



RISUS - Journal on Innovation and Sustainability  
volume 11, número 1 - 2020  
ISSN: 2179-3565

Editor Científico: Arnaldo José de Hoyos Guevara  
Editor Assistente: Rosa Rizzi  
Avaliação: Melhores práticas editoriais da ANPAD

## COOPERATION NETWORKS AND ORGANIZATIONAL FACTORS ON SUSTAINABLE INNOVATION

*Redes de cooperação e fatores organizacionais na inovação sustentável*

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### ABSTRACT

Sustainable innovations need more partnerships than available within the boundaries of an organization. Cooperation with research organizations, public institutions, nongovernmental organizations, intermediary organizations and other pressure groups as external actors for sustainable innovation play an important role in organizational performance. Some organizational factors such as knowledge management, learning, and culture influence this relationship as internal factors. There has not been a comprehensive conceptual model that considers the relationships among external actors, organizational factors, and sustainable innovation in the literature yet. In this study, we propose a conceptual model to show all relationships between these factors following a systematic literature review to identify all-important relationships. The model takes a general perspective, beginning with establishing cooperation to the end of firm performance. It can also provide a basis for researchers to test the relationships and to evaluate all factors that affect sustainable innovation, and sustainability-based firm performance for managers.

**Keywords:** Cooperation networks; Sustainable innovation; Conceptual model; Organizational factors.

**ACEITO EM:** 30/01/2020

**PUBLICADO:** 30/05/2020



## REDES DE COOPERAÇÃO E FATORES ORGANIZACIONAIS NA INOVAÇÃO SUSTENTÁVEL

*Cooperation networks and organizational factors on sustainable innovation*

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### RESUMO

As inovações sustentáveis precisam de mais parcerias do que as disponíveis dentro dos limites de uma organização. A cooperação com organizações de pesquisa, instituições públicas, organizações não governamentais, organizações intermediárias e outros grupos de pressão como atores externos da inovação sustentável desempenham um papel importante no desempenho organizacional. Alguns fatores organizacionais, como gerenciamento de conhecimento, aprendizado e cultura, influenciam esse relacionamento como fatores internos. Ainda não existe um modelo conceitual abrangente que considere as relações entre atores externos, fatores organizacionais e inovação sustentável na literatura. Neste estudo, propomos um modelo conceitual para mostrar todas as relações entre esses fatores após uma revisão sistemática da literatura para identificar todas as relações importantes. O modelo adota uma perspectiva geral, começando com o estabelecimento de cooperação até o final do desempenho da empresa. Também pode fornecer uma base para os pesquisadores testarem os relacionamentos e avaliarem todos os fatores que afetam a inovação sustentável e o desempenho da empresa com base na sustentabilidade para os gerentes.

**Palavras-Chave:** Redes de cooperação; Inovação sustentável; Modelo conceitual; Fatores organizacionais.

## INTRODUCTION

The relationship between cooperation networks and sustainable innovation is one of the most important issues at the intersection of sustainable development and innovation management fields. Sustainable innovation also presents some new challenges and needs more integrated and wide-ranging thinking for practitioners. Firms must re-evaluate their internal capabilities, such as organizational culture, and leadership as well as stakeholder relationships (R. Adams et al. 2012). For environmental innovation, the external sources incorporate the environmentalist pressure of stakeholders and the pressure of environmental regulations while the internal sources could be considered as environmental leadership, culture and capability (Y. S. Chen, Chang, and Wu 2012). Yarahmadi and Higgins (2012) developed a conceptual framework that shows the relationship between collaboration with diverse organizations in order to develop environmental innovations and to identify the motivators for such partnerships. They considered many cooperation partners but did not consider pressure groups' viewpoint. Apart from that study, there has not been a comprehensive conceptual model presented in literature yet to posit the influence of external actors and internal factors that affect sustainable innovation. More research may be needed to better understand the role of cooperation for sustainable innovation and even eco-innovation (Wagner and Llerena 2011). In order to fill this gap, the research question is to understand what external and internal factors that affect the sustainable innovation and to identify the potential relationships among these factors. The first step is an initial study that propose a conceptual model by employing systematic literature review approach. Our next step that will be performed in another study is to verify the model to test the relationships with data gained from industry.

This study presents an integrated conceptual model that clarifies the relationship between cooperation networks and sustainable innovation considering internal factors by employing systematic literature review. The model takes a general perspective, beginning with establishing cooperation to the end of sustainable innovation. The remaining sections of this paper are organized as follows. Theoretical background explain sustainable innovation literature and Section 3 presents a detailed dimension of methodology followed. Section 4 mentions the propositions based on conceptual model. Conclusion and further research are presented in Section 5.

### 1. THEORETICAL BACKGROUND

While environmental innovation are more widely defined, the definitions presented for sustainable innovation in the academic literature is limited although it has been widely used over the last decade (Quist and Tukker 2013). There are some different terminologies and definitions for sustainable innovation in literature, such as 'sustainability-oriented innovation (SOI)' (Klewitz and Hansen 2014); sustainability-driven innovation (Trifilova et al. 2013); 'sustainability-related innovation'(Wagner 2008) and 'innovation with high social benefits'(Wagner 2010). We prefer to use the term 'sustainable innovation' in this study. Bos-Brouwers (2010) defines sustainable innovation as 'innovations in which the renewal or improvement of products, services, technological or organizational processes not only delivers an improved economic performance, but also an enhanced environmental and social performance, both in the short and long term have the capacity to generate positive social and environmental impacts'. Another definition is 'Sustainable innovation is a process where sustainability considerations (environmental, social, and financial) are integrated into company systems from idea generation through to research and development (R&D) and commercialization. This applies to products, services and technologies, as well as to new business and organizational models' (Charter and Clark, 2007). We will broadly define sustainable innovation as 'any new or significant improvement of products, technological or organizational processes and systems commercialized or internally implemented successfully, that not only provide economic benefits but also generate positive social and environmental impacts.' At the

same time, although the term sustainable innovation has been used interchangeably with other sustainability-related concepts such as green innovation, eco innovation and environmental innovation, we consider environmental (or green or eco) innovation to be a part of sustainable innovation because sustainable innovation covers environmental innovation and incorporates social dimensions alongside environmental aspects as can be seen in Fig.1. Therefore, sustainable innovation introduces some new challenges and requires more integrated and comprehensive thinking for practitioners. Firms must reconsider their internal capabilities, such as organizational culture, and leadership as well as stakeholder relationships (R. Adams et al. 2012).

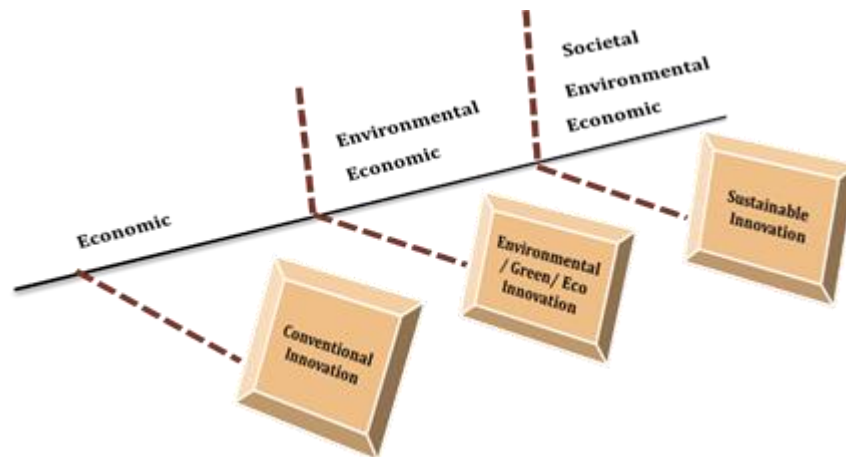


Figure 1. Sustainable innovation

The innovation capability of a firm is not solely determined by internal factors, such as its management, strategy, and culture, but also by the extent of cooperation with external stakeholders, such as public organizations, knowledge institutes, customers, stakeholders, and capital providers (Hofman and Bruijn 2010). The companies have no R&D departments or do not work with a network of external partners (other firms or institutions), the pressure from consumers will not effectively translate to a new product or process that reduces the impacts on the environment (Cainelli et al. 2015). Li et al. (2017) consider both external legitimacy pressure and internal profitability; their interaction affects corporate green innovation practices. At the same time, functions of a firm such as R&D, marketing and operations acting together in an integrated way with external actors is crucial to develop a successful environmentally sustainable product innovation (De Medeiros, Ribeiro, and Cortimiglia 2014). To avoid confusion, in the remainder of this paper, we will use the term environmentally-oriented product innovation instead of environmentally sustainable product innovation. Actively managed collaboration with internal and external stakeholders can provide important sources for innovations that make contributions to the welfare of the society and natural environment by addressing stakeholder expectations (Ayuso et al. 2011). Managers enable customer capital growth developing information technology (IT), fostering relationship learning activities and developing green innovation performance with clients through managerial actions and strategies (Leal-Millán et al., 2016). More activities and cooperation with partners for sustainable innovations increase the number and impact of them and deliver many opportunities to compensate for a lack of resources, especially for SMEs (Bos-Brouwers 2010). Furthermore, effective public support structures and intermediary organizations can play an important role in facilitating innovative process (Hofman and Bruijn, 2010). Moreover, SMEs can remodel their innovation process to collaborate more frequently with external actors beyond the firm level to strengthen the innovative capacity for SOIs (Klewitz and Hansen 2014)

