A literature review of sustainable consumption and production: A comparative analysis in developed and developing economies

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Abstract

Sustainable consumption and production is identified as one of the essential requirements for sustainable development. Due to different economic conditions and socio-cultural factors, sustainable consumption and production requires a diverse focus in developing and developed economies. To date, few efforts have been made to systematically compare the status of sustainable consumption and production and its direction from the perspective of developing and developed economies. This paper provides a literature review of published articles in international scientific journals related to sustainable consumption and production between 1998 and 2018 inclusive. Three carefully designed questions are proposed and answered in this article, forming the basis for conducting a comprehensive comparative analysis of the differences and challenges in sustainable consumption and production practices within developed and developing economies. The findings strongly suggest that countries in Europe hold international leadership in sustainable consumption and production practices. This finding, alongside others, is analyzed and discussed in greater detail in this paper, resulting in the articulation of gaps and future research opportunities in the current body of the literature.

1. Introduction

In the 1970s, the scientific community began to realize that unsustainable development was leading toward environmental and economic collapse. This warning is also known as "limits to growth", which was proposed by the Club of Rome (Meadows et al., 1972). After decades of economic development, sustainable development (SD) is assumed to be an attempt "without alternative" for the survival of humankind (Seiffert and Loch, 2005). As a predominant goal and crucial necessity for establishing SD, the integration of consumption and production systems with SD was formulated and implemented (Akenji and Bengtsson, 2014; Lozano et al., 2015). The concern over sustainable consumption and production (SCP) patterns has been elevated to an unprecedented level and has gained international prominence. A series of international conferences related to on-going climate changes and SCP matters have been held. The Johannesburg Plan of Implementation in 2002 called for all countries to promote SCP patterns with the developed countries taking the lead and with all countries benefiting from the process, and a decade later, the United Nations Conference on Sustainable Development (Rio+20) reaffirmed that SCP was a cornerstone of SD, proposing a 10-Year Framework of Programmes on SCP patterns.

Such triggers have encouraged various stakeholders, such as government regulatory agencies, relevant international organizations, and education and science institutions to incorporate SCP at their corporate and strategic planning levels. A number of prior studies in SCP related research have substantially addressed the integration of economic growth, environmental protection and social inclusiveness from both the consumption side and production side. Based on the boundaries outlined in Sub-section 2.2, previous reviews papers in this field have been identified (see Table 1). Only three papers were identified as having reviewed the SCP literature from different perspectives (Brizga et al., 2014; Pallaro et al., 2015; Roy and Singh, 2017). Brizga et al. (2014) provided a review on SCP policy development and implementation based on publications from 1990 to 2010. Pallaro et al. (2015) centered their review on SCP considerations in the automotive sector. Furthermore, Roy and Singh (2017) performed a review of related literature on SCP with a focus on business areas. Apart from these reviews, three articles have solely focused on the sustainable consumption field (Caeiro et al., 2012; Grabs et al., 2016; Liu et al., 2016). To our knowledge, no research has been carried out attempting to systematically compare SCP developments and shortcomings with respect to developed and developing economies.

Table 1. Previously published review papers

Authors and year	Time horizon	Field	N	Comments
Roy and Singh (2017)	1990-2016.07	Both	71	Area of focus: Business Research questions: • What principal themes of research exist in SCP literature for characterizing the prevailing business focus?

				● How can these principal themes be further explicated to outline the theme-specific key implications for guiding scholarly work?
Pallaro et al. (2015)	2004-2014	Both	42	Area of focus: Automotive sector Research questions: ● What are the main challenges to and drivers of sustainable production and consumption in the automotive industry? ● What concepts, methodologies and tools have been used so far for achieving sustainable production and consumption? ● What more needs to be done to move closer to more comprehensive sustainable practices in the automotive sector?
Brizga et al. (2014)	1990-2010	Both	N.A.	Area of focus: SCP policy development and implementation Research questions: ● SD strategies and their objectives ● Policy instruments and their organizational and legal mechanisms utilized for governing SCP ● Characteristics of SCP in other sectoral policies and initiatives
Caeiro et al. (2012)	1979-2011	C	49	Area of focus: Household SCP Research questions: ● Household sustainable consumption metrics ● Methodological approach to HSC indicators
Grabs et al. (2016)	N.A.	C	93	Area of focus: Grassroots initiatives in sustainable consumption Research questions: ● Which factors and processes do provide motivations and support for implementing sustainable consumption practices in a grassroot setting? ● Which group factors and processes are the main source of support in sustaining grassroot support operation? ● Which societal processes and framework settings result in successful implementation of grassroots initiatives?
Liu et al. (2016)	2003-2013	C	N.A.	Area of focus: Sustainable consumption in China Research questions: ● How are Chinese sustainable consumption initiatives addressed based on various implementation approaches? ● What are the main sustainable consumption patterns in Chinese society?

Note: The third column means that the reviewed papers only addressed the sustainable production (P) field, or only the sustainable consumption (C) field or both. N denotes the number of reviewed articles.

Hence, the major contribution and theoretical underpinnings of this work are to (a) conduct a comprehensive literature review in the SCP research domain with respect to the carefully defined taxonomies and (b) to utilize the results of the literature review in performing a comparative analysis to shed light on the fundamental SCP differences and areas of focus between developed and developing economies. The remainder of this paper is structured as follows. Section 2 presents the research design of this paper. Section 3 encompasses the descriptive and content analyses of the related articles. A detailed comparative analysis and discussion on the results of Section 3 are presented in Section 4. Furthermore, Section 5 discusses the opportunities for future work based on various research gaps identified in Section 4. Final remarks and limitations are presented in Section 6.

2. Research Design

2.1 Research questions

The insights from pervious literature surveys presented in Table 1 have been utilized to orchestrate and build the research questions in this article. Together with our scholarly experiences, these insights resulted in the initial formulation of these questions. The final structure of the following three questions was the result of several modifications we made after analyzing and reviewing the related papers. The insights obtained from the descriptive and content analysis presented in Section 3 were utilized to further investigate and discuss these research questions in Section 4.

RQ1: What are the fundamental differences in pursuing SCP initiatives and practices between developed and developing economies?

RQ2: What are various quantitative/qualitative methods and validation approaches developed in analyzing, adopting and implementing the SCP patterns in developed and developing economies?

RQ3: Which industries are involved in the SCP considerations in developed and developing economies?

2.2 Research methodology and boundaries

The main concern of the literature analysis phase is to provide high quality and reliable insights on the topic of interest. Therefore, the article types that are included in this analysis are delimitated to peer-reviewed journal papers published in English and indexed in the Scopus database. Because SCP was first defined in the Oslo Symposium 1994, we chose 1994 as the first year of publication where works were sought. The first journal papers found were from the year 1998; hence, the researched period in this study is January 1998 to April 2018. A total of 90 articles were carefully chosen after considering the delimitations criteria. The detailed article search process is presented in Table 2. To perform a valuable literature analysis that can yield consistent outcomes, it is vital to delimitate the study by means of suitable limitations (Seuring and Müller, 2008). For the current study:

(1) The research topic is restricted to "sustainable consumption and production", which excludes articles that solely consider "sustainable consumption" or "sustainable production". Papers either focusing on the production side (agri-food production, chemical production, energy production) or the consumption side (mobility, housing, clothing and nutrition) were excluded. For example, a special issue on the "sustainability of seafood production and consumption" in *Journal of Cleaner Production* was found. The topics of the published articles in this special issue include capture fisheries, aquaculture, processing, distribution and consumption. None of these papers were considered in our SCP articles database because they focused solely on consumption systems in the seafood industry.

(2) Articles that only focused on "consumption and production" without a discussion of sustainability were excluded because the current paper aims to review all articles in the domain of sustainability integrated with consumption and production operations.

(3) As the focus of this review is explicitly on SCP, papers concentrating on the broader area of sustainable supply chain management and waste management were eliminated. Furthermore, the research articles that discuss solely consumption and production in various industries without any consideration of sustainability aspects were also excluded.

(4) Articles focusing on technical science, as well as those in the public health field, metabolism, and microcosmic chemical systems were excluded from the current review database.

