A Classification Model of Social Sustainability Risks in Manufacturing Product Development

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Abstract. In sustainability context, social risks are having equal importance with technical and environmental risks. However, most previous studies focusing on product development risks are mostly paying attention to operational risk and overlooking an effort to classify socially oriented sustainability risks in product development. Scientific efforts attempt to classify social sustainability risks in product development are scare in reference. Motivated by this gap, this paper presents a pilot study in categorizing social sustainability risks from literature survey. Our initiative presented three categories of product social sustainability risks namely regulatory, personal and consumer and product sustainability risks. Departing from this initial effort, opportunities for further investigations are also presented.

Keywords: Sustainability risk, Product development, Manufacturing, Social risks, Social impact.

1 INTRODUCTION

Product development is manifestation of strategic effort aimed to increase business profitability that will in turn improve business sustainability. Considering this important function, identification, assessment and preparation on appropriate preventative measures against impact of risks during product development is important. In summary, managing risks in product development activity is undoubtedly important for sustaining business. In line with growing attention to focus sustainability recently, effort to consider all dimensions of sustainability which is not covering only on economic and environmental dimensions but also social dimension. Capability to recognise and to make prioritization of risk is becoming vital and adopted as determinant of the enterprise to achieve better business performance. Considering the strategic role of risk identification in product development, the number of efforts to

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investigate risks in product development is growing. Pujovic et al. [1] presented application of multi criteria decision making method to access criticality of risks in product development using the fuzzy-AHP method. Salavati et al. [2] presented effort to improve product performance based on risk evaluation. Galli [3] present profiling of risk typology and its relation with business performance. Skec et al. [4] presented risks identification in product development stages using risk breakdown matrix. Cauhan et al. [5] propose taxonomy of product development risks using auto industry setting and [6] presented risk modes in product development project. Despite scientific efforts to improve understanding of typological of product development risks are increasing as has been presented by previous scholars, it is evident that those previous works are inclined to general product development risks with least attention to show typological risks related with social risks. Ignorance on social risks may cause companies suffering from unintended occurred risks caused by socially related problems [7]. Compared to economic and environmental risks, resolving social issues are much more complicated since impact of social risks can affect to various stakeholders with yearly time horizon of risk exposure duration and claiming more costly recovery efforts [8]. Considering the magnitude and time horizon of the impact of social risks, improving understanding of category of social risks is getting important but still becoming least research area investigated by previous research in product development discipline. Motivated by this research gap, this paper is aimed to present categorization of social risks in product development based on literature survey. Contribution of this paper is related to the dimensions and exemplary of social risks in product development inspired from previous studies dealing with eco social sustainability in manufacturing. The structure of the paper is written as in the followings. In section 2, overview of risk and differentiation between operational and sustainability risk is presented and extended with research methodology used for the study in section 3. Section 4 relates to the categorization of social sustainability risks produced from literature survey. Conclusions and potential research direction from these initial studies are presented in section 5.

2 SOCIAL SUSTAINABILITY RISK IN PRODUCT DEVELOPMENT

Presenting the manifestation of effect of uncertainty against the achievement of reaching objectives, risk is manifested as negative or positive uncertainty. The former is usually commonly mentioned as risk and the latter is popularly called opportunity. Inherently, risk possess two inherent attributes namely likelihood of occurrence and impact of its effect. Likelihood of occurrence is related to the probability that a certain risk will occur and usually represented with ordinal numerical value ranging from 0 which denote impossibility that a certain risk will occur and 1 which indicate that likelihood of a certain risk will occur. Meanwhile severity of risk impact is usually represented with ordinal numerical value ranging from 1 which denote that the impact of a certain risk factor is not impacting at all and 10 represents disastrous impact. Considering temporal effect, typical risk affecting temporary disruption is named operational risks meanwhile risk affecting disruption in longer time horizon and to various stakeholders is named sustainability risk. Within product development process,

the emergence of risk can be caused by the rising of technological development, the dynamic of the market preference and also the change of business relationship among enterprises [9].

3 METHODOLOGY

The existence of social risks studies is dispersed in various reference sources. For this reason, generic keywords (i.e. "product risk", "product development risk", "social risk indicators") were launched in five international databases (i.e. ScienceDirect, Emerald, Wiley, Springer and Inderscience) to collect most relevant studies, as in [10]. Articles written in a language other than English were excluded from the search process. Then, the relevance of sources was investigated by manually reading the title and abstract. Relevant sources were then classified according to full-text analysis, taking a cue from the classification of eco-sustainability indicators in the manufacturing sector adopted by [11] and [12]. In this contribution, the social sustainability risks, described in the considered studies, have been classified into three dimensions:

- Community indicator deals with the willingness of companies to undertake business partnership with public in their surroundings.
- Employment indicator represents the willingness of the companies to take responsibility in fulfilling the needs of their employee.
- Consumer and product indicator relates with companies' capability to fulfil the needs of the consumer in terms of quality, safety and product maintainability.

4 RESULT AND DISCUSION

The more general result of the analysis and classification of the sources considered is reported in Table 1, where they have been classified according to the three considered social sustainability dimensions, described in the previous section.

