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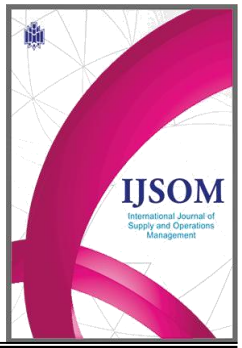

Interpretive Structural Modeling (ISM) for Analysis of Factors Affecting Marketing Efficiency of Fresh Mango Supply Chain: Indian Perspective

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Abstract

An effective marketing strategy is essential to get a competitive price to the farmer and the best quality product to the customer. Marketing efficiency (ME) reflects the distribution of price between producer and customer in the fruit supply chain. Farmers mostly use traditional marketing because of fear of the perishability and seasonal nature of the mango, leading to significant price fluctuation. The major scope of this paper is to identify, study and model various factors, and their effect on ME and farmers' profit. After reviewing the available literature and taking experts opinion, eighteen factors were found which directly or indirectly affect ME. Interpretive Structural Modeling (ISM) is an ideal method to determine the key factors that influence ME. The developed ISM model is helpful for farmers to make appropriate decisions in the mango marketing system. After analyzing various factors, the following three factors are primarily responsible for improving ME and farmers' profit. These are lack of government control and assistance in the marketing system, lack of industrial and business approach in farming, and lack of education or low education levels of farmers.

Keywords: Mango supply chain; Marketing efficiency (ME); interpretive structural modelling (ISM); MICMAC analysis.

1. Introduction

Agriculture is the backbone of the Indian economy and an essential source of income generation. Agriculture creates opportunities for employment and provides food and nutritional security to the people (Report GOI, 2011). In India, agriculture and allied sectors contribute 16 percent of gross domestic product (GDP) and employ over 58 percent of the workforce (Report - Planning Commission, GOI, 2012). Horticultural sector is one of the fastest growing sectors, and mango plantation is one of the contributors to this sector. Mango is widely cultivated in almost all the states of India. It stands at the number one position in the world and contributes nearly 42.06 percent of total production (Post-harvest profile of mango, GOI, 2013).

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The nation's prosperity is vital, and it depends on the well-being of farmers. The falling prices of agricultural produce and the uncertain nature of the market mainly affect farmers. Hence, intermediaries in the supply chain take undue advantage of this situation. An efficient marketing system is very essential for getting competitive price for products. It helps to expand farm income, broadening of market openings, development of agro-based industries, increase in the economic growth of the nation by value addition, scope in employment generation, and better utilization of available resources (Committee Report, 2013). Measured profitability will be a testament to the efficient functioning of the market (Vadivelu et al., 2013). The marketing of mango is currently restricted due to the lack of marketing knowledge and poor marketing management. There is a large gap between the price paid by urban customers and the price received by farmers. Hence, it reflects inefficient marketing arrangements (Hegde and Madhuri, 2013). In India, mangoes reach the end customers through various marketing channels. Each marketing channel has its own benefits. Marketing efficiency of any particular channel is evaluated by observing the farmers' profit or share in terms of consumers' money, and depends upon price spread throughout the supply chain (Dastagiri et al., 2013). Briefly, ME is subject to the net price received by the farmer after factoring marketing cost and marketing margin. This can be shown in a formula as below:

Acharya's formula for ME (Dastagiri and Chand, 2010; Dastagiri et al., 2013 and Panda and Sreekumar, 2012)

$$Marketing\ Efficiency\ (ME) = \frac{Net\ price\ received\ by\ farmer(FP)}{Marketing\ Cost\ (MC) + Marketing\ Margin(MM)}$$

Table 1. Price spread for a dozen mangoes in different marketing channels (Value in Rupees and values in parentheses indicates the percentage cost in terms of price paid by the customer) (Post-harvest profile of mango, GOI, 2013).

No.	Particulars	Channels				
		I	II	III	IV	V
1	**Mango Farmers**					
	Selling Price	115.2	138.8	134.4	211.6	400
	Marketing Cost	--------	--------	5.6		80
	Net Price Received by farmer	115.2	138.8	128.8	211.6	320
2	**VT/CA/PHC**					
	Purchase Price	115.2	138.8	-------	--------	-------
	Marketing Cost	6.4	12.8	-------	--------	-------
	Net Margin or profit	19.2	33.6	-------	--------	-------
	Sale Price	140.8	185.2	-------	--------	-------
3	**Local Wholesaler**					
	Purchase Price	140.8	185.2	134.4	211.6	--------
	Marketing Cost	4.8	33.6	4.8	18.8	--------
	Net Margin or profit	17.6	46.6	22.8	38	--------
	Sale Price	163.2	265..4	162	268.4	--------
4	**UCT/ Distant Wholesaler**					
	Purchase Price	163.2	265.4	162	-------	--------
	Marketing Cost	60.8	---------	58	-------	--------
	Net Margin or profit	67.2	---------	64	-------	--------
	Sale Price	291.2	---------	284	-------	--------
5	**Retailer**					
	Purchase Price	291.2	265.4	284	268.4	--------
	Marketing Cost	32	36	28.8	37.6	--------
	Net Margin or profit	76.8	98.6	87.2	94	--------
	Sale Price	400	400	400	400	400
	Total Marketing Cost (MC)	104 (26)	82.4 (20.6)	97.2 (24.3)	56.4 (14.1)	80 (20)
	Total Marketing Margin (MM)	180.8 (45.2)	178.8 (44.7)	174 (43.5)	132 (33)	00 (00)
	Gross (Price Spread)	284.8 (71.2)	261.2 (65.3)	271.2 (67.8)	188.4 (47.1)	80 (20)
	Consumers Purchase Price	400 (100)	400 (100)	400 (100)	400 (100)	400 (100)
	Marketing Efficiency of channel From Equation (a)	0.40	0.53	0.47	1.12	4

Note: UCT - Up Country Trader and VT/CA/PHC -Village trader/Commission Agent/Pre-harvest Contractor

From Table 1, we can see that the fifth channel is the most effective channel as it provides the highest ME. Unfortunately, very few farmers are aware of this channel. The main focus of this study is how to improve the efficacy of marketing

channels so that farmers will benefit from mango cultivation and distribution. Table 1 shows the influence of the supply chain on the price of a dozen mangoes.

Although natural conditions for cultivation of mangoes are favourable, and production is satisfactory as well, farmers are not ensured that they would get a good return of their farm produce. A complete set of activities, from production to marketing, has to be developed and provided to enhance the lives of small farmers. Indian farmers should be innovative, technology-oriented, and competitive in the global market. The government, policymakers, researchers, and extension workers should ensure that farmers adopt new tools and farming technology that will enable them to increase productivity and revenue (Doubling Farmers' Income-Volume III, 2017). However, the major problem faced by Indian farmers in the mango supply chain is marketing. The scope of this paper is to study the ME of the mango supply chain, particularly in the Indian context. When we address the ME of the supply chain, the primary focus is on increasing farmers' profit and reducing the loss from the production stage to consumption. Therefore, it requires analysis of various factors that directly or indirectly affect the ME of mango supply chains. Hence, for effective decision making, we need to correlate various factors and analyze the interaction among the factors which deal with the mango supply chain system.