(5) Governmental documents, regulations, laws, SCP practical projects, corporation activities, webpages, handbooks, and reports were not considered in this study.

Table 2. Stages involved in the selection of articles.

Stage	Details
Stage 1: Keywords search	● Query string: "sustainable" OR "sustainability" AND "consumption and production" OR "production and consumption", OR "producing and consuming" OR "consuming and producing", "sustainable C&P", "sustainable P&C", "SCP." ● Search Databases: Scopus ● Search space: article title OR abstract OR keywords ● Article type: peer-reviewed journal papers ● Time range: published from January 1, 1994 to April 25, 2018.
Stage 2: Select and sort	● To guarantee a similar quality level for the papers, articles published in journals indexed in Scopus were considered. ● Editorial notes, special issue introductions and prefaces, book sections, and calls for papers were eliminated.
Stage 3: Refine, select and sort	● The authors carefully read the downloaded articles (Stage 2) full texts and defined clear boundaries to delimitate the search to ensure that the articles truly focus on the SCP field. ● After adopting the delimitations, the "snowball" method (Glock, 2017) (considering the references of references) was also used to identify all relevant papers.

2.3 Coding process

Based on the coding process model developed by Mayring (2004), three structural dimensions, namely, SCP in developed and developing economies, research methodologies and validation approaches were applied, and classifications by industry sectors were defined. The work presented in Tseng et al. (2013) is used as a sample to demonstrate the coding process employed in categorizing the selected papers in Sub-section 2.2.

(1) SCP in developed and developing economies. This paper involved authors from more than one country and represented a collaboration from India, China and the United Arab Emirates. However, this paper discusses the SCP practice in India, so it clearly falls into the "developing economies" category. The actual application/analyzed country/region has been considered to categorize the articles rather than the authors' affiliation.

(2) Research methodologies and validation approaches were applied. As an analytical hierarchy process (AHP) is utilized, it is placed into the "multi criteria decision modeling" category regarding the research methodologies applied. The proposed model was applied to a real-world practical case study, so it falls into the "real-world application/case studies" category regarding validation approaches.

(3) Classification by industry sector. With the presented case study, this paper evaluated the barriers in adopting SCP in an Indian company that manufactures plastic products. Therefore, it falls into the "manufacturing" category.

2.4 Rigor of the coding process

The process of coding for each category could have been affected by subjectivity. To ensure the objectivity of the research process, the double-check guidelines proposed by Seuring and Müller (2008) were used. The coding process was performed both by the first author and second author, independently. If a disagreement arose or an author was uncertain about how to best code an article, a third and fourth author would participate, and a collaborative decision was made. Inter-coder reliability was calculated based on the proportion of total pairwise agreements between the coders, which is proposed by Cronbach (1951). The Cronbach coefficient alpha was 0.89, which is an acceptable reliability score because it exceeds 0.70, which is a recommended minimum threshold.

3. Descriptive and content analysis

The analysis approach pursued in this section consists of two parts, i.e., descriptive and content analysis. Descriptive analysis is performed to describe some of the basic features of research accomplished in the SCP domain, such as publications per year and main journals (see Sub-section 3.1). Furthermore, content analysis is utilized to interpret the content of the published literature within the SCP domain through the systematic classification taxonomies, thereby resulting in the identification of current and future patterns (Hsieh and Shannon, 2005). Content analysis was performed with respect to that statuses of different economies to understand the focus of various economies on the theme of the study. The developed/developing classification is based on United Nations classification of economies (UN, 2012).

To answer the three research questions in Sub-section 2.1, three content analysis classification taxonomies have been identified, i.e., (a) SCP in developed and developing economies, (b) research methods and validation approaches, and (c) associated industries. These three content analysis taxonomies have been defined based on the insights gathered from the previously published literature reviews related to SCP and to provide enough insights to perform a comparative analysis on SCP considerations within developed and developing

economies presented in Section 4. The details of each of these classifications are reported in Sub-sections 3.2 to 3.4.

3.1 Publications per year and main journals

Figure 1 depicts the frequency of the publications per year contextualizing knowledge production over time in the SCP field across the Scopus database. The numbers of publications have increased in recent years, mainly from 2007 onwards. This period encompasses 85.6% of all the publications with an average of 7.0 publications per year from 2007 to 2017. Overall, the general pattern indicates increased interest in SCP focused publications. At least two publication quantity peaks can be identified in Figure 1. The top year with highest publication quantity is 2016 (12). Some of these peaks correspond to special issues published on SCP-related research. In 2010, a special issue titled "sustainable production and consumption" was sponsored by *Journal of Industrial Ecology*. In 2011, a special issue entitled "promoting transformation towards sustainable consumption and production in a resource and energy intensive economy - the case of Finland" was sponsored by *Journal of Cleaner Production*. In 2016, two special issues entitled "transitions to sustainable consumption and production in cities" and "sustainable consumption and production - research, experience, and development" were sponsored by *Journal of Cleaner Production*.
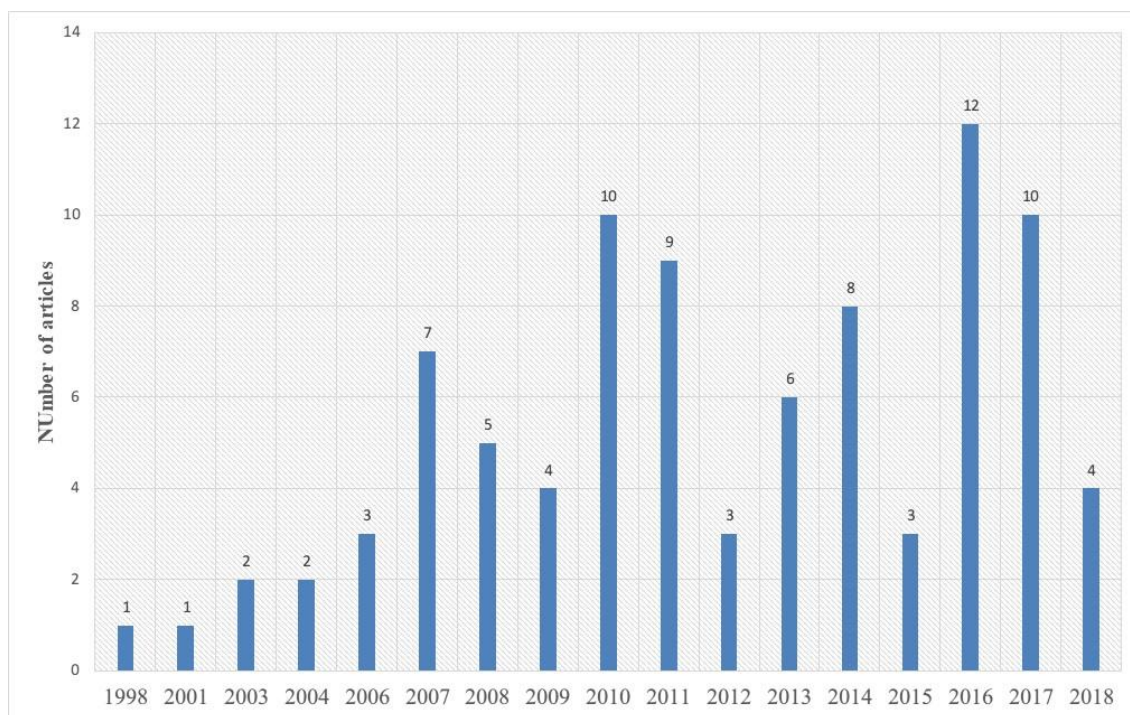
Note: There is a dip in 2018 as data were collected only up to April 25, 2018.

