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Decision support system in supply chain: A systematic literature review

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A B S T R A C T

Systematic literature review in supply chain and decision support system, in general, have been rapidly performed during the last decade. However, the studies on the epistemological progress of decision support system related to the supply chain are still lacking. This study intended to provide comprehensive information on the trends, methodologies and the applications on different sectors and platforms used by scientists for building their decision support systems in supply chain. We used different keywords to collect the raw data based on articles published in well-known journals in the world to select the eligible studies which furthermore assembled. The data were processed by using bibliometric tool in VOSviewer and Microsoft Excel. The results of this systematic review give some key learning of the trends on the use of decision support system on smoothing the flow of supply chain and the logistic performance in the last decade and also provide a background for future research related to the fields.

1. Introduction

There is a common understanding from all stakeholders and entrepreneurs around the world about the importance of information technology to support the business activities in fast-flowing information and rapid change of customer preference era. The latest trend causes a shift in the production process which later affects the flow of the supply chain as overall, with the fear of overexploitation and inefficiency from upstream to downstream. Carter and Rogers (2008) proposed the idea of sustainable supply that emphasize more on economic, environmental and social dimensions. Decision support system (DSS) is one of the best features that arise from the latest trend and is also able to support the major concern in the supply chain. DSS was first mentioned by Gorry and Scott Morton (1971) and it has been widely used in many applications (Djamasbi & Loiacono, 2008). DSS is intended to support decision-makers to assist and improve their decisions regarding the process and the outcome of their business activities, which are in the form of a guidance to select the best sets of option to increase the efficiency, profit and customer satisfaction in regard to the product (Todd & Benbasat, 1999; Speier & Morris, 2003; Wang & Benbasat. 2009).

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Many studies have examined the use of DSS in supporting related business processes. For example in health sector (Hemmat et al., 2019; Belciug et al., 2020), transportation (Rico et al., 2019; El Abdallaoui et al., 2018), tourism (Tan et al., 2018; Yo et al., 2017), fisheries and marine affairs (Sholahuddin et al., 2017; Garmendia et al., 2010), environmental (Amir-Heidari & Raie, 2019); oil industry (Shafiee et al., 2018). This trend signifies a very versatile applications of DSS combined with many attributes and tools with other methods to support the decision-making process.

Despite the usefulness of DSS to decrease the complicity of their decision (Chan et al., 2015), decision support system also faces criticism when current and potential users do not always take advantage of DSS to support their decision-making, either due to knowledge and awareness, or because of the structure of the DSS itself. The user often and repeatedly uses the DSS when the easiness and the usefulness are there (Chan, 2009). Thus, DSS has to be customized based on the work and problem. To date, data warehouse, data mining (Alkahtani et al. 2019), business intelligence (Delen & Pratt, 2006) and statistical analysis (De la Rossa et al. 2004) are being adopted into DSS. The current function of DSS is not only limited to database system but also an expert system that assist decision maker to solve the problem.

The effectiveness of DSS is also depended on the construction and features, in particular in the supply chain, the balance of information and availability to transfer demand and supply needed between each echelon from down-stream to up-stream, makes DSS has to be constructed carefully and comprehensively to assist the decision-maker in the supply chain. As the number of papers published in the supply chain area has grown substantially lately, there are also broad areas and approaches that are used to develop each decision support system in the supply chain, therefore, to address the issue on obtaining the most effective DSS for supply chain, we conduct a systematic literature review. Garcia et al. (2016) pointed out the importance of literature review to prevent the failure of build a DSS, thus, we systematically analyze the literature on DSS on the supply chain, by addressing the following research questions:

RQ1: What are the most effective models used on DSS in supply chain?

Currently there are many approaches, methods, models and technologies that are used. Therefore, the answer for this question can shed light on the most common and effective approaches for DSS in supply chain.

RQ2: What are the activities in supply chain that can be covered and assisted by DSS?

The result of the study can provide broad information of the versatility of DSS in every part of the supply chain and, at the same time, it also gives information on which part of supply chain we may use DSS system.

RQ3: What is the common output provide by DSS in supply chain?

The result of this question can provide the most common outputs from DSS that can be used in the supply chain. This is important to figure out about the power of DSS itself and the result includes the explicit output (document, guidance, and strategy).

RQ4: What industry uses DSS in supply chain used the most?

DSS applications in the supply chain are broad from medical to tourism. The result of this question can provide the information about which industry and the most one to use DSS in the supply chain. At the same time, it provides some information on which industries have used less and this can help find the gap for future applications of DSS in the supply chain.

In this context, the main aim of this paper is to provide a comprehensive systematic review of the use of decision support system in the supply chain. Furthermore, this paper is organized into five sections. Section 1 contains the introduction and research objectives; section 2 is associated with the methodology for this review. Section 3 presents the result; Section 4 and Section 5 respectively report the discussion and conclusion and proposes a research gap and proposed future research.

2. Material and Method

2.1 Data Resources

A systematic review of literature in this study is related to the decision support system in the supply chain. Systematic literature review is good for locating, selecting, analyzing, appraising and evaluating the literature that is relevant to a particular research question (Denyer & Tranfield, 2009). The preparation of the systematic literature review is carried out based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) approach (Liberati et al. 2009). For this reason, the literature used in this study was taken from several major and respected publishing, such as Science direct, IEEE, Emerald, Springer, and also added with the largest indexed database in Scopus, this is due to an effort to gather high-quality paper related to decision support system in the supply chain. Literature data from 2011-2019 was used in the study, which were obtained by the following keywords: DSS AND Supply chain; Web DSS and Supply Chain; decision support system AND supply chain.

