Method and Approach Mapping of Fair and Balanced Risk and Value-added Distribution in Supply Chains: A Review and Future Agenda

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***Abstract* — This paper proposes a fair and balanced risk and value-added distribution as a novel approach for collaborative supply chain. The objective of this article is to analyze the existing methods and approaches for risk management, value-adding, risk and revenue sharing to develop a new framework for balancing risk and value-adding in collaborative supply chains. The authors reviewed and synthesized 165 scientific articles which were published between 2001 and 2017. The reviewed articles were categorized into supply chain management and performance, risk management, value-added, fair risk and value-added distribution and supply chain negotiation. The potentials identified for future research were the importance of decision-making and sustainability for effectiveness of supply chain risk management. Most previous authors have applied an approach of revenue and risk sharing with both decentralized and centralized supply chains to achieve the fair risk and value-added distribution. The dominant methods we found in literature were game theory and complex mathematical formulation. Most literature focused on operation research techniques and there was a lack of discussion of the intelligent system approach. The contribution of this paper was mapping the method and approach in risk management, value added analysis and develop new framework. This paper developed and suggested a new framework for a fair and balanced risk and value-added distribution model. For a future agenda, we point towards the development of a systematic intelligent system applying soft-computing techniques and knowledge transfer for maintaining sustainable supply chains.**

Keywords — *Fair risk and value-added distribution, Supply chain collaboration, Revenue sharing, Risk management, Risk sharing*

1. Introduction

Supply chain (SC) management aims to coordinate stakeholders, develop costumer value-adding, maximize profit and maintain competitive advantage and service level [1]–[3]. To achieve this objective, it needs an appropriate supply chain strategy involve risk management and value-added enhancement. Previous research has summarized the steps for supply chain risk management, involving identification, assessment, monitoring and risk learning with knowledge transfer among stakeholders [4]. The last step of risk management is a supply chain collaboration approach which aims to maximize profit, minimize risk and negative impact in the business process [5], [6]. In addition, supply chain value-added should be identified in every step of business process since it is an important step to increasing it.

Collaborative supply chain is beneficial in identifying information flow, knowledge transfer and effective risk mitigation in proper decision-making [7]. Previous research agreed that the collaborative supply chain would maintain a good demand response, more flexible supply chain, cost reduction up to 12% and efficient resource management consumption [8], [9]. The study of collaborative supply chain is always challenging and lacking in real world practice, therefore it needs to be discussed thoroughly and maintain an operational application [10], [11].

Earlier, previous research has developed a profit or revenue sharing to raise the supply chain profit. Moreover, we have to consider risk mitigation and decision-making in this model because of the unpredictable and uncertainty variables in supply chain environment [12]. Risk and value-adding is a conflict objective then it would be more comprehensive in a balanced condition to maintain business sustainability. Therefore, supply chain fair and balanced risk and value-added distribution model is introduced to accommodate an effective supply chain collaboration and coordination. To enrich the analysis, this model is divided into 2 different approaches, within the revenue sharing and risk sharing approach. The revenue sharing approach emphasizes on profit distribution among supply chain stakeholder [2], [13] meanwhile the risk sharing focuses on uncertain supply and demand and its effect to the business [14]–[16].

Today, the risk and revenue sharing approach only focused on the stakeholder profitability [2], [17].

This paper aims to analyse the method and approach in order to map fair and balanced risk and value-added distribution model in supply chain then organizing a framework. This article analyses the important consideration of risk and value-adding comprehensively to maintain a fair and balanced risk and value-added distribution in the supply chains. Firstly, the risk and value-added will be analysed, then the fundamentalist theory of supply chain collaboration and coordination is structured. Finally, a conceptual definition and framework for fair and balanced risk and value-added distribution approach will be mapped and further possible improvement will be discussed.

2. Method

2.2. Critical review framework

We categorize this critical review into 5 main topics, they are supply chain configuration and mechanism, supply chain risk management, value-added analysis, fair risk and value-added distribution model, also supply chain negotiation. Supply chain management describes the configuration models which are mostly discussed in the literatures. Supply chain risk management and value-added topics explained the definitions, factors and methods in previous literatures. This paper focused on the approach and method applied by authors for fair risk and value-added distribution topic and we defined the framework. The supply chain negotiation is the decision-making framework to implement the fair risk and value-added distribution with a user-friendly system based. Finally, in the end of the review, we suggest a global framework. The framework of this review is depicted in Figure 1.

2.3. Scientific articles sources and the year of publication

We have reviewed 165 scientific articles correlated to our main topics. The scientific articles are 141 Journals, 20 Books, PhD thesis, guidelines and 4 Proceedings which published between 2001 and 2017. The literatures based on main topics are defined in Table 1 and the year of publication is depicted in Figure 2.

Table 1. The number of scientific articles on each main topic

No	Main Topic	Quantities
1	SC management and performance	38
2	SC risk management	60
3	SC value-adding	23
4	Fair risk and value-added distribution	34
5	SC negotiation framework	10
	Total	**165**

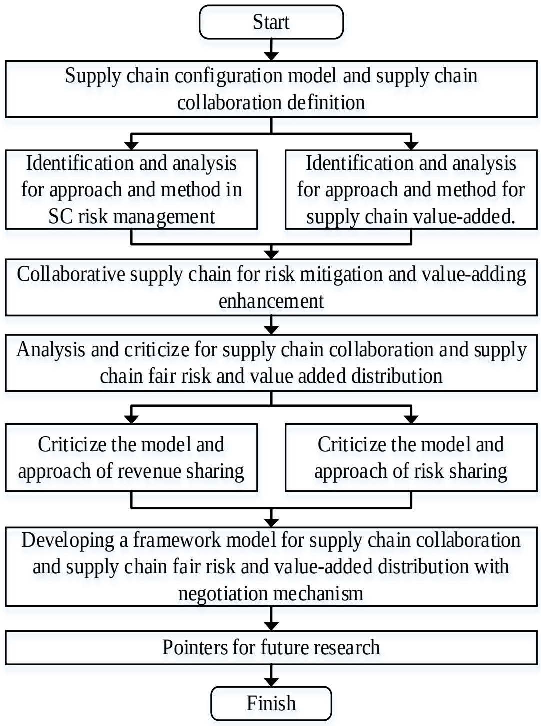


Figure 1. The review framework and structure

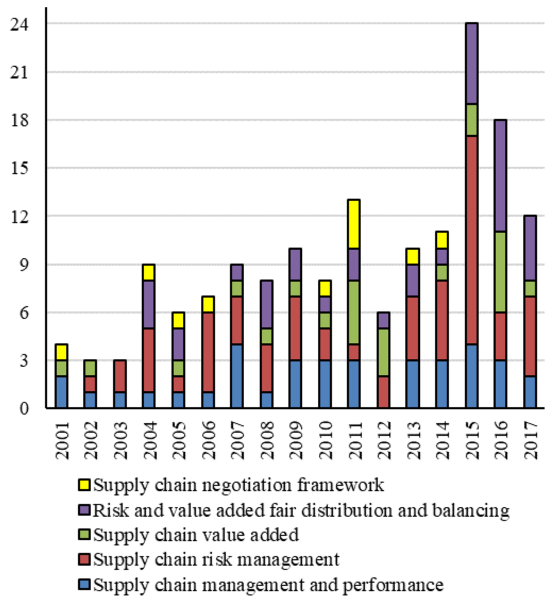


Figure 2. Temporal distribution of the articles

Table 1 and Figure 2 showed the supply chain risk management topic being a common topic in last 15 years. However, in the past few years, the supply chain risk management topic was always developing risk mitigation methods and approaches. In 2015, this topic is mostly available in the scientific articles and significantly increasing in every year, which means this topic provides an opportunity to explore and develop a new approach and framework. On the other hand, the review for method and approach of supply chain fair and balance risk and value-added distribution is desired and vital.