Figure 1. Number of publications per year across the period studied

The spread of journals in which articles appeared is interesting. Articles were most often published in engineering and economics journals. The 90 journal papers were published in 45

different journals. The publications in *Journal of Cleaner Production* alone amounted to one third of the entire 90 papers. The remaining publications are scattered among various journals and venues, such as *Natural Resource Forum*, *International Journal of Production Economics*, and *Ecological Economics* (see Figure 2).
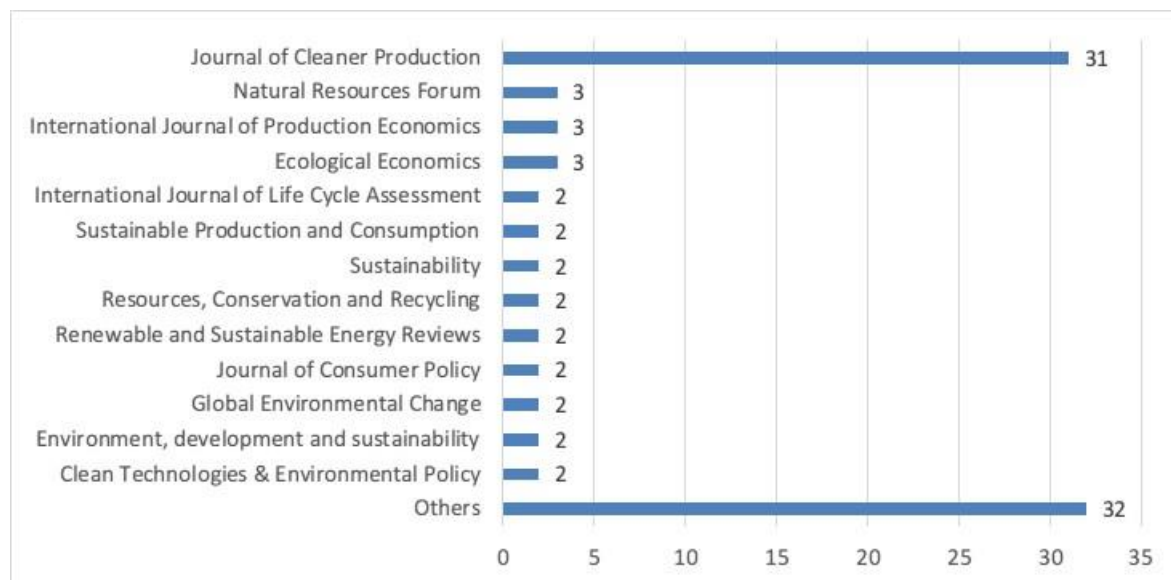
Figure 2. Number of papers in the main journals from the bibliography

3.2 SCP in developed and developing economies

Strategies for SCP differ for various countries depending on economic condition, demography, and socio-cultural factors (Spaargaren, 2011). This classification divides the research articles into two main categories, i.e., SCP practices in developing/underdeveloped economies and SCP practices in developed economies. The main purpose for this division is to identify the fundamental areas of focus on either of these economies and compare them with each other to highlight any shortcomings and commonalities discussed in Sub-sections 4.1 and 4.2. It should be noted that these economies were identified based upon the actual application/analyzed country/region rather than the authors' affiliation. The results of these categorizations are reported in Table 3 and Table 4 for developing/underdeveloped and developed economies, respectively. In both tables, some of the references might be duplicated, as the authors of those articles addressed two or more economies in their analysis. Therefore, the total quantity adds up to more than 90 if absolute numbers of publications are considered. Furthermore, there are some articles that address the SCP practices in a broader economy, such as the European Union (EU), without explicitly examining any specific country. Table A1 tabulates the results of this third categorization.

Table 3. SCP in developing/underdeveloped economies

Developing/underdeveloped economy	Reference	Count
India	Mangla et al. (2017); Luthra et al. (2017); Luthra et al. (2016); Soni et al. (2016); Dubey et al. (2016); Hoff et al. (2014)	6
China	Ely et al. (2016); Vergragt et al. (2016); Schroeder (2014); Chiou et al. (2013); Liu et al. (2010)	5
Turkey	Soyhan (2009); Bilen et al. (2008); Yılmaz and Uslu (2007)	3
Malaysia	Wong et al. (2016); Adham et al. (2015)	2
Thailand	Thongplew et al. (2017); Mungkung et al. (2012)	2
Indonesia	Moreno-Peñaranda et al. (2015)	1
Tikopia	Mertz et al. (2010)	1
Mexico	Corral (2003)	1
Nigeria	Hoff et al. (2014)	1
Total		22

Table 3 shows that 22 articles among 90 identified articles studied SCP from theoretical and practical perspectives in developing/underdeveloped economies. Approximately 86% of the 21 articles focus on SCP in Asia. India (6 articles) and China (5 articles) appear as the most productive countries, followed by Turkey (3 articles). It is quite reasonable that India and China are in the forefront considering their large populations and that they are among the most rapidly rising economies. Table 4 shows that 25 articles among 90 identified articles study SCP from theoretical and practical perspectives in developed economies. In particular, 24 articles studied SCP issues in European countries. Finland (7 articles) appears as the most productive country, followed by the UK (5 articles), Germany and Spain (3 articles each).

Table 4. SCP in developed economies

Developed economy	Reference	Count
Finland	Niinimäki and Hassi (2011); Berg (2011); Berg and Hukkinen (2011a); Berg and Hukkinen (2011b); Honkasalo (2011); Lehtoranta et al. (2011); Risku-Norja and Mäenpää (2007)	7
UK	Dewick and Foster (2018); Azapagic et al. (2016); Berg (2011); Seyfang (2004); Yakovleva and Flynn (2004)	5
Germany	Hoff et al. (2014); Lorenz and Veenhoff (2013); Grözinger et al. (2010)	3
Spain	Cazcarro et al. (2016); Staniškis (2012); Partidário et al. (2007)	3
Lithuania	Staniškis (2012); Staniškis et al. (2012)	2
Sweden	Berg (2011); Petry et al. (2011)	2
Netherlands	Petry et al. (2011)	1
Australia	Clay et al. (2007)	1
Austria	Schönhart et al. (2009)	1
Bulgaria	Staniškis (2012)	1
Canada	Petry et al. (2011)	1
Czech Republic	Dobes (2016)	1
Estonia	Staniškis (2012)	1
Romania	Lakatos et al. (2018); Deselnicu et al. (2014)	2
Total		25

Note: The total number excludes duplicate articles.

Regarding the third category, Table A1 shows that 46 articles address SCP practices in a broader economy without explicitly examining any specific country. Brizga et al. (2014) studied the progress achieved and the main challenges of SCP in post-Soviet republics. Eight articles presented SCP issues in European countries; these focus on SCP policy briefs and implementation (De Camillis and Goralczyk, 2013; Liobikienė and Dagiliūtė, 2016; Tukker et al., 2008), SCP action plans and pathways (Kielin-Maziarz, 2013; Kovács, 2011; Nash, 2009), labelling schemes (Dendler, 2014) and green public procurement (Burja, 2009). Three articles discussed sustainable green design and practice (Tseng et al., 2013), policy frameworks (Zhao et al., 2008) and trends, challenges & options in Asia (Zhao and Patrick, 2010). Barber (2007) analyzed initiatives and activities on building corporate and institutional policies aiming to promote SCP in North America. The other 33 articles studied general research in the SCP field and do not focus on any countries or economies in particular. In these 33 articles, European scholars co-authored 31 papers, which shows that Europe plays an important role in increasing the engagement of developing economies in SCP practices and implementing strategic and technical approaches to address SCP issues. This result coincides with Peeters and Deketelaere (2006) findings.

3.3 Research methods and validation approaches

Achieving SD is subject to utilizing appropriate approaches that set the objectives on integrating consumption and production (Stevens, 2010). In this sub-section, the reviewed research articles are categorized based on their methodologies applied in the domain of SCP with respect to issues in either developed economies or developing economies. The insights obtained from this categorization are used to compare these economies in greater detail in Sub-section 4.3. As tabulated in Table 5, six separate categories of research methodology techniques have been identified as a result of reviewing the articles: (1) policy, program, initiative, strategy (PPIS) review and analysis; (2) empirical study, expert theoretical review and survey; (3) mathematical modeling and multi-criteria decision modeling (MCDM); (4) statistical data analysis; (5) lifecycle analysis, carbon and water foot printing-based approaches; and (6) others.

