Study of Saudi Arabian Manufacturing and Service Organization Sustainability and Future Research Directions

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Abstract. Currently, organizations face a range of dynamic challenges to maintain long-term market sustainability. Examples of these challenges are developing and improving their product and or service quality, increasing operational efficiency, complying with safety regulations, enhancing the triple bottom line of agility in manufacturing products and satisfying customer demand. Saudi Arabia has a vision for 2030 where sustainability is one of the corner stones. Here the objective is to explore sustainability awareness in Saudi organizations and their commitment to sustainability; and to present a brief review of approaches adopted by researchers who have implemented sustainability evaluations in different organizations around the world. It is evident that Saudi manufacturing organizations continue to pursue long-term market sustainability, but researchers have not explored sustainability in detail. In particular, an assessment of the sustainability of Saudi manufacturing organizations is lagging. Further studies are needed to develop a model that can be used to assess the sustainability of Saudi manufacturing and service organizations.

Keywords:
Sustainability, Manufacturing organizations, Service organizations, Indexing
1. Introduction

Manufacturing and service organizations face a range of dynamic challenges to compete and experience long-term market sustainability; to the organization also must recognize economic, social and environmental sustainability. The importance of sustainability is distributed equally in multiple domains, as presented in figure 1. Positively social, environmental, and economical serve as a basic domain for sustainability standards for indexing and certification systems in recent years [1]. Furthermore, cultural, technological, and political development are suggested as additional domain and or dimension for sustainable development [2]. In addition, researchers and practitioners [3] noted that concentrating on one domain and ignoring the other domains jeopardizes the sustainability of organizations.

![Figure 1. Three main dimensions of sustainability](image)

After the initial conceptualization of sustainability, the United States environmental protection agency re-defined sustainable manufacturing as adopting manufacturing processes which minimize environmental negative impacts while protecting energy and natural resources as well as economically viable [4]. Considering this, sustainable manufacturing is defined as transformation of manufacturing activities by minimizing machining costs and eliminating waste without harmful impact on the environment [5]. Thus, in order to develop an effective sustainable manufacturing strategy, manufacturing and service organizations should develop sustainability metrics and benchmark the performance of the organization based on economic, environmental and social criteria. There are number of studies on sustainability assessments that focus on manufacturing and service organizations. These studies propose various sustainability indicators that are measured in different units. However, the formation of a sustainability strategy that aligns profit goals with the policies of an organization and the aggregation of these sustainability performance indicators into a single index are research gaps [6].

The paper contribute to explore sustainability awareness in Saudi organizations and their commitment to sustainability. Also, present a brief review of approaches adopted by researchers who have implemented sustainability evaluations in different organizations around the world to pursue long-term market sustainability. It is evident that an assessment of the sustainability of manufacturing organizations is lagging and further studies are needed to develop a model that can be used to assess the sustainability of Saudi manufacturing and service organizations.

This paper is organized into five sections. Section 1 describes the sustainability evaluations that were implemented in different organizations by researchers and practitioners. A brief review of their study and assessment approach that focuses on the sustainability of manufacturing and service organizations is presented in section 2. Section 3 presents the awareness of sustainability at the local and
international level for Saudi Arabian manufacturing and service organizations. Subsequently, section 4 presents our proposed research plan to develop a model that can be used to assess the sustainability of Saudi manufacturing organizations. Lastly, section 5 concludes and presents future research directions.

