

# Assessing the social sustainability of supply chains using Best Worst Method

**Hadi Badri Ahmadi** (Corresponding author)

School of Management Science and Engineering  
Dalian University of Technology  
No. 2 Linggong Road, Ganjingzi District  
Dalian Liaoning Province (116023), P.R of China  
E-mail: hadi@mail.dlut.edu.cn

**Simonov Kusi-Sarpong**

School of Management Science and Engineering  
Dalian University of Technology  
No. 2 Linggong Road, Ganjingzi District  
Dalian Liaoning Province (116023), P.R of China

Eco-Engineering and Management Consult Limited  
409 Abafum Avenue  
TI's - Adentan, Accra-Ghana  
E-mail: simonov2002@yahoo.com

**Jafar Rezaei**

Faculty of Technology, Policy and Management  
Delft University of Technology  
2628 BX Delft, the Netherlands  
E-mail: j.rezaei@tudelft.nl

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**Abstract** – A truly sustainable organization needs to take the economic, environmental and social dimensions of sustainability into account. Although the economic and environmental dimensions of sustainability have been examined by many scholars and practitioners, thus far, the social dimension has been received less attention in literature and in practice, in particular in developing countries. Social sustainability enables other sustainability initiatives and overlooking this dimension can have a serious adverse impact across supply chains. To address this issue, this study proposes a framework for investigating the social sustainability of supply chains in manufacturing companies. To show the applicability and efficiency of the proposed framework, a sample of 38 experts was used to evaluate and prioritize social sustainability criteria, using a multi-criteria decision-making method called the ‘best worst method’ (BWM). The criteria are ranked according to their average weight obtained through BWM. The respondents view ‘contractual stakeholders influence’ as the most important social sustainability criterion. The results of this study help industry managers, decision-makers and practitioners decide where to focus their attention during the implementation stage, to increase social sustainability in their organizational supply chain and move towards sustainable development.

**Keywords:** Sustainable supply chain management; social sustainability; best worst method; BWM

## 1. Introduction

Industrialization contributes to the damage caused to the natural environment and to human life (Kusi-Sarpong et al., 2015). As a result, there is a pressing need for organizations to work together in sustainable supply chains (Fabbe-Costes et al., 2014), taking into account both social criteria and economic and environmental criteria (Mangla et al., 2014). With our increasing knowledge about sustainability, government policies, and growing community awareness, sustainable performance is increasingly becoming an important organizational strategy (Gaziulusoy, 2015; Govindan et al., 2016). However, thus far, literature has focused on social sustainability to a much lesser extent, which is unfortunate, since not only can social sustainability practices help improve

other aspects of sustainability, but all three dimensions are required to build a truly sustainable business (Seuring and Muller 2008; Ashby et al., 2012).

So far, several researches have proposed sustainability frameworks that include all three dimensions, albeit with a greater emphasis on economic and environmental sustainability. However, only a few have tried to examine social standards using empirical analysis. To correct this imbalance, this paper proposes a unified evaluation framework designed to investigate social sustainability within the context of Iran's manufacturing sector. In this study, social sustainability criteria are evaluated and prioritized utilizing a novel multi-criteria decision-making method (MCDM) named the 'best worst method' (BWM) (Rezaei, 2015, 2016). We selected the Iranian manufacturing supply chain for two main reasons. Firstly, the Iranian economy to a large extent depends on its manufacturing sector (after oil and gas). At the same time, it is a sector that faces serious challenges, ranging from strike actions due to work safety and health reasons, to employee rights in relation to bad employment practices. Secondly, the sector is growing and requires some form of best practices with regard to the social sustainability of supply chains to guide new entrants and existing companies in making sustainability-related decisions to reshape the sector's negative social reputation. Although, in order to have a sustainable supply chain management (SSCM), the triple-dimension (economic, environmental and social) should be considered together, we focus on the social dimension to extend our understanding of this dimension. As such, the results of this study could be useful as input for comprehensive sustainable supply chain management decisions. More specifically, this paper addresses the following objectives:

- (1) To identify social criteria, with the aim of proposing a social sustainability evaluation framework within the context of the manufacturing industry;
- (2) To specify the relative importance of the social sustainability criteria for the manufacturing industry;
- (3) To identify the managerial and practical implications of the research;

To achieve these objectives, first a literature review is conducted within the sustainable supply chain management discipline, to identify potential social sustainability criteria, and subject them to several rounds of reviews by industrial experts, to propose a comprehensive supply chain social sustainability framework, after which BWM is used to evaluate the proposed framework. In other words, we determine the relative importance (weights) of the criteria and prioritize them according

to their importance to organizational sustainability. This paper offers two main contributions. Firstly, we develop a framework for investigating social sustainability within the context of the manufacturing sector. Secondly, we propose a new MCDM method (BWM) to analyze and evaluate social sustainability.