Table 5. Categorization of the methodologies/tools employed with respect to different economies

Methodology	Developed economies	Developing economies	General research	Count
PPIS review and analysis	Dewick and Foster (2018); Liobikienė and Dagiliūtė (2016); Kielin-Maziarz (2013); Lorenz and Veenhoff (2013); Staniškis et al. (2012); Berg (2011); Berg and Hukkinen (2011a); Honkasalo (2011); Kovács (2011); Niinimäki and Hassi (2011); Nash (2009); Tukker et	Adham et al. (2015); Schroeder (2014); Zhao and Patrick (2010); Soyhan (2009); Zhao et al. (2008)	Zisopoulos et al. (2017); Geels et al. (2015); Akenji and Bengtsson (2014); de Haen and Réquillart (2014); Brodhag (2010); Fedrigo and Hontelez (2010); Stevens (2010); Lebel and Lorek (2008);	15/5/11 total 31

	al. (2008); Barber (2007); Clay et al. (2007); Seyfang (2004)		Kuhndt et al. (2008); Clark (2007); Barber (2003)	
Empirical study/expert theoretical review/survey	Govindan (2018); Lakatos et al. (2018); Dendler (2014); Deselnicu et al. (2014); Staniškis (2012); Berg and Hukkinen (2011b); Lehtoranta et al. (2011); Petry et al. (2011); (Schönhart et al., 2009); Partidário et al. (2007); Yakovleva and Flynn (2004)	Thongplew et al. (2017); Ely et al. (2016); Vergragt et al. (2016); Moreno-Peñaranda et al. (2015); Tseng et al. (2013); Mertz et al. (2010); Bilen et al. (2008); Yakovleva and Flynn (2004)	Notarnicola et al. (2017); Pialot et al. (2017); Sala et al. (2017); Vinkhuyzen and Karlsson-Vinkhuyzen (2014); Gandenberger et al. (2011); Spangenberg et al. (2010); Church and Lorek (2007); Maxwell et al. (2006); Maxwell and Sheate (2006); Haake and Jolivet (2001); Mulder (1998)	11/8/11 total 30
Mathematical modeling and MCDM	Azapagic et al. (2016); Risku-Norja and Mäenpää (2007)	Luthra et al. (2017); Mangla et al. (2017); Luthra et al. (2016); Chiou et al. (2013)	Bai et al. (2018); Ülkü and Hsuan (2017); Zhu et al. (2006)	2/4/3 total 9
Life cycle management and carbon/water foot printing-based methods	Cazcarro et al. (2016); Hoff et al. (2014); De Camillis and Goralczyk (2013)	Soni et al. (2016); Hoff et al. (2014); Mungkung et al. (2012); Liu et al. (2010)	Parent et al. (2013); Ridoutt and Pfister (2010)	3/4/2 total 8
Statistical data analysis	Grözinger et al. (2010)	Dubey et al. (2016); Wong et al. (2016); Brizga et al. (2014); Corral (2003)	Gilli et al. (2017); Cohen and Muñoz (2016)	1/4/2 total 7
Other tools	Dobes (2016); Burja (2009)		Schinkel and Spiegel (2017); Jonkutė and Staniškis (2016); Cohen (2010)	2/0/3 total 5
Total				34/25/32 total 90

Note: In the last column, the number format is "a/b/c total d". The a and b indicate the number of articles with respect to developed economies and developing economies, respectively. The c indicates the number of articles on general research, which does not focus on any countries or economies. The d indicates the total number of articles in each row.

Among the categorized set of methods, 34.4% of the articles deployed a review and analysis technique to examine various PPISs, which were developed and considered by various private or public stakeholders. The PPISs facilitate a more integrated approach to enhancing sustainability performance. It is demonstrated that the authors in these articles would target policymakers, as well as governments and regulatory agencies as their primary audiences. Empirical study, expert theoretical review and survey has been categorized as the second most applied sets of methodologies in the SCP domain (33.3%). Nine papers out of 90 strived to apply mathematical modeling and multi-criteria decision-making approaches to address the identified gaps in the SCP research domain. Life cycle management and carbon/water foot printing sets of methodologies are also among the approaches considered within SCP research (8.89%). Statistical data analysis is the least commonly applied methodology among scholars

within the SCP research domain, with only approximately 7.8% of the research activities adopting statistical methods to derive their theoretical claims in conjunction with using either primary or secondary data. This observation is not surprising given that there are many research activities focused on PPISs, empirical study, expert theoretical review and surveys. As illustrated by the SCP definition in the Oslo Symposium 1994, SCP provides a comprehensive framework for issues surrounding the use of resources that not only focus on improving resource efficiency and minimizing its use but also addressing well-being and basic needs. This broad view of SCP results in researchers and practitioners addressing SCP issues systematically from a higher-level perspective, such as developing plans and providing guidelines for SCP implementation and adoption. Consequently, fewer works focus on building mathematical models to address SCP issues.

The articles were also reviewed in light of the validation approaches of their methodologies regarding various economies. The main purpose of validation approaches analysis is to provide insights into how the developed methodological tools have been validated (see Sub-section 4.3). As tabulated in Table A2, three illustration types are used to validate the theoretical gaps and empirical claims made by various authors. Just over 54% of the papers that have been analyzed are based entirely on theoretical grounds. The authors of these papers defined a theoretical gap or empirical claim and discussed these gaps and claims through various theoretical lenses. Several papers "generated numerical tests" to demonstrate the proficiency of the developed approach, with the authors of these articles developing an approach or research methodology but not applying them to a real case study (only seven papers in total). In 37.8% of the reviewed papers, case studies were used to illustrate the applicability of the proposed model or approach. The literature suggests that using numerical testbeds might be an appropriate approach for verification purposes but does not really validate the proposed method unless it is practically applied to a real world application (Ghadimi et al., 2017a, b; Schinkel and Spiegel, 2017; Wang et al., 2015).

3.4 Classification by industry sector

The SCP literature appears to focus on several industrial sectors. The reviewed articles are classified based on industries in which their proposed approach has been validated to enhance the understanding of sectorial influences on SCP in various economies (see Sub-section 4.4). The North American Industry Classification System (NAICS) (United States Census Bureau, 2017) was used for this purpose. Based on the results, applications to illustrate SCP patterns and practices are conducted primarily in agricultural and manufacturing related industries.

Table A3 shows that 48.9% of the articles are based on general industry, which means their focus are policy reviews or general models. The table also shows that the second largest group of articles focuses on the manufacturing industry (31.1%). Two main reasons can be

used to justify the focus on SCP in several manufacturing industries. The first can be characterized as the nature of production operations themselves, which plays an important role in adopting sustainability practices (King and Lenox, 2001). The second reason is the historical focus of various local and international environmental regulations on manufacturing plants due to their large share of environmental pressures and social burdens (Gilli et al., 2017; Hassini et al., 2012). Closer examination of the manufacturing industry sector tabulated in Table A4 shows that a handful of research papers categorized as manufacturing primarily addressed food manufacturing. Finally, the third largest group of articles focuses on the agriculture industry (16.7%). Apart from the sustainability studies on the consumption and production of certain industries, several scholars studied SCP across multiple industries (Adham et al., 2015; Brizga et al., 2014; Cohen and Muñoz, 2016; Dobes, 2016; Liu et al., 2010; Tukker et al., 2008; Zhao et al., 2008), which possibly resulted in an increase in external validation, and generalization of findings and result implications.

4. Discussion of research findings

Building on the result of the literature analysis in Section 3, this section performs a comparative analysis aiming to address RQ1, RQ2 and RQ3. The analysis of Sub-sections 4.1 and 4.2 is based on the content analysis in Sub-section 3.2. Moreover, the analysis of Sub-sections 4.3 and 4.4 is built upon the results presented in Sub-sections 3.3 and 3.4, respectively.

4.1 Fundamental SCP differences in developed and developing economies

SCP systems include "top-down" sustainable efforts by policy-makers and "bottom-up" activities by companies (Akenji and Bengtsson, 2014; Tseng et al., 2013). The "top-down" efforts result in an economical intervention by government, and the "bottom-up" efforts incorporate firms' SCP commitment into their business activities. It is found that the focus on SCP practices varies based on economic conditions. Generally, developing the economy is always a top priority in developing economies where sustainability has been overlooked over the last decades. Many efforts have been made on "bottom-up" activities, whereas "top-down" efforts are mostly neglected by government authorities. Developed economies are active both in "top-down" and "bottom-up" efforts and have a portfolio of interventions at both the supply and demand side.