At the same time, in terms of importance of cooperation, the integration of external stakeholders may be seen as more important in environmentally oriented product innovation than in traditional innovation. Environmental innovations are systemic in nature, credence and complex features require higher interdependencies with external

Stakeholders (De Marchi 2012). In the same study, the author also mentioned that R&D collaboration with scientific agents—including universities, consultants and research centers- for innovations that reduce the impact on the environment are much more crucial than other innovations and that public grants stimulate environmental innovations more than conventional innovation. Furthermore, in terms of cooperation type, previous studies have not taken the full range of firms' stakeholders into consideration relevant to sustainability performance; the focus has been on traditional external actors such as, universities, R&D institutions, other firms and public organization (Ayuso et al. 2011). For sustainable innovation, cooperation with diverse stakeholders including financial, governmental and educational actors as well as firms, researchers, knowledge transfer actors, and end-users is needed (Quist and Tukker 2013). In this study, all these stakeholders are taken into consideration.

On the other hand, internal or organizational factors such as culture, management systems influence the relationship between cooperation networks and sustainable innovation. Firms have to manage knowledge sourced from collaboration with internal and external stakeholders in order to convert into new ideas for innovation (Ayuso et al. 2011). Further, according to Ayuso et al. (2011) if firms do not have enough capacity to absorb this knowledge and integrate it into their innovation processes, they may not be able to develop sustainable innovations although they may have the ability to access useful knowledge from diverse stakeholders. Moreover, mutual learning and collaboration are considered as necessary to create sustainable innovations (Quist and Tukker 2013) and innovation-oriented learning and interfunctional collaboration within an organization also are success factors of an environmentally-oriented product innovation (De Medeiros, Ribeiro, and Cortimiglia 2014), thus also necessary for sustainable innovation.

Furthermore, the structural factors, (e.g. company size, age and sector) should be considered while handling the relationship between cooperation networks and sustainable innovation as a whole. R&D intensity is commonly used as a control variable in econometric analysis and it is related not only to one organizational factor but is also a trigger for several factors. On the other hand, although Guoyou et al. (2013) state that the main target of environmental complaints from pressure groups is often large companies. Hofman and Bruijn (2010) state that SMEs, either face struggles to challenge policy changes or have great difficulty in understanding the boundaries of governmental sustainability policies and regulations to create innovation.

As a final point, there is imbalance in the literature suggesting that firms do not pay attention to the social dimension of sustainability as much as environmental considerations (R. Adams et al. 2012). Studies about eco-innovations help us to understand sustainable innovation but it is not sufficient to understand it completely. In this study, we paid attention to the social aspect of the triple bottom line approach, a concept introduced by Elkington (1997) and added the concept of corporate social responsibility (CSR) to our model in order to be meaningful.

## **2. METHODOLOGY: A SYSTEMATIC LITERATURE REVIEW**

In this study, a systematic literature review was performed to obtain and analyze the publications about cooperation networks, organizational factors, and sustainable innovation. The main factors were identified and the relationships among the factors were established in order to propose a conceptual model. In this part of the study, a systematic literature review was conducted to identify the external actors and organizational factors that affect sustainable innovation and to determine their relationships. Systematic literature review, is a methodology which differs from conventional reviews in that it aims at “synthesizing research in a systematic, transparent, and reproducible manner” and includes both a quantitative, bibliographical analysis and a more qualitative thematic analysis (Tranfield et al. 2003). The systematic review can be considered a new approach in management and organization studies even though other disciplines have appreciable methodological developments (Adams et al. 2012). Several researchers have already used this methodology in the sustainable innovation management-related areas in recent years. Klewitz and Hansen (2014) conducted a systematic literature review to develop an integrated framework on SOIs of SMEs in order to explain how distinct strategic sustainability behaviors can describe contingencies in types of innovation practices. De Medeiros et al. (2014) also used this method to identify critical success factors for environmentally oriented product innovation. Although they have a similar

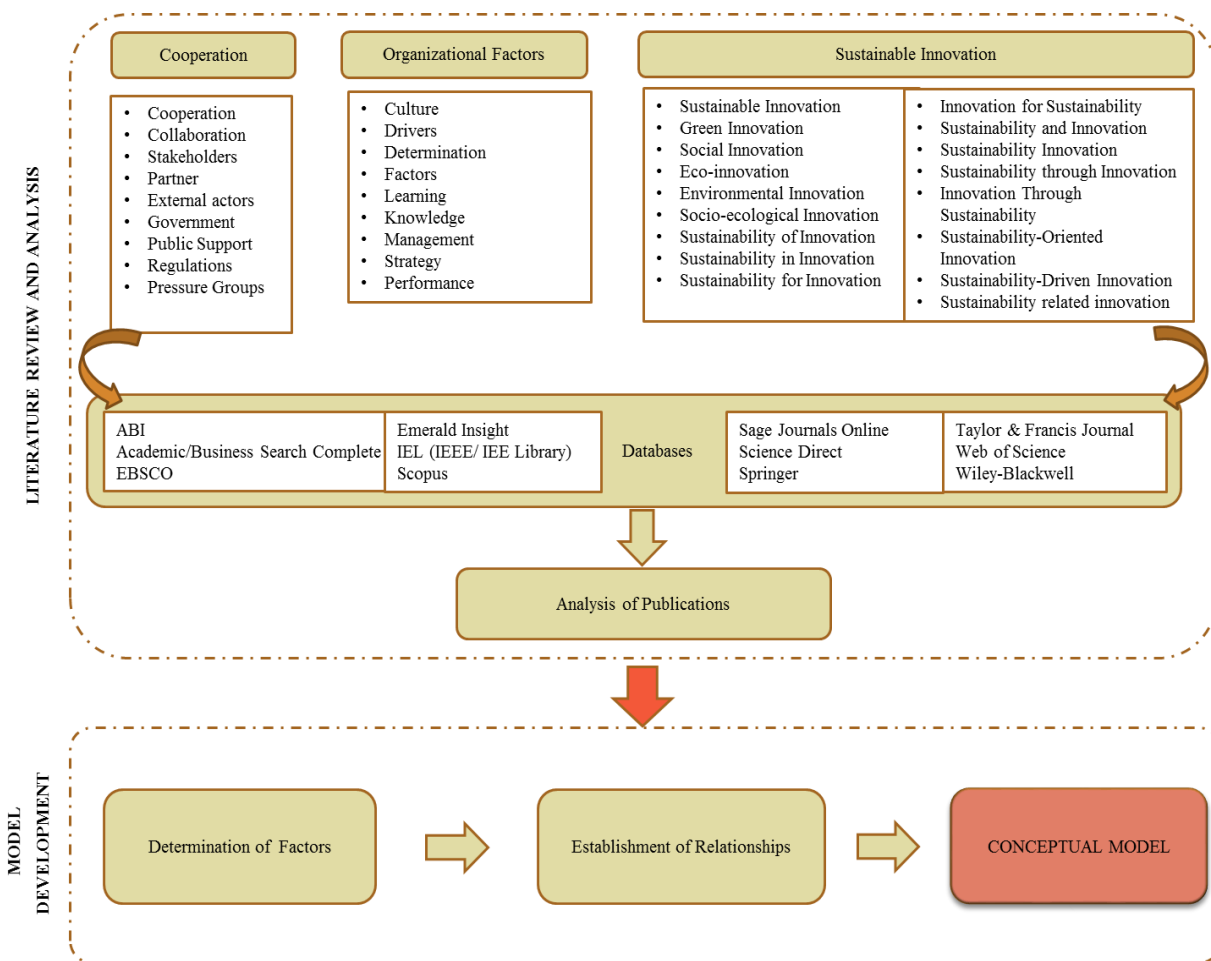
base as that used in this study to perform systematic literature review there are a few differences in the scope and steps they follow. We followed steps similar to Klewitz and Hansen's (2014) study (based on Seuring et al. 2005) but with some modifications as will be discussed.

