Identifying key performance factors for sustainability development of SMEs — integrating QFD and fuzzy MADM methods

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ABSTRACT

It has been confirmed that there exist significant and positive relationships between corporate social responsiveness and profitability. The improvement of sustainability management and performance for a company is an opportunity for a firm’s development and growth rather than a threat. Unlike large companies, it can be more difficult for small and medium-sized enterprises (SMEs) to achieve sustainable enterprises, as shortage of resources is a common feature for most SMEs. Therefore, SMEs should effectively utilize their limited resources and prioritize their performance factors in terms of a balanced scorecard (BSC) approach in elaborating their sustainability development. In order to select important elements in the wide range of sustainability indicators suggested in the literature and launch performance factors for improving the sustainability of manufacturing SMEs, this research utilizes quality function deployment (QFD) approach as the basic structure, in which it combines with fuzzy Delphi method (FDM), modified fuzzy extent analytic hierarchy process (FEAHP) and technique for order preference by similarity to an ideal solution (TOPSIS) method to prioritize the performance factors. This integrated model is able to provide a manager to identify key performance factors and deploy the company’s resources in order to develop the sustainability included in the company.

1. Introduction

An increasingly important recognition is that the economic development of organizations needs to be balanced with environmental protection and social care (Shultz and Holbrook, 1999; Burke and Gaughran, 2007; Diab et al., 2015). Sustainability has become an imperative responsibility for enterprises to survive in the current society due to the threats created by traditional manufacturing practices, and regulations imposed by stakeholders (Barrett, 1994). Therefore, the concept of sustainable development has gradually received attention (Govindan et al., 2013). Sustainable manufacturing implies the creation of products that utilize minimum resources, has minimized negative impacts on the environment and are safe for society at an affordable cost. Thus, enterprises must change the traditional operating model. When considering the company’s strategic direction, they must also incorporate the subject of sustainable development into the strategic analysis (Amrina and Yusof, 2011).

SMEs normally participate as supplier of the supply chain systems of large companies in many industries. Unlike large companies, who have prepared for appropriate management approaches to sustainability development, SMEs need a framework allowing them to identify and implement their sustainability development scheme. Not only by the stakeholders, but also from the focal companies of the supply chain systems (Burke and Gaughran, 2007). Sustainability consideration for a supply chain network includes choosing materials, packaging, transportation modes and supplier selection (Carter and Easton, 2011). Therefore, SMEs are critical for the sustainability development in supply networks. Nonetheless, according to Hillary (2004) SMEs are responsible for 70 percent of all industrial pollution. Accordingly, large firms and governments direct their attention towards increasing SME firms’ engagement in sustainability initiatives (Jenkins, 2009).

Researchers suggest that sustainable development strategies and approaches need to be devised to take into account the various characteristics of SMEs since simply transferring sustainability practices developed by large firms to SMEs have been found inappropriate (Rahbek Pedersen, 2009). SMEs need to develop practical implementation knowledge or tools required to...
manage sustainability aspects in their operations (Burke and Gaughran, 2007). How to identify appropriate management systems to their sustainable development is a vital issue for SMEs. Therefore, Bonn and Fisher (2011) suggest that managers need to combine different factors with different sustainability measures into the strategic decision-making process. Accordingly, this will enable a company to identify opportunities from its improvements in sustainability. Loucks et al. (2010) also point out that due to a shortage of resources and discrete structural features and profiles compared to larger firms, SMEs need different strategies to promote sustainable development. There is no research in the literature reporting how to meaningfully engage SMEs in making the connection between strategy implementation and sustainable development.

The sustainable development concept includes societal, economic and environmental development (Jenkins and Yakovleva, 2006; Seuring and Müller, 2008; Erol et al., 2011; Govindan et al., 2016). However, these three dimensions mutually connect with and restrain each other (Garbie, 2015). For a traditional enterprise system, economic development is normally taken as its main consideration, and often omits the dimensions of society and environment. Unlike large companies, it is more difficult for small and medium-sized enterprises (SMEs) to achieve sustainable enterprises, as a shortage of resources is a common feature for most SMEs (Cras and Vereecken, 2005). Therefore, when the SMEs invest in sustainable development, they must consider their own characteristics to more effectively use resources. In terms of how to move away from current unsustainable patterns in the production and consumption of material goods, SMEs need to experiment with how performance factors can be used to create managerial momentum, not only in the direction of greater competitiveness, but also greater sustainability. SMEs should effectively utilize their limited resources and prioritize their performance factors in terms of the balanced scorecard (BSC) approach in elaborating their sustainable development.