Interpretive structural modeling (ISM) is a well-known, well-established, and interactive learning methodology. Various researchers increasingly use it for defining problems and identifying interrelationships among the factors. In this approach, a set of directly and indirectly related factors are moulded into a well-defined and precise structural model (Attri et al., 2013). The experts' opinions upon interpreting the relations between each set of variables will make the model more transparent and progressively straightforward. Therefore, the collective understanding of this relationship is well-developed by using ISM. The graphical model satisfies the requirements of policymakers by depicting the impact of ME on farmers' income.

The main objectives of this paper are:

- To identify the various factors relevant to the problem in the Indian context.
- To suggest strategies and policies for improving ME.
- To exercise the contextual relationship between eighteen identified factors and MICMAC analysis, and determine key factors responsible for improving ME.
- To provide significant motivation to the researchers, practitioners and suggest directions for future research.

The remainder section of this paper is organized as follows. Section 2 discusses the literature survey on fruit supply chain management, ME of fruit supply chain and formulation of ISM model helpful for strategic decisions. Section 3 deals with research methodology and steps involved in ISM model development. Section 4 identifies the eighteen factors that affect the ME of the mango supply chain and formulation of an ISM model. In section 5, MICMAC analysis is discussed to arrive at a driving power and dependence power of factors. Based on the comprehensive study, results and discussion are provided in section 6. Section 7, discussed the advantages, limitations and managerial implications of this study. Lastly, in section 8, we conclude the paper by giving suggestions for improving ME of the mango supply chain and the future scope of this study.

2. Literature Survey

Supply chain system for mangoes encompasses a balanced and efficient interrelation between input supply, production, harvesting, storage, processing, marketing and export. Therefore, it is necessary to organise all the members in the supply chain to achieve better ME. In this section, the relevant literature related to the ME of the mango supply chain is reviewed. Managing fresh fruit supply chains is a complex task as some of the crucial factors to consider are public health, fruit quality, demand and price variability, and the limited shelf life. Hence, it is necessary to propose a methodology and identify the factors that affect the ME of mango supply chains.

Panda et al. (2012) studied the various factors that influence selection of marketing channel for fruit and vegetable farmers. He utilized a multinomial logistic regression model for the study and analysis of ten independent factors that impact the choice of market participation. Finally, he concluded that four significant components, such as access to market information, training, education, availability of better market infrastructure and value addition, and grading, guaranteed to shift the attitude of farmers from nonmarket participation to formal marketing. Moreover, Negi et al. (2015) identified various issues in the fruits and vegetables supply chain sector, such as cold chain facility, fragmented supply chain, infrastructure facility, transportation facility, processing and value addition, losses and wastage of fresh produce in the

supply chain, farmers' income, utilization of new technology, etc. Lastly, he proposed that these factors have an adverse effect on the overall growth of agriculture and effect on the Indian economy. Sudharshan G. M. and Anand M. B. (2013) found post-harvest losses both in physical and economic terms at different stages of pomegranate handling. He had suggested various techniques to reduce post-harvest expenses and focussed on improving the overall efficiency of the fruit supply chain. Based on the study, a new policy was designed to encourage farmers and other concerned persons to spread awareness of the latest technology. Also author investigated factors for increasing ME of selected commodities, some interventions in the supply chain were found to be necessary, such as scale up the quantity or volume of produce handled for utilizing the advanced method, better transportation facilities to reduce transportation cost, market integration, gathering market information regularly about the wholesale market price and retail price, improved infrastructure in the marketplace, government regulation and control on transparent marketing practices for commodities, etc. (Dastagiri et al., 2013). Raut et al. (2019) proposed a fuzzy Multi-Criteria Decision Making approach to improve food losses through cold-third party logistics providers (CTPLs) evaluation and the selection process. This investigation helps to guide managers of the food industry, CTPLs, and government agencies in formulating strategies for the practical food supply chain. One of the author investigated clustering approach for storage and transportation of different fruits and vegetables that saved significant investment in developing infrastructure components and energy consumption. This approach proved helpful for decision making by farmers, farmer producer organization (FPO), cold-storage owners, practicing managers, policymakers and researchers in the areas of cold-chain management (Bhatnagar et al., 2019).

Goli et al. (2018) presented an optimization framework for producing and distributing supply chains with a cooperating strategy and integrating closed-loop supply chains with open-shop manufacturing and economic lot and delivery scheduling problems (ELDSP). Author had applied this integration for better coordination between the members of the supply chain. He also formulated a new multi-objective mathematical model, whose main contribution is integrating financial and physical flows in a closed-loop supply chain. This proposed mathematical model maximizes the cash flow, maximizes the total created jobs in the supply chain, and maximizes the reliability of consumed raw materials (Goli et al., 2019). Another study, he proposed a robust multi-objective multi-period aggregate production planning (APP) problem based on different scenarios under uncertain seasonal demand. The author had minimized the total cost, including in-house production, outsourcing, workforce, holding, shortage and employment/unemployment costs, and maximized customer satisfaction (Goli et al., 2019).

Pfohl et al. (2011) had considered twenty-one factors for the structural analysis of potential supply chain risks. ISM model was established by identifying interrelationship between risks derived at different levels in the supply chain and classified the risks according to their driving and dependence power. Author identified twenty-four factors of supply chain management enablers (SCMEs). The ISM model and the fuzzy MICMAC approach established the driving power and dependence power of SCMEs, which helps to formulate strategic decisions in their organization and top management Gorane et al., 2012). Another author identified the sixteen causal factors for food wastage, and by using the ISM approach, found key factors responsible for food loss (Balaji et al.,2016). Gadasa et al. (2017) identified fourteen causal factors for post-harvest losses. The ISM model was developed that identified the critical elements with high driving power. A recent study (Chowdhury et al., 2019) identified potential supply chain risks. The ISM model was developed, and by using MICMAC analysis, he had classified the risks based on driving and dependence power.

From the above study, most of the researchers found various factors that impact on the selection of marketing channel in the fruit and vegetable supply chain. However, the ME of the mango supply chain is a comparatively new scope for research that needs to be explored and developed. In a developing country like India, research on building a profitable and sustainable ME strategy has been limited. By applying the above-mentioned studies, we can arrive at a cost price for the farmer's produce and deliver a better product to the customer. Looking at data obtained from various reliable sources, it has been deduced that no study had been done to investigate the interactions among the factors which affect the ME of the mango supply chain, and thus there is a need to develop and formulate a model that helps to improve the ME and farmers' share of the mango supply chain.