The rest of the study is structured as follows. In Section 2, a literature review regarding sustainable supply chain management and social sustainability criteria is conducted. The proposed methodology is discussed in Section 3. In Section 4, a real world application of the proposed framework is provided, the results of which are presented and discussed in Section 5. Finally, the conclusion and suggestions for future research are presented in Section 6.

## **2. Review of literature**

In this section, we start by reviewing sustainable supply chain management in general, and then focus on the social sustainability criteria in supply chain management.

### **2.1 Sustainable supply chain management**

Supply chain management (SCM) can be defined as a set of approaches and practices for managing and achieving effective coordination within organizations (cross-functional) and between organizations (cross-organizational) in a supply chain, with the aim of improving customer service, asset utilization, profit generation, and cost reduction (Croxtton et al., 2001). In a supply chain, multiple decision-makers are involved in managing processes, resources, and information that may not necessary be totally under their direct control (Hassini et al., 2012). In other words, organizations along the supply chain must integrate their operations and work together to make their supply chain operations sustainable (Luthra et al., 2017; Mathivathanan et al., 2017). Sustainable supply chain management (SSCM) can be described as managing the supply chain activities, operations, resources, information and funds, with the goal of maximizing the profitability of the supply chain, as well as social well-being (e.g. the impact of the supply chains on its employees, customers and society), and at the same time minimize any negative environmental effects (Hassini et al., 2012; Shi et al., 2017; Zhang et al., 2016). There are several aspects to SSCM and it requires multi-operational functions to attain a competitive advantage (Su et al., 2016; Ahmad et al., 2016). In short, SSCM focuses on preserving the environment and improving socio-economic dimension for long-term sustainable development (Ahi and Searcy,

2013; Formentini and Taticchi, 2016; Fahimnia et al., 2017; Linton et al., 2007; Leppelt et al., 2013). SSCM is driving corporations to improve their social, economic and environmental performance across their supply chains (Lin and Tseng, 2016; Genovese et al., 2017). The potential environmental and societal effects of an organization's supply chain operations are both huge and difficult to manage (Kusi-Sarpong et al., 2016; Bai et al., 2017). As such, SSCM minimizes the negative impacts of operations and improves firm value/efficiency with regard to environmental, economic and social dimensions towards sustainable development, which is seen as a way to improve supply chain management, with a significant impact on the company's competitiveness and supply chain operations, the aim being to build the necessary capabilities to compete and strengthen the company's sustainable competitive and collaborative advantage (Tseng et al., 2008; Wong et al., 2014).

According to Chardine-Baumann and Botta-Genoulaz (2014), one of the approaches to improving organizational performance is through supply chain sustainability. This has an impact on a company's competitiveness and its supply chain performance. Managing these initiatives and programs involves multi-dimensional issues, such as supplier selection, and using green technology to increase sustainable collaborative competitive advantage (Seuring et al., 2008). In SSCM literature, it is clear that implementing sustainable initiatives and programs reinforces proficiency and cooperation among partners and stakeholders by improving their environmental performance, minimizing waste and saving costs (Linton et al., 2007). This reaffirms the need for the combination of the economic, environmental and social aspects of business theory and practices towards achieving sustainable supply chain management. As such, for organizations to enhance their sustainability, business operations have to control their operations, with the long-term objective of maintaining the well-being of society, the economy and the environment (Hassini et al., 2012). It is for this reason that many companies are beginning to use sustainability indicators to evaluate their level of sustainability, albeit with a predominant on environmental sustainability (Tseng, 2013; Tseng et al., 2008; Seuring and Muller, 2008).

Srivastava (2007) proposed a SSCM decision-making framework that focuses on five key strategic areas, including product design, material selection, the production process, finished product delivery to the customer, and the management of end-of-life products at the end of their life cycle. Although Srivastava (2007) developed a sustainability framework, the operational criteria did not

include clear criteria covering the social dimension and, without that social dimension, any sustainability initiative is bound to be deficient and incapable of dealing with the social impact. Carter and Rogers (2008) integrated resource dependence theory, population ecology and the corporation resource-based view to develop an SSCM framework, taking into account basic supporting facts which are required in the implementation of SSCM practices. The authors examined the relationships between social, environmental and economic performance with regard to obtaining long-term economic viability within an SCM context. However, the focus on social sustainability criteria was limited when the framework was being developed, which meant that the social sustainability issues were addressed to a lesser extent. Liu et al. (2012) conceptualized a new hub-and-spoke framework comprising six dimensions (people, product, process, project, planning and promotion). In their study, green marketing and SSCM were integrated to build supply chain capabilities more effectively to meet the needs of green customers. However, they did not focus much on social sustainability and its impact on the case companies. Manzini and Accorsi (2013) developed a framework for managing sustainability, safety and quality in food supply chains, but their framework did not include the social sustainability dimension. An SSCM practice framework was developed by Esfahbodi et al. (2016) based on environmental and cost performance practice sets, which clearly did not discuss or consider the supply chain social sustainability dimension to help build the capabilities needed to deal with social issues in emerging economies.