3. Findings

3.1. Supply chain configuration and mechanism models

Supply chain (sc) management comprises 3 main activities, they are supply activity (upstream), distribution activity (downstream) and maintain an ultimate relation to consumer [18]. The supply and distribution activity aim to create value which consumer willing to pay and makes supply chain profitability. The value means that the product is distributed in appropriate time and quality based on the consumer needs [19]. Moreover, supply chain configuration and mechanism for modern business process needs more than downstream and upstream activities. The company should observe the flow of goods, material, and information, business performance and sustainability to achieve the supply chain goals. In this case, it is important to consider collaborative supply chain approach [20].

Collaborative supply chain has a strong correlation for stakeholders coordination to obtain profit, revenue sharing, risk mitigation, improves performance and service level as well as information sharing in downstream and upstream activities [7], [21], [22]. Collaborative supply chain is defined as a long-term relationship between the supply chain stakeholders to cooperate, share information and create business strategies in order to improve the supply chain performance and decision-making flexibility [9], [23]. Based on the literatures, we found 4 characteristics of supply chain configuration, they are decentralized supply chain, centralized supply chain, closed-loop supply chain and integrated supply chain.

Centralized supply chain configuration arises when the stakeholders have the same objective, then they merge and coordinate to minimize cost and maximize profit. This configuration is led by a decision-maker who is responsible to organize a fair revenue for each stakeholder based on their trade, demand and investment [1], [24]. On the contrary, the decentralized supply chain is an independent model, each stakeholder can make his own decision to gain an optimal strategy in order to achieve the goal [25]. An integrated supply chain configuration means that 2 stakeholders cooperate in investment and determine the product selling price to achieve the common profit [26]. Stakeholders should agree which aspects and factors to be merged and integrated in order to minimize risks. The closed-loop supply chain which has been modeled by Gao *et al.*, [27] and Hey, [15] are designed to optimize all possible resources and achieve a better coordination in a supply chain scope. In a closed-loop supply chain, manufacturer collected the end product costumer to reuse and recycle and comprises all coordinated relationship between forward and reverse [28].

The centralized and decentralized supply chain configurations are the most dominant models to accommodate collaborative supply chain also fair risk and value-added distribution. The collaborative supply chain models in literatures are depicted in Figure 3.

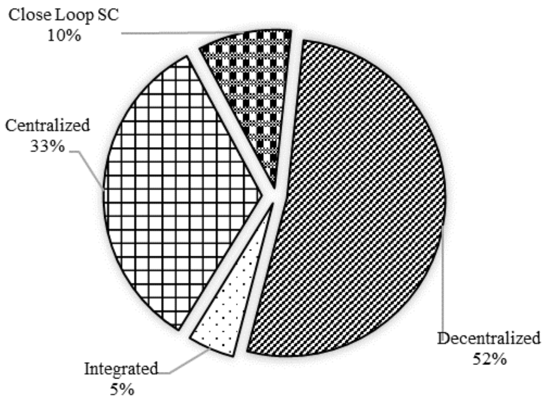


Figure 3. Supply chain configurations in literatures

3.2. Method and approach for supply chain risk management

3.2.1. Supply chain risk management definition

Many authors have proved that an efficient supply chain risk management could increase performance and competitiveness of a company or organization [29]. Risk management has developed widely in terms of method and approach, since it is triggered by the information and technology, unstable global economic condition, supply chain complexity, company's merging and unique business process model [30], [31]. These factors led the raising of internal risks and it affected an ineffective decision-making [32]. In addition, external risks which come from the environment, organization, and other unpredictable variables affecting the company's reputation and consumer trust [33]–[35].

The number of rising risks follow the complexity of supply chain configuration models [36]. The risk potentials do not only come from traditional risk, but also from supply chain collaboration as well as poor decision-making [9], [37]. Those factors make supply chain stakeholder vulnerable to the expose risk, therefore an effective method is needed to minimize the risks. Furthermore, risk identification and assessment was widely known as the first step in supply chain risk management, then Pujawan and Geraldin, [38] Muchfirodin [39] and Oliva [36] suggested supply chain and business process identification as the ultimate first step to mitigate the risks before risk identification.

Supply chain mechanism identification is an important way to understand the problem and to recognize the different characteristics of the configuration and risks in each supply chain. For instance, the risks characteristic of agri-food supply chain and manufacture supply chain has a distinct difference in terms of material flow, stakeholders and the material management in each stakeholders' level. The risk in agri-food supply chain is affected by the climate condition, seasonal production, agricultural specific regulation, product yields, processing factors, and strong influence of the society [34], [39]–[41]. In the manufacture, the risks are characterized by uncertain demand and supply but the probability of the raw materials problem is close to zero.

Supply chain risk defined as a possible deteriorated problem arising from the potential problem in each activity and the effect of improper decision which may give a negative impact to all stakeholders [37], [42]. Minimizing the risk at a certain point is needed before its ruins another stakeholder and whole supply chain. Then the effective handling of supply chain risk to all stakeholders and flow is called supply chain risk management. The main global activity of supply chain risk management is to customize some appropriate strategies by coordinating supply chain stakeholder to minimize the risk sensitivity, establish a good risk responsiveness and increase supply chain profitability [31], [43], [44]. In order to achieve the goals, supply chain risk management needs to observes and identifies risk factors in the entire supply chain, [45], assess and analyze the risks and create a strategic way to mitigate the risks [46]. The aforementioned steps are conventional ways to minimize the risk, on the other hand the risk minimization can be affected by a collaboration and coordination of the stakeholder's supply chain and achieve a fair risk sharing, efficient supply chain flow and increased the profitability and sustainability [47].

3.2.2. Standard and Guidelines of Risk Management

In this section, we briefly review the risk management guidelines to apply in supply chain and organization scopes. The following standard and guidelines of risk management have been applied in many organizations to manage the risk efficiently. The risk management guidelines to discuss in this section involved Institute of Risk Management (IRM): 2002, International Standard Organization (ISO) 31000:2009, Indonesian National Standard (SNI) ISO 31000: 2011, and Risk Management Society. The steps of risk management standards are described in Table 2.

The Institute Risk Management (IRM), [48] defines 6 steps of risk management and identify company objectives as the most important step to know the factors, sources and threats which can obstruct the goals. The last step is risk monitoring to ensure the all steps run well and to anticipate impacts of the risk management implementation to the company. Committee of Sponsoring Organizations of the Treadway Commission (COSO), [49] defines the Enterprise Risk Management as a risk management approach involving entities, stakeholders, companies' strategic plans to find the unexpected factor, control the risk then ensure the objectives achievement. COSO and IRM have a similar opinion on the importance the objectives definition and risk identification as an activity of entities and stakeholders to achieve the goals.

Table 2. Risk management guidelines

No	Guideline	Risk management steps
1	Institute of Risk Management (IRM) 2002	1. Company's goals definition 2. Risk assessment ➢ Risk identification ➢ Risk description ➢ Risk estimation 3. Risk evaluation 4. Internal and external reporting and communication 5. Risk treatment 6. Monitoring
2	COSO- ERM an integrated framework	1. Objective settings 2. Event identification 3. Risk assessment 4. Risk response 5. Control activities 6. Information and communication 7. Monitoring
3	International Standard Organization (ISO) 31000: 2015	1. Definition of 11 risk management principles 2. Risk management framework definition ➢ Management mandate and commitment ➢ Plan, Do, Check, Act principles implementation ➢ Risk management framework arrangement ➢ Risk management implementation ➢ Framework's monitoring and review ➢ Temporal framework evaluation 3. Risk management process ➢ Contextual decision ➢ Risk assessment ➢ Risk control 4. Communicating, monitoring and reviewing
4	The Risk Management Society (2014)	1. Risk identification ➢ Brainstorming ➢ Interview with What-If method ➢ Checklists 2. Risk analysis ➢ Risk control with company's common method ➢ Consequence/likelihood matrix ➢ Expert assessment ➢ Root cause ➢ Cause-effect analysis ➢ Influence diagram ➢ Bow ties diagram ➢ Monte Carlo simulation 3. Risk evaluation ➢ Alarp method ➢ Solution effect analysis ➢ Force field diagram ➢ Divergent path

ISO 31000:2015 contains a generic manual for inter-organization risk management involving principals, framework and process [50]. The risk management principal includes 11 fundamental principles which should be applied by the company effectively. The risk framework would come with a mandate and the commitment of company also the implementation of 'Plan, Do, Check and Act'. The risk management process consists of contextual implementation, risk assessment and risk treatment and finally as communication, monitoring and review. These principles and framework applied globally by some companies and followed by other standard, including Indonesian National Standard, [51] and Risk Management Society, [165].