2.2. Data Selection

Criteria in selecting articles include articles must be in English; full text is available in accordance with systematic review and research question topics in this study and is limited to pre-determined journals and databases. Collecting data includes titles, abstracts, years, keywords, publishers and keywords exported into Ms Excel which are then processed and processed according to the research question (RQ) in this study. The data collected included 2041 articles from various journals and publishers, then they were reduced by duplicating and relevance articles as much as 1176 so that the remaining articles were 865. Furthermore, from the remaining number of articles, we have filtered them based on the suitability of articles with the topic on this systematic review and obtained 152 articles. In the next step, we obtained 88 articles to be useful in the systematic review in this study (Fig. 1).

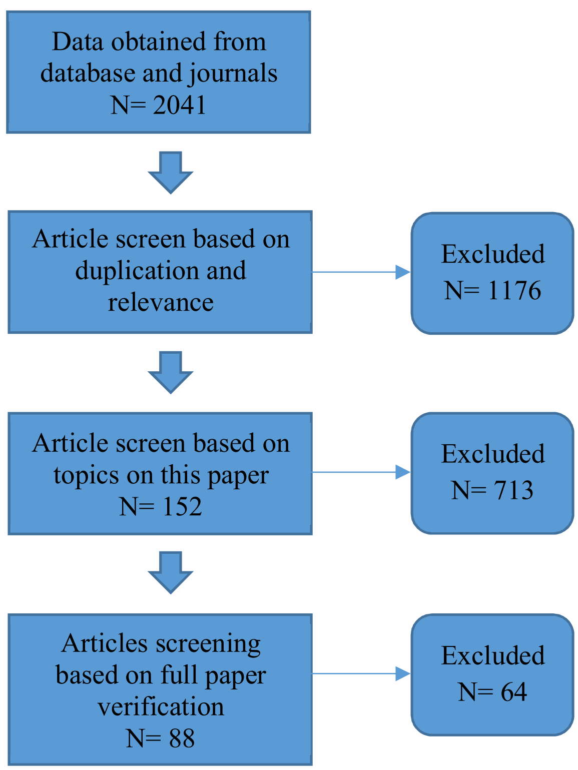

Fig. 1. Data selection process

2.3. Data description

The data obtained and used in this study show that in the past 9 years the number of publications specifically on the implementation of DSS for supply chains has been increased where the highest publication was in 2013 with 14 articles followed by the publication in 2018 with 13 articles. The result has also shown the lowest number of articles published related to DSS in the supply chain was in 2011 with 6 articles followed by 7 articles published in 2016 (Fig. 2). In Fig. 3, it can be seen that in the recent years from 2016 and above, it appears that the focus of research related to the supply chain decision support system was on the implementation and evaluation of decision making.

Figure 2. Number of publication used in this study

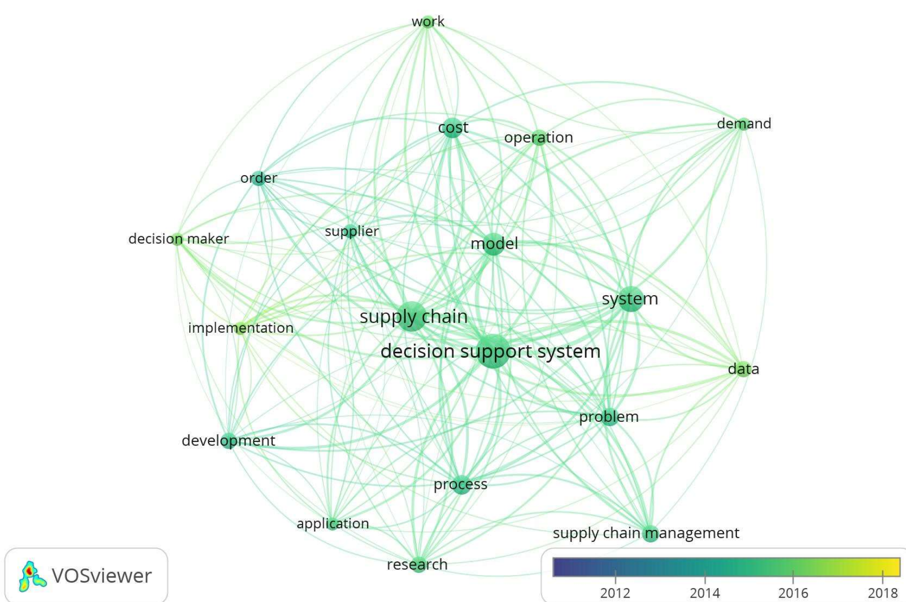

Fig. 3. Yearly publication main topics

It was further found that the articles published during the last 9 years were published in various journals evenly and were not stacked in one particular journal (Fig. 4). 88 articles used in this study came from 70 journals and proceedings, which the finding also obtained that the most journals whose articles were used in this study were 5 articles on Lecture Notes in Computer Science followed by the Journal of Manufacturing Technology Management, Decision Support Systems and International Journal of Production Research each with 3 articles and then the rest of the articles were evenly distributed in the remaining journals. In Fig. 5, it can be seen that based on bibliometric analysis, three topic group clusters were obtained from 88 articles used in this study. The first red cluster is the main cluster which is the main topic in DSS and Supply chain. The second cluster which shown in green is the topic that discusses the approach used, then the third blue cluster is obtained from the application of the built-in DSS.