**Step1: Identification of Keywords**

Keywords were identified under three categories for a total of 36 to execute the search: they were related to cooperation networks (9 keywords), organizational factors (10 keywords), and sustainable innovation (17 keywords). All keywords used in the search may be seen in Fig.2.

**Step 2: Development of exclusion and inclusion criteria**

The literature review included relevant studies in both academic and grey literature sources for only sustainable innovation and closely related terms (e.g. sustainability related innovation, sustainability innovation); while searching environmental innovation and closely related terms (e.g. eco-innovation, green innovation) databases were limited to peer-reviewed academic journals because sustainable innovation is a newer concept than others and there are some prominent studies in grey literature (e.g. Adams et al. 2012).



**Figure 2. Methodology**

At the same time, we focused only innovation related studies and did not consider other sustainability related concepts such as sustainable manufacturing, eco-efficiency, or greening activities. The keywords were

also searched for the ‘title’, ‘abstract’, and ‘keywords’ fields in each paper. Search for documents published within the period from 1987 to end of March 2017 were designated because SOIs have received prominent attention in practice and international research since the publication of the Brundtland report (1987) (Klewitz & Hansen 2014). As a final point, non-English and non-full text publications were excluded to be able to use selected articles for model development. All inclusion criteria can be seen in Table.1.

**Table 1. Inclusion Criteria**

Search in	Title/Abstract/Keywords
Time Period	1987-2017
Publication Type	all types for sustainable innovation only peer-reviewed academic journals for other sustainability type innovation
Language	English
Full text	Only full text

**Step 3: Execution of search**

The review was executed in two different ways. The first review was conducted for sustainable innovation and closely related concepts (SOI, sustainability driven innovation etc.), and 2244 initial publications were obtained. The second one was executed for other sustainability related innovation (green, environmental, and eco-innovation) and 1478 articles were found. In order to provide a manageable number and to increase the relevancy to factors, cooperation related and organizational factors related keywords were cross searched with sustainable innovation related keywords (e.g. “sustainable innovation” AND “external actors”; “sustainability oriented innovation” AND “culture”) in prominent databases (e.g. ABI, EBSCO, Emerald, Web of Science) as can be seen in Fig.2. The number of publications was reduced from 2232 to 142 and from 1478 to 149, respectively for the two collections, after title and abstract analysis during the searching. In addition, the 5 most relevant articles that were unintentionally eliminated because of cross searching were added by hand to the publication pool and thus, 296 publications were finally obtained to make the classification.

**Step 4: Identification of evaluation criteria and development of A, B, C, D list**

The quality of publications was assessed on six dimensions: degree of relevancy to the factors and cooperation networks, method, clarity of literature, existence of hypothesis or proposition, operational definition, and measurement. Degree of relevancy to factors was evaluated from ‘Very Good’ to ‘Not Relevant’ to be able to determine the more related factors to sustainable innovation. The literature reviewed by the authors in their articles was also evaluated from ‘Very Clear’ to ‘Not Clear’ to be able to identify whether there exists a strong relationship with sustainable innovation. In addition, the existence of a hypothesis or proposition, operational definition and measurement will provide us means to establish the relationships in the model development phase. These publications were analysed in-depth in full text in terms of evaluation criteria to classify to A, B, C, and D lists. These lists are seen in Table.2 with evaluation criteria and number of publications per list.

**Table 2. Evaluation criteria and number of publications**

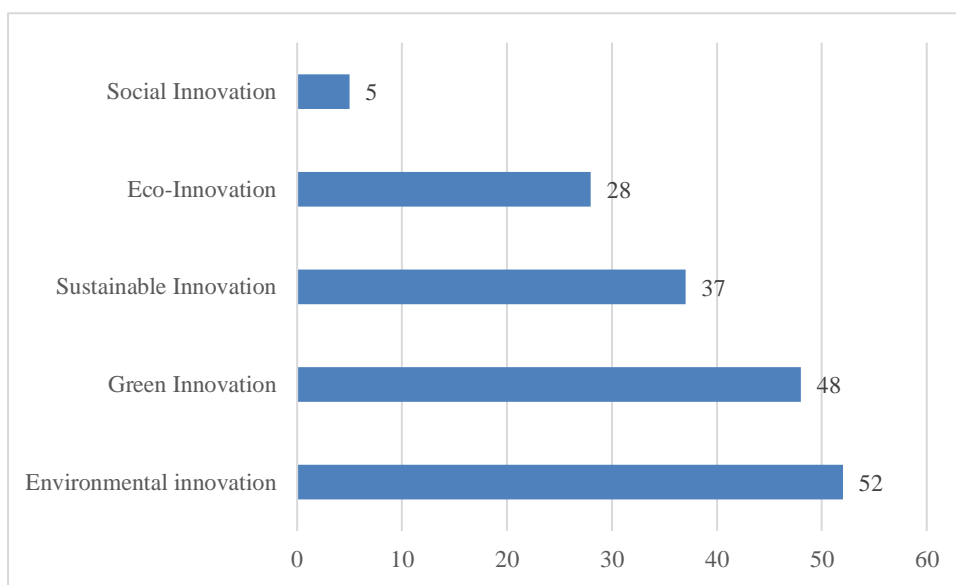
Criterion	A	B	C	D
Degree of Relevancy to Factors	Very Good	Good	Weak	Weak/Not Relevant
Method	Quantitative	Quantitative/Qualitative	Qualitative	Qualitative or N/A
Literature	Very Clear	Very Clear/Clear	Clear	Not Clear
Hypothesis/Proposition	Hypothesis	Hypothesis/Proposition	NA	NA
Operational Definition	Available	Available/NA	NA	NA
Measurement	Available	Available/NA	NA	NA
Number of Publications	56	51	63	126



The D list was not considered for descriptive analysis because of its evaluation results and all descriptive analyses were conducted on A, B, C lists (total 170). Most publications of D list also include grey literature.

### *Step 5: Descriptive Analysis*

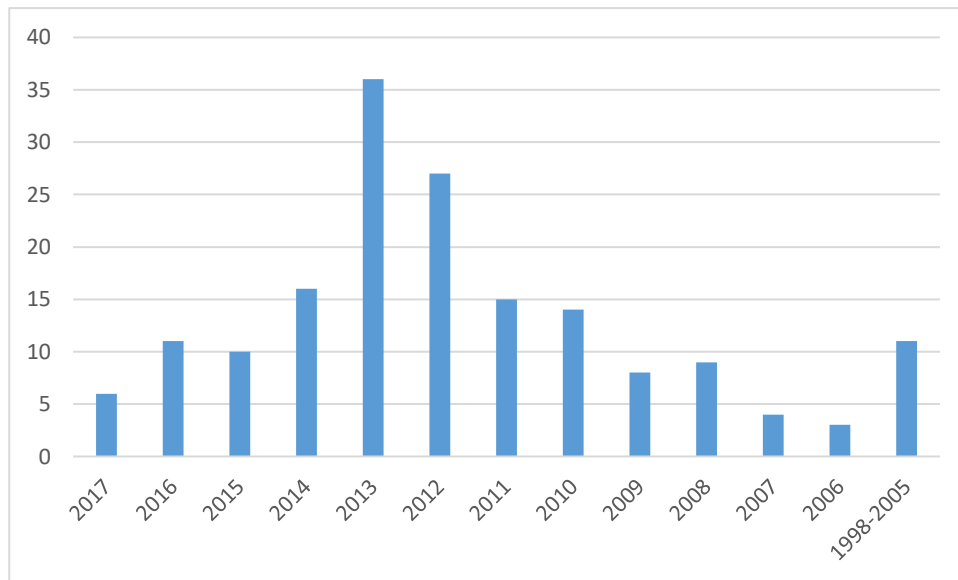
Descriptive analysis was conducted in terms of publication type, innovation-sustainability aspect, year of publication, journal name, and method by using 170 publications in the A, B, C lists. 163 of them are journal articles and others are 5 book chapters and 2 working papers [(Wagner 2008) and (Adams et al. 2012)]. At the same time, sustainable innovation and related terminologies were mentioned in 35 studies. Fig.2 shows the distribution of concepts used in publications in terms of sustainability aspects of innovation.



