the expansion of customer requirements and expectations, thinking in systems, and continuous improvement. Thanks to the integrated corporate management systems, it is possible to evaluate each sub-area according to specific regulations and objectives. One of the most important management systems for companies is a quality management system, in which not only sector-specific standards but also, for example, environmental management or occupational safety regulations have been embedded in recent years.

The present study aims to represent a hierarchical structure of quality management-related models, tools. This structure needs to be compared with the tools and models primarily aimed at environmental performance, sustainability, or its measurement and analysis. The objective is to try to establish their relationship with the elements of quality management or how they can be supported by it.

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2 Research

2.1 Definitions and models of quality management

Implementing quality management aspects to the companies' operations is one of the first steps towards satisfying customer and social expectations. When mass production started, it became apparent that the companies need some supporting models and methods. When operations became smooth (or smooth enough), the focus of some models shifted to analyze and understand the customer expectations. Reaching a higher-level customer satisfaction (related to spoken and hidden needs) became highly important, along with building up and developing reliable and standardized processes and continuously improving company operation to perform well in the market.

All the processes and stakeholders of the organizations should be part of the quality management system. The operation should be continuously developed based on the TQM (Total Quality Management) philosophy principles. Applying tools with different complexity (models, methods, indicators) on different levels and for different purposes is necessary. These hierarchy can be seen in Figure 1,

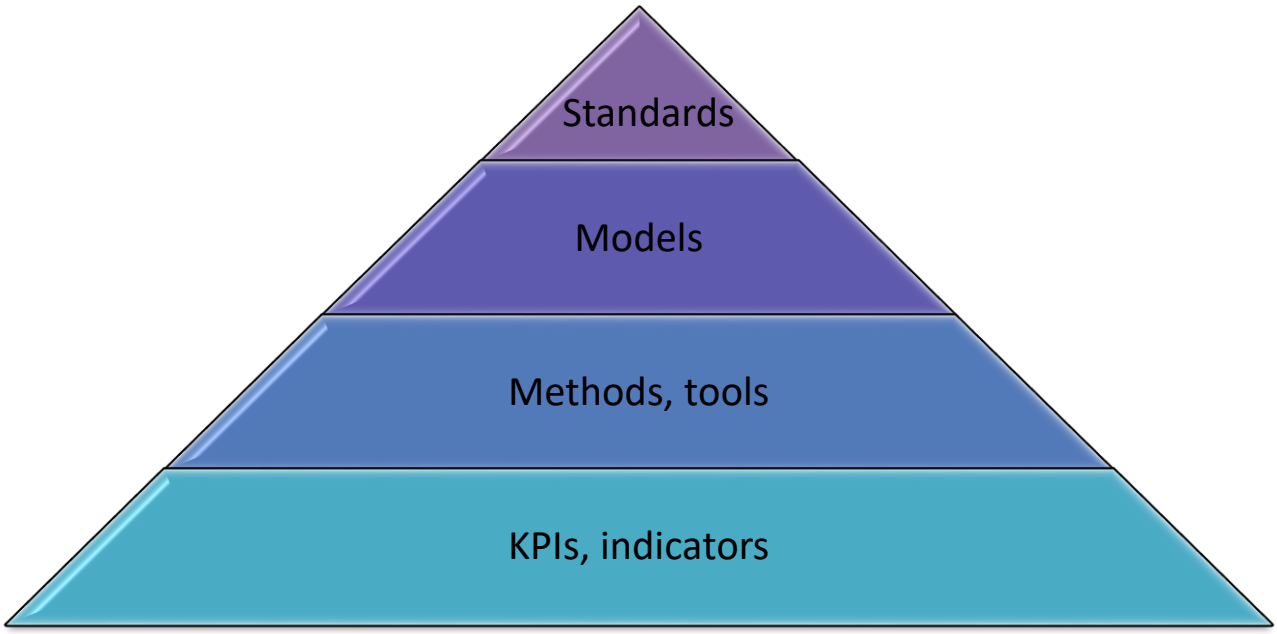

Figure 1. Quality system hierarchy

If we start on the highest level, with standards, one of the most important models or frameworks is ISO standards. The ISO 9000 family can define a basis, a requirement package to implement on the strategic level of the quality management philosophy. The certification of ISO standards ensures that the companies perform in a predefined way from the quality point of view.