2. Literature Review

Many published studies focus on the assessment of sustainability for manufacturing and service organizations. Agrawal, Chaganti and Nune [5] evaluated sustainability in small-scale Indian industries. They used multi-attribute decision-making approaches, such as Analytical Hierarchy Process (AHP) and the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS). Parmar and Desai [7] evaluated sustainable lean six sigma enablers using Fuzzy Decision-Making Trial and Evaluation Laboratory (DEMATEL) technique. Pourvaziry et al. [8] evaluated the dimensions and enablers affecting a Sustainable World Class (SWC) manufacturing model, where Fuzzy DEMATEL and analytic network process (ANP) were chosen for the sustainability evaluation. Ying Wang and Yun Yang [9] analyzed indicators of sustainability performance based on practices of green innovation and presented an approach as a case study in Chinese manufacturing industry. Agrawal and Vinodh [10] evaluated sustainability of Additive Manufacturing (AM) processes using Grey-Based conceptual model; Krajnc et al. [11] evaluated manufacturing process sustainability performance adopting economic, environmental, and social dimensions of sustainability. Whereas, Singh, Olugu and Musa [12] proposed a Fuzzy rule with based expert system for evaluating sustainable manufacturing performance in Small and Medium Enterprises (SMEs) in Malaysia. Trianni, Cagno, Neri, and Howard [13] conducted several case studies for small and medium manufacturing enterprises within Italy and Germany working in the metalworking and chemical sectors. Ziout, Azab, Altarazi and ElMaraghy [14] developed a Multi-Criteria Decision-Making method to measure the positive outcome of reusing a manufacturing system from the sustainability point of view in a developing country. Table 1 summarizes selected industry for the researchers, objective of their study and assessment approach adopted by them.

Table 1. Summary of the literature review

| Year | Reference | Focus Industry | Objective of Study | Assessment Approach |
|------|-----------|----------------|--------------------|---------------------|
| 2005 | [11]      | Oil & Gas      | Benchmarking manufacturing industries based on sustainability dimensions | Composite sustainable development index |
| 2013 | [14]      | Manufacturing   | Multi criterion approach to reconfigure manufacturing system and measure its impact on performance | AHP |
| 2014 | [15]      | Manufacturing   | Adopt quantitative techniques to assess manufacturing sustainability dimensions | Visual Basic |
| 2016 | [16]      | Manufacturing   | To evaluate a sustainable manufacturing performance by adopting an expert system | Fuzzy rule-based expert |
| 2019 | [13]      | Manufacturing   | To evaluate a sustainable manufacturing performance | Emergent coding technique |
| 2020 | [5]       | Machining       | To evaluate machining processes sustainability for Indian SMEs | AHP, TOPSIS |
| 2020 | [7]       | Manufacturing   | To evaluate enablers of sustainable lean six sigma using fuzzy DEMATEL | Fuzzy DEMATEL |
From published literature, it is evident that the academics and experts implemented sustainability evaluations in various Industries. However, the process of sustainability evaluation is still in the growth stage. There are good efforts in implementing sustainability in Saudi Arabia. The awareness of Saudi Arabian organizations of sustainability is studied and presented in section 3.

3. Awareness of sustainability among Saudi Arabian organizations

As a part of 2030 global plan for sustainable development, world leaders accepted a very important goals to preserve the environment, guarantee prosperity for all stakeholders, rejecting all kind of inequalities and improve the lives of people worldwide. In this regard, multiple countries, administrations, industries, and public societies collaborate with the United Nations and began to organize efforts to accomplish the 2030 sustainable development goals [18]. Correspondingly, the Kingdom of Saudi Arabia took the initiative to adopt the well-known 17 sustainable development goals [18]. In fact, Saudi Vision 2030 is constructed based on three key pillars that adopted specific objectives to be achieved by 2030: a vibrant society, a thriving economy, and an ambitious nation [19]. The pillars of Saudi Vision 2030 that are aligned with the sustainability dimensions are presented in figure 2.