3. Research Methodology

The ISM was proposed by Prof. J Warfield (1974) to analyze the mutual interactions between the various factors that provide meaningful insights into decision-making. ISM is a well-established, quick learning procedure and philosophy to define a problem (Diabata and Govindanb, 2011). In this approach, mental knowledge of a set of different group of people, directly and indirectly, related factors are structured into a meaningful, pervasive, efficient structural model. Recently, this approach was used by various researchers to establish the correlation among various factors. The ISM approach starts with recognizing various factors related to the problem or an issue. An attempt is made to analyze the interactions between

the various factors pertinent to the mango supply chain from the harvesting stage till it reaches the end customer. The ISM model will help decision-makers to formulate policy for enhancing ME, contributing to both organizations and society. It will also help to improve productivity. The MICMAC analysis classifies and identifies eighteen factors which affect ME in terms of driving and dependence power (Mabrouk et al., 2020)

The following steps are involved in the ISM methodology

- Identify the various factors relevant to the problem or issue. It can be achieved by field survey, group discussion, conducting interviews, and expert opinions from various domains.
- Decide the pairwise contextual relationship between each factor that the mango supply chain would examine.
- Once the contextual relationship is established, develop a structural self-interaction matrix (SSIM) based on a pairwise comparison of factors.
- Then SSIM is converted into an initial reachability matrix (RM) by replacing V, A, X, O with binary number 1 and 0.
- Convert the initial reachability matrix into the final reachability matrix and check it for transitivity.
- Arrange the factors according to their levels, and then the final reachability matrix is converted into the conical matrix format.
- Draw a digraph and remove the transitive links based on the above-given relationships in the reachability matrix.
- Convert this resulting digraph into ISM based structural model. Replace the element nodes with the statement, review the model, make the necessary modification, and check it for conceptual inconsistency.

4. ISM Model Development

The ISM transforms unclear, poorly articulated mental models into decision making visible models. The group of people decides whether and how the variables are related to each other. The models' overall structure is extracted from the complex set of factors (Sharma et al., 2011). In this methodology, the comprehensive system is portrayed as a graphical model. Many researchers use this technique to decide the order and direction of relationships between the major key factors. Figure 1 shows the complete flow chart of preparation of the ISM model (Joshi et al., 2009).

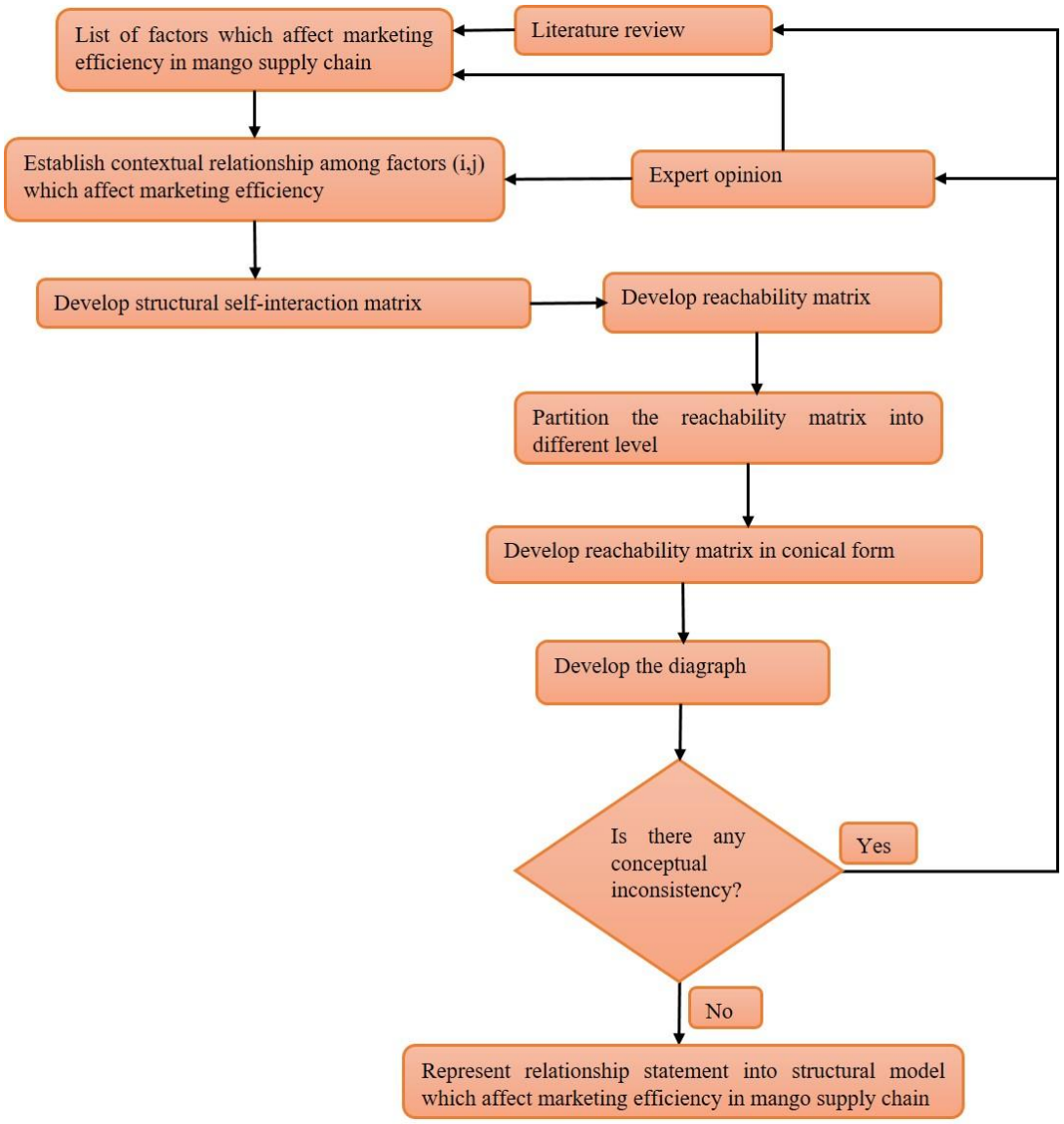

Figure 1. Flow chart showing the development of the ISM model that affects marketing efficiency in the mango supply chain.

Identification of Factors that Affects Marketing Efficiency of Mango Supply Chain

The critical factors have been identified through an extensive literature survey, data collected from the National Horticulture Board, Planning Commission Report (Government of India), recent updates about price variation in agriculture commodities from Maharashtra State Agriculture and Marketing Board (MSAMB), articles published in research papers, journals, master theses, and doctoral theses, etc., manual of mango post-harvest process management practices and opinions of experts from the various sectors involved in mango farming, marketing, wholesaling, retailing, etc. The primary geographical regions that have been considered for this study include Maharashtra's Konkan regions of Raigad, Ratnagiri, and Sindhudurg. These regions are credited with cultivating the richest mango variety 'Alphonso'. This variant of mangoes has a global demand due to its delicious taste.

Table 2. Profile of Experts

Sr. No.	Field experience in years	Performance in business related activities	Designation of Expert
1	15	Food Processing	Plant in-charge
2	20	Marketing	Wholesaler
3	12	Marketing	Retailer
4	25	Academia	Professor
5	15	Farming	Producer
6	20	Marketing	APMC officer
7	18	Marketing(MSAMB)	State Government officer
8	15	Financing	Bank Manager

The eight experts that were selected from various domains have a minimum of twelve years of experience in procurement/processing/selling of fruits and decision-makers in their respective fields (Table 2). The first candidate hails from the food processing industry. Others are farmers, wholesalers, retailers (a businessman dealing with fruit), an agriculture produce marketing committee (APMC) officer, a state government officer engaged in marketing (MSAMB), a banker for providing finance, and academia consulting professionals with personal networks. The interview is conducted based on a structured and semi-structured questionnaire. Two weeks were designated to collect literature and data, expert opinion, and brainstorming sessions to identify the various factors. As a result, eighteen factors are identified, directly or indirectly affecting ME and ultimately affecting the farmer's income (Table 3).