A review of existing literature indicates that, although there are significant attempts in existing literature to address the issue of organizational and corporate sustainability, few studies have focused extensively and specifically on the social dimension of sustainability (see also Kleindorfer et al. (2005), Seuring and Muller (2008) and Seuring (2013)). According to Mani et al. (2016), more study is required to examine the social sustainability dimension in developing nations. It is against this backdrop that this paper attempts to investigate organizational sustainability with specific focus on the social sustainability of supply chains. Figure 1 shows a distribution of papers based on sustainability dimensions.

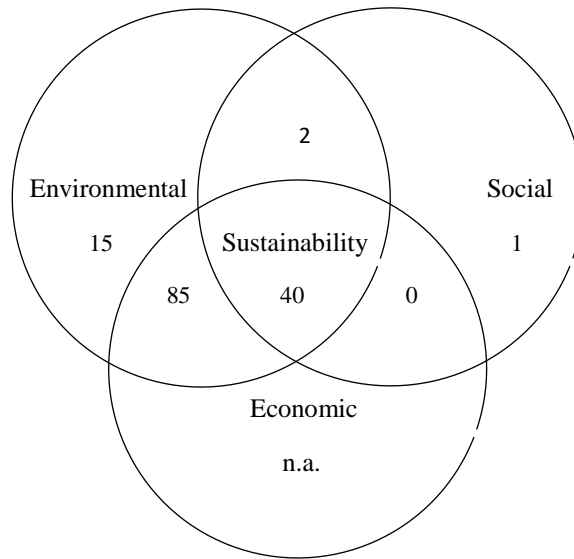


Figure 1. Distribution of papers based on sustainability dimensions (Carter and Rogers, 2008; Brandenburg et al., 2014)

According to Figure 1, very few studies have included the social dimension. In essence, there is only one paper that has investigated social sustainability (Hutchins and Sutherland, 2008), while two papers focused on social and environmental sustainability (Baskaran et al., 2012; Xu et al., 2013). These results are consistent with the outcomes of a more comprehensive literature review conducted by Brandenburg et al. (2014), which showed that only four out of 134 papers looked at either social, socio-environmental or socio-economic criteria.

## 2.2 Social sustainability criteria

In addition to the economic and environmental sustainability of organization's operations, social sustainability should also be taken into account when firms are aiming at achieving sustainable development. Social sustainability is about how social issues should be managed in a way that increased a corporation's long-term survival (Carter and Rogers, 2008). Human rights, workers' health, diversity, equity and other social and safety-related issues are important elements when it comes to the sustainability of manufacturing companies and should be taken into account when evaluating, for instance, their suppliers (Bai and Sarkis, 2010). Other researchers use the same description for addressing social issues in the supply chain (Macombe et al., 2013; Sala et al., 2013; Martinez-Blanco et al., 2014). Determining global and universal social sustainability measures and dimensions is challenging, because there is no conceptual clarification, particularly in the manufacturing and operations sector, or, for that matter, in developing countries. Hence, supply

chain managers have no enough understanding of the social issues involved and how they can be evaluated and managed (Gopal and Thakkar, 2016).

Very few studies to date have incorporated sustainability management practices that include social dimensions in their SSCM frameworks. In most cases, social initiatives undertaken by organizations in an attempt to deal with corporate sustainability have a short-term focus (Badri Ahmadi et al., 2017). These attempts do not help build the capabilities and resources needed to systematically and comprehensively manage the societal impacts from organizational supply chains towards improving social measures. Some studies have taken a first initial step in examining and identifying some useful social sustainability-related dimensions and criteria, but they fail to integrate them into a unified and more comprehensive framework, which is exactly the aim of this study.