In developing economies, there are often inadequate resources to meet essential necessities where millions of people are facing under-consumption (Clark, 2007). Governmental policies in these economies tend to develop the economy and feed the hungry, rather than consider environmental performance (Fang et al., 2007), even though they have observed the environmental failures of the development pattern of the "developed" ones (Manohar and Kumar, 2016; Vergragt et al., 2016). These behaviors are often referred to as a backward attitude tending to "grow first, clean up later" (Rock and Angel, 2007). Along with

per capita increase in income and living standards, great pressures on the environment in developing economies have drawn broad attention all over the world. The developing economies are now facing a serious need to trade off the economic development and their environmental protection. Many activities have been performed from a "bottom-up" aspect, such as implementation of SCP strategies at corporate levels (Wong et al., 2016), adoption of cleaner technologies (Corral, 2003) and ecological product design (Mungkung et al., 2012). However, the "top-down" efforts are still in the pilot study phase. For example, the United Nations Environment Programme (UNEP) launched a sustainable development model in Guiyang, China to illustrate the governmental function in promoting economic development in rapidly developing economies (Clark, 2007). However, governance functionality for SCP is nevertheless unsatisfactory in several aspects (Schroeder, 2014) and these programs do not result in the intended success.

In developed economies, established mature production technologies limit the fundamental change of environmental burden from the manufacturer (Moors et al., 2005). On the other hand, facing excessive, wasteful and inefficient resource use, considerable effort is being undertaken to alter over-consumption patterns (from the consumption perspective) resulting in reduced material and energy intensity (Jonkutė and Staniškis, 2016; Staniškis, 2012). Meeting these two challenges requires a portfolio of interventions at both the supply and demand side. Such a portfolio is needed because there are strong interlinkages between the supply and demand sides. Hence, apart from "bottom-up" efforts, developed economies are active in "top-down" to achieve SCP. National SCP programs are developed to achieve SCP with nationwide participation.

4.2 SCP focus areas in the most active developed and developing economies

In this sub-section, the findings in Sub-section 3.2 have been investigated in greater detail to identify specific focus in the most active developed or developing economies regarding SCP practices. China, India and Turkey are categorized as being the most active developing economies in the SCP domain. Finland, the UK and Germany are the three most active developed economies. In an earlier study by Tukker et al. (2008), food, housing, energy use and mobility were identified as the most influential factors in the SCP domain (70-80%) and attracted the greatest amount of effort in the SCP practices. Table 6 tabulates the five identified focus areas based on the research conducted in these six countries. The results are harmonized with Tukker's earlier study, although it can be observed that the areas of focus of SCP, such as materials and products, and leadership, have also been investigated in recent years.

Table 6. Identified SCP areas of focus in top listed developed and developing countries

Focus area	China, India and Turkey	UK, Finland and Germany
Materials and products	Mangla et al. (2017); Luthra et al. (2017); Luthra et al. (2016)	Honkasalo (2011); Niinimäki and Hassi (2011)
Energy and industrial ecology	Soni et al. (2016); Soyhan (2009); Bilen et al. (2008); Yılmaz and Uslu (2007)	Azapagic et al. (2016); Lehtoranta et al. (2011)
Leadership	Dubey et al. (2016); Schroeder (2014)	Berg (2011); Berg and Hukkinen (2011a); Berg and Hukkinen (2011b); Seyfang (2004)
Agri-food	Ely et al. (2016); Hoff et al. (2014)	Dewick and Foster (2018); Hoff et al. (2014); Lorenz and Veenhoff (2013); Risku-Norja and Mäenpää (2007)
Housing and life/work style	Vergragt et al. (2016); Liu et al. (2010)	Grözinger et al. (2010)

From the Finnish perspective, SCP main focus areas started with food, housing and mobility and have since been extended to materials and products (Honkasalo, 2011). Consumers in Finland have the right to choose their own lifestyle as it relates to product consumption but are also informed about the environmental burdens of these products (Niinimäki and Hassi, 2011). From the Indian prospective, more focus has been given to identifying the barriers and drivers of adopting SCP initiatives with some reference to plastic and automotive product manufacturers (Luthra et al., 2017; Luthra et al., 2016; Mangla et al., 2017). In China, although technological improvement has reduced the energy and material intensity, household consumption has balanced the technical achievement and results in the growth of CO_2 emissions (Liu et al., 2010), which is called a rebound effect (Staniškis, 2012). Although China plays a substantial role in the global economy, no articles have focused on global SCP issues or solutions, which can be considered a major drawback in all developing economies (Schroeder, 2014).

With reference to Indian organizations, the role of top management as an internal agent should be tied to that of external agents, such as governmental and community pressures, in mitigating the effects of organizational barriers in SCP implementations (Dubey et al., 2016). However, it seems that such pressures are not obligatory nor enforced, especially from governmental SCP policies and programs (Dubey et al., 2016; Schroeder, 2014). In developed economies, such as Finland and the UK, there are advanced SCP programs in place that look compelling on paper. However, there are discrepancies between the program action plans and the actual governmental commitment to drive the incorporated SCP agenda forward (Berg, 2011). It can therefore be perceived that although there are considerable differences in SCP development between developed and developing economies, the levels of governmental commitments in these two distinct economies still lag behind actual SCP practices.

4.3 Applied tools and approaches in SCP research

Almost 35% of the published literature employed PPISs as their research methodology, which highlights the fact that governmental policies, various strategic initiatives and programs are the crucial elements that must come together to achieve a sustainable consumption and production system. As tabulated in Table 7, PPISs for SCP practices are different in various countries and economic regions depending on demography, economic conditions and cultural factors (Adham et al., 2015; Liobikienė and Dagiliūtė, 2016; Schroeder, 2014). However, most of the reported content on SCP practices draws greater attention to the issues in developed economies, especially the UK and Finland, and very few have paid attention to issues in developing economies. From the point of view of economics, one important factor that affects this trend and distribution can be attributed to the higher amount of research and industrial funding provided by governments and funding agencies in developed economies. This point can also be linked to fundamental SCP differences in these two distinct economies that were discussed in Sub-section 4.1.

Moreover, although there are many studies on building theoretical and political aspects of promoting SCP implementation (e.g., PPISs and empirical approaches), these initiatives and policies seem to apply a "mild" mandate on industrial and business organizations. Adapting new sustainability rules and governmental regulations would not be possible without quantitatively modeling consumption and production activities, which should lead to more quantitative approaches after legislation (de Haen and Réquillart, 2014). However, the analysis in Sub-section 3.3 demonstrates limited considerations of quantitative methods to quantify and evaluate the effects of new policy and strategy reforms on SCP practices in various focus areas (highlighted in Sub-section 4.2). The quantitative methods assist in enhancing the decision making process in their respective business environments (Tseng et al., 2018).

Furthermore, although many scholars reported guidelines and frameworks in improving SCP implementation policies and initiatives, limited governmental and management support in adopting these advances would still result in unsustainable consumption behaviors of consumers and inefficient production activities of manufacturers (Luthra et al., 2016). Table 7 shows that PPISs are rarely found to enforce sustainability integration with industrial practices, educational institutions, national governments, local authorities, and the public/consumers in developing economies. For developing economies, while SCP as a concept is introduced very early, it is not yet a priority. Over the last several years, a couple of pilot studies were carried out in several developing economies (Schroeder, 2014). The government collected relevant experiences and lessons, and learned through implementation to set up national regulations and standards, which resulted in promoting the SCP concept in new industrial sectors and regions.