![Figure 2. Pillars of Saudi Vision 2030.](image-url)
In addition, the Saudi Arabian government is ready to facilitate incentives for land use, discounts, concessions, and contract awards to industries that contribute to all sustainability dimensions and achieve an acceptable sustainability level. Furthermore, the ability to issue green bonds is another sustainability benefit that manufacturing and service organizations can provide. Both issuers and investors alike are interested in these green bonds because they will balance both environmental and economic concerns. However, corporations have gradually issued green bonds to grow their market appeal to a broader investor class. On other hand, the Kingdom announced various programs and directions to achieve its Vision 2030. These programs address the necessity of raising the awareness of sustainability in manufacturing and service organizations that are consistent with objectives at the local and international level. Indeed, Saudi Arabia incorporated many systems that are fully compatible with corporate sustainability concepts and international standards, such as the Global Reporting Initiative (GRI) [20]. This effort was implemented via the successive long-term development plans in the Kingdom that primarily focused on developing the citizens capabilities, achieving their dreams and ambitions, fulfilling their needs, and improving their live standard, since the ultimate target of sustainable development is the Saudi citizens [21-22]. From the open source published literature, it is evident that organizations in Saudi Arabia have started to implement sustainability at the local level. In fact, there are many reasons for manufacturing and service organizations to pursue sustainability, such as improving operational efficiency by cutting costs and eliminating waste, attracting new customers and boosting their competitive advantage, strengthening their brand, solidifying their reputation and building trust of the public, structuring long-term business capability, and effectively handling opportunities and regulatory constraints [23]. There are few Saudi organizations that are aware of sustainability, and below are some of their contributions to sustainability.

The Saudi Electricity Company (SEC) is one of the organizations that issued several sustainability reports [24]. In their latest sustainability report, the SEC divided its sustainability pillars into environmental, social and governance (ESG). Their ESG framework includes three key sustainability drivers, first is to drive focus on low carbon emission; secondly drive circular economy by empowering people and communities; and lastly drive responsible business practices. SEC sustainability framework includes multiple sustainability performance criteria and indicators, refer to figure 3. Moreover, as part of the SEC sustainability implementation, they released a capital smart metering project, which is contributing to energy efficiency, reducing greenhouse emissions, and mitigating climate change, and it is qualified under its green Sukuk framework [25].
Figure 3. SEC’s ESG drivers, performance criteria and indicators [24]

Similarly, the Saudi Telecom Company (STC) considered multiple sustainability drivers and designed their sustainability strategy by incorporating 10 out of the 17 sustainable development goals into their business strategy, programs, and management systems in a manner that is consistent with the GRI. The STC developed 17 issues (indicators), prioritized them using a materiality analysis matrix and grouped the issues into seven key focus areas (refer below figure 4). [26]
As sustainability initiative, to improve energy efficiency, the Saudi energy efficiency center (SEEC) set guidelines both front government as well as private sectors. In government and private industrial sectors, the SEEC developed a method for observing the implementation of standards and specifications of both locally and imported equipment to guarantee the compliance of energy efficiency requirements. Moreover, they set a sustainability initiative to conserve and rise the efficiency of energy consumption in the petrochemical, iron, and cement industries in both new and running plants. Indeed, the SEEC aims to increase energy efficiency during production and consumption to preserve natural resources in the Kingdom and enhance sustainable economic development and social welfare [27]. Figure 5 shows the sustainability model for the SEEC.

![Figure 5. SEEC’s Sustainability Model](image)

**Figure 5. SEEC’s Sustainability Model**
The Saudi Basic Industries Corporation (SABIC) is an international producer of different chemical products. The company is located in Riyadh and runs its manufacturing operations around the world. Sustainability is their essential pillar, and their objective is to accomplish an exceptional result in the areas of environment, health, and safety, innovation, social accountability, supply chain management and development of human capital. SABIC is continuously assessing fuel efficiency and sustainability during initial stage of design and conceptualization process, ensuring emissions reduction of greenhouse gas, decreasing energy consumption, and both material and water wastes reduction [28]. The SABIC sustainability report outlines how their actions are supporting a circular economy; addressing climate change; and including environmental, social and governance (ESG) [29]. Moreover, their commitment to innovation is responsible for their development of sustainable products, operations, and business model. In addition, SABIC is contributing to a circular economy by building resilience into their business by implementing 5 pillars throughout a portfolio of products and services, which SABIC named the TRUCIRCLE program, as shown in figure 6 [29].