Below the standards there are the different models, which are focusing on a specific aspect e.g., on process improvement or on self-assessment. The most popular ones of these models are:

- DMAIC (Define-Measure-Analyze-Improve-Control): process improvement model,
- PDCA (Plan-Do-Act-Check): process development/improvement model,
- EFQM (European Foundation of Quality Management): self-assessment model
- ASPICE (Automotive Software Process Improvement and Capability dEtermination): special process improvement model,
- Six Sigma: process improvement model.

Below the models, we can define methods and tools. They are helping to perform the different activities required by the models, e.g. identify the root cause for problem solving. These elements can be categorized according to their scope or whether they are soft or hard (i.e. how deep mathematical knowledge is necessary to apply them).

Finally, the companies can identify KPIs or indicators to measure the performance of their operation or the progress towards the objective traced by a standard or a model. Measurements and KPIs categorize three types of process performance [1]:

- In-Process performance: Cp, Cpk – process capability,
- Output performance: ppm, number of fully implemented software requirements,
- Outcome performance: related to customer feedback, satisfaction, number of new customer projects.

Quality is about customer needs, but it is important to see that these needs are constantly changing and so all the tools should be changed. New aspects have to be involved, new operations, processes have to be considered while the whole system is changing, and the different elements and levels are affecting each other. Fortunately, quality management is ready (and has the tools) to deal with these problems. For example, with FMEA (Failure Mode and Effects Analysis) quality managers can consider if there are changes in a higher level, there will be changes on each level, so some actions have to be performed on lower levels as well. Beside the complexity of the organizations and their environment, they are constantly changing as well. In this turbulent context, the tools and their focus have to be continuously adapted. Quality management models and methods are up for these challenges as well. Their scopes are expanding, and they are taking into consideration the most important trends [8] e.g., they are dealing with risk assessment (in ISO standards [7] and or in the new FMEA Handbook [6]) or they are considering sustainability issues – as one of today's most important topics.

2.2 Definitions and models related to sustainability

As sustainability is one of the most complex problems of our life, it can be interpreted on many levels. The solution to such a problem needs different tools on the different levels (Figure 2), so sustainability has aspects and methods on several levels. We find a similar approach for structure as in the case of quality management.