Table 7. SCP PPIS focus in developed and developing economies

Type	Reference	Focus	Developed economy	Developing economy
Policy	Liobikienė and Dagiliūtė (2016)	SCP policy implementation in the EU	√	
	de Haen and Réquillart (2014)	Policies on SCP of food systems	General research	
	Schroeder (2014)	SCP governance system in China		√
	Honkasalo (2011)	Finish policies on SCP	√	
	Brodhag (2010)	Policies on SCP related to sustainable tourism and social responsibility	General research	
	Zhao and Patrick (2010)	Policy measures on green development of SCP patterns.		√
	Nash (2009)	SCP and sustainable industrial policy action plan	√	
	Soyhan (2009)	Energy policy in Turkey		√
	Zhao et al. (2008)	SCP regional policies on sustainable urban development in Asia-Pacific		√
Programme	Kielin-Maziarz (2013)	EU SCP action plan	√	
	Staniškis et al. (2012)	SCP activities in Lithuania		√
	Berg (2011)	Finland, Sweden and the UK SCP programs	√	
	Berg and Hukkinen (2011a)	The Finnish program to promote SCP	√	
	Tukker et al. (2008)	10-year framework of SCP programs for developed economies	√	
	Clay et al. (2007)	Sustainability Victoria program on reducing environmental impacts	√	
	Clark (2007)	UNEP SCP activities		√
	Barber (2003)	World Summit on Sustainable Development Plan of Implementation	General research	
Initiatives	Adham et al. (2015)	Malaysian initiatives on SCP		√
	Akenji and Bengtsson (2014)	SCP in sustainable development goals (SDGs)	General research	
	Barber (2007)	SCP initiatives in Canada and USA	√	
Strategy	Dewick and Foster (2018)	Procurement strategies and interactive buyer-supplier relationship strategies	√	
	Zisopoulos et al. (2017)	A conceptual energy-based framework for a resource efficient agri-food sector	√	
	Geels et al. (2015)	Analytical strategic positions in SCP-debates	General research	
	Lorenz and Veenhoff (2013)	Strategies in sustainable food consumption and production in Germany	√	
	Niinimäki and Hassi (2011)	Product design strategies in niche markets	√	
	Kovács (2011)	Sustainable food production and consumption	√	
	Fedrigo and Hontelez (2010)	Blueprint for European SCP	√	
	Stevens (2010)	Sustainability strategies in terms of correcting market and system failures	General research	
	Lebel and Lorek (2008)	SCP systems in fair trade initiatives	General research	
	Kuhndt et al. (2008)	International initiatives on SCP	General research	

	Seyfang (2004)	UK strategy for SCP	√	

The main objective from the sustainable production side is to efficiently manage scarce resources with respect to socio-cultural factors in production (Ghadimi et al., 2013; Pallaro et al., 2015). From the sustainable consumption side, the main objective is to increase consumer awareness toward pursuing sustainable purchasing behaviors (Liu et al., 2016). The direct and indirect relationships between these two sides can be regarded as a dynamic environment that requires investigation. As addressed in Sub-section 3.2, many articles have employed empirical and theoretical analysis to investigate these relationships; such analysis is grounded in various theories, such as moral leadership (Vinkhuyzen and Karlsson-Vinkhuyzen, 2014). However, more technical approaches that encompass the capability of capturing such dynamics within the consumption and production sides need to be developed. Research into developing dynamic models allows the SCP system to be represented as a feedback process as a way of examining the long term behaviors of such systems over time, such as system dynamics simulation (Tseng et al., 2018).

4.4 SCP practice trends in industrial sectors

Based on the findings in Table A3, the SCP practices have been addressed more frequently in manufacturing and agriculture industries. Further breaking down the works related to manufacturing and agricultural industries shows us that scholars from developing economies have a "narrow focus" and tend to investigate the SCP domain within their own countries given that they are searching for local solutions. In contrast, scholars from developed economies have a "broad focus" and tend to have a comprehensive view investigating SCP-related issues within and outside their countries. In developing economies, SCP patterns in manufacturing industries have received considerable attention. This pattern is not surprising since manufacturing operations have been identified as an important driver for economic growth in developing countries (Szirmai and Verspagen, 2015). Developing countries, such as China and India, are becoming increasingly industrialized, resulting in more environmental and social burdens. Abundant human resources and low salaries together with other economic factors such as tariffs, governmental incentives and tax reductions results in more manufacturing activities being outsourced to these countries. Although this leads to a considerable economic growth, as two major consumers of raw material and energy resources, China and India generate a significant amount of manufacturing waste.

Govindan (2018) highlighted population growth as a fact that is inevitable and cannot be changed. An immediate consequence to the production side is the need for more food production. Simultaneously, higher consumption in both developed and developing economies results in higher food waste. In developed economies, the SCP focus has shifted from manufacturing industries to the agri-food context and service industries. Although food is abundant in developed economies, sustainable food consumption and production have not

received significant attention (Govindan, 2018; Lorenz and Veenhoff, 2013). Sustainable food consumption and production indicators need to be developed to measure the sustainable patterns in agri-food industry in developed economies. A major challenge in the agri-food industry is to achieve a reduction of food miles leading to lower food loss and food waste. Logistical solutions must be re-adjusted to improve the global food transportation network. This re-adjustment can be investigated and researched in developed economies' supply chains due to the availability of informational and technical advancements in both rural and urban areas. On the contrary, these enablers of SCP developments in developed economies act as barriers in developing economies (Adham et al., 2015).

In addition, recent decades have seen the rapid economic evolution from a manufacturing base to a service orientation (Sengupta et al., 2006; Smith et al., 2007). SCP practices in service industries (Church and Lorek, 2007; Petry et al., 2011) are in their early stages. In the related literature, no published article has discussed SCP developments in service type industries. More business models for realizing SCP patterns in service industries must be investigated and developed.

5. Research opportunities in the field of SCP

The comparison and discussion in Sections 3 and 4 shed light on potential directions for future work. Opportunities for SCP depend highly on economies with a variety of economic conditions and socio-cultural factors. The variation in these conditions leads to different potential directions of SCP across the world, and targeting interventions to locations with high potential leads to efficiency.

5.1 Opportunities for SCP in developing economies

The 90 identified articles strongly suggest that countries in Europe hold international leadership regarding SCP practices. However, SCP is a complicated and slow process, and there is uncertainty as to whether the lessons from the European countries' experience can be transferred to other developing economies, such as China and India. Some proposed frameworks in developed economies require highly complex and sophisticated accounting systems, effective monitoring and governmental enforcement, and corporate social responsibility (Vergragt et al., 2016). These factors might be difficult to adopt in many developing economies. From an economic perspective, factors such as corruption, income inequality and poverty act as fundamental barriers to adopting SCP practices in developing economies (Frieden, 2017; Hope, 2017). As highlighted in Table 5, most PPISs are reported to be related to developed economies, where greater levels of governmental monetary support are provided to research institutes and governmental agencies. Therefore, further studies call for an exploration of the barriers, drivers and the extent of developing economies adopting and implementing the SCP frameworks, PPISs, and models utilized in developed economies based on different social contexts.

5.2 Opportunities for SCP in developed economies

Unlike the early stages of SCP practices in developing economies, it is relatively mature in the developed economies. Various research activities focusing on PPISs and theoretical reviews have been found that concern SCP related issues from a strategic point of view, which is not surprising given the many national and international PPISs that focus on developing plans and providing guidelines for SCP implementation and adoption. However, it is important to measure the environmental and economic impact of such PPISs. A project in Ireland, entitled sustainability evaluation metric for policy recommendation (SEMPRe), focuses on developing a quantitative evaluation of sustainability policies based on various identified SD indices. Given the multi-criteria nature of sustainability, a possible improvement to this sustainability scoring approach would be the incorporation of MCDM approaches in the assessment procedures (Fitzgerald et al., 2012).

As discussed in Sub-section 4.4, wide utilization of data-gathering technologies across various industries in developed economies can positively expand and drive research opportunities in these economies. Future research activities should be cultivated in terms of developing SCP sustainability performance assessment indicators in an integrated manner with regard to various industries, such as agri-food, transportation logistics, plastics, computer and electronic product manufacturing. Within this setting, MCDM techniques, fuzzy inference modeling combined with life cycle analysis and foot-printing methodologies have been deemed beneficial and provide potential opportunities for future research developments. Moreover, with links to MCDM approaches, stochastic or discrete multi-objective mathematical and simulation approaches must be developed and investigated due to uncertainty in customer demand, sustainable product availability and consumers' sustainable purchasing behaviors associated with sustainability integration.