In a study by Amindoust et al. (2012), it is noted that, in a socially responsible supply chain, companies should take the health and safety conditions of their employees into account, as well as other critical social criteria. Bai and Sarkis (2010) have divided social sustainability criteria into internal and external social criteria. Health and safety factors and employment practices are categorized as internal social criteria while the influence of local communities, contractual stakeholders and other stakeholders are categorized as external social sustainability criteria. Azadnia et al. (2015) used occupational health and safety management system, training education and community development as social sustainability criteria, while Badri Ahmadi et al. (2017) used the influence of contractual stakeholders, health and safety as social sustainability criteria, along with other environmental and economic criteria, in order to develop a sustainable supplier selection framework. Govindan et al. (2013) used the influence of local community, health and safety measures, employment practices and the influence of contractual stakeholders as social sustainability criteria. Labuschagne et al. (2005) evaluated the social sustainability performance of an organization and its operational activities, with a focus on stakeholder participation, external population, internal human resources, and macro-social performance. They found that the existing performance measurement frameworks for evaluating overall organizational sustainability do not effectively deal with all sustainability dimensions at an operational level (Rajak & Vinodh, 2015).

Ciliberti et al. (2008) examined the problems faced by small and medium-sized enterprises (SMEs) to extend socially responsible behavior to suppliers operating in developing nations, while

Hutchins et al. (2013) developed a framework for specifying the social impact of production along a product or process life-cycle, including the social dimension of sustainability (Rajak & Vinodh, 2015).

The review presented above shows that, although there are various frameworks that have attempted to address the social sustainability dimension, these attempts are few and far between, which means they cannot help organization build the resources and capabilities they need to manage the societal impact from their operations comprehensively and systematically. Because a more comprehensive and unified framework, with the aim of helping manufacturing industries incorporate social sustainability into their supply chains is currently unavailable, we felt that it warranted investigation. In this paper, 16 social sustainability-related criteria were identified according to the literature review (see Table 1).

**Table 1:** Social sustainability criteria according to the literature

<b>Criteria</b>	<b>References</b>
Influence other stakeholder	Gauthier (2005), Presley et al.(2007)
Work conditions	Hutchins and Sutherland (2008), Matos and Hall (2007)
Contractual stakeholders influence	Govindan et al. (2013), Presley et al.(2007), Badri Ahmadi et al.(2017)
Occupational health and safety management system	Azadnia et al. (2015), Luthra et al. (2017), Bai and Sarkis (2010)
Enforcement	Zhang et al.(2013), Sarkis et al. (2010)
Business practices	Matos and Hall (2007), Azapagic and Perdan (2000), Castka and Balzarova (2008)
Information disclosure	Luthra et al. (2017), Amindoust et al. (2012), Kuo et al. (2010)
Employment practices	Bai and Sarkis (2010), Govindan et al. (2013)
Influence local communities	Gauthier (2005), Presley et al.(2007)
Work health and safety	Badri Ahmadi et al.(2017), Azadnia et al.(2015), Amindoust et al.(2012), Aydin et al. (2010)
Societal commitment	Hutchins and Sutherland (2008), Matos and Hall (2007)
Training education and community influence	Badri Ahmadi et al.(2017), Azadnia et al.(2015)
Human rights	Matos and Hall (2007), Azapagic and Perdan (2000)
Customer issues	Veleva et al. (2001), Kainuma and Tawara (2006)
Respect for the policy	Kuo et al. (2010)
Research and development	Zhang et al.(2013)

### 3. Methodology

According to Table 1, social sustainability is a multi-criteria concept, so in order to assess relevance of the various criteria, we could use a multi-criteria decision-making method (MCDM). There are a number of MCDM methods available, for more information, we recommend Triantaphyllou (2000) and Greco et al. (2005), among others. MCDM methods have been applied to problems in various fields, including sustainable supply chain management. For more information about the latter, we recommend Seuring (2013). In this study we use the ‘best worst method’ (BWM), an MCDM method that which has not been used in this area before and that has unique advantages for this paper. The method’s description is elaborated in the next section.

### 3.1 Best worst method

The best worst method (BWM) is a method that has been developed to solve MCDM problems (Rezaei, 2015, 2016) and that is based on pairwise comparison. Compared to other MCDM methods, BWM has two key advantages: i) it needs less pairwise comparison data compared to a full pairwise comparison matrix, and ii) the results generated by BWM are more consistent than those of the other MCDM methods, which use a full pairwise comparison matrix, which is also the main reason for using BWM in this study. The method has been already utilized in several real-world problems. For instance, Rezaei et al. (2016a) have used BWM to determine the best freight bundling configuration for transporting freight from outstations to airports. In another study by Rezaei et al. (2016b), the method was used to select the best suppliers considering environmental and economic criteria. Torabi et al. (2016) developed a framework for assessing risk in the business continuity management system context, with the aim of evaluating the identified risks. Some other examples of BWM application include evaluating barriers to energy efficiency (Gupta et al., 2017), evaluating external forces in oil and gas industry (Ahmad et al., 2016), evaluating enablers of technological innovation (Gupta and Barua, 2016), supplier selection (Gupta and Barua, 2017), transportation mode selection (Guo and Zhao, 2017), scientific output quality assessment (Salimi 2017) and measuring the efficiency of university-industry PhD projects (Salimi and Rezaei, 2016).