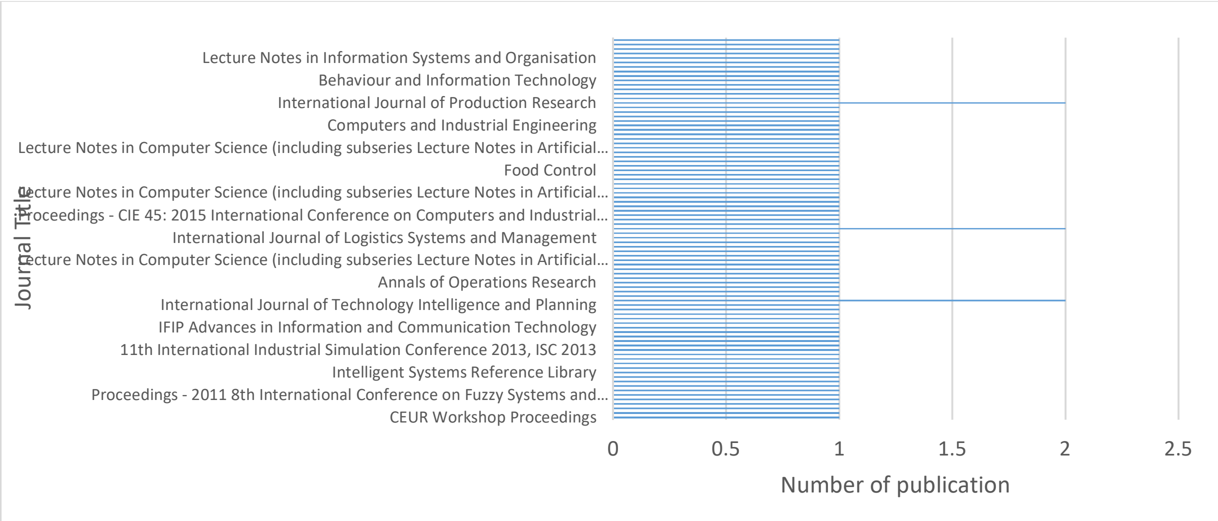

Fig. 4. Publication based on the journal' title

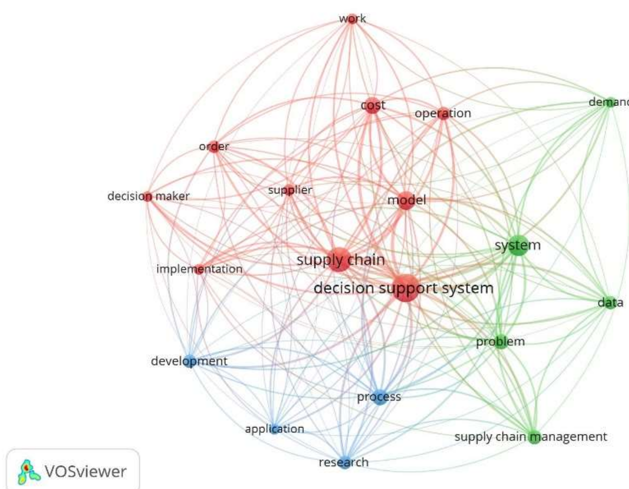

Fig. 5. Network publication topics

3. Results

RQ1: What are the most effective models used on DSS in supply chain?

The results obtained are shown in Fig. 6 and Table 1. It can be seen that the most widely used approach in the application of the supply chain decision support system is numerical simulation which includes the use of linear programming, semantic and fuzzy logic where 63% of articles use numerical analysis on DSS chains supply. Furthermore, the results of a review analysis also found that the use of multi-criteria decision making and multi-objective decision making were in the second place and 20% of the articles used these techniques in this study. Simulation analysis is in the third position where 9.10% of articles use a simulation approach to build DSS in the supply chain. Then respectively, the web-based approach combined with other methods such as simulation, numerical analysis and spatial was 8%, followed by 3% for artificial intelligence, 3% on spatial-based and 1% on big data.