**Figure 3. Sustainability innovation concept coverage**

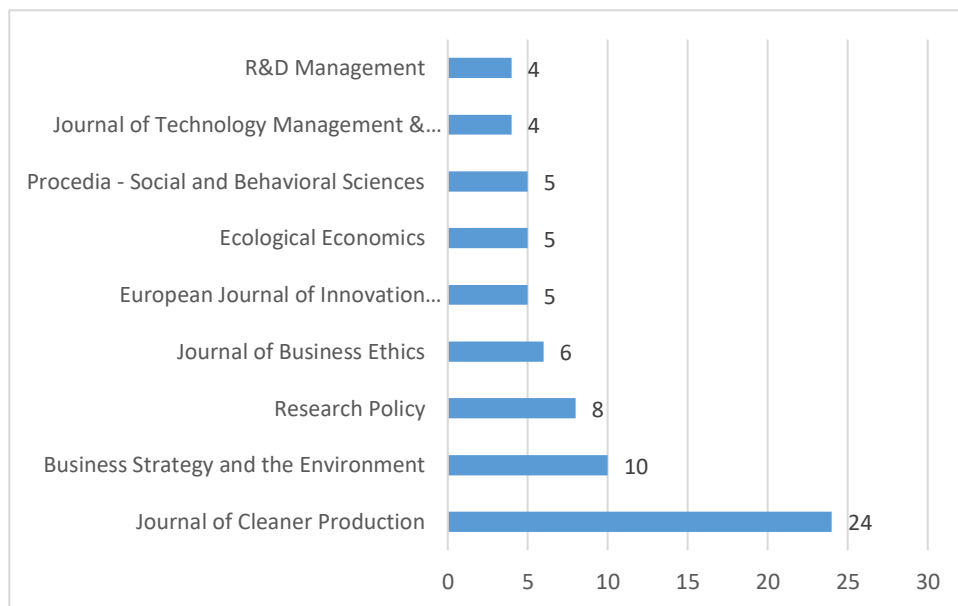
In addition, even though the start of the period of analysis was chosen based on the Brundtland Report (WCED, 1987) publication, in our publication pool, the oldest article was published in 1998 and the number of publications had increased since the mid of 2000 (see Fig.4). The reason behind this can only be the relationship between sustainable innovation and innovation related studies that we focus on our study. Figure 3 indicate that number of publication after 2013 follows a regular trend. In addition, there are fewer publications in 2017 than previous years because our search was finished March of 2017.





**Figure 4. Year of publication.**

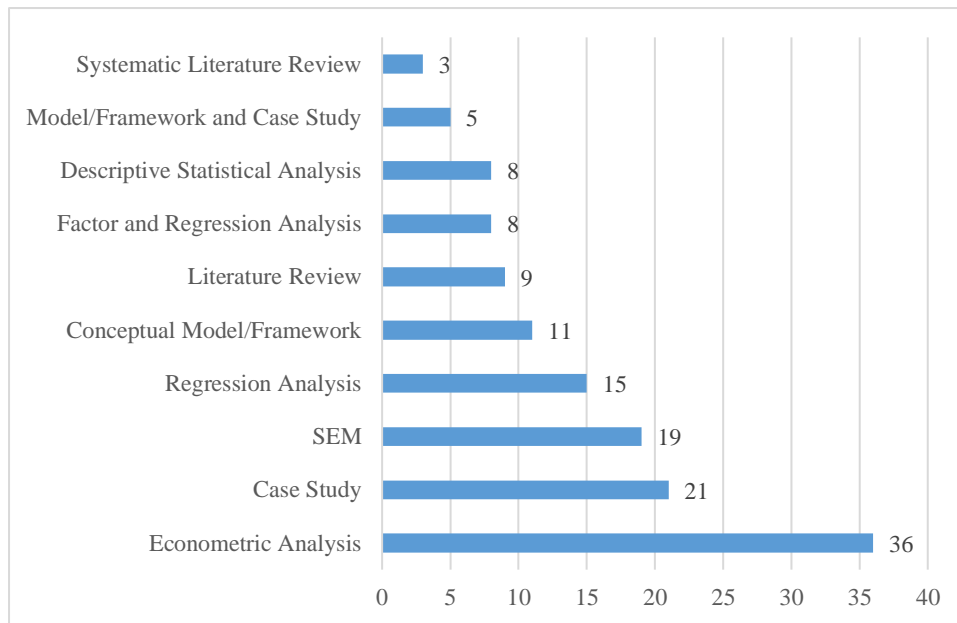
According to the review, the Journal of Cleaner Production contained the largest number of publications with 24 articles; Business Strategy and the Environment is the second with 10 articles. The other more prominent journals may be seen in Fig.5.



**Figure 5. Publication source**

As a final point, we analyzed the research methodologies to identify the most common methods mentioned or used by three or more articles. Econometric analysis (36 articles) was the most common method authors used to determine especially the drivers of sustainable innovation. Case study was another method that was used commonly in order to provide a base for future quantitative analysis. Regression and Structural Equation Modelling (SEM) were conducted in articles in order to validate the relationships between organizational factors and sustainable innovation. Eleven studies proposed conceptual frameworks or models to identify the factors and

their relationships. Literature review was used in nine articles while three articles employed systematic literature review. The distribution of articles reviewed, based on method used, can be shown in Fig. 6.



**Figure 6. Methods of analysis used**

### ***Model Development***

The last two steps, Step 6 and Step 7, can be named model development phase and are differentiated from Klewitz and Hansen's (2014) study because of the differences in targets. Our study focuses only on innovation (sustainable or environmental innovation) related studies in order to determine factors and establish the relationships.

### ***Step 6: Determination of Factors***

The A, B, C lists were used to determine the factors that are related to sustainable innovation. These factors were classified based on three dimensions: external actors, organizational factors, and output factor (sustainable innovation). Cooperation networks and related concepts that can be observed with references are presented in Table.3. Cooperation, collaboration, stakeholder, governmental support, regulation or regulatory and other pressure groups come into prominence in general. In sustainable innovation literature, different terminologies and taxonomies of cooperation networks such as external actors, stakeholders can be found. Table.4 shows some prominent terminologies and corresponding taxonomies.