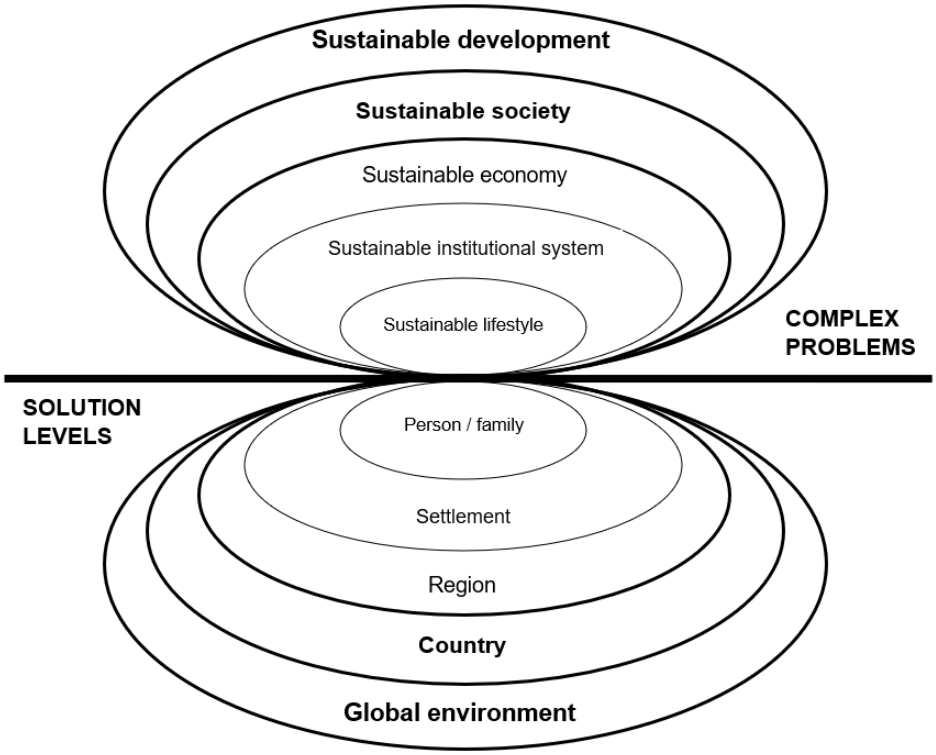

Figure 2. Levels of complex challenges and responses [5].

Today the basis for the whole system is the 17 objectives, the Sustainability Development Goals (SDGs) presented by the United Nations [15]. These aims provide the starting point. These are not simple indicators these represent a global scope on sustainable development level. The

SGUs are focusing on a common aim, but we have to separate it according to Figure 2., on human level and problem level also. Without wishing to be exhaustive, here are some goals as an example:

- Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
- Ensure availability and sustainable management of water and sanitation for all.
- Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.
- Make cities and human settlements inclusive, safe, resilient, and sustainable.
- Take urgent action to combat climate change and its impacts.

To set appropriate environmental policy objectives, it is essential to know the state of the environment as a whole, as a complex system, and thus all its environmental, economic, and social conditions and consequences [4]. For this reason, many models have been developed in the 20th century to describe sustainability. In the mid-1990s, the DPSIR (Driver-Pressure-State-Impact-Response) model appeared as a framework for indicators describing sustainability. [14] This model combines more models to create a much more complex system (see Figure 3). “According to this systems analysis view, social and economic developments exert Pressure on the environment and, as a consequence, the State of the environment changes, such as the provision of adequate conditions for health, resources availability and biodiversity. Finally, this leads to Impacts on human health, ecosystems and materials that may elicit a societal Response that feeds back on the Driving forces, or on the state or impacts directly, through adaptation or curative action.” [3]

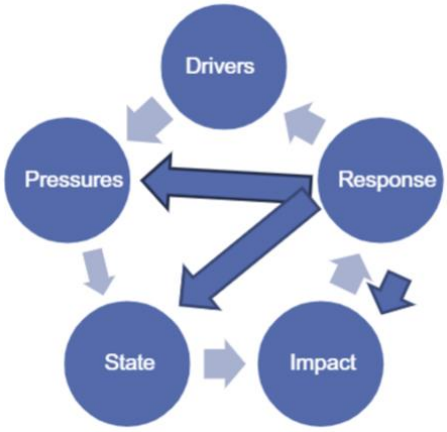

Figure 3. DPSIR model [2].

Following the earlier defined hierarchy, after the frameworks, we have to mention the indicators. First of all: what kind of indicators do we have; and how can we structure and categorize them according to their scope? Smeets & Weterings answered these questions by identifying four groups for the classification of indicators [13]:

- Type A: Descriptive indicators – What is happening to the environment and to humans?
  These indicators describe the situation related to main environmental issues.
- Type B: Performance indicators – Does it matter?
  The scope of these indicators is to measure the ideal (target) and the actual environmental situation. How far are we from the targets?
- Type C: Efficiency indicators – Are we improving?
  They describe the impact and effect of the product and processes and the environment's human activities.
- Type D: Total welfare indicators – Are we on whole better off?