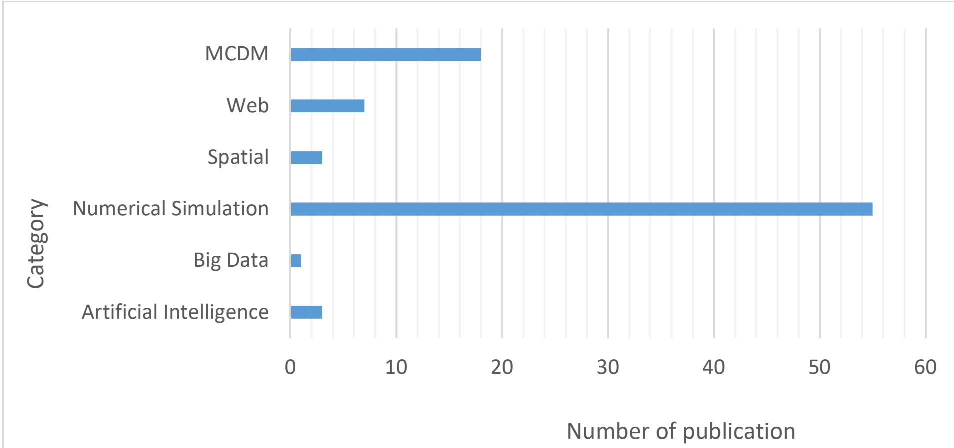

Fig. 6. Method used on the study

Table 1
Article based on categories in RQ1

Category	Article number*
Artificial Intelligence	Park et al. (2018), Dev et al. (2017), Lara Gracia and Vangampler (2012),
Big Data	Vera-Bequero et al. (2015)
Numerical simulation	Yan et al. (2019), Gardas et al. (2019), Gromov et al. (2019), Fowler et al. (2019), Singh et al. (2019), Brauner et al. (2019), Gupta et al. (2018), Essien et al. (2018), Fikar (2018), Dellino et al. (2018), Buhulaiga and Telukdarie (2018), Attadjei et al. (2018), Chee et al. (2018), Perboli and Rosano (2018), Silva and Rupasinghe (2017), Brauner et al. (2017), Boonsothonsatit (2017), Benazzouz et al. (2017), Singh and Randhawa (2016), Biswas and Samanta (2016), Jenoui and Abouabdellah (2016), Brauner et al. (2016), Qiu et al. (2015), De Meyer et al. (2015), Borade and Sweeney (2015), Shi et al. (2015),Moynihan and Wang (2015), Jenoui and Abouabdellah (2015), Monteleone et al. (2015), Nunez and Cruz-Machado (2014), Borodin et al. (2014), López-Milán and Plà-Aragonés (2014), Turki and Mounir (2014), Lättilä et al. (2013), Kumar et al. (2013), Van der Spiegel et al. (2013), Kumar et al. (2013), Ponis and Christou (2013), Lenny Koh et al. (2013), Dong and Srinivasan (2013), Park and Yoon (2013), Lättilä and Kortelainen (2013), Kumar et al. (2013), Malairajan et al. (2013), Gerasimov et al. (2013), Rabenasolo and Zeng (2012), Mrtens et al. (2012), Lange et al. (2012), Su et al. (2012), Kumar et al. (2012), Kristianto et al. (2012), Ngai et al. (2012), Lam et al. (2011), Lin et al. (2011), Greco et al. (2011), Hu et al. (2011)
Spatial	Guerlain et al. (2019), Escalante et al. (2016), Zhang et al. (2016)
Web	Azzamouri et al. (2019), Zhang (2018), Krishnaiyer and Chen (2017), Carvalho et al. (2014), Chang (2014), Guo and Guo (2014), Weng et al. (2011)
MCDM	Eydi and Fazli (2019), Kumar et al. (2019), Rezaei et al. (2018), Drakaki et al. (2018), Sahu et al. (2018), Osorio Gomez et al. (2017), Marimin et al. (2017), Balaman et al. (2016), Boonsothonsatit et al. (2015), Scott et al. (2015), Karthik et al. (2015), Yan et al. (2014), Boonsothonsatit et al. (2014), Teniwut and Maimin (2013), Saksrisathaporn et al. (2013), Miah and Huth (2011)

RQ2: What are the activities of in supply chain that are covered and assisted by DSS?

Decision support systems cover various parts of the supply chain, however in general according to the results of the study, it is found that DSS in the supply chain is mostly used to deal with suppliers, including the selecting of suppliers, evaluating supplier performance, organizing suppliers and selecting potential suppliers which were account for 15% of all articles on DSS in the supply chain. The second problem that also used a lot of DSS methods in the supply chain was delivery and transportation. It was found that as many as 14% of articles reviewed assisted decision-makers in helping them to facilitate and smooth the distribution flow of both input and production output. Furthermore, DSS in the supply chain was also used to optimize production and manage the general supply chain which accounted for 13% of the existing articles, followed by the use of DSS in the entire supply chain activities for 9%. Thus, over 50% of the articles focus on the problems of suppliers, delivery and transportation, optimization of production and production and inventory, while some other articles focus on issues such as customer forecasting, optimization of decision making, location determination, planning, scheduling, security, risk and cost of efficiency (Fig. 7; Table 2).