Risk Management Society (RIMS) adopted ISO 31000 then develops a new method, technique and framework which includes risk identification, risk analysis and risk evaluation. Risk identification step performed by brainstorming, interview with what-if method and checklists. Risk analysis begins with understanding the regular risk mitigation method in the company, implementing the consequence/likelihood matrix, expert assessment, root cause, cause-effect analysis, influence diagram, bow tie diagram and Monte Carlo simulation. In the last step, the risks are evaluated by Alarp method, solution effect analysis, force field diagram and divergent path.

3.2.3. *Current issue: supply chain risk management method and approach*

Previous research developed risk management methodologies widely to solve the company's problem and risks. Generally, supply chain risk management approach includes 4 main steps, (1) risk identification, (2) risk analysis, (3) risk management and (4) risk monitoring [30], [52]. Briefly, Ghadge *et al.*, [53] and Fahimnia *et al.*, [54] combined the third and fourth step into risk mitigation. Therefore, we categorize supply chain risk management methods and approaches in 3 main steps i.e. risk identification, risk assessment and risk mitigation as described in Table 3.

Table 3. Method and approach for supply chain risk management

Steps	Approach	Description	Authors
Risk identification	In-depth interview	A deep interview with supply chain stakeholders	[36], [39]
	Interviewed based SCOR	List of interview questions according to matrices of Supply Chain Operation Reference (SCOR)	[31], [38], [44]
	Risk mapping	Risk mapping and description according to an approach by World Bank	[39]
	Literature review	The risks are identified based on the previous research in an appropriate business process	[32], [55]
	Exploratory Factor Analysis	Risk identification by categorizing the most potential risk statistically	[55]
	Questionnaire	List of questions delivered to the supply chain stakeholders	[56]
	Fault Tree Analysis	Risk identification with Boolean (AND/OR), it is not appropriate to supply chain risk management	[57], [58]
Risk assessment	House of Risk 1	Risk analysis based on a House of Quality and FMEA framework	[38]
	Fuzzy Based	Fuzzy set theory framework to assess the risk factors	[55]
	FMEA	Risk potential based on value of detection, occurrence, severity and risk priority number (RPN)	[32], [59]
	Fine Kinney Method	Risk classification based on value of event, factor and risk impact	[60]
	Bayesian Belief Network	Risk assessment by networking, cause-effect diagram and risk probability by experts	[61], [62]
	MAFMA	A FMEA method which considers cost attribute	[63]
	AHP/Fuzzy AHP	A relative assessment of risk	[42], [60]
Risk mitigation	ANP-BOCR	Risk mitigation by a network of strategy considering benefit, opportunity, cost and risk (BOCR)	[39]
	Interpretative Structural modeling	Risk mitigation with organization structural approach to deliver preventive actions	[33], [42], [64]
	House of Risk 2	The house of risk framework for risk mitigation	[38]
	Fuzzy order function	A complex mathematical formulation based on a fuzzy approach for risk assessment	[65]
	Interview	The interview to the stakeholders for the risk mitigation actions	[32]

Risk identification is the main step to analyze and identify the potential uncertain factors and activities against the supply chain. The risks can be simply identified by Supply Chain Operation Reference (SCOR) framework [31], [38] or literature review [36], [39]. The risk identification techniques are various, such as risk by cause [53], Fault Tree Analysis (FTA) [57], [58], in-depth interview and causal-effect diagram [61]. We found that risk identification solely by SCOR framework makes incomplete identification, therefore we need a literature review, in-depth interview and cause-effect analysis. In the contrary, the supply chain risk identification with Fault Tree Analysis (FTA) will not be a good analysis since does not suitably with supply chain system [61].

The risk analysis and assessment would assess each item in detail based on possibility of risk occurrence in a specific case. The analyzed risks come from the result of risk identification which considering qualitative or quantitative risk assessment approach. The qualitative risk assessment describes the potential supply chain risk, while the quantitative ones estimates and describes with a specific value [66]. Generally, the quantitative risk assessment described clearly as folding of risk probability and risk consequence in the specific point of the case, which mathematically describe in Eq. 1.

$$Risk = Probability \times Consequence \qquad (1)$$

The risk assessment results are usually risk priority from expert, focus group discussion, in-depth interview and needs to be mitigated by an appropriate management [22]. Some methods and techniques for risk priorities by the expert assessment are Failure Mode and Effect Analysis (FMEA), House of Risk (HOR) and Fine Kinney Method which generally following the formulation of Eq. 1. Besides that, the risk prioritization can be determined by AHP technique, consensus and experts focus group discussion. The important ones that risk priority is not always in a rank-base determined by the expert [42], but it can be prioritized by Bayesian Belief Network [62] or by determining the financial effect of each risk [22].

Nowadays, the risk assessment framework is dominated by the qualitative approach [29], [67]. Moreover, many literatures suggested to apply the quantitative approach to identify and mitigate the risk [54] since the qualitative risk assessment cannot inform the potential possible risk rising statistically and distinctly [68]. Sáenz and Revilla, [69] mentioned that about 60% of the company's managers do not realize the impact of the risk which is caused by unstructured and the uncleared definition of possible risks. Therefore, the theory building that describes on the literatures massively should be directed to the practical methods within quantitative approach [64].

The risk mitigation is the last step of the supply chain risk management which aims at reducing the occurrence and possibility of risk impact [70]. The mitigation is focused on the most prioritize risk among all assessed risk with considering cost. Jüttner *et al.*, [71] suggests to mitigate the risk with avoidance, control, cooperation, then Chopra and Sodhi, [72] state the mitigation by adding capacity, having redundant suppliers, increasing responsiveness and flexibility, aggregating the demand, increasing capability, and having more customer accounts. According to Xia *et al.*, [73], a supply and demand risk which faced by supplier and retailer, a risk mitigation with risk sharing can be performed by choosing a reliable supplier as retailer's request or investing in supplier to increase reliability. The risk mitigation techniques and methods commonly applied in the literatures are strategic implementation model through ANP-BOCR [39], Interpretative Structural Modelling [33], [42], [64], or interview and expert consensus [32].

The aforementioned on the risk approach and methods states that not all researchers provide a risk analysis mechanism comprehensively which is combining risk identification, analysis and mitigation. Generally, previous research focus on risk identification massively and lack of observation on risk mitigation area [74]. Table 3 shows there are only 3 papers state the risk management completely, who are Pujawan and Geraldin, [38], Muchfirodin *et al.*, [39] and Giannakis and Papadopoulus, [32]. Therefore, the risk analysis and management need to be delivered integrally and comprehensively then supply chain risk can be minimized, guarantee the sustainability and profit of supply chain in the future [64], [75].

3.3. Supply chain value-added analysis method

Supply chain value-added analysis is a method to identify the effectiveness of upstream to downstream activities of the supply chain. Basically, value-added is an increase in the value of raw material or commodity (for agricultural supply chain) as it adds input or further processing [2]. Furthermore, supply chain value-adding is created specifically by a series of activities and relationship of each stakeholder and it will be determined by the amount that would be paid by final costumers [76], [77]. Changes and increases of supply chain value-adding depends on particular input and treatment so that it can improve the quality, product availability in the appropriate place and time, its benefit to customers and streamline for a better financial economy [78]–[81].

Manning, [82] states that the supply chain value-adding is related to the intrinsic product quality, cost, delivery time, flexibility and innovation. The value-added concept seeks to increase value of product quality, availability and location, also benefit that obtained by costumer [83]. Value-adding is also determined by effective relationship and activities among the stakeholders so that it can improve coordination, more efficient resource used and better financial flow [79], [84].