5.3 Opportunities for SCP in both developed and developing economies

(1) Trade-off analysis between various stakeholders and target audiences

Various stakeholders and target audiences have been identified who can benefit and are contributing to SCP practices, i.e., (a) academics, such as scientists, researchers and educational agencies; (b) government, policymakers and regulatory agencies; and (c) industrial and business companies. From the governmental point of view, public initiatives, strict laws and political regulations must be implemented to achieve SCP patterns. From the business community perspective, new innovative green technology, SCP performance measures, and sustainable strategies must be incorporated into various business operations. From an academic perspective, educational programs are greatly needed to educate consumers in purchasing more responsibly (Schinkel and Spiegel, 2017).

Within this context, another field of research that has not been reflected on involves uncovering and understanding behavioral characteristics of these stakeholders. Within both

developed and developing economies, behavioral characteristics are critical elements to support successful innovation for sustainability in line with local and international SCP patterns. Trade-offs may arise as benefits for stakeholder are offset by harm to another. Transition to an SCP pattern requires analysis of the complex and non-linear relationships between various stakeholders and target audiences. Hence, dynamic approaches, such as system dynamics and agent-based models, provide opportunities to describe the feedback process and examine the long term sustainable behaviors of these stakeholders and target audiences (Tseng et al., 2018).

(2) Consumers and producers' sustainable behavior analysis

SCP requires a holistic consideration of product life cycle management from the perspective of business organizations; management must be enforced by governments to integrate production with consumption. If this is not realized and properly addressed, then customers will still look for low priced products and will not care about sustainable consumption. Even in the case of awareness of environmental issues and intentions to change purchasing behavior, additional efforts are still required to translate these intentions into action and to sustain that behavior (Scherer and Verburg, 2017).

From a supply chain point of view, approaches such as eco- and sustainability- labelling, mass media and educational programs may result in consumers' awareness about SCP patterns and may alter their consumption behaviors. In this regard, more scholarly and governmental attention is needed to measure the effects of such consumer awareness together with societal and governmental pressures on altering the production behaviors of manufacturers, which would open many avenues for future research. As such, developing multi-agent systems with embedded analytical models (Ghadimi and Heavey, 2013) can be regarded as an opportunity for future advancement in line with considerations of both consumption and production in a sustainable manner. Using such models, the purchasing behaviors of consumers in response to undertaken sustainability practices from the manufacturer, distributer, retailer and supplier's sides (or vice versa) can be investigated.

(3) Additional SME-related works in SCP practices

In both developed and developing economies, large firms have an advantage in adopting sustainable practices over small and medium enterprises (SMEs) (Hassini et al., 2012). Many articles have studied and validated theoretical claims in the SCP research domain through the adoption of a case study or pilot case from large and multinational organizations (Luthra et al., 2017; Mangla et al., 2017). Large firms seem to be engaged in SCP activities in terms of impact on organizational routines, technology innovation, and resource commitment.

However, the majority of organizations in all developed and developing economies are considered SMEs (Ghadimi et al., 2018; Johnson, 2015). It is estimated that SMEs account for up to 70% of industrial pollution worldwide (Gerstenfeld et al., 2000; Revell et al., 2010), making their collective ecological and social impact overwhelming. That said, SMEs have

received less attention with regard to sustainability in all aspects, especially SCP (Jenkins, 2006). Only two articles focused on SMEs among the 90 research articles identified, i.e., Luthra et al. (2016) and Partidário et al. (2007). Given the significant scale of small businesses in both developed and developing economies, their aggregate sustainability achievements would have major effects on SCP patterns in these economies. Consequently, proper methodologies and business models must be created to increase SMEs' SCP considerations, minimizing their inefficiencies and finding ways to make sustainability a value rather than a cost (Garetti and Taisch, 2012).

6. Conclusion and limitations

Sustainable consumption and production plays an essential role in promoting sustainable development, as emphasized by the UN's SDG # 12. Sustainable consumption and production has attracted considerable attention in both developed and developing economies. Debate about SCP patterns in various economies can differ depending on factors such as cultural diversity, stage of economic growth and political procedures. In developing economies, there are often insufficient resources to meet essential needs, whereas in developed economies, established mature production technologies limit fundamental changes of the environmental burden. These fundamental differences in developed and developing economies call for more research and analysis to illuminate various themes, focus areas and commonality, which to our knowledge, is rare within this research domain. This paper presents a comprehensive comparative analysis informed by a systematic literature review on SCP related considerations between developed and developing economies. This paper identifies fundamental SCP differences in developed and developing economies and analyzes the most active developing and developed economies in the area of SCP by providing a thorough comparison leading to detailed insights with regard to the considered taxonomies. It can be concluded that SCP practices by these two distinct categories of economies can have a mutually positive impact with a mutually exclusive relationship. The presented comparative analysis coupled with our own perspectives and experiences can help to meaningfully guide future advancements in the strategic area of SCP within both developed and developing economies.

A limitation of this study is that only peer-reviewed journal publications were included for the literature review and comparative analysis on the fundamental SCP differences between developing and developed economies. Although this method can provide clear indications of which economies are considering SCP practices and how, the reported results may not be used as an indication for the countries that do not publish their results in peer reviewed journals. For instance, based on the Environmental Performance Index published in 2018, Switzerland ranks first out of 180 countries with a sustainability ranking of 87.42 out of a possible 100. However, to our knowledge, no peer-reviewed journal publication has been published to disseminate Switzerland's SCP patterns.

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Appendix A. Supplementary data

The following data are supplementary to this article:

Table A1. SCP in other economies

Other economies (No. of articles)	Reference	Geographic location of author's affiliation (No. of authors)
Post-Soviet republics (1)	Brizga et al. (2014)	Latvia (1); Ukraine (2)
EU (8)	Liobikienė and Dagiliūtė (2016); Dendler (2014); De Camillis and Goralczyk (2013); Kielin-Maziarz (2013); Kovács (2011); Burja (2009); Nash (2009); Tukker et al. (2008)	UK (3); Italy (3); Belgium (2); Lithuania (2); Poland (1); Netherlands (1); Norway (1); Denmark (1); Belgium (1); Germany (1); France (1)
Asia (3)	Tseng et al. (2013); Zhao and Patrick (2010); Zhao et al. (2008)	China (3); Philippines (3); Germany (2); Taiwan (China) (1)
North-America (1)	Barber (2007)	USA (1)
General research not focusing on any countries or economies (33)	Govindan (2018); Bai et al. (2018); Notarnicola et al. (2017); Gilli et al. (2017); Pialot et al. (2017); Schinkel and Spiegel (2017); Sala et al. (2017); Ülkü and Hsuan (2017); Zisopoulos et al. (2017); Cohen and Muñoz (2016); Jonkutė and Staniškis (2016); Geels et al. (2015); Akenji and Bengtsson (2014); de Haen and Réquillart (2014); Vinkhuyzen and Karlsson-Vinkhuyzen (2014); Parent et al. (2013); Gandenberger et al. (2011); Brodhag (2010); Cohen (2010); Fedrigo and Hontelez (2010); Ridoutt and Pfister (2010); Stevens (2010); Spangenberg et al. (2010); Lebel and Lorek (2008); Kuhndt et al. (2008); Church and Lorek (2007); Clark (2007); Maxwell and Sheate (2006); Maxwell et al. (2006); Zhu et al. (2006); Barber (2003); Haake and Jolivet (2001); Mulder (1998)	Germany (12); France (11), United Kingdom (9); Netherlands (8); Italy (8); United States (8); Canada (4); Denmark (4); Switzerland (2); Sweden (1); Belgium (2); Lithuania (2); Japan (2); Spain (2); Chile (1); South Africa (1); Israel (1): Australia (1); New Zealand (1); Turkey (1); Thailand (1); China (1)

Table A2. Validation approaches with respect to that statues of different economies