**Table 3. External actors and their references**

External Actors	References
<b>Cooperation / Collaboration / Stakeholder</b>	(Adams et al. 2012), (Klewitz & Hansen 2014), (Ayuso et al. 2011), (Tello & Yoon 2008), (Sarkis, et al., 2010), (Hofman and Bruijn, 2010), (Adams & Comber 2013), (Quist & Tukker 2013), (Yarahmadi & Higgins 2012), (Wagner & Llerena 2011), (De Marchi 2012), (Leenders & Chandra 2013), (Cuerva et al. 2014), (Petruzzelli et al. 2011), (Tseng et al. 2012), (Huang et al. 2009), (Guoyou et al. 2013), (Wu 2013), (Triguero et al. 2013), (Paraschiv et al. 2012), (Klewitz et al. 2012), (Doran & Ryan 2012), (Hansen & Klewitz 2012), (Del Brio & Junquera 2003), (Mazzanti & Zoboli 2008), (Mazzanti & Zoboli 2009), (Wagner 2007), (Rennings & Rammer 2011), (Cainelli & Mazzanti 2013)
<b>Governmental Support/Incentive</b>	(Ketata et al. 2014) (Cuerva et al., 2014, (Maçaneiro et al. 2013), (Doran & Ryan 2012), (Li 2014), (Yarahmadi & Higgins 2012)
<b>Regulation/Regulatory</b>	(Tello & Yoon 2008), (De Medeiros et al. 2014), (Ketata et al. 2014), (Leenders & Chandra 2013), (Weng & Lin 2011), (Aguilera-Caracuel & Ortiz-de-Mandojana 2013), (Chen et al. 2012), (Huang et al. 2009), (Qi et al. 2010), (Horbach et al. 2012), (Triguero et al. 2013), (Maçaneiro et al. 2013), (Doran & Ryan 2012), (Kesidou & Demirel 2012), (Dong et al. 2014), (Demirel & Kesidou 2011), (Park 2004), (Yalabik & Fairchild 2011), (Horbach 2008), (Cleff & Rennings 1999), (Mehamli 2013), (Li 2014), (Eiadat et al. 2008), (Berrone et al. 2013), (Kammerer 2009), (Rennings & Rammer 2011), (Wagner & Llerena 2011), (Henriques & Sadorsky 2007), (Hou et al. 2017), (Zailani et al. 2015), (Li et al. 2017) , (Huang et al. 2016)
<b>Other Pressure Group/Market or Customer Demand</b>	(Klewitz & Hansen 2014), (Huang et al. 2009), (Tello & Yoon 2008), (Leenders and Chandra, 2013, (Weng & Lin 2011), (Cuerva et al. 2014), (Lin et al. 2013), (Chen et al. 2012), (Qi et al. 2010), (Horbach et al. 2012), (Triguero et al. 2013), (Paraschiv et al. 2012), (Kesidou & Demirel 2012), (Doran & Ryan 2012), (Park 2004), (Yalabik & Fairchild 2011), (Cleff & Rennings 1999), (Eiadat et al. 2008), (Kammerer 2009), (Mehamli 2013), (Henriques & Sadorsky 2007), (Zailani et al. 2015), (Rezai et al. 2016), (Huang et al. 2016)

We classify the external actors mainly into two groups as cooperation networks and pressure groups. Cooperation networks include: Firms (customer, supplier and rival), research organizations (universities, institutes, etc.), public support organizations, intermediary associations, and NGOs, in accordance with the literature. In addition to cooperation networks, pressure groups play an important role on sustainable innovation. We consider pressure groups (named as stakeholder's pressure in some studies) as: firms, governmental regulators, and NGOs. Suppliers, customers and competitors, as firms, not only cooperate with a certain company but also can apply pressure on it to drive sustainable innovation just as NGOs. At the same time, regulatory stakeholders consist of the legislative and executive branches of the government and the organizations protecting the natural environment (Huang et al. 2009). Social organizations like labor organizations that can be considered as NGOs focus on promoting social aspect of sustainability in order to provide social awareness in developing new strategies and policies. Secondly, we consider all organizational factors together in order to determine the most important umbrella concepts related to the relationship between cooperation networks and sustainable innovation. All factors obtained from literature can be seen in Table.5. Factors that are mentioned in the majority of papers as a topic or sub-topic were chosen while those mentioned only once or a few times were overlooked. In some studies, these factors were mentioned as drivers or determinants of sustainable innovation (especially environmental innovation) adoption, performance, or success.

**Table 4.** Taxonomies and references

References	Cooperation Definition	Taxonomy
(Klewitz & Hansen 2014)	External Actors	Value Chain Network (Customer, Larger Buyers); Regulatory Network (Governments, Authorities ); Knowledge Network(Universities, Research Centres)
(Ayuso et al. 2011)	Stakeholder	Internal; External
(Yarahmadi & Higgins 2012)	Cooperation	Supply-Chain Members(Suppliers, Customers); Knowledge Leaders (Technology Centres, Research Institutes , Universities); Governmental Agencies, NGOs, Competitor, Industry Association,
(Huang et al. 2009),	Stakeholder	Regulatory; Internal; Market
(Guoyou et al. 2013)	Stakeholder	Foreign Customers, Stockholders, Foreign Investors, Community, Regulatory
(Qi et al., 2010)	Stakeholder	Client, Employees, NGOs, Community
(Sarkis, et al., 2010)	Stakeholder	Company, Public, University, NGO

Even though studies about eco-innovations are not sufficient to understand sustainable innovation completely, they help us understand progress towards that goal. Most authors focus on organizational and technical capabilities, in order to provide a base for sustainable innovation. Chen (2016) used simulation to find influencing factors of enterprise sustainable innovation ability into three aspects: knowledge innovation capability, production innovation capability, and market innovation capability, and provided a theoretical model for firms to improve their sustainable innovation. Technological, organizational and environmental dimensions from the aspect of technical innovation are considered as determinant factors (Weng & Lin 2011). Cuerva et al. (2014) also consider R&D and human capital as technological capabilities and environmental management systems (EMS) as organizational capability for determinants of eco-innovation. Additionally, firms' technological and organizational capability are considered supply-side drivers by Horbach (2008) and some other researchers also used this approach [ (Doran & Ryan 2012) (Horbach et al. 2012), (Triguero et al. 2013)]. In order to build technological capabilities inputs like education of the employees or R&D investment, also interpretable as an indicator of technological capabilities are essential (Horbach 2008). The construct "technological competence" is defined as a statement by the company of a propensity to invest in R&D, organizational structure, and human resources to work in an innovative and proactive way in terms of eco-innovation (Antonioli et al. 2013). On the other hand, Ketata et al. (2014) address strong benefits of investing in the training of employees and their individual absorptive capacity to develop or strengthen sustainable innovation capabilities and they also measured absorptive capacity by the training expenditure per employee and R&D intensity. At the same time, R&D is considered as complementarity for environmental innovations by Mazzanti and Zoboli (2008). We consider that R&D investments or R&D activities should be used as a control factor (R&D intensity) in accordance with literature because they are related not only to one main factor but also are a trigger for several factors. Moreover, some fundamental changes in firms' culture, human resources and the other organizational capabilities are required for adopting green practices (Lin & Ho 2008).

**Table 5. Organizational factors and references**

Organizational Factors	References
EMS/Environmental Formalization/Status/Tools/Implementation/Practices	(Wagner 2007), (Leenders & Chandra 2013), (Cuerva et al. 2014), (Maçaneiro et al. 2013), (Kesidou & Demirel 2012), (Demirel & Kesidou 2011), (Del Brio & Junquera 2003), (Mazzanti & Zoboli 2008), (Horbach 2008), (Ziegler & Nogareda 2009), (Theyel 2000), (Henriques & Sadorsky 2007), (Triguero et al. 2013), (Horbach et al. 2012), (Ganapathy et al. 2014), (Kong et al. 2016), (Li et al. 2017)
Corporate Social Responsibility Practices	(Tello & Yoon 2008), (Cuerva et al. 2014), (Kesidou & Demirel 2012), (Demirel & Kesidou 2011), (Wagner 2010)
Reputation/Image	(Klewitz & Hansen 2014), (Maçaneiro et al. 2013), (Demirel & Kesidou 2011), (Park 2004)
Culture/Climate	(Adams et al. 2012), (Adams & Comber 2013), (Ishak & Ahmad 2011), (Chen et al. 2012), (Paraschiv et al. 2012), (Albort-Morant et al. 2016)
Leadership & Management	(Bossink 2007), (Ishak & Ahmad 2011), (Chen et al. 2012), (Triguero et al. 2013), (Paraschiv et al. 2012), (Del Brio & Junquera 2003), (Leal-Millán et al. 2016), (Lopez-Valeiras et al. 2015)
Cross-functional/ Intra-Organizational Collaboration	(De Medeiros et al. 2014), (Petruzzelli et al. 2011), (Huang & Wu 2010), (Chen 2016)
Management Commitment / Encouragement / Support/ Concern	(Wagner & Llerena 2011), (Lin & Ho 2008), (Weng & Lin 2011), (Ho et al. 2009), (Qi et al. 2010), (Huang & Wu 2010), (Ar 2012), (Maçaneiro et al. 2013), (Hansen & Klewitz 2012), (Eiadat et al. 2008), (Chang & Chen 2013), (Delmas & Pekovic 2016), (Iranmanesh et al. 2017)
Quality of Human Resources, HR Practices	(Ayuso et al. 2011), (Fadhilah & Ramayah 2012), (Lin & Ho 2008), (Weng & Lin 2011), (Cuerva et al. 2014), (Paraschiv et al. 2012), (Del Brio & Junquera 2003), (Antonioli et al. 2013), (Ho et al. 2009)

Organizational environmental capabilities are often improved by implementing EMS (Kesidou & Demirel 2012) or green capabilities such as systematic environmental analyses, environmental training and certified EMS (Kammerer 2009). Similarly, the adoption of corporate social responsibility (CSR) practices may be considered as green or social capability. In light of the literature review, we determine the main factors that affect sustainable innovation as EMS practices, organizational culture and CSR practices. Table.6 shows main organizational factors and their related sub factors from literature. Quality of human resources and HR practices did not classified under any main factor because human resources are related to each main factors and can be considered providing a base for each factor. These main factors and their relationships to sustainable innovation is briefly discussed below.