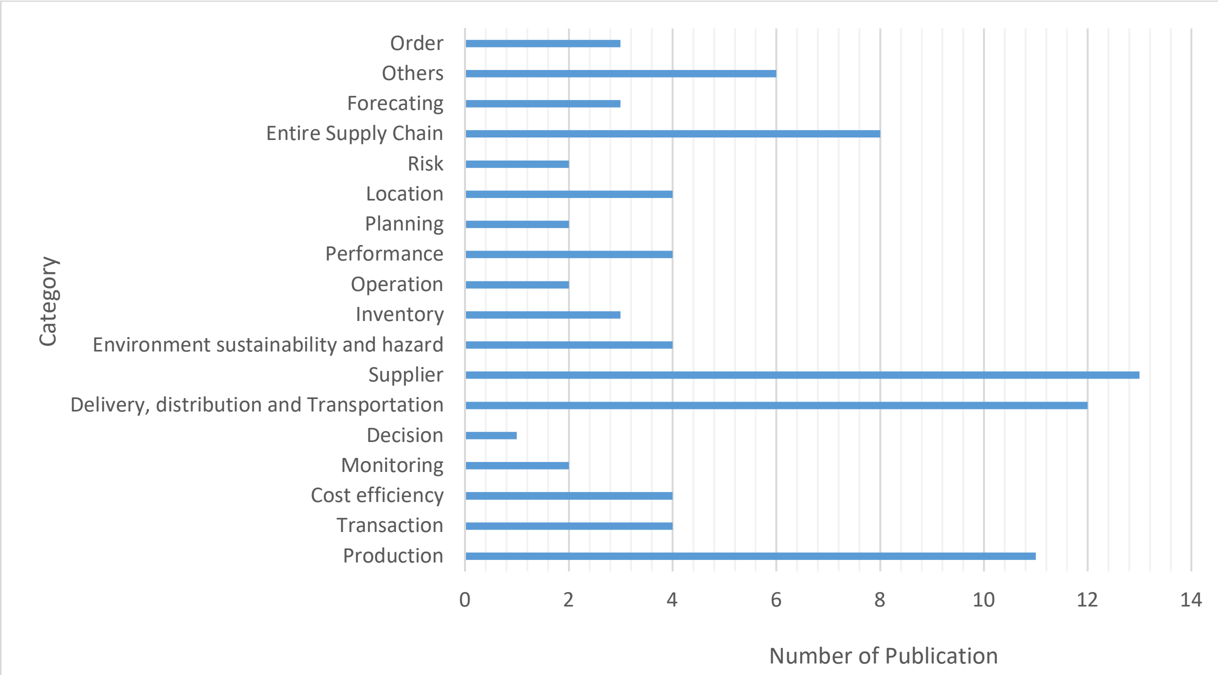

Fig. 7. Field cover by DSS in Supply chain

Table 2
Article based on categories in RQ2

Category	Article number*
Production	Gardas et al. (2019), Fowler et al. (2019), Rezaei et al. (2018), Gupta et al. (2018), Buhulaiga and Telukdarie (2018), Escalante et al. (2016), Balaman et al. (2016), Qiu et al. (2015), Borodin et al. (2014), Park and Yoon (2013)
Transaction	Yan et al. (2019), Brauner et al. (2019), Moynihan and Wang (2015), Vera-Bequero et al. (2015)
Cost efficiency	Borade and Sweeney (2015), Boonsothonsatit et al. (2015), Yan et al. (2014), Boonsothonsatit et al. (2014)
Monitoring	Krishnaiyer and Chen (2017), Singh and Randhawa (2016)
Decision	Brauner et al. (2016)
Delivery, distribution and transportation	Guerlain et al. (2019), Gromov et al. (2019), Essien et al. (2018), Fikar (2018), Perboli and Rosano (2018), Biswas and Samanta (2016), Chang (2014), Turki and Mounir (2014), Malairajan et al. (2013), Gerasimov et al. (2013), Mrtens et al. (2012), Ngai et al. (2012)
Supplier	Eydi and Fazli (2019), Kumar et al. (2019), Sahu et al. (2018), Jenoui and Abouabdellah (2016), Shi et al. (2015), Scott et al. (2015), Jenoui and Abouabdellah (2015), Kumar et al. (2013), Ponis and Christou (2013), Rabenasolo and Zeng (2012), Miah and Huth (2011), Lin et al. (2011)
Environment sustainability and hazard	Van der Spiegel et al. (2013), Kumar et al. (2013), Lenny Koh et al. (2013), Teniwut and Maimin (2013)
Inventory	Zhang (2018), Dev et al. (2017), Lättilä et al. (2013)
Operation	Park et al. (2018). Osorio Gomez et al. (2017)
Performance	Marimin et al. (2017), Saksrisathaporn et al. (2013), Kumar et al. (2012), Greco et al. (2011)
Planning	López-Milán and Plà-Aragonés (2014), Lange et al. (2012)
Location	Drakaki et al. (2018). Zhang et al. (2016), De Meyer et al. (2015), Weng et al. (2011)
Risk	Benazzouz et al. (2017), Hu et al. (2011)
Entire Supply Chain	Singh et al. (2019), Brauner et al. (2017), Boonsothonsatit (2017), Carvalho et al. (2014), Nunez and Cruz-Machado (2014), Dong and Srinivasan (2013), Lättilä and Kortelainen (2013), Kumar et al. (2013), Su et al. (2012), Kristianto et al. (2012)
Ordering	Guo and Guo (2014), Erdem and Göen (2012), Lam et al. (2011)
Forecasting	Dellino et al. (2018), Silva and Rupasinghe (2017), Monteleone et al. (2015)
Others	Azzamouri et al. (2019), Attadjei et al. (2018), Chee et al. (2018), Bohanec et al. (2017), Karthik et al. (2015), Lara Gracia and Vangampler (2012)

RQ3: What is the common output provided by DSS in supply chain?

The more versatile output provided by a decision support system, the more powerful and useful the DSS will be in supporting the decision making the process. The results of this study found that most of the outputs from DSS in the supply chain were in the form of documents and data. The documents and data produced include documents containing storage network data, consumer forecasting data, and sales, effective and optimal transaction data, undistorted supply chain path data, which were accounted for 77.27%. The second output that was generated by the DSS in the supply chain was associated with information and guidance in determining the strategy.

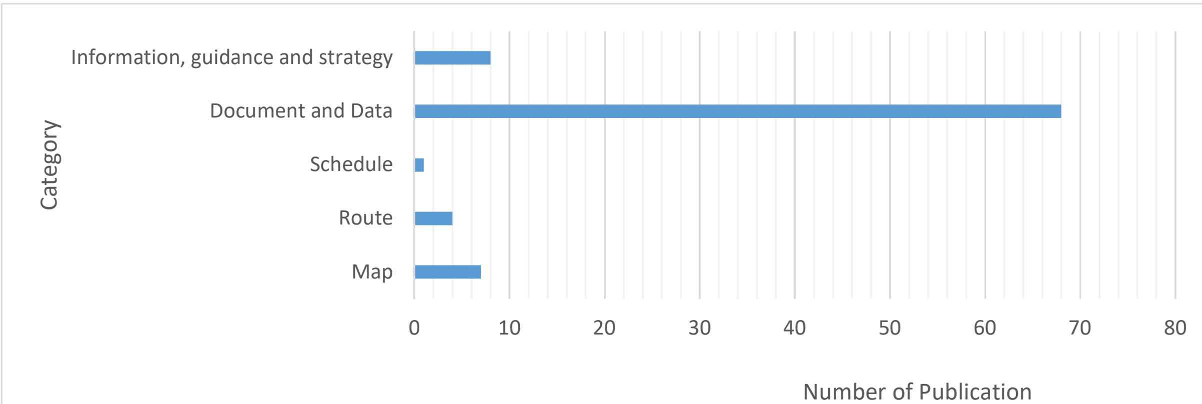

Fig. 8. Output provide by DSS in supply chain

Related outputs include guidance in selecting and evaluating suppliers, guidance in policy-making processes, guidance in selecting effective goods delivery routes and guidance in the process of determining bureaucratic decision making which covers 9.09% of articles reviewed in this study. Furthermore, the DSS output in the supply chain also provided which was in the form of a map and accounted for 7.95%. Maps produced by DSS in the supply chain of articles reviewed in this study include maps of crop planting locations and planning maps for new plant developments. Further results also found that other DSS outputs that also appeared were optimal schedules and travel routes with 4.55% and 3.41%, respectively (Fig. 8; Table 3).