Table 3. Factors that directly or indirectly affect the ME

No.	**Factors**	**References**
1	Long marketing channel and too many intermediaries	Report - Planning Commission, GOI (2012) ; Gardasa et al. (2017); Negi and Anand (2015); Rais and Sheoran (2015).
2	Lack of government control and assistance in the marketing system	Rais and Sheoran (2015); Sivaraman (2016); ASSOCHAM (2011); Viswanadham (2006).
3	Lack of farmers' association and organization	Report GOI (2011); Committee Report (2013); Sivaraman (2016); Dardak (2015).
4	Lack of transparency in the market and available information system	Rais and Sheoran (2015); Balaji and Arshinder (2016); Yadav (2016); Hegde and Madhuri (2013).
5	Lack of introducing innovative marketing channels like direct marketing	Report GOI (2011); Dastagiri et al. (2013); Doubling Farmers' Income-Volume III (2017).
6	Wastage due to the absence of cold chain, cold storage and warehouse facility	Balaji and Arshinder (2016); Negi and Anand (2015); Yadav (2016); Sudharshan and Anand (2013).
7	Lack of transportation and poor road infrastructure	Samanta (2015); Sivaraman (2016); Hegde and Madhuri (2013).
8	Nature of produce like perishability (poor shelf life of fruit) and seasonality	Gardasa et al. (2017); Post-harvest profile of mango, GOI (2013); Hegde and Madhuri (2013); Rong et al. (2011).
9	Lack of linkages with new marketing models like supermarket, retail market, etc.	Dastagiri et al. (2013); Michelson et al. (2012).
10	Lack of traceability, grading, standardization and quality control procedures	Balaji and Arshinder (2016); Bosona and Gebresenbet (2013); Sagheer et al. (2008); Wilson and Clarke (1998).
11	Lack of direct linkage with retailers, processors and exporters	Report - Planning Commission, GOI (2012); Doubling Farmers' Income-Volume III (2017); Committee Report (2013).
12	Poor post-harvest management practices	Murthy et al. (2009); Negi and Anand (2015); Post-harvest profile of mango, GOI (2013); ASSOCHAM (2011).
13	Small landholding capacity and subsequent low volume of produce	Report - Planning Commission, GOI, (2012); Agriculture Census, (2014); Hegde and Madhuri (2013).
14	Lack of skilled and trained labor for various operations at farm and market place	Gardasa et al. (2017); Negi and Anand (2015).
15	Lack of linkages with industry, institution and private organization	Report - Planning Commission, GOI (2012); Gardasa et al. (2017); Doubling Farmers' Income-Volume III (2017).
16	Lack of utilization of secondary agricultural resources	Report GOI (2011); TESCA Report (2008); Cardoena et al. (2015).
17	Lack of industrial and business approach in farming	Report - Planning Commission, GOI (2012); New farm start-up (2011); Doubling Farmers' Income-Volume III (2017).
18	Lack of education or low education levels of farmer	Report GOI (2011); Gardasa et al. (2017); Hegde and Madhuri (2013).

4.1.1 Long Marketing Channel and Too Many Intermediaries

The product reaches the customer through various marketing channels, and several marketing intermediaries such as commission agent/village trader/upcountry trader, wholesaler, retailer, etc., are involved. The presence of these intermediaries is blocking the necessary information and hinders essential data required for marketing, which results in poor coordination in the supply chain (Shukla and Jharkharia, 2013). In addition, these intermediaries take a considerable part of the profit margin and reduce the income share that should ideally be shared with the farmer (Rais and Sheoran, 2015).

4.1.2 Lack of Government Control and Assistance in the Marketing System

As India is an agricultural country, the government must prioritize farmers while preparing agricultural marketing policies. The government is responsible for formulating new policies required for effective market functioning and can bridge the gap between public and private industries. The institutions should help to provide regular training to farmers and encourage research activities in farming and marketing and establish organization-friendly policies beneficial for farmers (Committee Report, 2013). It includes farming, post-harvest processing, distributing produce to the customer, cold storage, suitable marketing infrastructure, transportation infrastructure, financial institutions, research for utilizing advanced technology, etc. (Sivaraman, 2016). The Department of Agriculture and the National Horticulture Board should promote private partnerships in this sector by providing subsidies wherever necessary (Gardasa et al., 2017).

4.1.3 Lack of Farmers' Association and Organization

In India, most of the farmers have small and marginal landholding capacity. They usually depend on intermediator since they have a limited market reach to get their products to the urban market. The involvement of cooperative associations will reduce intermediaries. Hence, the efficient flow of products takes place among various members in the fruit supply chain which helps strengthen business activity and the supply chain (Report - Planning Commission, GOI, 2012). The farmers' association will create more opportunities and involvement in an effort to solve most of the problems related to input supply, credit, transportation, distribution, storing, grading and standardization, marketing, and export. Collaboration with private companies creates employment, market development, and will boost the rural economy (Doubling Farmers' Income-Volume III, 2017 and Dardak, 2015). The Association can provide required bargaining power and help to accumulate higher prices from a wholesaler or retailer while achieving competition among buyers. Ultimately, it will help to reduce marketing costs and provide a better price gain to farmers for their produce.

4.1.4 Lack of Transparency in the Market and Available Information System

Market transparency, such as price, production, and stock, is essential to have valid market information to the market participants for making economic decisions. Transparency helps increase market's effectiveness and reduces information asymmetries for the policymaker (Ahlers et al., 2013). Accurate, relevant, and timely data about market conditions help market participants reduce uncertainty in price volatility. Market transparency is further helpful for policymakers to use market measures, adopt market signals, and create instruments to assist in balancing price volatility. Agriculture Marketing Information System (AMIS) has multiple functions, such as the interaction between various people ranging from farmers to consumers, collecting information about aggregation, sorting, and grading, analysis of market fluctuations, and evaluation of market price for various products. AMIS helps farmers make accurate decisions relevant to customer competition, marketing environment, government policies, schedule of harvesting, suitable marketplace, storing the product or sending the product to the market and market demand, etc. (Report - Planning Commission, GOI, 2012). The right market information system shortens marketing channels and reduces transportation costs ensuring fair marketing transaction and helps to share the risks and benefits (Doubling Farmers' Income-Volume III, 2017).

4.1.5 Lack of Introducing Innovative Marketing Channels Like Direct Marketing

Direct marketing strategies include a farmers' market, open market, direct sales to hotels and restaurants, food hubs, institutions, and end customers without an intermediate. Agro-tourism and online marketing help to sell their produce directly to the customer at a fair price. Farmers can use creative marketing techniques such as roadside marketing, farmers' markets, curbside markets, and pick-your-own. It becomes more economically viable and beneficial for both customers as well as the farmer. This channel not only saves post-harvest loss but also increases farmers' share by eliminating the middleman in the supply chain (Doubling Farmers' Income-Volume III, 2017).

4.1.6 Wastage Due to Absence of Cold Chain, Cold Storage and Warehouse Facility

India is the second-largest producer of fruits and vegetables in the world, with China being in the first place (Horticulture database-2014). Approximately 25 to 30 percent loss occurs due to insufficient cold chain infrastructures like refrigerated transport, pack houses, collection centres, and cold storages during the journey from the farm to the marketplace. The provision of cold storage and controlled air conditioning will help to increase the shelf life of fruit (Balaji, 2016). It also reduces transport bottlenecks at peak time and maintains the quality of products during the long waiting time (Sivakumar et al., 2011).