### ***Environmental Management System (EMS) Practices***

EMS is the most commonly mentioned factor that affects environmental innovation as an organizational capability or green capability. Many authors mention different approaches to indicate use of EMS practices such as EMS implementation (Wagner 2007), EM Tools (Horbach 2008), EM Status (Del Brio & Junquera 2003), EM Practices (Theyel 2000). In addition, Maçaneiro et al. (2013), state environmental formalization concept that is defined as the existence of internal organizational structures specifically targeted to environmental issues and measured by EMS practices as a contributor. On the other hand, Li (2014) states total environmental quality management and ISO14000 certification as environmental innovation practices. We consider that ISO 14001, EU Eco-Management and Auditing Scheme (EMAS), ISO 50001 energy management systems and other environmental related quality management systems could all be grouped together with EMS Practices. Managing environmental issues is crucial for sustainable innovation as well because it is one dimension of triple bottom line approach. EMS practices also support performing the societal aspect of sustainable innovation.

**Table 6. Main organizational factors and their sub factors**

Main Factors	Sub Factors
EMS Practices	EMS Implementation
	EM Practices/Tool
	Environmental Formalization/Status
CSR Practices	EMAS, EMS, ISO 14001 etc.
	CSR
	Reputation
	Image
Organizational Culture	Culture/Climate
	Leadership & Management
	Inter functional Collaboration
	Management Commitment/Support
	Vision/Policy

In environmental innovation literature, there are few studies about CSR that compare them with EMS because of its nature and definition. Socially responsible practices include environmentally responsible initiatives related to the management of natural resources and the implementation of eco-innovation (Cuerva et al. 2014). Beside employment/labor practices and human/social rights, CSR which is a debated and contemporary idea that accommodates environmental problems is the other important backbone for enhancing corporate image (Demirel & Kesidou 2011). Therefore, corporate image, reputation, code of conduct, working conditions, human rights, occupational health and safety can all be considered as components of CSR practices. In order to accomplish the social innovation projects, companies should integrate CSR practices in firm's business strategy with a strong top management commitment (Altuna et al. 2015). Firms should pay attention to enhance societal benefits of their products, processes, and supply chain systems by implementing socially responsible practices when introducing sustainable innovation.

### ***Organizational Culture***

Organizational culture plays a crucial role in creating sustainable innovation. Paraschiv et al. (2012) define the sustainability oriented organizational culture as "An organizational culture centered on sustainability is an organization where members have common beliefs and opinions about the importance of balancing economic efficiency, social equity and environmental responsibility that are guiding managers and employees in their behavior and decision-making process". Environmental culture is also described as "a symbolic context about environmental management and environmental innovations within which interpretations guide behaviors and processes of members' sense-making"(Chen et al. 2012). At the same time, in order to implement an environmental innovation strategy, managers' attitudes toward understanding the priority of environmental issues besides having environmental knowledge and skills play an important role (Eiadat et al. 2008). Besides, the construct "top management support" is defined as "managers' perceptions that the environment is highly relevant for business (Maçaneiro et al. 2013) and this support provides employees motivation and resources in order to adopt environmental innovations (Weng & Lin 2011). Top management team must communicate the requirements and nature of sustainable goals and embed SOI principles into the organizational strategy by demonstrating and communicating commitment to SOI (Adams et al. 2012). A shared organizational belief to develop green innovations is also provided via top managers' environmental leadership (Chen et al. 2012).

In addition, Huang and Wu (2010) integrate corporate environmental policy and top management support as a construct of corporate environmental commitment and Chang and Chen (2013) used this term in order to indicate its effects on green innovation performance. Moreover, the collaboration and coordination of different

departments and divisions provide many initiatives of adopting new technologies; this is also an easier way to manage such initiatives from the top management endorsement (Ho et al. 2009). Cross-functional integration also facilitate communication and cooperation among different divisions (Huang & Wu 2010). As a result, organizational culture and values that include the three key aspects of sustainable development play a special role for organizations that incorporated the principles of sustainability into corporate strategy (Paraschiv et al. 2012). Thus, we consider that organizational culture covers environmental and societal commitment, managerial support, organizational climate and belief, management concern, inter/cross functional integration and knowledge sharing, allocation to high quality human resources to innovation activities and leadership. Sustainability oriented organizational culture can be considered the soft side of sustainable innovation and it plays a main and crucial role of failure or success of a sustainable innovation by allocating the human capital to innovation activities. At the same time, sustainability oriented organizational culture is a motivator providing a firm atmosphere in order to constitute necessary condition for sustainable innovation in terms of environmental and societal awareness.

**Table 7. Relationships identified through literature**

Main Factors	Relationship		References
Cooperat ion Networks	Cooperation	SI	(Ayuso et al. 2011)
	Cooperation	EI	(Cainelli et al. 2015), (Yarahmadi & Higgins 2012), (De Marchi 2012), (Cuerva et al. 2014), (Klewitz et al. 2012), (Mazzanti & Zoboli 2008), (Mazzanti & Zoboli 2009), (Wagner 2007)
	Governmenta l Support	SI	(Ketata et al. 2014)
	Governmenta l Support	EI	(Yarahmadi & Higgins 2012), (Lin & Ho 2008), (Weng & Lin 2011), (Cuerva et al. 2014), (Li 2014), (Weng et al. 2015)
	NGO's cooperation	EI	(Yarahmadi & Higgins 2012)
	Supplier/Cust omer/ Rival	EI	(Yarahmadi & Higgins 2012), (De Marchi 2012), (Wu 2013) (Cuerva et al. 2014), (Chiou et al. 2011), (Weng et al. 2015)
	Research Organization	EI	(Yarahmadi & Higgins 2012)
	Industry Association	EI	(Yarahmadi & Higgins 2012)
Pressure Groups	Regulation	SI	(Ketata et al. 2014)
	Regulation	EI	(Huang et al. 2009), (Weng & Lin 2011), (Aguilera-Caracuel & Ortiz-de-Mandojana 2013), (Chen et al. 2012), (Guoyou et al. 2013), (Qi et al. 2010), (Kesidou & Demirel 2012), (Dong et al. 2014), (Demirel & Kesidou 2011), (Yalabik & Fairchild 2011), (Horbach 2008), (Mehamli 2013), (Li 2014), (Henriques & Sadorsky 2007), (Eiadat et al. 2008), (Berrone et al. 2013), (Kammerer 2009), (Rennings & Rammer 2011), (Hou et al. 2017)
	NGO's pressure	EI	(Berrone et al. 2013)
	Other Pressure Groups	EI	(Huang et al. 2009), (Weng & Lin 2011), (Cuerva et al. 2014), (Lin et al. 2013), (Chen et al. 2012), (Guoyou et al. 2013), (Qi et al. 2010), (Kesidou & Demirel 2012), (Yalabik & Fairchild 2011), (Li 2014), (Henriques & Sadorsky 2007), (Eiadat et al. 2008), (Kammerer 2009)
Organiza tional Culture	Culture	EI	(Chen et al. 2012)
	Leadership	EI	(Chen et al. 2012)
	Leadership	SI	(Bossink 2007)
	Environment al Managerial Commitment	EI	(Lin & Ho 2008), (Weng & Lin 2011), (Ho et al. 2009), (Qi et al. 2010), (Huang & Wu 2010), (Ar 2012), (Eiadat et al. 2008), (Chang & Chen 2013)
	Inter/cross functional Collaboration	EI	(Wu 2013), (Huang & Wu 2010), (Petruzzelli et al. 2011)
EMS Practices	EI	(Cuerva et al. 2014), (Kesidou & Demirel 2012), (Demirel & Kesidou 2011), (Mazzanti & Zoboli 2008), (Horbach 2008), (Ziegler & Nogareda 2009), (Henriques & Sadorsky 2007), (Theyel 2000), (Wagner 2007), (Ganapathy et al. 2014), (Kong et al. 2016)	
CSR Practices	SI	(Wagner 2010)	
CSR Practices	EI	(Cuerva et al. 2014), (Kesidou & Demirel 2012), (Demirel & Kesidou 2011)	



**Step 7: Establishment of Relationship**

We used A and B lists to establish the relationship in order to develop a model. The methodology for developing the framework should be implemented by building logical relationships with carefully selected concepts [ (Yarahmadi & Higgins 2012), from Wacker (1998)]. This phase also involves the combination of results from the systematic literature review. In light of the literature review, Table.7 shows all the main dual relationships among factors that were mentioned in step 6. In order to establish these relationships, we combine environmental innovation and sustainable innovation as sustainable innovation; all different types of cooperation as a concept of cooperation networks; all different types of pressure groups as pressure groups; and each other main organizational factor remains as the same concept. All these relationships on sustainable innovation obtained from a detailed analysis of relationships found from literature can be seen in Table 8.