Table 3
Article based on categories in RQ3

Category	Article number*
Map	Guerlain et al. (2019), Drakaki et al. (2018), Fikar (2018), Escalante et al. (2016), Zhang et al. (2016), De Meyer et al. (2015), Weng et al. (2011)
Route	Gromov et al. (2019), Perboli and Rosano (2018), Malairajan et al. (2013), Gerasimov et al. (2013)
Schedule	Azzamouri et al. (2019)
Document and Data	Yan et al. (2019), Singh et al. (2019), Zhang (2018), Essien et al. (2018), Dellino et al. (2018), Park et al. (2018), Attadjei et al. (2018), Chee et al. (2018), Sahu et al. (2018), Dev et al. (2017), Silva and Rupasinghe (2017), Brauner et al. (2017), Boonsothonsatit (2017), Osorio Gomez et al. (2017), Marimin et al. (2017), Benazzouz et al. (2017), Krishnaiyer and Chen (2017), Bohanec et al. (2017), Singh and Randhawa (2016), Balaman et al. (2016), Biswas and Samanta (2016), Jenoui and Abouabdellah (2016), Brauner et al. (2016), Qiu et al. (2015), Borade and Sweeney (2015), Shi et al. (2015), Boonsothonsatit et al. (2015), Moynihan and Wang (2015), Scott et al. (2015), Jenoui and Abouabdellah (2015), Monteleone et al. (2015), Vera-Bequero et al. (2015), Karthik et al. (2015), Carvalho et al. (2014), Nunez and Cruz-Machado (2014), Borodin et al. (2014), Yan et al. (2014), López-Milán and Plà-Aragonés (2014), Chang (2014), Boonsothonsatit et al. (2014), Turki and Mounir (2014), Guo and Guo (2014), Lättilä et al. (2013), Kumar et al. (2013), Van der Spiegel et al. (2013), Kumar et al. (2013), Ponis and Christou (2013), Lenny Koh et al. (2013), Dong and Srinivasan (2013), Park and Yoon (2013), Lättilä and Kortelainen (2013), Teniwut and Maimin (2013), Kumar et al. (2013), Saksrisathaporn et al. (2013), Rabenasolo and Zeng (2012), Mrtens et al. (2012), Lange et al. (2012), Su et al. (2012), Kumar et al. (2012), Erdem and Göen (2012), Kristianto et al. (2012), Lara Gracia and Vangampler (2012), Ngai et al. (2012), Lam et al. (2011), Miah and Huth (2011), Lin et al. (2011), Greco et al. (2011), Hu et al. (2011)
Information, guidance and strategy	Gardas et al. (2019), Fowler et al. (2019), Eydi and Fazli (2019), Brauner et al. (2019), Kumar et al. (2019), Rezaei et al. (2018), Gupta et al. (2018), Buhulaiga and Telukdarie (2018)