The study of value-adding/revenue analysis through 4 variables: profit margin, liquid assets for expansion, ability proportion ratio for accounts payable and binary bankruptcy risk. An increasing of value-adding will incur costs, so it should optimize the amount of value-added [2]. Significantly, the improvement in quality of raw material and commodity with suitable quantity can increase its value-adding [85]. In addition, an increase in value-adding must be carried out to attract costumer's interest and give a significant benefit to the stakeholders and supply chain [86]. Value-adding can be determined by the value that is willing to be paid by consumers for a product after tax, employee's compensation and gross production/operating cost [87].

Supply chain value-adding needs to be analyzed to identify cost and profit distribution on each stakeholders in supply chain [88] then achieve supply chain sustainability. Value-adding and profit in supply chain highly determines financial condition in competitive business [89] therefore it makes this information is highly recommended to be understood. Supply chain value-adding information is important to understanding the complex relation and determine each stakeholder's performance in supply chain [90], [91]. In addition, value-adding information in supply chain needs to be known for investment opportunities [78], [92] and give company financial information and condition to maintain competitive advantage [89].

Various value-added analysis methods have been developed to give value-adding information in business. Value-added model that frequently used to identify supply chain is Hayami value-added [93] by analyzing product information and profit obtained by the company. However, it is implemented only in one commodity/product so it needs modification. Previous authors have modified Hayami's value-added method to analyze value-added in palm oil [92] and sugarcane agro-industry [94], so it can be applied to analyze agricultural and agro-industry supply chain which have more than one harvesting period in annual term.

The most common used of value-added calculation methods in manufacturing and financial sector are Economic Value-added (EVA), Cash Value-added (CVA) and Taylor and Heyes value-added methods. EVA is implemented by Kyriazis and Anastassis, [95] for the financial sector and proves has a stronger relationship by stakeholder based calculation. CVA is a modification of Operating Cash Value-Added (OCF) and Operating Cash Flow Demand (OCFD) [96]. In other hand, Taylor and Heyes method is implemented in real estate sector [97].

Manning, [82] introduced Value Chain Analysis (VCA) method based on margin approach as a standard approach to control value in the supply chains. VCA is a multi-dimension assessment to measure value performance and product flow analysis in supply chain [98], information flow and value chain performance [99] also determine stakeholders relationship and performance in the supply chain [90]. In practice, VCA chooses a particular value stream in supply chains to execute the improvement effort called as Value Stream Mapping (VSM) method [100]. VSM describes current value condition (*current state*) and develop potential activity which does not give value-added through the process improvement (*future state*). The weaknesses in VSM are not able to accommodate cost calculation and value-adding [98] and inability to explain the supply chain's stakeholder interrelationship [84].

Deng *et al.*, [78] and Jraisat, [83] analyze value-adding in supply chain through survey and questionnaire methods considering sales and production information, distribution channel, cost, profit, main activity also upstream and downstream chain relationship. This questionnaire requires many stakeholders to generalize the survey's result. Furthermore, value-added analysis based on quality also known as Supply Chain Quality Management (SCQM) framework based on Total Quality Management [101]. SCQM aims to establish effective and systematic relationship between stakeholders to increase value-adding by focusing on customer, process management, supply chain management and effective decision-making [84].

A comprehensive supply chain value-added creation has a large effect on citizen and regional economy, in the contrary makes value added as individual asset face difficulty to reach the objectives [102]. The value-added study does not only focus on financial, product, and profit aspects. Moreover, value-added study focus on stakeholder interrelationship in supply chain network [83], considering risk [79], and starting risk sharing concept [78]. Chen, [103] states that an effort to increase supply chain value-adding should not only based on conventional technique, but also must apply intelligent system and negotiation, so information will be clearly understood. Based on this consideration, supply chain fair risk and value-added distribution by considering the intelligent system in analysis were important to develop.

3.4. Supply chain fair and balanced risk and value-added distribution definition

The concept of supply chain fair and balanced risk and value-added distribution arise since the value chain approach failed to increase the supply chain sustainability [104] and the fact of supply chain upstream stakeholder always suffers from a loss, whereas the customers pay a quite high value-adding price on the supply chain downstream sector [85], [88], [105]. This condition is also proved when the price is fluctuated, the upstream stakeholder is the one who bears losses, in this way mitigation is required to undertake [106]. Supply chain fair and balanced risk and value-added distribution is an approach to achieve supply chain optimization and risk mitigation. This approach is important to consider as an uncertainty condition by stakeholder inter-cooperation and an effect of bad decision-making in the prior period. Therefore, fair and balanced for risk and value added approach tries to create a *win-win condition* by dividing and distributing value-adding and risk upon all stakeholders in order to optimize value chain performance at once [10], [107], [108].

Fair risk and value-added distribution is needed to improve inter-stakeholder coordination to win the market competition [1], improve supply chain's agility and flexibility performance, create supply chain's inter-stakeholder synergy, maximize the product value to customers and distribute a fair profit for each supply chain's stakeholders [33], [108]. Actually, fair and balanced risk and value-added distribution approach also supports by Frumkin and Keating, [89] and Ralston, [23], that to increase efficiency and effectiveness required to consider value-added and risk sharing continuously among stakeholders in supply chain/organization.

Fair risk and value-added distribution approach categorized as a collaborative concept in supply chain, thus it also applies to revenue sharing, risk sharing, wholesale price contract, penalty scheme contract and other approaches [17], [108], [109]. Collaborative supply chain defined as an effort to develop a good business relationship in order to increase the performance and to achieve supply chain's objective through fair risk and profit sharing, information sharing and cost minimizing [5], [110]. Collaboration is essential to develop since it can increase benefit revenue in each stakeholder and conduct an effort to minimize risk through coordinated mitigation [6], [23].

Based on literature review, collaborative model for fair distribution and balancing in coordinating supply chain are revenue sharing, risk sharing, cost sharing, and wholesale price sharing model as depicted in Figure 4. In addition, revenue sharing and risk sharing model are dominant for supply chain fair and balanced for risk and value-added distribution, therefore in this critical review, we focus on those two models.

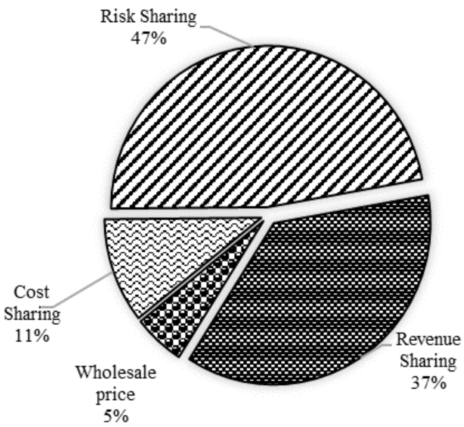


Figure 4. Collaboration and fair distribution concept in supply chain

3.4.1. Method and approach for revenue sharing in supply chain

The mostly mechanism for performing revenue sharing concept in business is profit sharing after sales. This mechanism executed operationally on two stakeholders, retailers can get a lower product price from the manufacturer then after the product is sold, they will share the profit with manufacturer as much as sharing revenue level which is set before [13]. The total profit earned will be greater if the mechanism leader is the one who owns the greatest revenue. Revenue sharing model by Qin and Yang [13] have not considered the supplier competition, retailer and product price changing yet, thus Cachon and Lariviere [108] improves it by some scenarios, such as a single supplier, competing suppliers and competition on retailer level. In that study, we found the revenue sharing model is not suitable for all industries and it cannot coordinate the supply chain when the demand does not occur naturally. A considered variable in revenue sharing by Qin and Yang [13] and Cachon and Lariviere [108] are product quality and price.

The revenue sharing concept did not consider risk variable comprehensively, Chauhan and Proth [1] tried to considers price risk and stakeholder investment risk. Thus, revenue sharing aims to distribute supply chain inter-stakeholder profit properly with their investment risk. In the contrary, Z. Yao *et al.*, [111] develop a concept with price only contract. Z. Yao *et al.*, [111] defined revenue sharing as some fix revenue fractions that should be paid and share by the retailer to supplier based on product unit to sale.