4.1.7 Lack of Transportation and Poor Road Infrastructure

The World Bank study estimated that in India, 20-30 percent of the farm produce is wasted due to either inadequate rural road network or poor road condition, which adversely affects the farmers' income (Vanek and Sun, 2008, Committee Report, 2013). Poor road condition is responsible for damaging delicate fruits such as mangoes (Vega, 2008). Generally, the mangoes are transported to various marketplaces by road for quick and timely delivery. A delay in their delivery to customers leads to spoilage (Hegde and Madhuri, 2013; and Negi and Anand, 2015). Broad market access is necessary to farmers' which increases buying competition among the customers. Poor rural road infrastructure limits the capability of farmers to travel and communicate with urban customers (Samanta, 2015).

4.1.8 Nature of Produce Like Perishability (Poor Shelf Life of Fruit) and Seasonality

Mangoes lose their quality and value over a certain period of time, even with appropriate handling throughout the supply chain (Sivakumar et al., 2011). It requires cold storage, refrigerated chain and post-harvest equipment to prevent damage and improve the shelf life of produce. After post-harvesting, it requires constant quality testing during the journey from farm to customer. The entire process is very costly (Kasso and Bekele, 2016). Marketing campaigns and pricing become more complex and demand a competent and instant plan of action. The producer faces the risk of income variation due to the perishable and seasonal nature of the fruit (Rong et al., 2011). The time window between a products' arrival at the market store and its sale must match peak quality time otherwise profits will drop drastically (Post-harvest profile of mango, GOI, 2013). The nature of the product must be taken into account while selecting the marketing channels for urban and the global market.

4.1.9 Lack of Linkages with New Marketing Models like Supermarket, Retail Market, etc.

Marketing costs will reduce if there is a direct linkage with organized retail outlets and supermarkets like D Mart, Big Bazaar, Godrej Nature's Market, etc. (Dastagiri and Immanuelraj, 2012). The supermarket sold a wide variety of commodities under a single roof and located nearby a housing area for easy and convenient access to people (Eriksson et al., 2016). The supermarket can maintain direct linkage with the farmers, develop good business relationships with this new marketing model, and benefit to both.

4.1.10 Lack of Traceability, Grading, Standardization and Quality Control Procedures

Traceability in the supply chain brings transparency and improves operational efficiency as well as market efficiency. Traceability would ensure the safety and quality of fruit (Balaji and Arshinder, 2016). Quality standards are decided based on specific characteristics such as size, weight, colour, appearance, texture, etc. Other aspects such as moisture content, sweetness, taste, ripeness, chemical content, etc., are involved in accepting the standards. Standardization helps to maintain uniform quality, which will be achieved by adopting modern technology for accurate sorting and grading (Bosona and Gebresenbet, 2013). Grading and standardization of fruit help ensure common trade language, avoid physical handling and checking, protect the customer by providing quality, and prevent exploitation by intermediaries (Sagheer et al., 2008).

4.1.11 Lack of Direct Linkage with Retailers, Processors, and Exporters

Farmers' direct contact with retailers, processors, and exporters is an excellent alternate choice from farmers' point of view, which is cost-efficient, reduces handling time, and enables improvement in service quality. The ultimate marketing margin will reduce drastically (Report - Planning Commission, GOI, 2012). The right marketing strategy is essential to scale up marketing operations, which helps to increase farmers' revenue. Active market participation is necessary for extending the bargaining power of farmers (Doubling Farmers' Income-Volume III, 2017).

4.1.12 Poor Post-Harvest Management Practices

Post-harvest procedures include cleaning, washing, hot water treatment, hydro-cooling, drying, sorting and grading, and packaging, etc. (Tefera et al., 2007). Approximately 20-25 percent of fresh fruits are discarded every year due to poor post-harvest management practices. This loss can be reduced to a certain extent by using suitable measures and technology relevant to post-harvest management (Post-harvest profile of mango, GOI, 2013). Good post-harvest management practices help to improve the shelf life of mango, retain freshness, appearance, and prevent deterioration (Baloch and Bibi, 2012). It also helps to attract buyers' attention and delivers a competitive price to the producer. The major cause of losses is during storage, ripening, bruising injury, and fungal disease (Murthy et al., 2009; Sivakumar et al., 2011). The effective post-harvest management skills include advanced technology for maintaining the cold chain, post-harvesting processes, and right packaging technology, etc.

4.1.13 Small Landholding Capacity and Subsequent Low Volume of Produce

It is essential to implement such a marketing strategy that is beneficial to the small and marginal farmer. They are facing several challenges, even in access to inputs to marketing their produce. They are usually dependent on other large scale farmers or agents to access land, water, information, credit, technology, and marketing, and face difficulties of liberalization, globalization, integration of value chains, market volatility, and other risk factors. In addition, they also face problems like inadequate storage facilities, lack of mechanization, shortage of transportation facilities, etc. It is practically difficult and unaffordable to market their produce because of the small volume/quantity. Hence, farmers have to always depend on intermediaries who usually take undue advantage of this situation. Small farmers will be able to handle these challenges if there is a proper marketing system for their small surpluses (Hegde and Madhuri, 2013).

4.1.14 Lack of Skilled and Trained Labour for Various Operations at Farm and Market Place

In a supply chain, skilled and experienced labour is essential for minimizing wastage during the handling of produce. It includes different functions like loading/unloading, stacking, weighing, and transferring of produce from one place to another. Labour charges harm ME and affect the open market price. The governing body, the market committee (APMC), should control the volume of the products handled and the net value received by farmers (Report - Planning Commission, GOI, 2012). Post-harvest losses and deterioration of quality mainly occur because of improper care and poor handling of produce. Manual loading/unloading with unskilled labour causes severe damage to produce leading to wastage. Hence skilled and trained workers ought to be employed for overall post-harvest operation (Gardasa et al., 2017).

4.1.15 Lack of Linkages with Industry, Institution and Private Organizations

Public-private partnership (PPP) adds value to the supply chain functioning of post-harvesting processes. Our country produces more than we require, but the surplus produce does not reach all consumers. Cold storage has become paramount for successful food and agricultural policy (Committee Report, 2013). The government should encourage the public and private companies to exchange information and formulate organization-friendly policies beneficial for both. It is necessary to provide subsidies to farmers and distributors for overall growth of supply chain members (Committee Report, 2013). It is an excellent initiative to start the e-trading system by the Government of India through its 'Digital India' movement. But it will fall short of the expectations unless adequate support is not received from private players and institutions (Doubling Farmers' Income-Volume III, 2017).

4.1.16 Lack of Utilization of Secondary Agricultural Resources

Agriculture is aimed to become the largest enterprise, and it can survive only if it grows consistently. Value addition to primary production and establishing agricultural enterprises in rural India will create additional job opportunities. It will help to improve the nutritional status of the people (Report GOI, 2011). Secondary agriculture provides value addition using efficient technologies, market information, and consumer preference for agricultural products. Creating facilities for primary processing of farm products will add value to the essential agro commodities to allow farmers to get better returns (TESCA Report, 2008). Output or bi-product produced from farming has inherent value, and nothing is a waste matter if it is put to gainful use. Cleaning, sorting, and grading agro-produce for marketing purposes is necessary, and in this process, there will be some wastage. This wastage of post-harvest processing and other wastage like mango stone, mango skin, etc., can be reutilized effectively. It can add value to primary agriculture and become a secondary source of income to farmers.