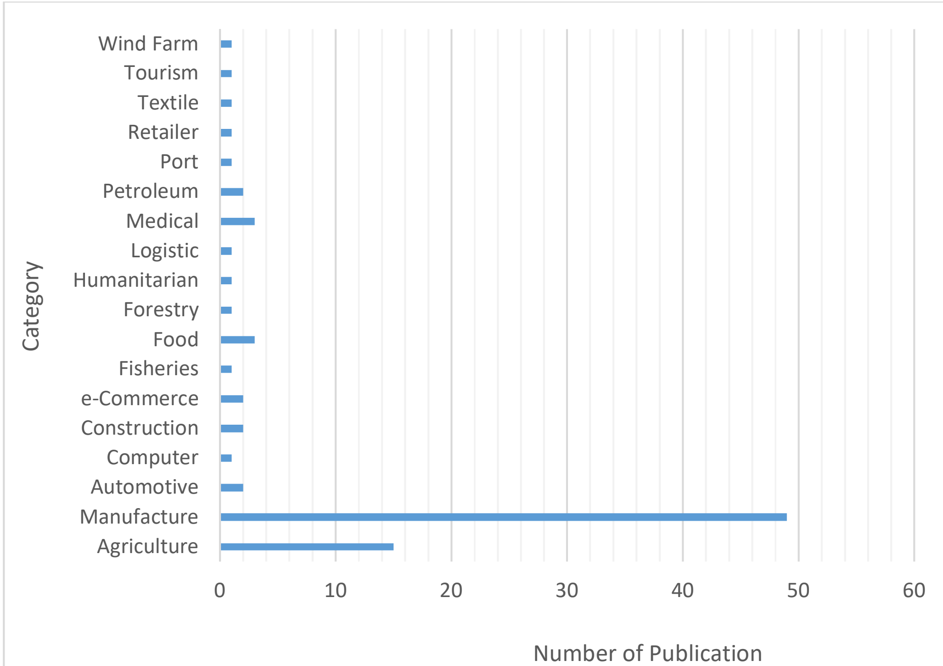

Fig. 9. Industry cover by DSS in supply chain

Table 4
Article based on categories in RQ4

Category	Article number*
Agriculture	Gardas et al. (2019), Rezaei et al. (2018), Essien et al. (2018), Marimin et al. (2017), Bohanec et al. (2017), Escalante et al. (2016), Singh and Randhawa (2016), Balaman et al. (2016), Zhang et al. (2016), Qiu et al. (2015), De Meyer et al. (2015), Borodin et al. (2014), López-Milán and Plà-Aragonés (2014), Mrtens et al. (2012), Hu et al. (2011)
Manufacture	Fowler et al. (2019), Singh et al. (2019), Azzamouri et al. (2019), Eydi and Fazli (2019), Brauner et al. (2019), Zhang (2018), Drakaki et al. (2018), Gupta et al. (2018), Park et al. (2018), Attadjei et al. (2018), Chee et al. (2018), Perboli and Rosano (2018), Dev et al. (2017), Silva and Rupasinghe (2017), Brauner et al. (2017), Boonsothonsatit (2017), Osorio Gomez et al. (2017), Krishnaiyer and Chen (2017), Brauner et al. (2016), Shi et al. (2015), Boonsothonsatit et al. (2015), Moynihan and Wang (2015), Scott et al. (2015), Vera-Bequero et al. (2015), Karthik et al. (2015),Nunez and Cruz-Machado (2014), Yan et al. (2014), Chang (2014), Boonsothonsatit et al. (2014), Turki and Mounir (2014), Guo and Guo (2014), Lättilä et al. (2013), Kumar et al. (2013), Kumar et al. (2013), Ponis and Christou (2013), Lenny Koh et al. (2013), Dong and Srinivasan (2013), Lättilä and Kortelainen (2013), Kumar et al. (2013), Malairajan et al. (2013), Su et al. (2012), Kumar et al. (2012), Erdem and Göen (2012), Kristianto et al. (2012), Ngai et al. (2012), Lam et al. (2011), Weng et al. (2011), Miah and Huth (2011),
Automotive	Carvalho et al. (2014), Park and Yoon (2013), Greco et al. (2011)
Computer	Lin et al. (2011)
Construction	Guerlain et al. (2019), Sahu et al. (2018)
e-Commerce	Yan et al. (2019), Kumar et al. (2019)
Fisheries	Teniwut and Maimin (2013)
Food	Fikar (2018), Dellino et al. (2018), Van der Spiegel et al. (2013)
Forestry	Gerasimov et al. (2013)
Humanitarian	Saksrisathaporn et al. (2013)
Logistic	Biswas and Samanta (2016)
Medical	Benazzouz et al. (2017), Jenoui and Abouabdellah (2016), Jenoui and Abouabdellah (2015)
Petroleum	Gromov et al. (2019), Buhulaiga and Telukdarie (2018)
Port	Lara Gracia and Vangampler (2012)
Retailer	Borade and Sweeney (2015)
Textile	Rabenasolo and Zeng (2012)
Tourism	Monteleone et al. (2015)
Wind Farm	Lange et al. (2012)

RQ4: What industry uses DSS in supply chain the most?

The results of the study show that the industry that utilizes the most DSS in the supply chain is in the manufacturing industry (55.68%), which includes companies engaged in the production of medicines, fertilizers, zinc, and others. The industrial sector which also uses a lot of DSS in supply chain activities is agriculture, (17.05%). Companies engaged in the agricultural industry include seeds, crops and other agricultural activities in general. Furthermore, the results of this study also found that the following industries utilizing DSS in the supply chain: automotive (2.27%), computers (1.14%), construction (2.27%), e-Commerce (2.27%), fisheries (1.14%), food (3.41%), forestry (1.14%), humanitarian (1.14%), logistics (1.14%), medical (3.41%), petroleum (2.27%), ports (1.14%), retailers (1.14%), textile (1.14%), tourism (1.14%), wind farm (1.14%) (Fig. 9; Table 4).

4. Discussion

The complexity of the problems in the supply chain is influenced by various factors, some of which are the level of the echelon supply chain and the industrial base. Thus, the treatment of handling problems in each industry sector will certainly be different, which will have an impact on the utilization of the decision support system for handling problems in the supply chain. The results have shown that the use of numerical simulation is an approach that is widely used to build a decision support system in the supply chain (Gromov et al., 2019; Buhulaiga et al., 2017; De Meyer et al., 2015; Nunes & Cruz-Machado, 2014). Numerical simulation has advantages when compared with other approaches, one of which is to save time in its ability to handle complex problems in the supply chain. However, in its implementation, the use of numerical simulation should have been followed by other approaches such as web and spatial, which in practice up till recently have received little attention.

The approach that is also widely used for DSS in supply chains is the multi-criteria decision making (MCDM) and multi-objective decision system approach (MODM) (Karthik, et al., 2015; Boonsothonsatit et al., 2014; Miah & Hut, 2011). The MCDM and MODM approaches have been widely used in decision-making processes both in the supply chain and in other fields. This extensive use of the approaches shows the strength and versatile of this approach, however another limitation that often arises is the weakness in determining weight and the formulation of hierarchical structures that are still quite subjective and rigid, therefore when the complexity of the problem increases, the flexibility of adjustments for changing conditions in the field is hard to accomplish which takes time to adjust. Other approaches to DSS for supply chains such as artificial intelligence (Silva & Rupasinghe, 2017) and big data (Vera-Baquero et al., 2014), spatial approaches (Guerlain, et al. 2019) and the web-based (Azzamouri, et al. 2019) have still not been widely used. The trend still is on track in the opposite direction with the current trend, when the development of big data, data mining and web-based systems have been widely used in various fields, whereas studies in the DSS supply chain field are still very limited.

In the supply chain, the relationship flow usually starts from the supplier of raw materials and usually ends in the distribution of goods to consumers. This relationship from upstream to downstream involves many parties and one of them is the supplier. The role of suppliers is very important to improve the performance of raw material availability which will have an impact on production performance. The results of this study confirm the crucial role of suppliers where the utilization of DSS in supply chains has been widely used for supplier relationships (Sahu, et al., 2018; Jenoui & Abouabdellah, 2016; Scott, et al., 2015; Ponis & Christou, 2013). DSS is built in the supply chain to overcome problems with suppliers, including the problems in choosing suppliers, evaluating relationships with suppliers for measuring supplier performance. Problems that also get considerable attention to the use of DSS in the supply chain are production (Gardas et al., 2019; Rezaei et al., 2018; Escalante et al., 2016) and delivery, transportation and transportation (Fikar, 2018; Essien et al., 2018; Turkey & Mounir, 2014). Maintaining production performance is also one of the most important factors to maintain supply chain performance in general, the deterioration of production time and the accuracy of the quantity and quality of products produced are important to reduce additional costs such as inventory costs and costs arising from production errors. Likewise, with the smooth distribution process both input and output which has a very significant impact on supply chain performance and each actor in it.