Sensitive demand risk affecting price can be minimized by coordinating and increasing the supply chain profit simultaneously [112]. Some mitigation effort to do involves reducing price increases risk at the retailer level so that supply chain profit can grow exponentially. Furthermore, Avinadav *et al.*, [113] and J. Zhang *et al.*, [114] extend the Z. Yao *et al.*, [111] models' by considering risk for product quality risk on the supply chain. Therefore, risk-seeking stakeholder will obtain profit, revenue sharing and stronger supply chain's performance.

Pan *et al.*, [17] established a revenue sharing model in supply chain which is dominated by manufacturer and retailer. The findings show that it is better to apply revenue sharing contract than wholesale price. The weakness of this model lies on the linear demand assumption and no inter-stakeholder relationship explanation.

The most implemented research methods in the revenue sharing model are the game theory, Stackelberg and Bayesian game. These research method is quantitative and formed into a complex math formulation. Moreover, in previous studies, the overall supply chain risk is not the main focus yet, moreover in macro term, such as risk of supply, demand, investment and lack of inventory. The previous study summaries related to revenue sharing can be seen in Table 4.

Table 4. Revenue sharing approach and method in supply chain

Author	Product	Approach/method	Stakeholders	Parameters	Demand assumption	Risk
[13]	Non-agricultural product	Decentralized game theory/ Stackelberg game	Single Supplier Single Retailer	Revenue and quantity	Stochastic and deterministic	Demand risk
[108]	Non-agricultural product	Centralized game theory	Single and multiple Retailers	Wholesale price and revenue to share	Demand as variable of price	Risk neutral
[1]	Non-agricultural product	Centralized, mathematical formulation model	Single Provider Single Retailer	Inventory provider, inventory retailer, price with retailer	Demand as variable of price	Investment risk
[111]	Substitutable product	Decentralized, Stackelberg and Bayesian Nash game	Single Manufacturer and 2 competitive retailers.	wholesale price and revenue to share for retailer	Linear demand model with normal distribution	No risk
[113]	Apps	Decentralized and centralized Mathematical model formulation	Single Developer and single strong Retailer	Revenue, price, quality investment	Price and Quality as demand accelerator	Stakeholder sensitivity to risks
[114]	Agriculture and non- agriculture product	Integrated and decentralized with Stackelberg game	Single Manufacturer Single retailer	Revenue, investment and cost	Dependent price demand	No risk
[17]	Undefined	Scenario and mathematical formulation modelling	Manufacturer dominated and Retailer dominated	Price and profit	Linear demand	No risk
[112]	Undefined	Decentralized with Nash Bayes and Stackelberg game	Single Vendor and Single Buyer	Number of shipment, selling price, order size	Deterministic but price sensitive	No risk
[27]	Undefined	Closed loop SC; Nash and Stackelberg game	Single Manufacture Single Retailer	Pricing decision	Uncertain and asymmetric information	No risk

Revenue sharing model and approach which are developed to fix the value chain concept in order to increase supply chain performance and sustainability, still has weaknesses and limitations. The weakness in revenue sharing is its poor coordination when there is a demand risk affected by the downstream stakeholder. It also has poor coordination among the downstream competing inter-stakeholder since the price and quantity factor require a full supervision with very limited information [108]. Thus, every stakeholder has a proportional profit/loss on the risk, but the fact it is vice versa [1]. The weakness of revenue sharing in supply chain is also stated by J. Zhang *et al.*, [114], that is not suitable to be applied in supply chains if the investment and competition in supply chain's stakeholder are taken into account. Revenue sharing does not consider the supply chain risk at all, so it can decrease the supply chain's performance and benefit as well.

Some previous authors have tried to fix revenue sharing approach in supply chain, for instance considering general marketing risk and risk in determining profit sharing, considering risk sensitivity in supply chains revenue sharing [113]. A research by Hu and Feng, [115] adds it by considering supply and demand uncertainty in supply chain to revenue sharing model. But, generally considered risks in revenue sharing are only for supply and demand risk on two stakeholders, without any consideration for comprehensive supply chain risk.

3.4.2. Method and approach for risk sharing in supply chain

On the above revenue sharing and balancing model, the supply chain risk has not been considered in particular. Risks of revenue sharing are on the price and demand risk [1], product quality and investment risk [1], [26], [113] quality risk and cost risk [112]. In addition, there are only a few researches considering the risk aspect in supply chain decision-making process [116]–[118]. Moreover, decision-making in supply chain is vital to consider since it has a complex and uncertain process [119]. Therefore, it needs literature study and exploration for risk which related to supply chain profit sharing decision.

Risk sharing is a supply chain risk mitigation method conducted by inter-stakeholder collaboration comprehensively [16]. Risk sharing attempts to balance between financial risk and business risk which are correlated to each other. Controlling the financial risk will provide an effect on business risk; therefore they have to be in a balanced position. [120].

Risk sharing model for agricultural products has been modeled by He and Zhang [14], which focuses on production risks due to the uncertain raw materials ratio in make-to-order supply chain model. The scenario model is (1) Risk sharing if the production is below target (URS-1); (2) Risk sharing if the production is below target (URS-2); (3) Risk sharing if there is an over production (ORS); and (4) Performing a combination of below target risk sharing model and over production (Hybrid). The difference between URS-1 (1) and URS-2 (2) are the bearer of over production risk (supplier/retailer). ORS Model designed that if there is a production shortage then it will be borne by supplier from other fund resource, while if there is an over production, the retailer will buy those excess with lower price according to prior agreement. The findings show that the scenario which considers supply's shortage and excess in risk sharing (Hybrid model) can minimize *double marginalization effect* risk, thus it can provide an incentive to the stakeholder and fulfill the customers' demand. According to He and Zhang [14] risk sharing hybrid model can be seen in Eq. 2 and Eq. 3.

$$\Pi_4^S = wq + w_e E_u[(UQ - q)^+] - cQ - (1-\beta)c_e E_U[(q - UQ)^+] \quad (2)$$

$$\Pi_4^S = \text{Supplier profit} - \text{Production Cost} - \text{Production loss by over production} \quad (3)$$

Source: He and Zhang [14]

Risk sharing model with the same scenario is also implemented by Hey, [15] in a closed-loop supply chain. The authors consider demand risk and supply risk between the manufacturer and supplier. In contrast with He and Zhang, [14], Hey, [15], establishes a profit model based on risk sharing for supplier and manufacturer stakeholder for a transparent profit distribution for both parties. Risk sharing model established by Ghadge *et al.*, [16] considers the uncertain price and demand risk that is claimed has not been explained in previous studies. The solution offers a determination of an optimal production quantity based on demand forecasting by using integer programming so the price fluctuation would not arise. In this model, the problem becomes simply, since it is modeled into make-to-order supply chain scenario as He and Zhang, [14] models'.

Supply chain risk sharing model in the previous studies tended to consider the price uncertainty variable [121]–[123]. Wei *et al.*, [121] determined the price based on the assumption that demand and price variables are linear then the stakeholder tended to have no risk, while Ma and Li [122] determined the price in risk averse stakeholder. Finally, Li *et al.*, [124] found that optimal price in risk averse supply chain will have a lower price but in reverse there will be a stockpiling in the supplier side. It does not necessarily mean that it has a better risk neutral because it will trigger other risks affecting the price stability. Therefore Li *et al.*, [124] suggested to paying attention for risks from all stakeholders comprehensively in order to maintain the supply and price stability in the supply chains.

Price optimization with considering risks has also been studied by Shen *et al.*, [12] and Zhang *et al.*, [26] and it supported by Santosa *et al.*, [37] as well, suggesting a reasonable price determination by considering stakeholder's performance and value-added into account. Shen *et al.*, (2013) established an optimal price determination model by considering losing risk on risk neutral, risk aversion, risk minimization and risk control at the supplier. Zhang *et al.*, [24] considered retailer service level risk and customer loyalty that are limited by particular and it will affect the price level. Santosa *et al.*, [37] composed a risk sharing model through product price optimization on each stakeholder. This model uses risk as performance measurement factor in giving an incentive, but it did not lead to fair risk and value-added distribution. In other studies, Zhang and Hong, [125] determined the product quality price on two supply chain levels with optimal investment. Ding *et al.*, [25]; Sang, [126] and Wang, [127] attempt to determine the optimal price by fuzzy theory to define variables which face uncertain risk. This model adopts Stackelberg game method on the retailer and manufacturer level to optimize the price.