4.1.17 Lack of Industrial and Business Approach in Farming

It is necessary to change the approach of people towards agriculture as a profession. It will be beneficial for farmers to boost their income if it is treated as farm industry/business (New Farm Start-up, 2011). Why should we not consider the agriculture field as business like other professions? Agriculture has the potential of starting a farming business that meets various needs and interests. The government and society must encourage the young generation to adopt new technology and perspective towards farming as a profession. It is essential to identify the type of business that best suits your passion, interest, and available resources. In farming business, resources, information, and suitable conditions can be manipulated to achieve the required business goal. There are two major tasks for achieving the goal: First, incorporate new technology into the farming enterprises and second, how to mentally and financially adjust management of their resources to meet the challenges of varying costs, prices, and climatic conditions. A new start-up requires decision-making skills such as recognising problems, finding observations, analysing observations and testing alternative solutions, choosing the best course of action on a decision, taking responsibility for those decisions, etc.

4.1.18 Lack of Education or Low Education Levels of Farmers

Education has the potential to make desirable changes in humans, for example upgraded knowledge, change in attitude, thinking ability, developed skills, etc. The adoption of modern tools and technology increases farm productivity, creating a new marketing strategy, it requires knowledge, and it will come through education (Hegde and Madhuri, 2013). Acquiring technologies helps to develop both economic and social value and achieve economic growth. Technology enhances 'digitized' life using a mobile phone, internet, cloud technology, etc. Involving intelligent systems like the Internet of Things (IoT), artificial intelligence (AI), smart transportation and distribution, advanced Geographic Information System (GIS), etc., will make things easy and accessible. Effective supply chain that empowers farmers with timely and relevant information to enable better returns for their produce. Farmers should acquire knowledge of the latest trends in the supply chain by attending exhibitions, seminars, and training (Gardasa et al., 2017). Utilizing the latest technology like the cold chain, cold storage facility, modern fast transportation system, advanced post-harvest management practice, new packaging technology, etc., will reduce the post-harvest losses (Negi and Anand, 2015).

4.2 Development of SSIM

From the analysis, expert opinion, and after identifying contextual interrelationship among the eighteen significant factors shown in Table 3, the SSIM has been formulated. The experts are from various domains, highly knowledgeable in their respective fields such as industry, academia, and banking. Four symbols (V, A, X, O) for analysing factors denote the direction of interrelationship used (Babu et al., 2020).

V – Factor i will contribute to helping factor j;
A - Factor j will help to make factor i;
X - Factors i and j will help to contribute to each other; and
O - Factors i and j have (unrelated) no relation with each other.
See Table 4 for SSIM, which is based on contextual relationships.

Table 4. Structural Self Interaction Matrix – SSIM

Factors	**18**	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
1. Long marketing channel and too many intermediaries	A	A	O	A	X	A	A	A	A	A	A	A	A	A	A	A	A	-
2. Lack of government control and assistance in the marketing system	X	X	X	V	V	V	V	V	V	O	V	V	V	V	V	X		
3. Lack of farmers' association and organization	V	X	V	V	V	V	V	V	V	V	V	O	V	V	V			
4. Lack of transparency in the market and available information system.	A	A	V	V	V	O	V	V	X	V	V	O	V	V				
5. Lack of introducing innovative marketing channel like direct marketing	A	X	V	X	O	V	A	X	V	V	X	A	V					
6. Wastage due to absence of cold chain, cold storage and warehouse facility	A	A	V	A	X	O	A	A	V	A	V	A						
7. Lack of transportation and poor road infrastructure	O	O	V	V	V	O	V	V	V	V	V							
8.Nature of produce like perishability (shelf life of fruit) and seasonality	A	A	O	A	O	O	A	A	A	A								
9. Lack of linkages with new marketing models like supermarket, retail market etc.	A	A	X	X	X	V	X	X	X									
10. Lack of traceability, grading, standardization and quality control procedures	A	A	V	A	X	O	A	A										
11. Lack of direct linkage with retailers, processors and exporters	A	A	V	A	V	V	A											
12. Poor post-harvest management practices	A	A	V	X	V	V												
13. Small landholding capacity and subsequent low volume of produce	A	A	V	A	V													
14. Lack of skilled and trained labor for various operations at farm and market place	A	A	O	A														
15. Lack of linkages with industry, institution and private organization	X	X	V															
16. Lack of utilization of secondary agriculture resources	A	A																
17. Lack of industrial and business approach in farming	X																	
18. Lack education or low education levels of farmers	-																	

4.3 Initial reachability Matrix

Next step, the SSIM is converted into an initial reachability matrix (Table 5) by substituting V, A, X, O binary numbers 1 and 0 as per the case (Babu et al., 2020).

The following rules apply for substitution of 1 and 0.

- If (i, j) entry in the SSIM is V, then (i, j) entry in the initial reachability matrix as 1 and the (j, i) entry as 0;
- If (i, j) entry in the SSIM is A, then (i, j) entry in the initial reachability matrix as 0 and the (j, i) entry as 1;
- If (i, j) entry in the SSIM is X, then (i, j) entry in the initial reachability matrix as 1 and the (j, i) entry also as 1;
- And if (i, j) entry in the SSIM is O, then (i, j) entry in the initial reachability matrix as 0 and the (j, i) entry also becomes as 0.

After completing the initial reachability matrix (Table 5), convert this matrix into a final reachability matrix by incorporating the gap of transitivity. But in this case, there is no transitivity as such. The driving power of each factor is the total number of factors (rows), including itself, which may take the initiative. On the contrary, dependence power is the total number of factors (columns), including itself, which may take its initiative. The final reachability matrix (Table 6) obtained considering driving power and the dependence of each factor.

Table 5. Initial Reachability Matrix

Factors	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1
3	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
4	1	0	0	1	1	1	0	1	1	1	1	1	0	1	1	1	0	0
5	1	0	0	0	1	1	0	1	1	1	1	0	1	0	1	1	1	0
6	1	0	0	0	0	1	0	1	0	1	0	0	0	1	0	1	0	0
7	1	0	0	0	1	1	1	1	1	1	1	1	0	1	1	1	0	0
8	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
9	1	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	0	0
10	1	0	0	1	0	0	0	1	1	1	0	0	0	1	0	1	0	0
11	1	0	0	0	1	1	0	1	1	1	1	0	1	1	0	1	0	0
12	1	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	0	0
13	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0
14	1	0	0	0	0	1	0	0	1	1	0	0	0	1	0	0	0	0
15	1	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1
16	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0
17	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
18	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1