The BWM (Rezaei, 2015, 2016) is structured as follows:

**Step 1.** Identify a set of decision-making criteria. In this step, a set of criteria  $\{c_1, c_2, c_3, \dots, c_n\}$  is chosen for making a decision.

**Step 2.** The best criterion (e.g. most desirable, most important) and the worst criterion (e.g. least desirable, least important) are determined. In this step, the best and the worst criteria are identified by the decision-maker.

**Step 3.** The preference of the best criterion over all the other criteria is determined based on a score between 1 and 9, where a score of 1 means equal preference between the best criterion and another criterion and a score of 9 means the extreme preference of the best criterion over the other criterion. The result of this step is the vector of Best-to-Others (BO) which would be:  $\mathbf{A}_B = (a_{B1}, a_{B2}, a_{B3}, \dots, a_{Bn})$ , where  $a_{Bj}$  indicates the preference of the best criterion  $B$  over criterion  $j$ , and it can be deduced that  $a_{BB}=1$ .

**Step 4.** The preference of all criteria over the worst criterion is determined based on a score between 1 and 9. The result of this step is the vector of Others-to-Worst (OW) which would be:  $A_W = (a_{1W}, a_{2W}, a_{3W}, \dots, a_{nW})^T$ , where  $a_{jW}$  shows the preference of the criterion  $j$  over the worst criterion  $W$ . It also can be deduced that  $a_{WW}=1$ .

**Step 5.** The optimal weights ( $w_1^*, w_2^*, w_3^*, \dots, w_n^*$ ) are calculated. The optimal weights of the criteria will satisfy the following requirements: For each pair of  $w_B/w_j$  and  $w_j/w_W$ , the ideal situation is where  $w_B/w_j = a_{Bj}$  and  $w_j/w_W = a_{jW}$ . Therefore, to get as close as possible to the ideal situation, we should minimize the maximum among the set of  $\{|w_B - a_{Bj}w_j|, |w_j - a_{jW}w_W|\}$ , and the problem can be formulated as follows:

$$\min \max_j \{|w_B - a_{Bj}w_j|, |w_j - a_{jW}w_W|\}$$

Subject to

$$\sum_j w_j = 1 \tag{1}$$

$$w_j \geq 0, \text{ for all } j$$

Problem (1) can be transferred to the following linear programming problem:

$$\min \xi^L$$

subject to

$$|w_B - a_{Bj}w_j| \leq \xi^L, \text{ for all } j$$

$$|w_j - a_{jW}w_W| \leq \xi^L, \text{ for all } j \tag{2}$$

$$\sum_j w_j = 1$$

$$w_j \geq 0, \text{ for all } j$$

After solving problem (2), the optimal weights ( $w_1^*, w_2^*, w_3^*, \dots, w_n^*$ ) and  $\xi^{L*}$  are obtained.  $\xi^{L*}$  can be seen as a direct indicator of the comparison system's consistency. The closer the value of  $\xi^{L*}$  is to zero, the higher the consistency, and, consequently, the more reliable the comparisons become.

## **4. Real world application**

### **4.1 Social sustainability in Iran**

Recently, there has been an increasing worldwide demand for water, energy and mineral resources, which has pushed the global economy to focus on sustainable long-term development. In most cases, the main focus has been on economic sustainability. However, social and environmental sustainability have a major impact on economic decisions and policies that have a positive and long-term economic impact. Iran, the case country of this study, is a developing country in western Asia. Sustainable development in Iran is still in its early stages (Ghadimi et al., 2016). During the last years, there has been considerable attention to the non-economic aspects of sustainable development. Despite the many regulations and policies designed to move the country towards sustainable development, Iran, like many other developing countries, has so far not been successful in this initiative. The reasons may include lack of regulatory policy enforcement on the part of the government and a lack of top management commitment to implementing those initiatives on the part of industries/companies, which tend to focus more on economic sustainability. As a result, there has been pressure from various social activists at both a national and international level, which have caused Iranian manufacturing companies to systematically assess their direct and indirect social burden (Kusi-Sarpong et al., 2016). Research by Mani et al. (2016) indicates that social issues have been particularly problematic in developing countries and that developing countries need more research on social sustainability (Ehrgott et al., 2011). This study is intended meant as a first step in addressing some of the serious negative societal effects of the organizational supply chain operations in the manufacturing industry, especially in developing economies, and it one of the very few studies examining social sustainability in Iran.