The most applied supply chain approaches in the risk sharing model are centralized and decentralized to apply risk sharing in the supply chain. The method used in risk sharing is quite similar to revenue sharing, involves the game theory. Moreover, there are also some authors who include fuzzy model into their decision variables [105], [127]. In general, risk sharing model in literatures only involve two stakeholder levels, which means that it does not cover the whole supply chain. Risk sharing methods and approaches in the supply chains can be seen in Table 5.

Table 5. Method and approach for supply chain risk sharing

Authors	Approaches/ methods	Supply chain stakeholders	Risks
[14]	Centralized and Mathematical model	Single manufacturer Single retailer	Uncertainty production
[73]	Decentralized	Single supplier and single retailer	Supply and demand risk
[12]	Mathematical model formulation	Single supplier	Optimum price of product by product loss and probability loss
[121]	Centralized, Stackelberg game and Bertrand game	Two manufactures and single retailer	Risk neutral
[122]	Centralized, Stackelberg game and Bertrand game	Two manufactures and single retailer	Stochastic demand and risk averse
[37]	DEA, Hayami, Risk Index	All possible stakeholders	Optimum price by risk s
[24]	Decentralized and Centralized, Nash Game	Single retailer	Consumer loyalty
[15]	Decentralized and Centralized, Nash Game	Single manufacturer and Single retailer	Demand and supply risk
[16]	Integer programming	Single supplier and single buyer	Demand and price risk
[127]	Stackelberg game theory and fuzzy theory	Manufacturer and retailer	Market demand
[125]	Decentralized supply chain; Stackelberg game theory	Manufacturer and retailer	Price and quality risk

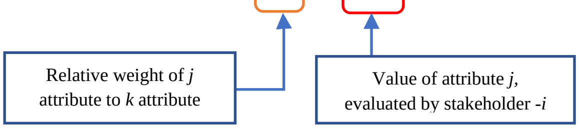
3.5. Negotiation framework in supply chain

Besides considering the risk and value-adding in supply chain, fair distribution and balancing model in supply chain requires a negotiation mechanism that is performed by its inter-stakeholder. The challenge comes from the existing theories and calculations since the fair and balanced distribution cannot explain the negotiation and bargaining mechanism yet [128]. Further, the new challenge is how to collaborate the agent's knowledge in executing the negotiation [129].

There are so many conflicting objectives in supply chains [28], value-adding and risk are two opposite aspects in the supply chain and it should be considered by the stakeholders. Thus, after we achieve fair risk and value-added distribution model, it requires a proper transaction which can apply well the model. Wang *et al.,* [129] mentioned that a negotiation system would fire well to making a conflict objective decision.

Negotiation mechanism is required in supply chain management, since every stakeholder in supply chains have different power and conflict objectives. Inter-stakeholder negotiations in the supply chain is a matter to control the risk and manage fluctuations in demand and price volatility [16], [130]. As an illustration, a negotiation framework designed by Xue *et al.,* [131] considered negotiation attributes and designed in a multi-agent system. Many attributes consideration in optimization is worth to be taken, based on the stakeholder agreement and then optimized by Multi-Attribute Utility Theory Technique (MAUT). MAUT works by determining the utility level as much as *n* attribute for every attribute matrix number-*j* and attribute number-*k* which are negotiated by *n* stakeholder, mathematically it can be seen in Eq. 4.

$$U_i = \sum_{j=1}^{n} w_j \times y_{ij} \quad (4)$$



Negotiation framework suggested by Xue *et al.,* [131] is implemented in the supply chain project planning and construction which involves multi-stakeholder based on multi-agent based system with internet-based. This framework also considers knowledge, ability, and preference of every stakeholder that is stored in a database system and controlled by a coordinator agent.

The negotiation mechanism arranged by Jiao *et al.*, [132] also managed a framework for production materials fulfillment in multi-agent based system. Negotiation agents are (1) a configuration agent as the product demand fulfillment coordinator, (2) contract manager who is responsible for searching the suppliers to fulfill the product demand, (3) information center as a contract manager facility to find the supplier candidates and (4) negotiation agent who directly negotiates with the supplier candidates to fulfill product demand. The negotiation mechanism begins with a customer request, then it is continued by negotiation until the desire deal is reached.

Negotiation is the right way to overcome the conflict objectives that occurs in inter-multi stakeholder of the supply chain. The higher level of stakeholder involves in supply chain, the more conflicts that must be overcome and the more complex negotiation mechanism that should be designed. Furthermore, Wang *et al.,* [129] simplified the complexity by clustered the stakeholders into two groups as buyer cluster and seller cluster. It is claimed to be the right solution, since every stakeholder will be a buyer and seller in particular transaction period.

4. Discussion

4.1. Gap and future potential exploration for risk management and mitigation

The probability of risk occurrence in the supply chain is higher than other business process. The supply chain risk commonly involves more than two companies in a merged and correlated work flow. The internal risk of company/stakeholder involving a supply chain will make a negative impact to other stakeholder and threaten all business process flow, so it should be well improve [133]. The occurrence of supply chain risk mentioned as the effect of uncertainty factors from process risk, control risk, demand and supply risk, environment and competitive risk also the complexity of business process [71]. Generally, there are 28 risk factors have been defined by the authors in the literatures in a decade, which is described in Table 6.

The uncertainty and complexity are the main factors which trigger the risk occur in supply chain. The supply chain complexity is affected by the alteration of main driver in business process, involving product and service complexity, outsourcing, economic globalization and e-business model [109]. The uncertainty factor of supply chain risk is caused by the fluctuation of demand and supply, lead time variability of transportation and delivery, response time, financial problem and company capacity availability [134]. Then other important factor affecting the supply chain risks come from the external factor, including political crisis, monetary fluctuation, inefficient strategy, natural disaster and finance [65].

Table 6. Aspects considered in supply chain risk management from various sources

Author	A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
[71]					√	√	√		√											√			
[7]	√								√		√				√	√							
[135]			√					√		√					√				√		√		
[136]		√											√			√							
[137]		√	√				√			√				√		√	√	√	√				
[138]				√						√							√		√				
[139]	√	√		√												√							
[140]				√						√							√		√				
[141]	√	√	√																				
[142]	√	√	√										√										
[70]	√	√	√																				√
[143]	√						√	√	√	√										√			
[46]	√			√						√	√		√	√	√	√							
[22]							√																
[117]	√	√					√			√	√					√							
[118]			√						√												√		
[53]					√	√		√		√													
[144]	√	√	√		√	√				√	√		√			√		√	√				
[145]			√						√	√			√			√					√	√	
[146]			√	√			√			√						√			√				
[61]			√	√								√			√	√							
[147]	√			√						√	√		√	√	√	√							
[148]			√		√		√	√	√	√													
[149]	√	√	√	√												√				√			
[150]			√						√	√			√			√					√	√	
[35]	√	√	√							√				√							√		
[47]	√	√	√							√		√											
[66]							√																
[62]	√	√								√			√	√									
[151]													√										
[44]	√	√	√										√										
[64]	√	√	√	√																			
[152]	√	√					√		√	√												√	

A= Demand; B= Supply; C= Production, Control and Operational Management: D= Environment; E= Globalization; F= Outsourcing; G= Supplier base; H= Complexity and competitiveness; I= Transportation and Delivery; J= Product quality and damage; K= Resource and labor; L= Infrastructure ; M= Information and communication; N= Raw material; O= Price; P= Financial; Q= Machine and equipment breakdown; R= Disaster; S=Legal liability and politic; T= Investment; U= Inventory and capacity; V= Forecasting; W= Security; X= Decision making

Based on analysis in Table 6, risk factors that obtain lack of consideration are price risk, technology and information usage, as well as decision-making risk. Moreover these aspects are fundamental and must be considered in risk management [9], [29]. Lee and Lodree, [116], Hahn and Kuhn, [117] and Tse and Tan, [118] also stated that the lack of information and technology consideration in risk management can affect a poor risk assessment in decision-making.