Table 6. Final Reachability Matrix

Factors	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	**Driving Power**
1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
2	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	17
3	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	17
4	1	0	0	1	1	1	0	1	1	1	1	1	0	1	1	1	0	0	12
5	1	0	0	0	1	1	0	1	1	1	1	0	1	0	1	1	1	0	11
6	1	0	0	0	0	1	0	1	0	1	0	0	0	1	0	1	0	0	6
7	1	0	0	0	1	1	1	1	1	1	1	1	0	1	1	1	0	0	12
8	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	3
9	1	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	0	0	11
10	1	0	0	1	0	0	0	1	1	1	0	0	0	1	0	1	0	0	7
11	1	0	0	0	1	1	0	1	1	1	1	0	1	1	0	1	0	0	10
12	1	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	0	0	12
13	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	4
14	1	0	0	0	0	1	0	0	1	1	0	0	0	1	0	0	0	0	5
15	1	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	14
16	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	3
17	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	17
18	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	16
Dependence Power	17	5	3	6	11	13	2	14	13	14	11	9	10	15	10	15	6	5	

4.4 Level Partitions

From the final reachability matrix, for each factor, the reachability set and antecedent set are found. The reachability set comprises of the factors themselves and different factors which it might affect to accomplish. In contrast, the antecedent set comprises the factors themselves and different elements that may affect accomplishing it. From that point, the intersection set is determined for every one of the factors. The factors for which the reachability and antecedent sets are equivalent are at the top level of the ISM hierarchy. The top-level factors are those components that won't lead to accomplishing some other factor over its own level of the hierarchy. When the top-level variables are distinguished, at that point, it is expelled from different elements (Table 7). At that point, a similar procedure is repeated to discover the variables at the following level. This procedure is looped until the level of every component is found. The level assessment procedure of all the eighteen factors finished in nine iterations (Table 8). These levels are used to help for building the digraph and the final ISM model. Table 8 shows the reachability set, antecedent set, intersection set, initial and final levels of all the significant factors.

Table 7. First Iteration for level partition

Factors	Reachability Set	Antecedent Set	Intersection	Level
1	1,14	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,17,18	1,14	I
2	1,2,3,4,5,6,7,8,10,11,12,13,14,15,16,17,18	2,3,16,17,18	2,3,16,17,18	
3	1,2,3,4,5,6,8,9,10,11,12,13,14,15,16,17,18	2,3,17	2,3,17	
4	1,4,5,6,8,9,10,11,12,14,15,16	2,3,4,10,17,18	4,10	
5	1,5,6,8,9,10,11,13,15,16,17	2,3,4,5,7,8,11,12,15,17,18	5,8,11,15,17	
6	6,8,10,14,16	2,3,4,5,6,9,11,12,14,15,17,18	6,14	
7	1,5,6,7,8,9,10,11,12,14,15,16	2,6,7	6,7	
8	1,5,8	2,3,4,5,6,7,8,9,10,11,12,15,17,18	5,8	
9	1,6,8,9,10,11,12,13,14,15,16	3,4,5,7,9,10,11,12,14,15,16,17,18	9,10,11,12,14,15,16	
10	1,4,8,9,10,14,16	2,3,4,5,6,7,9,10,12,14,15,17,18	4,9,10,14	
11	1,5,6,8,9,10,11,13,14,16	2,3,4,5,7,9,10,11,12,13,15,16,17,18	59,10,11,13,16	
12	1,5,6,8,9,10,11,13,14,16	2,3,4,7,9,12,15,17,18	9,12,15	
13	13,14,16	2,3,5,9,12,13,14,15,16,17,18	13,14,16	
14	1,6,9,10,14	1,2,3,4,6,7,9,10,11,12,14,15,17,18	1,6,9,10,14	I
15	1,5,6,8,9,10,11,12,13,14,15,16,17,18	2,3,4,5,7,9,12,15,17,18	5,9,12,15,17,18	
16	2,9,16	2,3,4,5,6,7,9,10,12,15,16,17,18	2,9,16	I
17	1,2,3,4,5,6,8,9,10,11,12,13,14,15,16,17,18	2,3,5,15,17,18	2,3,5,15,18,18,	
18	1,2,4,5,6,8,9,10,11,12,13,14,15,16,17,18	2,3,15,17,18	2,15,17,18	

Table 8. Level Partition of the Reachability Matrix

Factors	Reachability Set	Antecedent Set	Intersection	Level
1	1,14	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,17,18	1,14	I
2	1,2,3,4,5,6,7,8,10,11,12,13,14,15,16,17,18	2,3,16,17,18	2,3,16,17,18	IX
3	1,2,3,4,5,6,8,9,10,11,12,13,14,15,16,17,18	2,3,17	2,3,17	VIII
4	1,4,5,6,8,9,10,11,12,14,15,16	2,3,4,10,17,18	4,10	VIII
5	1,5,6,8,9,10,11,13,15,16,17	2,3,4,5,7,8,11,12,15,17,18	5,8,11,15,17	VI
6	6,8,10,14,16	2,3,4,5,6,9,11,12,14,15,17,18	6,14	IV
7	1,5,6,7,8,9,10,11,12,14,15,16	2,6,7	6,7	VIII
8	1,5,8	2,3,4,5,6,7,8,9,10,11,12,15,17,18	5,8	II
9	1,6,8,9,10,11,12,13,14,15,16	3,4,5,7,9,10,11,12,14,15,16,17,18	9,10,11,12,14,15,16	V
10	1,4,8,9,10,14,16	2,3,4,5,6,7,9,10,12,14,15,17,18	4,9,10,14	III
11	1,5,6,8,9,10,11,13,14,16	2,3,4,5,7,9,10,11,12,13,15,16,17,18	59,10,11,13,16	V
12	1,5,6,8,9,10,11,13,14,16	2,3,4,7,9,12,15,17,18	9,12,15	VII
13	13,14,16	2,3,5,9,12,13,14,15,16,17,18	13,14,16	II
14	1,6,9,10,14	1,2,3,4,6,7,9,10,11,12,14,15,17,18	1,6,9,10,14	I
15	1,5,6,8,9,10,11,12,13,14,15,16,17,18	2,3,4,5,7,9,12,15,17,18	5,9,12,15,17,18	VI
16	2,9,16	2,3,4,5,6,7,9,10,12,15,16,17,18	2,9,16	I
17	1,2,3,4,5,6,8,9,10,11,12,13,14,15,16,17,18	2,3,5,15,17,18	2,3,5,15,18,18,	IX
18	1,2,4,5,6,8,9,10,11,12,13,14,15,16,17,18	2,3,15,17,18	2,15,17,18	IX

4.5 Formation of the ISM model

Drawing a digraph based on the final reachability matrix, a structural model ISM is developed. For showing the relationship between two factors, i and j, an arrow is displayed from i to j and the generated digraph is called the initial digraph. While drawing the digraph, remove the transitivity from the original digraph (Figure 2). Review the model for conceptual inconsistency and make the necessary modifications. Finally, this digraph has transformed into an ISM model (Figure 3).