Examining sustainability at the corporate level (for a sustainable economy), we can formulate similar conclusions and expectations. The requirements for companies go well beyond the analysis and incorporation of environmental factors. Sustainability and all related activities are expected, especially for market-leading companies, including environmental assessment of an organization’s processes or an environment-centric approach extended to the entire logistics chain [4].

For companies, the scope is to design, produce parts and services, which can reach customer satisfaction, so characteristics meet the customer needs. Therefore, companies must investigate the sustainability of the process, product, and policy level and the seven resources (energy, material, money, infrastructure, air, water, people), which are defined in the literature [12].

To measure and develop the level of sustainability in the companies, they have to identify KPIs or indicators which can be used in their production/service area. In the phase of identification, the companies have to check if the indicators and the measurements [12]:

- are easy to understand for employees,
- can be calculated by already known methodology,
- are easy to implement into the current company's performance,
- can be used to measure the internal and external environment,
- can be continuously improved.

We need to differentiate the type of indicators according to how we use and how deeply we investigate the system and the aspects [9]. These different groups can help to identify which level is checked with the indicator or what is the scope of it. It helps to understand and use the indicators and indices.

Indicators describe the system's state related to one characteristic. Indicators show how far the current status is from the target state. *Index* is a metric fusing more indicators together. Indices represent a multidimensional view of the system. Indices were developed to support the decision-making. Sets of indicators as indices can highlight the development status of sustainability, the most critical and important aspects of development. There are two types of indices [10]:

- Indicator-based indices: a combination of indicators to check the coherence from process and indicators point of view. E.g.: City Development Index (CDI), Environmental Sustainability Index (ESI).
- Single-Unit Indices: show the connection between economic activities and the environment. E.g.: Ecological Footprint (EF), Water Footprint WF).

One of the most important and popular indices is the Dow Jones Sustainability Indices family. "The DJSI family tracks the stock performance of the world's leading companies in terms of economic, environmental and social criteria, providing investors with objective benchmarks for managing their sustainability investment portfolios" [11].

3 Results and summary

The starting point to understand the environmental aspects and perform the right process steps and measure their performance can be the ISO standards as guidelines. The ISO 14001:2015 (Environmental management systems – Requirements with guidance for use) is one of the basic ISO standards that the companies implement and certify for many years as environment-related requirement collection. This standard is also part of the integrated management system. But according to changing and increasing requirements, expectations, and needs, the companies need to react and improve their systems, processes, performance.

In the case of sustainability, organizations applying ISO started to make arrangements generally according to SDGs [7]. In Figure 4, it is visible that ISO collected and summarized every SDG in a related ISO standard to support the organizations in sustainability point of view.

Figure 4. ISO contributes to all of the Sustainable Development Goals [7]

On the model and method level, it is also essential to consider sustainability aspects. This can be the next step. The companies have to identify the elements of the methods and models, where there is a place for sustainability topics. The standards can show them guidelines t understand and good practices to implement sustainability logic and strategy. Still, on the lower level, there is also a need for a new approach. It is now a fast process, though,

We can see that the change and reaction are started from the quality management side to support the companies to understand and apply the sustainability aspects and requirements in the right way. The way for the full implementation will be slow; however, it is very urgent. With the guide of companies, the implementation on macro-level and micro-level also important. The companies can show an example, and their rules and strategies can be effective also on the "household level."

The key to success is the method of implementation of sustainability aspect, which can match with the companies' current operation. The quality management elements have been a regular part of the operation for many years; therefore, they can help applying sustainability view through its methods and models. The scope of our further research is to find the right and appropriate way for it. The next step in our study is to identify the most popular methods and indicators for sustainability point of view which are used at the corporate level and investigate common aspects of quality management.

Sustainable thinking started on several levels (see Figure 2), but the cooperation and the common toolset, steps, and defined systems are missing now. For such a complex problem as sustainability, we cannot apply only a bottom-up or a top-down strategy. For success, inner motivation is needed for the actors at every level, while higher-level actions are required as guidelines and examples and needed for making effective the whole strategy.

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