Type	Developed economies	Developing economies	General research	Count
Generated numerical examples/experiments	De Camillis and Goralczyk (2013)	Chiou et al. (2013)	Bai et al. (2018); Schinkel and Spiegel (2017); Ülkü and Hsuan (2017); Jonkutė and Staniškis (2016); Parent et al. (2013)	1/1/5 total 7
Real-world applications /case studies	Dewick and Foster (2018); Azapagic et al. (2016); Cazcarro et al. (2016); Dobes (2016); Deselnicu et al. (2014); Hoff et al. (2014); Staniškis (2012); Staniškis et al. (2012); Berg (2011); Berg and Hukkinen (2011a); Berg and Hukkinen (2011b); Lehtoranta et al. (2011); Niinimäki and Hassi (2011); Petry et al. (2011); Risku-Norja and Mäenpää (2007); Partidário et al. (2007); Yakovleva and Flynn (2004)	Luthra et al. (2017); Mangla et al. (2017); Dubey et al. (2016); Luthra et al. (2016); Soni et al. (2016); Wong et al. (2016); Moreno-Peñaranda et al. (2015); Hoff et al. (2014); Schroeder (2014); Liu et al. (2010); Corral (2003)	Pialot et al. (2017); Thongplew et al. (2017); Bai et al. (2018); Ridoutt and Pfister (2010); Spangenberg et al. (2010); Maxwell et al. (2006); Zhu et al. (2006)	17/11/7 total 34
Theoretical approach	Govindan (2018); Lakatos et al. (2018); Liobikienė and Dagiliūtė (2016); Dendler (2014); Kielin-Maziarz (2013); Lorenz and Veenhoff (2013); Honkasalo (2011); (Kovács, 2011); Grözinger et al. (2010); Burja (2009); Nash (2009); (Schönhart et al., 2009); Tukker et al. (2008); Barber (2007); Clay et al. (2007); Seyfang (2004)	Ely et al. (2016); Vergragt et al. (2016); Adham et al. (2015); Brizga et al. (2014); Tseng et al. (2013); Mungkung et al. (2012); Zhao and Patrick (2010); Soyhan (2009); Bilen et al. (2008); Zhao et al. (2008); Yılmaz and Uslu (2007)	Gilli et al. (2017); Notarnicola et al. (2017); Sala et al. (2017); Zisopoulos et al. (2017); Cohen and Muñoz (2016); Geels et al. (2015); Akenji and Bengtsson (2014); de Haen and Réquillart (2014); Vinkhuyzen and Karlsson-Vinkhuyzen (2014); Brodhag (2010); Cohen (2010); Fedrigo and Hontelez (2010); Mertz et al. (2010); Stevens (2010); Lebel and Lorek (2008); Kuhndt et al. (2008); Church and Lorek (2007); Clark (2007); Maxwell and Sheate (2006); Barber (2003); Haake and Jolivet (2001); Mulder (1998)	16/11/22 total 49
Total				34/23/34 total 90

Note: The description of the number format "a/b/c total d" in the last column is provided in Table 5.

Table A3. Industry sectors with respect to different economies' status

Industry category	Developed economies	Developing economies	General research	Count
Agriculture, Forestry, Fishing and Hunting	Dewick and Foster (2018); Cazcarro et al. (2016); Hoff et al. (2014); (Kovács, 2011); Risku-Norja and Mäenpää (2007); Yakovleva and Flynn (2004)	Ely et al. (2016); Adham et al. (2015); Moreno-Peñaranda et al. (2015); Hoff et al. (2014); Mungkung et al. (2012); Liu et al. (2010); Mertz et al. (2010)	Notarnicola et al. (2017); Sala et al. (2017); Zisopoulos et al. (2017)	6/7/3 total 15
Utilities	Azapagic et al. (2016); Tukker et al. (2008)	Soni et al. (2016); Adham et al. (2015); Soyhan (2009); Bilen et al. (2008); Yılmaz and Uslu (2007)	Cohen and Muñoz (2016)	2/5/1 total 8
Construction		Adham et al. (2015)		0/1/0 total 1
Manufacturing	Dobes (2016); Deselnicu et al. (2014); Lorenz and Veenhoff (2013); (Kovács, 2011); Niinimäki and Hassi (2011); (Schönhart et al., 2009); Tukker et al. (2008); Risku-Norja and Mäenpää (2007); Partidário et al. (2007); Yakovleva and Flynn (2004)	Luthra et al. (2017); Mangla et al. (2017); Ely et al. (2016); Luthra et al. (2016); Mungkung et al. (2012); Liu et al. (2010)	Gilli et al. (2017); Notarnicola et al. (2017); Pialot et al. (2017); Sala et al. (2017); Thongplew et al. (2017); Zisopoulos et al. (2017); Cohen and Muñoz (2016); de Haen and Réquillart (2014); Ridoutt and Pfister (2010); Kuhndt et al. (2008); Zhu et al. (2006); Mulder (1998)	10/6/12 total 28
Wholesale and Retail Trade		Adham et al. (2015); Liu et al. (2010)		0/2/0 total 2
Transportation and Warehousing	Tukker et al. (2008)	Wong et al. (2016); Chiou et al. (2013)	Cohen and Muñoz (2016)	1/2/1 total 4
Finance and Insurance		Corral (2003)		0/1/0 total 1
Educational Services	Petry et al. (2011)			1/0/0 total 1
Other Services (except Public Administration)	Dobes (2016)	Liu et al. (2010)	Church and Lorek (2007)	1/1/1 total 3
N.A.	Liobikienė and Dagiliūtė (2016); De Camillis and Goralczyk (2013); Dendler (2014); Kielin-Maziarz (2013);	Vergragt et al. (2016); Brizga et al. (2014); Schroeder (2014); Tseng et	Bai et al. (2018); Schinkel and Spiegel (2017); Ülkü and Hsuan (2017); Dubey et al. (2016); Jonkutė and Staniškis (2016); Geels et al. (2015);	16/6/22 total 44

	Staniškis (2012); Staniškis et al. (2012); Berg (2011); Berg and Hukkinen (2011a); Berg and Hukkinen (2011b); Honkasalo (2011); Lehtoranta et al. (2011); Burja (2009); Nash (2009); Barber (2007); Clay et al. (2007); Seyfang (2004)	al. (2013); Zhao and Patrick (2010); Zhao et al. (2008)	Akenji and Bengtsson (2014); Vinkhuyzen and Karlsson-Vinkhuyzen (2014); Parent et al. (2013); Gandenberger et al. (2011); Brodhag (2010); Cohen (2010); Fedrigo and Hontelez (2010); Grözinger et al. (2010); Spangenberg et al. (2010); Stevens (2010); Lebel and Lorek (2008); Clark (2007); Maxwell et al. (2006); Maxwell and Sheate (2006); Barber (2003); Haake and Jolivet (2001)	
Total				37/31/40 total 107

Note: N.A. indicates no mention in the article. Some articles were based on more than one industry sector and were therefore placed in each category. The description of number format "a/b/c total d" in the last column is available in Table 5.

Table A4. Industry sectors in manufacturing with respect to the statuses of different economies

Industry category	Developed economies	Developing economies	General research	Count
Food Manufacturing	Dobes (2016); Lorenz and Veenhoff (2013); (Kovács, 2011); (Schönhart et al., 2009); Tukker et al. (2008); Risku-Norja and Mäenpää (2007); Partidário et al. (2007); Yakovleva and Flynn (2004)	Thongplew et al. (2017); Ely et al. (2016); Mungkung et al. (2012); Liu et al. (2010)	Notarnicola et al. (2017); Sala et al. (2017); Zisopoulos et al. (2017); Cohen and Muñoz (2016); de Haen and Réquillart (2014); Ridoutt and Pfister (2010); Zhu et al. (2006)	8/4/7 total 19
Textile Product Mills	Dobes (2016); Niinimäki and Hassi (2011)			2/0/0 total 2
Apparel Manufacturing	Niinimäki and Hassi (2011)			1/0/0 total 1
Leather and Allied Product Manufacturing	Deselnicu et al. (2014)			1/0/0 total 1
Plastics and Rubber Products Manufacturing		Luthra et al. (2016)	Mulder (1998)	0/1/1 total 2
Fabricated Metal Product Manufacturing	Dobes (2016)			1/0/0 total 1
Electrical Equipment, Appliance, and Component Manufacturing		Thongplew et al. (2017)	Pialot et al. (2017)	0/1/1 total 2
Transportation Equipment Manufacturing		Luthra et al. (2017); Mangla et al. (2017)		1/2/0 total 3
General manufacturing			Gilli et al. (2017); Kuhndt et al. (2008)	0/0/2 total 2
Total				14/8/11 total 33

Note: The description of number format "a/b/c total d" in the last column is provided in Table 5.