The use of DSS also covers various problems in the supply chain, including transactions (Brauner et al., 2019; Moynihan & Wang, 2015), cost efficiency (Yan et al., 2014; Borade & Sweeney, 2015), monitoring (Singh & Randawa, 2015), decision making (Brauner et al., 2016), environment sustainability and hazard (Lenny Koh et al., 2013), inventory (Lättilä et al., 2013), operation management (Osoriuo Gomez et al., 2017), performance measurement (Marimin et al., 2017), planning (López-Milán & Plà-Aragonés, 2014), location (Zang et al., 2016), risk management (Benazzouz et al., 2017), entire supply chain (Kristianto et al., 2012), forecasting (Monteleone et al., 2015), orders (Guo & Guo, 2014), for instance for sustainable competitive advantage by Karthik et al. (2015) and genetic identification by Bohanec et al. (2017). Based on the results it can be seen that the use of DSS in the supply chain is influenced by factors of interest for the industry explicitly and comprehensively such as relations with suppliers, production and distributors compared with the complexity of particular cases of problems in the supply chain.

One of the advantages of DSS is the output that can be used directly by policymakers and decisions. For this reason, the output must be easily read and digested by the user. Based on the results of this study, the most frequently occurring forms of output are data and documents (Shi et al., 2015; Scott et al., 2015; Park et al., 2013; Attadjei et al., 2018; Dev et al., 2017; Silva et al., 2017). This result can be understood because the output is in the form of data and documents are very easy to read and use, compared with other outcomes such as information and guidelines that are universal and less specific. In addition to convenience factors, the problem factors handled by DSS in the supply chain also influence the output match produced, such as the output in the form of maps conducted by Guerlain et al. (2019), Drakaki et al. (2018), Fikar (2018) and Escalante et al. (2016). Another form that also appears in the use of supply chain DSS is the route as done by Malairajan et al. (2013) and Gerasimov et al. (2013). Thus, it can be seen that the output form of supply chain DSS is influenced by the ease of reading and type of assist in the use of the supply chain decision support system, in addition to the characteristic factors of the users. This is important in the context of the effectiveness of the supply chain DSS used.

Each industry sector has its own characteristics in terms of the complexity and problems that arise. Thus, the handling process tends to be customized between industries even intra-industry. DSS is present as a tool that can help solve problems that tend to be customized and unique. In the supply chain, until now the use of DSS is still very focused on the manufacturing sector, based on the results of this research, it was found that more than 50% of the articles focus on making DSS in the supply chain in the manufacturing sector (Azzamouri et al., 2019; Eydi & Fazil, 2019; Boonsothonsatit, 2017; Moynihan & Wan, 2015; Scott et al., 2015; Dong & Srinivasan, 2013; Greco, et al. 2011). The manufacturing sector is yet at the center of the attention of researchers in the world compared with other sectors because the standard system that has been built so that factors related to the assumption of supply chain DSS can already be predicted. This condition is different from the agricultural sector where the factors related to the assumption of DSS are still difficult to predict due to the presence of natural factors such as season and rainfall which still have significant effects. Nevertheless, the researchers began to focus on making DSS in the agricultural sector, as research conducted by Hu et al. (2011); López-Milán and Plà-Aragonés, (2014); Borodin et al. (2014); Qiu et al. (2015); Zhang et al. (2016); Escalante et al. (2016); Balaman et al. (2016); Rezael et al. (2018) and Gardas, et al. (2019). The use of DSS in the agricultural sector is still limited to distribution routes and products in general and has not varied in use such as the manufacturing sector in general. This condition must be a concern because the agricultural sector has a higher multiplier economic effect than other industries in general, so researchers need to focus on agricultural sectors and similar sectors such as fisheries, farming, and livestock.

The use of DSS in the supply chain has also been carried out by researchers in various sectors although there are not too many sectors, for example automotive (Park & Yoon, 2013), computers (Lin et al., 2011), construction (Guerlain, et al., 2019), e-Commerce (Yan et al., 2019), fisheries (Teniwut et al., 2013), food (Fikar, 2018), forestry (Gerasimov et al., 2013), humanitarian (Saksrisathaporn et al., 2012), logistics (Biswas & Samanta, 2016), medical (Benazzouz et al., 2017), petroleum (Buhulaiga & Telukdarie, 2018), ports (Lara Garcia & Vangampler, 2012), retailers (Borade & Sweeney, 2015), textile (Rabenasolo & Zeng, 2012), tourism (Monteleone et al., 2015) and wind farm (Lange et al., 2012). This empirical condition indicates that DSS used in the supply chain has been implemented in various industries even though in its implementation, the focus is on one sector but taking into account the distribution of its scope this shows the strength of DSS in helping to improve the supply chain performance.

5. Conclusion and gap for future studies

Based on the results of the research, the answers to the research questions have been obtained in this study. The answer to RQ1 shows that the most frequently used method and approach is numerical simulation compared with other approaches. Furthermore, for RQ2 it was found that the use of DSS in the supply chain was mostly used for handling problems with suppliers and delivery, distribution and transportation, then for RQ3 it was found that documents and data were a form of output generated by DSS in supply chain activities. For RQ4, it was found that the manufacturing sector uses the most DSS in supply chain activities. This condition has implications for subsequent studies, especially on the use of DSS in the supply chain following information technology trends and change of the future on each industry sector.

The use of DSS in the supply chain should be more focused on sectors that have significant and broad economic impacts such as agriculture, fisheries, animal husbandry, and farming. This is important because attention to these sectors in the last decade has been limited. Also, the approach used is also supposed to utilize a web-based DSS-based approach so that it could be utilized efficiently and tactically. Furthermore, further research related to the use of DSS in the supply chain must also be focused on supply chain issues in general, in the sense that it does not only focus on one part of the supply chain such as delivery routes or land identification but is comprehensive from upstream to downstream.

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