In relation to the decision theory, risk defined as a distribution of probability of an event having subjective value, then its result can be either positive or negative deviation from its expected result [153]. Supply chain decision-making in risk management is very essential to be considered as risks may occur by a wrong decision [37]. Furthermore, the information technology can affect decision making to improving risk probability in supply chain, then it is necessary to elaborate this field further [55], [64]. Thus, this topic is very potential to be further explored.

In addition, we do not merely pay attention to the research gap factor, but also pay attention to risk analysis method that must be explored further. The risk analysis method with risk optimization through risk sharing and sustainability aspect consideration is lack of attention over the last decade studies. Sustainability is one of issues that has not been discussed in detail. Sustainability is the newest issue in supply chain, and it has a potential to keep developing, so that it becomes huge opportunity for researchers to contribute in this topic [32], [154], [155]. In addition, it is required to consider sustainability dimensions and indicators since a competitive level in the supply chain is getting higher [156], [157].

In order to fill the research gaps above, we conclude some aspects that need to be considered in risk management which are price and decision making by using information technology. Regarding the risk analysis, both risks and aspects are combined using required analysis in risk management, which is risk minimization through risk sharing. A gap study in the supply chain risk management can be seen in Figure 5.

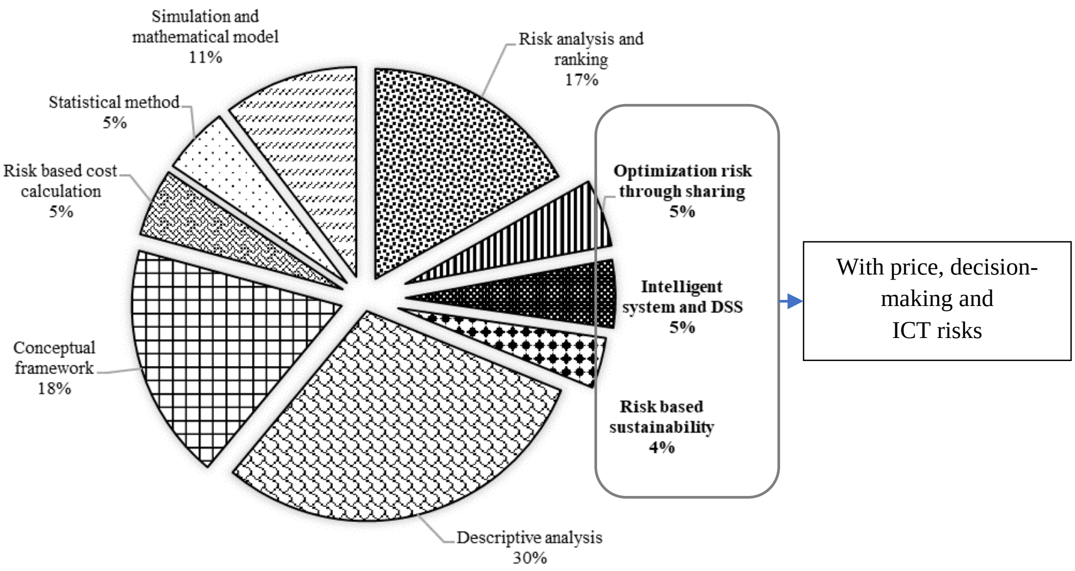


Figure 5. Risk analysis method on literatures and gaps

4.2. Critics for revenue and risk sharing, and developing for fair value-added and risk distribution model

As mentioned earlier, supply chain risk mitigation will be more effective if it is conducted through supply chain collaboration, revenue sharing and risk sharing. Revenue sharing and risk sharing mechanism defined in the previous research were too narrow, since they only consider two stakeholder levels, while in reality supply chain cases are more complex. The supply chain is not only limited on supplier-manufacturer and manufacturer-retailer relationship, but it also has a relationship to costumer that can affect risk, value-adding, and other uncertainty factors. The profit sharing which defined and modelled in revenue sharing or risk sharing before only proportional for single risk. Moreover, there are other risk factors should be considered as aforementioned to generate a more proportional profit sharing.

Generally, the supply chain configuration model known are decentralized, centralized, integrated and closed loop supply chain. In decentralized approach, stakeholder will obtain its own profit without considering a whole supply chain profit. This system will cause *a double marginalization problem* and higher risk, increasing in price and decrease in supply chain profit [26], [158]. Meanwhile, the centralized approach weakness is a stakeholder tends to control the whole supply chain and it trigger more risks [14]. The integrated supply chain model may discourage supplier and cause larger risks [159], [160].

According to Avinadav *et al.*, [113], supply chain centralized configuration is recommended for risk neutral and a risk taker stakeholder, whereas supply chain decentralized configuration is recommended for risk averse stakeholder. Moreover, in the centralized system, the price and service level on retailer level must be higher than decentralized system [26]. Based on that condition, the development of collaboration model in supply chain, we suggest forming a decentralized supply chain configuration, since it is suitable with the actual condition in the field in which each stakeholder have different objective and tend to provoke conflict. In addition, Method used in risk sharing and revenue sharing approach tend to be similar on game theory technique and math formulation, as depicted in Figure 6.

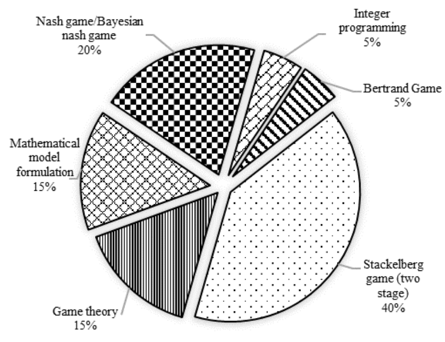


Figure 6. Method in risk and revenue sharing

Game-based method is mostly applied by previous research. The developed method is explored continuously by conducting improving the related factors and the decision variables. Furthermore, the game-based method in many literatures are referred to make-to-order production system, thus it needs more adjustment on supply chain system [161].

In complex math formulation, the risk and value-added sharing are formulated separately and they have not been formulated into a more proper negotiation framework yet. In fact, the supply chain fair and balanced risk and value-added distribution model have to be directed to soft-computing optimization method and it shall be combined with game theory-based method since it has a complex condition for effective decision-making. In order to develop its application in supply chain, this model have to be supported by information and communication technology (ICT) [62], [109], [162].

In its application, risk and revenue sharing must not be considered subjective, but it should be comprehensive. The weakness of revenue and risk sharing is found in the implementation and effectiveness affecting the decline in working performance and supply chain collaboration. Further, it is no longer appropriate to be implemented because such approach is only intended for the stakeholder having the same power in a supply chain [10].

Therefore, supply chain fair and balanced for risk and value added distribution approach provides an essential meaning to share risk and value-added comprehensively in order to increase supply chain' sustainability and profit [23]. Value-added distribution/revenue sharing in supply chain cannot stand alone to maximize supply chain profit. Regarding to this condition, a whole supply chain risk has not been considered much in supply chain revenue sharing, although by considering risk in revenue sharing, supply chain profit can be increased [113].

5. Pointers for future research

Based on previous explanation, collaboration in the supply chain has an important role in increasing supply chain efficiency and effectiveness. As mentioned before, this paper proposes fair risk and value-added distribution model in supply chain. This approach is claimed as the most appropriate concept since inability of risk sharing and revenue sharing to control a whole risk in supply chain [32], [34], it has not been able to comprehensively control profit maximization when there is a pressure from the outside environment [24], and the stakeholder's assumption with the same power in supply chain is no longer suitable to the real condition [10]. This finding is also supported by Zhang and Hong, [125] that stakeholders in supply chain needs more coordination to conduct profit sharing, cost sharing and investment cost sharing that is required to be implemented comprehensively on supply chain stakeholder with different power.

For the introduction in developing of fair risk and value-added distribution and balancing framework, the following suggestions are essential to be pointed for future research. The following are the summary from research gaps mentioned earlier.