The objective of this paper is to provide industrial managers, decision-makers and practitioners with an understanding of how supply chain social sustainability dimension can be used to decrease the industry social impact, to make their supply chains more sustainable and to move towards sustainable development. To exemplify the proposed framework's applicability and usefulness and to provide a comprehensive evaluation of social sustainability, a sample of 38 Iranian manufacturing sector practitioners was selected from industries as diverse as automotive, electric and electronic, chemical, telecom, cement, tile and motorcycle manufacturing companies with over 10 years working experience. They include ten general managers, fifteen supply chain

managers, two finance managers and eleven assistant supply chain managers. The research team conducted interviews and discussions with the practitioners and gathered data by informing them about the purpose of the study. A comprehensive description of BWM application is presented in the next section.

## **4.2 Application of the BWM**

### *4.2.1 Determination of decision criteria*

In this first step, the decision-makers identified a set of criteria to describe the subject matter. This section throws more light on the developmental and refinement processes of the framework proposed in this paper. The criteria were identified through a combination of a literature review and input from decision-makers and practitioners from Iran's manufacturing sector. Through the literature review, 16 social sustainability criteria were identified (see Table 1). In all, thirty-eight experts, each with over 10 years working experience in their respective fields, were involved. In the initial stage, a questionnaire with the abovementioned 16 social sustainability criteria were presented to the experts for review at different times, along with information on how to complete the questionnaire. The experts were asked to specify which of the criteria are more relevant to their organization's operations, by selecting "1" for relevant and "0" for irrelevant. The experts were then asked to suggest other relevant criteria based on their experience with regard to their company's social sustainability in particular and organizational sustainability in general. The research team agreed with the experts that criteria that were approved by at least thirty experts would be included in the next round of the review. Two additional criteria were suggested by two of the experts. In all, three rounds of interviews were conducted to refine the set of criteria. Ultimately, eight social sustainability criteria were selected (see Table 2).

**Table 2:** Social sustainability criteria selected for the assessment

<b>Criteria</b>	<b>References</b>	<b>Short description</b>
Work health and safety (SSC1)	Badri Ahmadi et al. (2017), Azadnia et al. (2015), Amindoust et al. (2012), Aydın Keskin et al. (2010)	This relates to the firms' focus on both their operation's and that of potential supplier's operation's health and safety practices.
Training education and community influence (SSC2)	Azadnia et al.(2015), Badri Ahmadi et al. (2016)	This relates to the transfer and impact of knowledge from employer to it employees and the community within which they operate.
Contractual stakeholders' influence (SSC3)	Presley et al. (2007), Govindan et al. (2013), Badri Ahmadi et al. (2017)	This relates to the level of attention a potential supplier pays to its stakeholders to get involved in its operations.
Occupational health and safety management system (SSC4)	Bai & Sarkis (2010), Azadnia et al. (2015), Luthra et al. (2017)	This relates to workers' health and safety, and welfare at the workplace.
The interests and rights of employees (SSC5)	Luthra et al. (2017), Amindoust et al. (2012), Kuo et al. (2010)	This has to do with factors that promote employee concerns and related sustainable employment issues.
The rights of stakeholders (SSC6)	Amindoust et al. (2012), Kuo et al. (2010), Luthra et al. (2017)	This relates to the rights of society, which has a stake in the business.
Information disclosure (SSC7)	Kuo et al. (2010), Luthra et al. (2017), Amindoust et al. (2012)	This has to do with firms providing their clients and stakeholders with related information about the materials being used during the manufacturing process and carbon emissions.
Employment practices (SSC8)	Bai & Sarkis (2010), Govindan et al. (2013)	This concerns programs and practices related to employees.

#### 4.2.2 Identifying the best and the worst criteria

In the second step, the 38 respondents specified the most and the least important social sustainability criteria, as the best and the worst criteria, using a questionnaire. The resulting best and worst are listed in Table 3.

**Table 3:** *Best* and *Worst* criteria identified by Experts 1-38

<b>Social sustainability criteria</b>	<b>Determined as <i>Best</i> by experts</b>	<b>Determined as <i>Worst</i> by experts</b>
Work health and safety (SSC1)	1, 9, 14, 16, 24	21, 29, 36
Training education and community influence (SSC2)	6, 22, 31, 38,27	8, 11, 14, 17, 34
Contractual stakeholders influence (SSC3)	8, 15, 20,3,30,32,34	25
Occupational health and safety management system (SSC4)	5, 11, 23, 28, 36	19, 37, 33, 15, 22, 31, 38,26,3, 9
The interests and rights of employees (SSC5)	2, 7, 17, 35	12, 28, 30, 32
The rights of stakeholders (SSC6)	10, 18	1, 7, 20, 23, 24, 35
Information disclosure (SSC7)	13, 21,25, 26, 33	4, 5, 10, 16, 18
Employment practices (SSC8)	4, 12, 19, 29, 37	2, 6, 13, 27

#### 4.2.3 Identifying the best criterion preference over all criteria

In the third step, the respondents were asked to specify the best criterion's preference over all other criteria, using 1 to 9 measurement scale. Table 4 shows the response of one of the respondents.