The above-mentioned discussion identifies that there exists a gap in the literature to show how SMEs will deploy their performance factors to become sustainable enterprise owing to limited resource of SMEs. It is imperative to fill this gap because SMEs are needed to adjust their direction in developing strategies in the new competitive era. So far, there is still a lack of study regarding how to use an integrated approach to the integration of interdependent objectives of the SMEs and the allocation of the limited resources to prioritizing their performance factors. This paper thus presents a novel integrated model to solve this problem. In view of above-mentioned perception, the direction of how to help SMEs prioritize appropriate performance indicators that can help the importation of sustainable development strategies is necessary for enhancing the company’s overall effectiveness. This study combines sustainability development requirements and balanced scorecard (BSC) performances through quality function deployment to develop the structure of the key performance indicators to guide the SMEs in importing sustainable development criteria.

The rest of this study is organized as follows. Section 2 identifies sustainable development criteria and balanced scorecard factors and surveys the related work of quality function deployment (QFD), Fuzzy Theory, fuzzy Delphi method (FDM), modified fuzzy extended analytic hierarchy process (FEAHP) and the technique for order preference by similarity to ideal solution method (TOPSIS). Section 3 depicts the detailed approaches, including QFD, Fuzzy Theory, FDM, FEAHP and TOPSIS, applied in this study. Section 4 demonstrates a case implementation. Finally, section 5 discusses the conclusions of our findings.

2. Literature review

It has been recognized that sustainability is a major source of competitive advantage in the future; therefore, the amount of investments in sustainability is increasing in all industries (Hopkins et al., 2011). In the literature of sustainability studies, it has been confirmed that there exist significant and positive relationships between corporate social responsiveness and profitability (Waddock and Graves, 1997; Margolis and Walsh, 2001; Ciliberti et al., 2008). Stocchetti (2012) also addressed that academia and practice have highlighted that the improvement of sustainability management and performance for a company is an opportunity to firm’s development and growth rather than a threat. Its benefits can enhance corporate reputation (Lee, 2012), obtain legality of management decisions under the monitor of stakeholders (Hart and Milstein, 2003), improve labor relations, attract more resources and mitigate stakeholders’ pressure applied to the enterprises (Hardjono and Marrewijk, 2001).

However, along the lines of the viewpoints of Bianchi and Noci (1998) and Labonne (2006), Loucks et al. (2010) reported that SMEs tend to take a passive view of sustainable development. Owing to the lack of financial knowledge and human resources, SMEs pay relatively insufficient attention to inspecting their environmental impact. Fortunately, Moore and Manning (2009) pointed out that many factors have gradually led SMEs to take the initiative in introducing the practice of sustainable development: (1) the acceleration of technological innovation; (2) the spread of globalized communication networks; (3) the development and linkage of supply chain systems; and (4) rapid market changes. However, consistent with the viewpoint of Kiron et al. (2013), Shields and Shelleman (2015) have highlighted that “a key challenge faced by many companies, both large and small, is that they currently lack a structure to integrate sustainability into business decisions”. Bonn and Fisher (2011) have also pointed out that methods facilitating enterprises in their sustainable development activities are extremely complicated tasks, as the measure of sustainability is complex and therefore requires an integration of various strategic considerations at different organizational levels.

When developing a sustainable policy, the enterprise can refer to the principles of the triple bottom line (TBL) for guidance (Elkington, 1997). The TBL system is composed of three dimensions: society, environment, and economy. Elkington (1997) also emphasized these three dimensions as people, planet, and profit, respectively. In brief, the TBL system refers to the responsible view of the enterprise and focuses on describing the enterprise’s effective implementation of economic, environmental, and societal criteria. Along with this observation, it has been commonly perceived that sustainability development involves a triple-bottom line approach (Dyllick and Hockerts, 2002; Seuring and Müller, 2008; Erol et al., 2011; Carter and Easton, 2011). Vinodh and Girubha (2012) and Seuring (2013) also adopted the three sustainability dimensions to review the research methodologies employed in the supply chain management. Recently Govindan et al. (2016) applied the TBL to employ a hybrid multi-criteria decision making approach to select the best sustainable construction material.

Following the same perception in the literature, it has provided valuable structures of sustainable development indicators. For example, Tseng et al. (2009) proposed that the indicators for measuring the sustainability of a manufacturing unit include: (1) energy and material impact on the natural environment, (2) economic performance, (3) community development or social justice, (4) the health and safety environment, and (5) green products. In Tseng’s (2013) research, the indicators have been summarized as: reduce its use of fresh water, material, energy, the amount of waste,
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