1. In general, there are only two stakeholder levels that involved in literature. It is suggested increasing stakeholder's level into several levels [27], [158] based on their actual authorization. However, this aspect requires supply chain identification.
2. Fair and balanced, collaborative and sharing concepts in previous studies are focused on risk neutral and risk averse. We found that they do not consider the risk of the whole supply chain yet. It requires an analysis and risk identification within quantitative and qualitative methods to consider risk in the supply chain.
3. Risk factors to be considered are supply chain sustainability and decision-making by utilizing information communication technology. Therefore, it is essential to have an intelligent decision support system by considering supply chain risks quantitatively and qualitatively.
4. The dominant method in fair risk and value-added method is game theory and mathematical model function. Therefore, it is an opportunity to develop an intelligent system or soft-computing that becomes an optimization trend in recent studies.
5. Models in the previous supply chain collaboration studies are not implemented in decision-making model yet. However, in fact, wrong decision-making will cause the domino effect in the supply chain. It is an opportunity to implement decision-making into Intelligent Decision Support System (IDSS) prototype.

Based on literature review and analysis as well as pointer for future research, we design a framework for supply chain fair risk and value-added distribution. The framework is started with supply chain identification, risk and value-added analysis, and fair risk and value-added distribution modelling. Finally, this framework is applied by a model implementation into an intelligent decision support system (IDSS). Therefore, a complete study framework can be seen in Figure 7.

The intelligent decision support system is organized in the form of a negotiation model for fair and balanced risk and value-added distribution in the supply chain. Negotiations in the supply chain involves multi-stakeholders who have different resources, different objectives and even conflict which is certainly require a decision support system utilize intelligent algorithms [163]. The negotiation model output in this system is an appropriate price with fair distribution of risk and value-added in each negotiating stakeholder. Since distributing of risk and value-added are balanced, the supply chain sustainability will achieve.

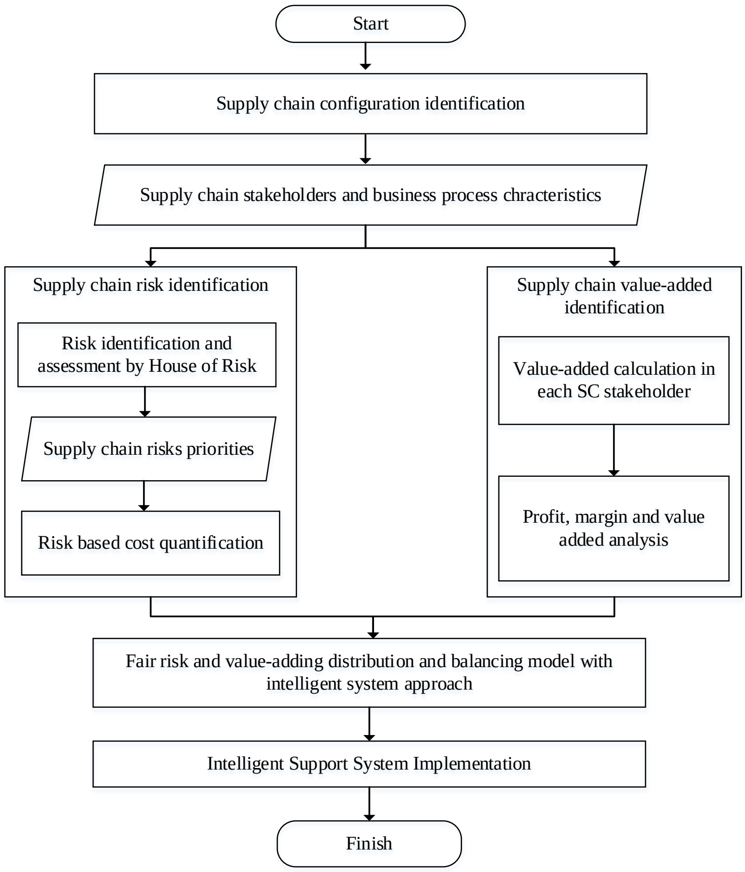


Figure 7. Fair risk and value-adding distribution and balancing framework

The negotiation in intelligent decision support system is very important since it gives an advantage in maximizing company's profitability, maintains a good customer relationship, balancing supply and demand, improving inventory management, and enhancing supplier relationship [164]. Intelligent decision support system framework for negotiation to optimize the fair risk and value-added distribution and balancing can be seen in Figure 8.

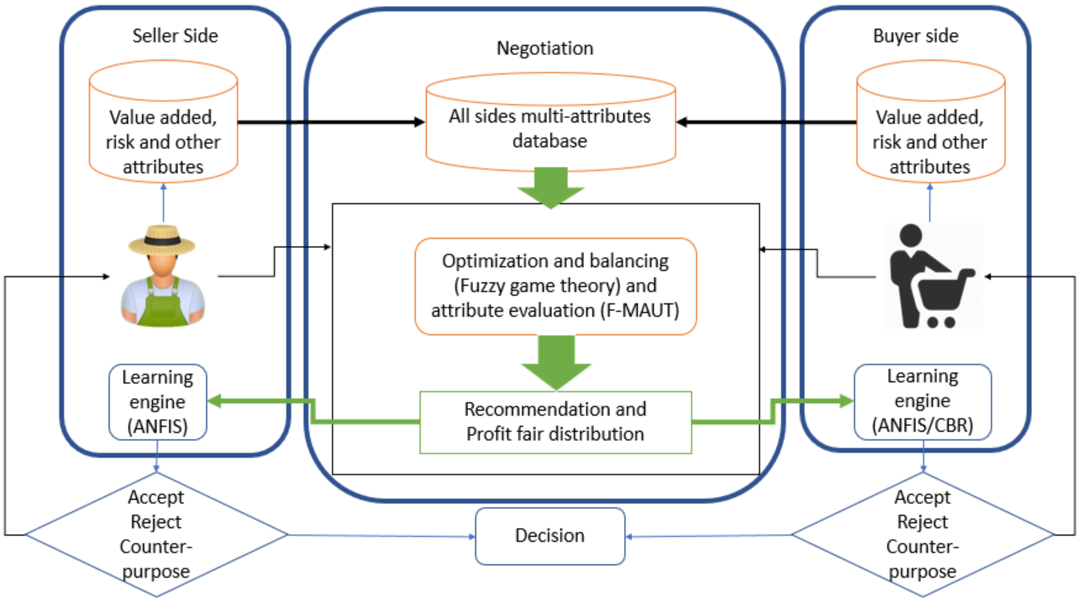


Figure 8. Framework intelligent decision support system

6. Conclusion and Recommendation

This review has defined and mapped a fair and balanced risk and value-added distribution as a novel concept in collaborative supply chain. This concept is fundamentally organized upon a risk and value-added as milestone and initial data of supply chain optimization. This review has succeeded to mapping the risk management and value-added technique over decade and made a suggestion for further research. Our review suggested for further research exploration to be developed are supply chain integration and collaboration issues, risk mitigation and assessment, reinforcement of information technology and decision-making aspects, as well as a sustainability.

The fair and balanced risk and the value-added distribution approaches that has been widely discussed in this research are revenue sharing and risk sharing. Both approaches still consider value-adding and risk separately using centralized and decentralized concepts. Sharing and balancing risk and value-adding methods which are widely used by previous authors are game theory, Nash-Bayes games, Stackelberg game and mathematical formulation.

Regarding to collaborative approaches as well as fair and balanced risks and value-added distribution, the previous research tended to suggest applying decentralized approach so that would achieve stakeholder global optimization and increase supply chain service level. Research's framework and method that must be taking into account and potential to be developed is the implementation of intelligence system and knowledge transfer which is organized in decision support system and its framework has been suggested in this review. It would increase value-adding and better risk mitigation. Finally, the fair risk and value-added distribution and supply chain optimization can be performed in much better way.

Acknowledgements

The implementation of this research project up to its publication was partly funded by Ministry of Research, Technology and Higher Education, Republic of Indonesia, under special education and research scheme grant: Master until Doctor Education program for brilliant undergraduate degree holder (PMDSU- *Pendidikan Magister menuju Doktor bagi Sarjana Unggul*) Batch II, fiscal year 2017. We would like to thank to Mr. Taufik Djatna from Bogor Agricultural University who has given constructive suggestions to enrich this journal.

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