Table 1. Classification of the considered sources according to the three dimensions of social risk factors in manufacturing product development.

Dimension	Risk Factor	Adopted From
Consumer and Product indicator	Lack of attention on providing product sold with product maintenance manual	[13], [14] as cited by [6]
	Lack of attention on providing product safety manual	[12]
	Less attention on important of product testing prior product launch to the market	[12]
	Lack of attention on caring to research and development efforts	[15] as cited in [11]
	Lack of attention to the adherence to the standard of regulatory body	[16] as cited in [11]
	Less ignorance on equipping products with safety guidance	[17] as cited in [11]

	Lack of attention on considering customer safety in designing product	[14] as cited in [11]
	Lack of attention on adherence to regulatory related products	[15] as cited in [11]
	Lack of attention to curb corruption practices	[19] as cited in [11]
Employment indicator	Lack of attention to increase workers skill	[10]
	Lack of attention on providing working safety apparatus	[20] as cited in [11]
	Weak relationship with workforce regulatory body	[21] as cited in [11]
	Limited allocation on time allowance to train employee	[22] as cited in [11]
	Lack of attention to the working loss hour due to sickness and absenteeism	[23] as cited in [11]
	Lack of environmentally friendly technology training to the employee	[21] as cited in [11]
	Limited feedback for improving working place safety and comfort	[22] as cited in [11]
	Knowledge gaps using social media and information technology tools	[23]
	Limited awareness training educating workers on working disease	[21] as cited in [11]
	Lack of attention on balancing man and woman workers	[24] as cited in [11]
	Limited effort to improve workers social compensation	[25] as cited in [11]
	Limited number on program to develop workers welfare	[26] as cited in [11]
	Limited number of skill development program for workers	[27] as cited in [11]
	Wage discrimination between man and woman	[28] as cited in [11]
	Lack of attention to the workers career development	[15] as cited in [11]
	Lack of attention to curb corruption practices	[15] as cited in [11]
	Lack attention to support workers with health insurance	This paper
	Less attention to workers turnover issue	[15] as cited in [11]
	Difficulty in obtaining competence workforce in the surrounding of the company	[12]
Community indicator	Lack of enthusiasm to undertake business partnership with local businessmen	[12]
	Inclination on using imported products	[29] as cited in [11]
	Less interest in assigning jobs to local person	[11]

Reliance on single supplier	[11]
Limited effort to collaborate with local business partners	[12]
Difficulty in obtaining local suppliers	[12]
Lack of interest in undertaking philanthropic activities to the local community	[12]

By analysing Table 1 the main risk factors on which to work to improve sustainability in each dimension, can clearly and systematically learnt. The main problems to be addressed regarding the Consumer and Product indicator concern the improvement of the product design, spending greater attention on the research and development of new solutions, which increase the added value of the product and its perception by the customer. To this end, it may be necessary to pay greater attention to these social aspects during product design, delving into issues such as user's perception and user's requirements [30]. At the same time, it could be useful to look for the intersection, from a forecasting perspective, between sustainability and the technological evolution of the product resulting from research and development [31]. Furthermore, it is necessary to provide greater customer assistance regarding aspects related to product maintenance. In this regard, targeted product design for maintenance and design for repairability interventions, supported by dedicated methodologies, could solve the problem.

The problems relating to the employment indicator instead refer above all to the lack of attention to increase employee competence until threat from obtaining competence workers in the surrounding of the companies. To this end, professional growth could be encouraged with the adoption of the new paradigms of Industry 4.0 [32].

Finally, the community indicator problems mainly refer to the lack of enthusiasm to undertake business partnership with local businessmen and serving philanthropic to the community surroundings. To further localize working partners, with sustainability advantages, their research must be supported by a greater focus on skills, for example by implementing collaborative work portals, as in the circular economy, and the construction of local supply chain consortia in a targeted way.

Thus, social risk classification model as presented in table 1 enable decision makers to determine relative impact of each social sustainability risk dimensions using multi criteria decision making tools as step toward determination on the score of the impact of a certain social sustainability risks in product development. While risk prioritization is therefore necessary for the research and selection of the many possible interventions to improve social sustainability in a targeted way.

5 CONCLUSION

Product development is an activity having tremendous impact to the sustainability of the companies. Nevertheless, studies dealing with efforts to identify the risks in product development are still mostly dominated by economic and environmental risks with less attention to social sustainability risks despite on situation acknowledging the important of considering the adverse impact of social risks to the various stakeholders.

Studies presenting the classification of social risks in product development is lacking. Motivated by this gap, this paper presents an initiative to present a conceptual social sustainability risk in product development based on literature survey. Departing from this initial study, some future research directions is viable. At first, undertaking perusal on validity of the social risk factors presented by this study using empirical investigations in both of manufacturing and service sectors. Next, social risk prioritization model considering the influence of hierarchical interrelationship among three dimensions of social sustainability risks using Interpretive Structural Modelling (ISM) and MICMAC method coupled with the DEMATEL technique is missing in previous studies. In the end, formulating decision support model for ranking social sustainability risks enable to gauge both of their positive and negative impact simultaneously to varying stakeholders is also missing and worth to be pursued.

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