**Table 8. The Relationships**

Relationships	
Cooperation Networks	Sustainable Innovation
Pressure Group	Sustainable Innovation
Organizational Culture	Sustainable Innovation
EMS Practices	Sustainable Innovation
CSR Practices	Sustainable Innovation

On the other hand, we cannot find any hypothesis or proposition on some clear relationships (for example, Pressure groups-EMS and Pressure groups-CSR) in cooperation networks and sustainable innovation literature; there are, however, hypotheses and propositions that support these clear relationships in literature that mentions sustainability related activities (Green activities, sustainable manufacturing etc.). Customer influence is positively related to EMS (Agan et al. 2013); similarly, there is a positive relationship between stakeholder pressure and the adoption of CSR practices (Yu & Choi 2014) as an example. Stakeholders’ pressure for environmental societal issues is one of the most important triggers for managers to perform environmental and socially responsible activities in order to provide a base for sustainable innovation. Similarly, the relationships among organizational factors, and the influence of cooperation networks on organizational learning was added the model.

In light of these explanations, we propose a conceptual model in order to show all relationships among these factors. As mentioned before, cooperation networks and pressure groups are placed in the model as external actors while Culture, EMS Practices and CSR Practices as internal factors. Sustainable innovation is also determined as an output factor. According to these relationships obtained from literature and explanations, we propose the model shown in Figure.7.

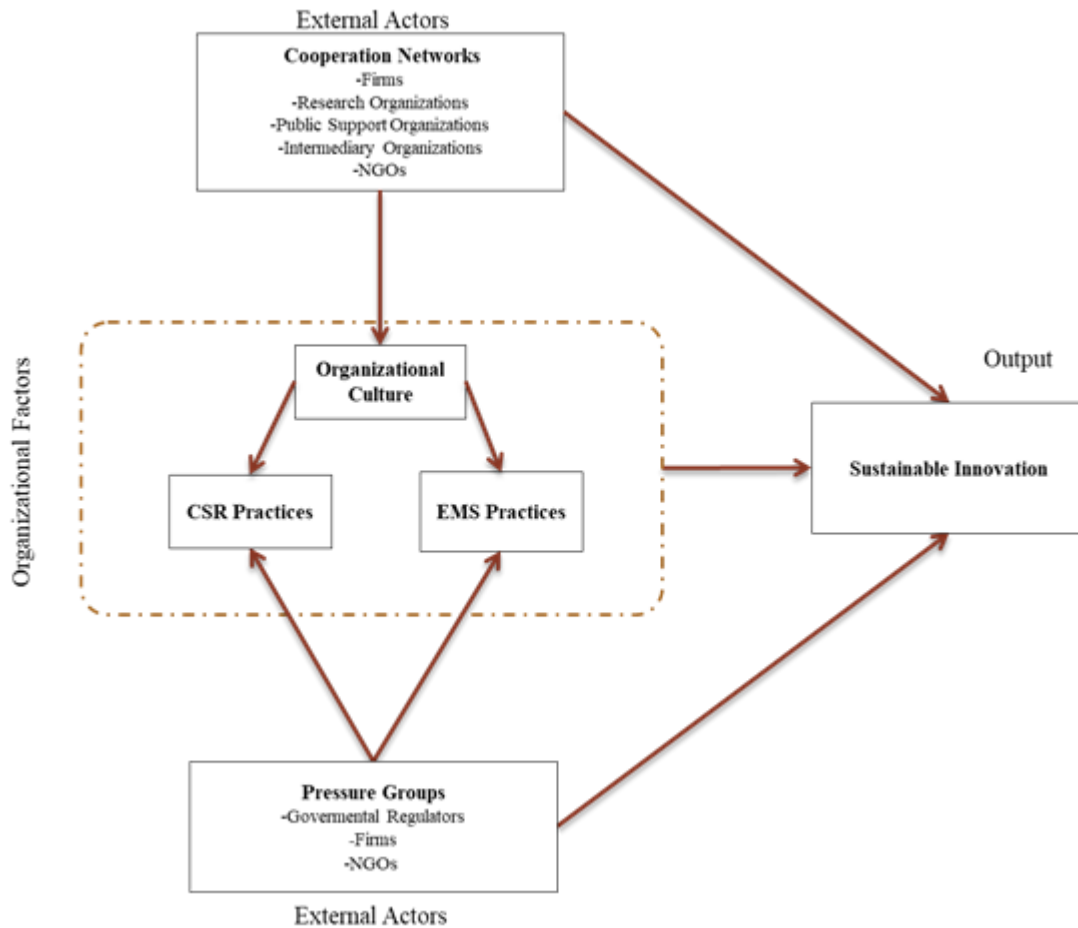


Figure 7. The proposed model

### 3. GENERAL PROPOSITIONS

In this part of the study, we will explain our general propositions according to the model proposed. They are based on relationships among main factors and do not involve the sub factors. In other words, when we propose the relationship between cooperation networks and sustainable innovation, for example, we consider that this relationship and the propositions that are based on this relationship covers all types of cooperation and sustainable innovation. The basis for some propositions is derived from existing literature on environmental innovation. Thus, when we constitute the propositions we assume that the same factors will also be influential for sustainable innovation because environmental innovation is a pre-requisite. In other words, explanations mentioned in environmental innovation literature were enriched for sustainable innovation. These propositions will be used for hypotheses in our experimental study.

In terms of cooperation networks, Ayuso et al., (2011) state that empirical results showed that engagement with external stakeholders (local communities, NGOs, government, etc.) has an influence on firm's sustainable innovation orientation. In addition, firms cooperate with public support organization and government agencies to gain legitimacy for their operations and obtain resources, especially funds to promote environmental innovation (Yarahmadi & Higgins 2012). Environmental innovations are also influenced by public grants than other innovations (De Marchi 2012). At the same time, Weng and Lin (2011) find that governmental support has

a significant influence on the adoption of green innovations for Chinese SMEs. Furthermore, cooperation with NGOs to receive consultation services as well as to avoid non-compliance risks promote environmental innovation (Yarahmadi & Higgins 2012). Moreover, engagement in cooperative activities with supply chain members including suppliers and customers as well as competitors advances environmental innovation (Yarahmadi & Higgins 2012) and R&D cooperation with suppliers also fosters environmental innovation (De Marchi 2012). Furthermore, cooperation with knowledge leaders is positively related to competency-oriented motivations and promotes environmental innovation (Yarahmadi & Higgins 2012); there is a significant positive correlation between environmental innovation and the interaction with universities and other scientific agents (De Marchi 2012). The research conducted by Weng et al. (2015) showed that pressure from competitors and the government, along with employee conduct, all had significant and positive effects on green innovation practices. Finally, industry associations provide a platform for members to engage in cooperative activities with each other on an environmental agenda; their strong connections with government bodies can provide support to obtain funds and to overcome high cost and risk of failure for their members. Thus, cooperation with industry associations can positively influence environmental innovation (Yarahmadi & Higgins 2012). Collaboration with external stakeholders are more important for sustainable innovation than environmental innovation in order to promote societal emphasis; also, sustainable innovations need more partnerships than available within the boundaries of an organization. Hence, we consider that collaboration with external stakeholders has an influence on firm's sustainable innovation. In light of these explanations, we propose the following statement:

**Proposition 1. *Cooperation networks have a positive influence on sustainable innovation***

Influence of pressure groups for environmental innovation is important (Horbach 2008) and environmental innovation practices are affected by competitive pressure significantly and positively (Li 2014). Green innovation also depends on the market pressures to a greater extent than other innovations (Cuerva et al. 2014). According to the research conducted by Huang et al. (2016) regulatory and customer pressure enhances green innovation performance. There is likely to be a positive association between the perceived pressure of regulatory stakeholders, including legislative, executive, and environmental groups, and the decisions to adopt green innovations (Huang et al. 2009). Additionally, regulations guide firm innovation, and companies should see regulative pressure as a means of improving productivity and thereby competitiveness (Maçaneiro et al. 2013). Sustainable innovation engagements were also influenced by direct regulatory pressure positively (Ketata et al. 2014). Similarly, (Berrone et al. 2013) state that the pressures arising from NGOs around a company's facilities are likely to increase the pressures on firm to comply with environmental standards and to foster environmental innovation. The adoption of green innovations for Chinese SMEs is also significantly influenced by customer pressure and regulatory pressure (Weng & Lin 2011). Zailani et al. (2015) also found that environmental regulations, market demand, and firm internal initiatives have a positive effect on green innovation initiatives according to the survey conducted on Malaysian automotive supply chain industry. Pressure groups are more crucial for sustainable innovation than environmental innovation because societal effects of an innovation are more abstract and harder to observe in short term than environmental effects. Furthermore, Rezai et al. (2016) identified internal and external social pressure as the main factor influencing the decision of the entrepreneurs' intention to implement green practices at the research among herbal-based SME entrepreneurs. Governmental regulators, especially labor organizations and NGOs can apply pressure on firms considering societal benefits while creating sustainable innovation. We enrich these explanations for sustainable innovation in the following statement. Therefore, we state our proposition:

**Proposition 2. *Pressure groups have a positive influence on sustainable innovation***

Proposition 2 covers the relationships between external actors and organizational factors. Stakeholders' pressure for environmental issues is a crucial trigger for environmental management practices to provide a base for sustainable innovation. The effect of customers on firms' EMS processes should not be overlooked. Large companies may require their suppliers to adopt EMS or other standards. This effect reveals through demanding

“green” specifications or indirectly by asking for ISO 14001 certification (Agan et al. 2013). At the same time, some governments strictly require basic environmental standards. Therefore, we propose the following statement:

**Proposition 2.1. *Pressure groups have a positive influence on environmental management practice***

In a similar vein, pressure groups, especially NGOs and governmental regulators become a trigger for societal practices such as health and safety and human/social rights. Stakeholder pressure has a significant and direct impact on the adoption of CSR practices (Yu & Choi 2014). Thus, our proposition is stated as:

**Proposition 2.2. *Pressure groups have a positive influence on corporate social responsibility practices***

Cooperation with external actors, especially universities, other research institutes, and intermediary associations help enhance to form firms’ organizational culture by influencing management approaches to sustainable innovation activities. This linkage has been missed in sustainable innovation literature. We highlight this relationship and formulate the following proposition:

**Proposition 3. *Cooperation networks have a positive influence on organizational culture***

Proposition 3 covers the interrelationship among organizational factors and the relationships between organizational factors and sustainable innovation. A number of empirical studies have found a positive relationship between EMS practices and environmental innovation though there are different results with different types of innovation. Horbach (2008) finds that for the introduction of environmental product innovations, environmental management tools are crucial while Wagner (2007) states that EMS implementation has significant positive influences on process innovations. Environmental EMS or ISO14001 certification also has a significant impact upon eco-innovations (Demirel & Kesidou 2011). At the same time, organizational capabilities related to EMS are not only crucial in increasing the resources allocation to eco-innovation activities but also play an important role in firms’ decision to undertake these activities (Kesidou & Demirel 2012). We consider that EMS practices are important for sustainable innovation as well and thus, we enrich these explanations for sustainable innovation in the following statement:

**Proposition 3.1. *Environmental management practices influence sustainable innovation positively***

Several studies investigate the impact of CSR practices on environmental innovation but they have no findings supporting their hypotheses [(Cuerva et al. 2014), (Kesidou & Demirel 2012), (Demirel & Kesidou 2011)]. However, Wagner (2010) states that firms maintain CSR and environmental management activities partly in the hope that this will develop such innovation in their organization. He mentioned that “CSR causes ‘innovation with high social benefits’ significant association between CSR activities in one period and ‘innovations with high social benefits’ in the subsequent period”. At the same time, CSR practices are related to societal side of sustainability and important for sustainable innovation. Therefore, our proposition is in the following:

**Proposition 3.2. *Corporate social responsibility practices influence sustainable innovation positively***

There are many studies that investigate the effect of organizational culture on environmental innovation. Supportive environmental leadership and environmental culture can help develop green innovations (Chen et al. 2012). In order to adopt environmental practices, organizational encouragement, especially top management support, give employees motivation (Lin & Ho 2008). However, Management’s high imposed pace of work has a negative effect on corporate sustainable innovation while impact of intrinsic motivations (through employee social interactions) has a positive impact (Delmas & Pekovic 2016). Hence, top management support and encouragement should give intrinsic motivations to employees in order to increase the social interactions among

employees. Green product innovation performance is positively affected by corporate environmental commitment and cross-functional integration (Huang & Wu 2010). At the same time, Weng and Lin (2011) state that organizational support have significant influences on the adoption of green innovations for Chinese SMEs. Wu (2013) also demonstrates that internal integration plays a key role in fostering green innovation. Similarly, Petruzzelli et al.'s (2011) findings reveal that the most valuable green innovations are those highly relying on collaborations among internal actors. Organizational culture affect EMS and CSR practices to obtain sustainable innovation. Notwithstanding, there is no hypotheses or proposition about organizational culture and sustainable innovation directly. We consider that organizational commitment, managerial support, interfunctional integration and system perspective as organizational culture that are important for sustainable innovation. Thus, we extend the finding to sustainable innovation and propose these following statements in light of explanation above.

**Proposition 3.3.** *Organizational culture influences corporate social responsibility practices positively.*

**Proposition 3.4.** *Organizational culture influences environmental management practices positively.*

**Proposition 3.5.** *Organizational culture influences sustainable innovation positively.*

Additionally, firm size, firm age, R&D intensity, sector, and country should be taken control variables into consideration while defining hypotheses of the experimental studies in regard to those propositions above. As mentioned previously, these structural factors affect the relationship between cooperation networks and sustainable innovation as well as organizational factors.

## CONCLUSION AND FURTHER RESEARCH

Cooperation networks and sustainable innovation could be considered two intimately related concepts because sustainable innovation depends on collaboration with external actors. Firms' sustainable innovation capability is not only determined by internal factors, but also depends on the nature of a firm's engagement with external actors. At the same time, firms must rethink their capabilities, knowledge management, leadership, culture, and stakeholder relationships because sustainable innovation presents some new challenges and requires more integrated thinking for practitioners (Adams et al. 2012). Many factors have influence on sustainable innovation. In this study, we aimed to propose a conceptual model that shows all key factors and the relationships among them. For this reason, a systematic literature review was conducted in order to identify the factors and establish their relationships. In the model, there are four factor clusters: cooperation networks and pressure groups as external actors; organizational culture, EMS and CSR practices as internal factors; sustainable innovation as output factors. We developed the conceptual model based on these factors and their relationships after employing the last two steps (Determination of Factors and Establishment of Relationship) of systematic literature review. In addition, the propositions are explained to indicate exact relationships among these factors. However, the propositions are in a general form and do not include components or types of factors. Future research could extend these propositions to components in accordance with the model to test the propositions empirically. Furthermore, this model can be used to evaluate all factors that affect sustainable innovation for industry managers. Additionally, researchers can use this model in order to test the propositions with data from industry. Measurement scales could be developed to measure each construct and structural equation modelling could be performed in order to show the relationships among all the variables. However, any hypotheses or propositions that take the relationships among the organizational factors into consideration were not found. These relationships could be investigated in future studies. Thus, these propositions will be used as hypotheses in our next experimental study.

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