**Table 4:** *Best* criterion preference over the other criteria for Expert 1.

<b>Criteria</b>	<b>SSC1</b>	<b>SSC2</b>	<b>SSC3</b>	<b>SSC4</b>	<b>SSC5</b>	<b>SSC6</b>	<b>SSC7</b>	<b>SSC8</b>
<b>Most important SSC1</b>	1	3	5	4	5	9	5	7

#### 4.2.4 Identifying the other criteria preference over the worst criterion

In this step, the respondents were asked to determine the preference ratio of all criteria over the least important criterion via a questionnaire, again using a measurement scale of 1 to 9. Table 5 displays the response of one of the respondent managers.

**Table 5:** Preference of all criteria over the *Worst* criterion for Expert 1.

Criteria	Least important criterion SSC6
SSC1	9
SSC2	2
SSC3	5
SSC4	3
SSC5	4
SSC6	1
SSC7	5
SSC8	3

#### 4.2.5 Finding the optimal weights of criteria

In this step, the optimal weights of the criteria are calculated, by solving the BWM optimization model for each of the 38 respondents. Next, a simple weighted average for each criterion is computed to obtain a single weight vector, as shown in Table 6, which indicates the average consistency ratio ( $\xi^{L*}$ ) is close to zero, hence the comparisons are highly consistent and reliable. Moreover, the standard deviation (s.d.) for each criterion can be found in Table 6. Small numbers for the s.d. show homogeneity among respondents.

**Table 6:** Results of BWM: criteria weights for the 38 respondents

Criteria	Average weight	s.d.
Work health and safety (SSC1)	0.120	0.029
Training education and community influence (SSC2)	0.118	0.032
Contractual stakeholders influence (SSC3)	0.292	0.031
Occupational health and safety management system (SSC4)	0.035	0.011
The interests and rights of employees (SSC5)	0.108	0.035
The rights of stakeholders (SSC6)	0.103	0.031
Information disclosure (SSC7)	0.115	0.040
Employment practices (SSC8)	0.109	0.038
<b>Average consistency, <math>\xi^{L*}</math></b>	0.0720	

## 5. Results and discussion

The final results of the study can be found in Table 6. The results provide some insight to make strategic managerial decisions. From Table 6, “contractual stakeholders influence (SSC3)” has the highest social sustainability criterion weight of 0.292. Contractual stakeholder influence is the most critical and important criterion when these organizations attempt to achieve social sustainability in

particular and organizational sustainability development in general. This was followed by “work safety and labor health (SSC1)” and “Training education and community influence (SSC2)”, with criterion weights of 0.120 and 0.118, respectively. The implication of this result for the manufacturing industry in Iran and other emerging economies is that contractual stakeholders influence requires the greatest and most urgent managerial attention in helping achieve improved social sustainability, and sustainable development in general. Once contractual stakeholder influence has been developed and implemented, it will set part of the foundation for inclusion and development of the other criteria, leading to the improvement of the entire program. This result further suggests that if the Iranian manufacturing organizations involved want to initiate and implement social sustainability in their supply chain operations, they start by focusing on promoting contractual stakeholder influence by strategically partnering with all potential stakeholders. This may strengthen the program capabilities and competencies, introduce some innovativeness in the program and set the stage for other criteria to be implemented. According to Bai and Sarkis (2010), manufacturing corporations acknowledge social standards like work health and safety issues and understand they are required to be considered when suppliers are selected. According to Ciliberti et al. (2011), stakeholders put considerable pressure on organizations to implement corporate social responsibility (CSR) management systems throughout the supply chain. Monitoring these activities is a significant step towards reducing adverse social impacts during manufacturing (Hsu et al., 2013) and enhancing supply chain sustainability (Gualandris et al., 2015).