Figure 6. SABIC TRUCIRCLE program [29]

The King Abdulaziz project for public transport, which is based in Riyadh, is comprised of a bus network and six metro lines. The project provides a safe and easy transport system that incorporates sustainability strategies from the early design stages into the testing and commissioning stages [30]. The Saudi investment recycling company (SIRC), which is the largest company in the Gulf region that manages industrial waste. The company contains a complete supply chain platform to receive, store, transport, treat and carefully dispose of dangerous waste caused by manufacturing organizations, and it integrates sustainability strategies in its daily operation [31]. Similarly, Saudi Aramco developed a framework that encompasses multiple focus areas to incorporate in its sustainability strategies and includes environmental impact reduction, climate change, rising societal value, and speed up human potential [32]. Sadara chemical company is a joint venture developed by Dow chemical and Saudi Aramco, and their sustainability strategies focus on safe operations excellence, value generation and growth, and organizational development. They identified 24 indicators to gauge their sustainability performance and used materiality analysis matrix to focus on areas that are the most important to the company to define future projects [33]. Thus, many Saudi manufacturing organizations are pursuing long-term market sustainability, but researchers have not explored sustainability in detail. In particular, an assessment of the sustainability of Saudi manufacturing organizations is lagging. The future research direction and proposed research methodology are presented in the following section.
4. Problem on Hand and Research Methodology

There are no studies in the literature on measuring the sustainability of Saudi manufacturing and service organizations. Publicly available sustainability reports did not provide guidance on sustainability assessment and estimation approaches. Thus, the problem at hand is to develop a model that can be used to assess the sustainability of Saudi manufacturing and service organizations. This model should analyze, estimate and decide whether Saudi manufacturing and service organizations are sustainable or need improvement in any dimension to achieve sustainability. Considering this objective, as a research methodology, the following ICDFS (identify, compare, design, find and suggest) approach is planned:

- Identify sustainability enablers and group them under sustainability dimensions by surveying the literature and/or conducting interviews with subject matter experts and academic professionals
- Compare, evaluate, rank and weight sustainability enablers by using multiple attribute decision-making methods
- Design a sustainability indexing model that is customized to Saudi Arabian manufacturing and service organizations.
- Identify the weaker enablers that limit sustainability of Saudi Arabian manufacturing and service organizations.
- Recommend some corrective actions to improve the sustainability of Saudi Arabian manufacturing and service organizations.

5. Conclusions and Future Research

There are many sustainability assessments that focus on manufacturing and service organizations. These studies propose various sustainability enablers that are measured in diverse units. However, the integration of these enablers into a single index is a research gap. Thus, there is a need for an assessment of the sustainability of manufacturing and service organizations using key sustainability metrics for a variety of organization-specific social, environmental, and economic criteria. These criteria should be relevant to in a credible and convincing way to the increasing number of investors who focus on sustainability. An effective sustainable business strategy should be developed, the organization sustainability risks should be reduced and future opportunities should be realized. Therefore, approaches for integrating indicators are either not well developed, are still under development, or not existing concerning all the sustainability aspects.

From the published literature, it is evident that researchers and practitioners implemented sustainability evaluations in different sectors. However, the process of sustainability evaluation is still in the growth stage. Many Saudi organizations are pursuing long-term market sustainability, but sustainability assessments of Saudi organizations are lagging. There is a need to evaluate sustainability enablers for Saudi organizations. The following is proposed:

- Study the effects of sustainability attributes on small-scale manufacturing industries.
- Adopt fuzzy artificial intelligence techniques to realize action plans and provide a guide on how to choose between sustainability indicators.
- Determine how to re-evaluate sustainability enablers and/or weights of the dimensions, since weights are used to reflect priorities according to evaluator opinion and may be affected by subjectivity of the evaluator.
- Analyse more detailed green innovation aspects and the sustainability decision problem.
- Develop a novel model (approach) to gauge manufacturing and or service organization sustainability.
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