“Occupational health and safety management system (SSC4)” has a weight of 0.035 and is ranked as the least important criterion, which is surprising, since the work health and safety criterion, which ranked second, is closely linked to this criterion. It is unclear why the respondent considered this criterion to be the least important. One possible reason is that the Iranian manufacturing sector may be less dependent on comprehensive employee wellbeing. It may also be that more highly ranked criteria have already been developed, which means there is a need to pay more attention to and implement the less developed criteria. From a practical perspective, it may also mean that occupational health and safety management system is more appropriate for the manufacturing industry in Iran and other developing nations, which are faced with labor market turbulence, to help them manage the sustainability of their supply chain operations. This shows that the manufacturing sector in Iran is still in its infancy when it comes to the implementation of social

sustainability criteria since the focus on and main avenues to enhance organizational social sustainability come from more fundamental (partnering) initiatives. It is, therefore, important for further research to be conducted after implementation, to identify whether the results were as predicted (Kusi-Sarpong et al., 2016). According to Table 6, information disclosure (SSC7) is the fourth critical and important social sustainability criteria. After SSC3, SSC1 and SSC2. The implication of this result is that Iranian manufacturing companies need to develop and implement information disclosure (SSC7) after considering and developing more important criteria, which are SSC3, SSC1 and SSC2, respectively, in their organizational supply chain to achieve social sustainability. SSC8 and SSC5, with weights of 0.109 and 0.108 are ranked fifth and sixth, respectively, which suggests that programs and practices that are related to (the rights and interests of) employees are not considered highly important in the Iranian manufacturing sector. SSC6 is ranked as the seventh most important social sustainability criterion, with a weight of 0.103.

The outcome of this study is at odds with previous studies on sustainability. For example, Azadnia et al. (2015) found that, "occupational health and safety management", which was ranked the lowest in our study, was ranked highest in that study. And although this empirical study adopted took a broader view on sustainability, the result of the earlier study is not surprising, since the wellbeing of employees, who are a critical asset in any organization, is paramount when it comes to achieving sustainable development. Another study by Badri Ahmadi et al. (2017), examining sustainable supplier selection in the telecom industry, found that contractual stakeholder influence, which was ranked highest in our study, was ranked lowest amongst the social criteria in their study. In light of the existing lack of empirical studies to support the findings of this study, and the fact that research into social sustainability in supply chains is clearly in its early stages, it may not be surprising to find mixed results at this stage. This results lead to a situation in which managers will have to decide which criteria they need to focus on first and which ones they want to postpone. However, the ultimate aim and feasibility of the initiatives involved may be to help managers to implement or adopt certain supply chain social sustainability criteria.

## **6. Conclusion and future researches**

The operations of manufacturing organizations have a massive global negative environmental and societal impact, in particular in emerging economies like Iran. In addressing these issues, several manufacturing organizations have started a number of initiatives. In addition, there are several

studies that have attempted to address the issue of sustainability in organizational supply chains. However, these initiatives and initial attempts tend to focus more on the broader spectrum of sustainability, rather than specifically on the social sustainability of supply chains. The few studies and organizational interventions that have included social dimensions into their SSCM frameworks and initiatives have only focused on some aspects of the supply chains.

The isolated and diverse frameworks developed do not help when it comes to the resources and capabilities needed to manage the social impact of the manufacturing industry, comprehensively and systematically and to achieve sustainable operations. An integration of these separate frameworks into a comprehensive framework helping the manufacturing industry incorporate social sustainability into their supply chains is currently unavailable. To remedy that situation, this paper started by conducting a review of existing sustainability studies, to identify potential criteria within the manufacturing context and subject them to several rounds of review by industrial experts, to propose a comprehensive framework. To help managers with the decision-making process, we introduced and used the ‘best worst method’ (BWM) to assess and rank the proposed criteria, using a sample of 38 experts.

The relative weights of the criteria were determined and then prioritized according to the value of the weights and their importance to organizational sustainability. The results show that, “contractual stakeholder influence” was the most criterion in terms of achieving social sustainability, while “occupational health and safety management system” was considered the least important. The proposed framework can help firms build the capability they need to realize sustainable development. In particular, the framework can aid supply chain managers and practitioners in developing countries to evaluate and determine the importance and impact of social sustainability practices in manufacturing corporations, as well as implementation paths, more effectively. Managers in manufacturing companies in Iran (and, by extension, in other developing economies) now have a tool they can use to evaluate and implement social sustainability.

This study does have a number of limitations and additional research is needed. The limitations provide ample room for improvement and can provide a useful basis for further research into this subject. One of the principal limitations to this study is its exploratory nature. The result presented here are exploratory in nature, in that they only consider a certain manufacturing sector in one region (Iran), making it harder to generalize the findings. However, given the homogeneity of the

respondents, we can be fairly certain about particular activities and concerns related to achieving social sustainability within Iranian's manufacturing companies and the manufacturing industry in general. Clearly, more and broader empirical research is required. The results also cover a single period of study. Longitudinal study is required to identify whether the rankings of the criteria would change over time. We suggest future researchers to use other MCDM models, together with our social sustainability criteria framework, to determine the weights, and compare the results of these models with our BWM results. It may be clear that social sustainability in emerging economies is a subject that merits and requires further study. In our view, this study helps lay the foundations for a research topic that will only gain in importance in years to come.

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