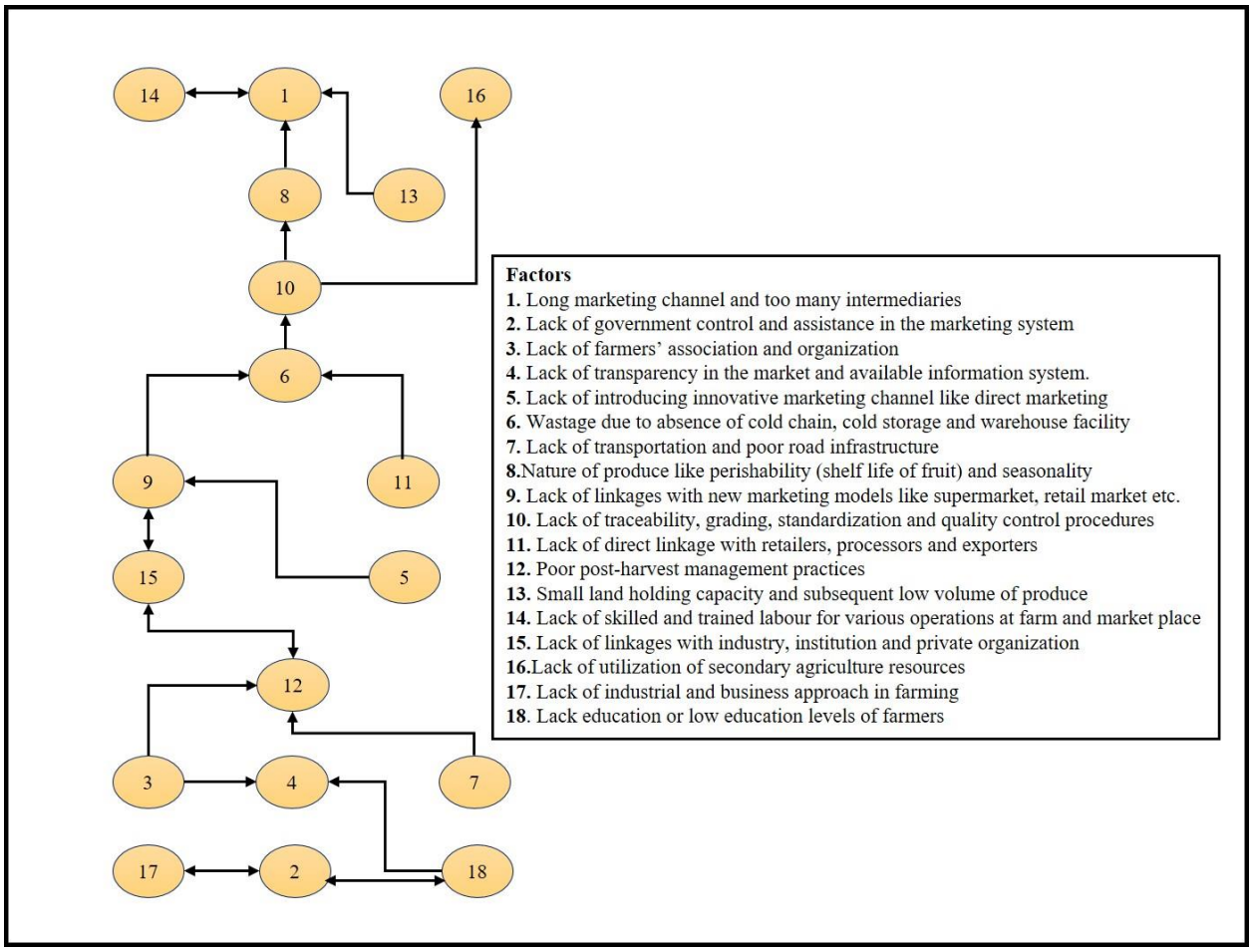

Figure 2. Digraph showing ISM model and relationship among the factors (Numbers 1 to 18 shows the factors that affect ME)

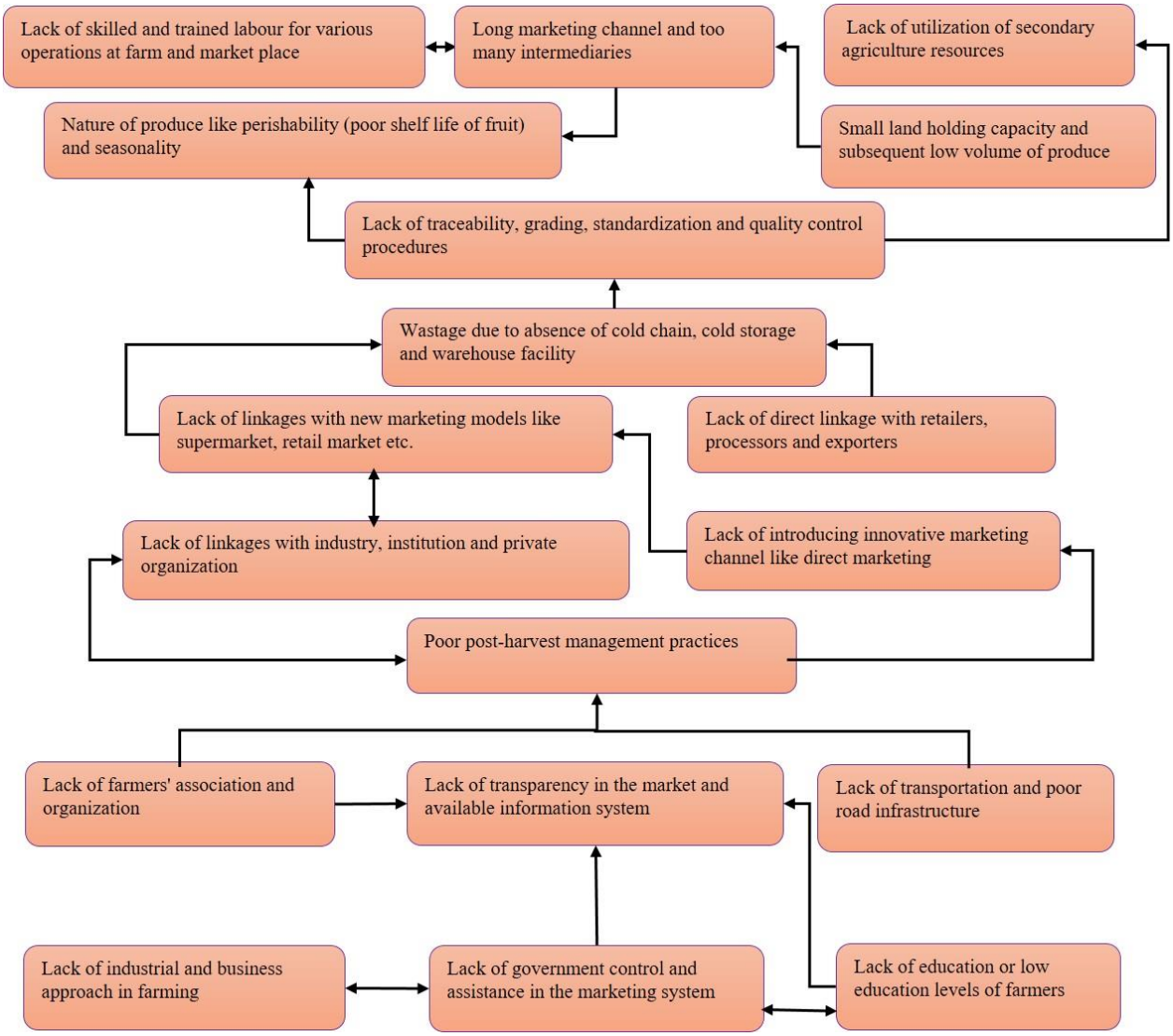

Figure 3. ISM model for eighteen factors

5. MICMAC analysis

The purpose of MICMAC analysis is to identify the factors which affect ME in mango supply chains, and this analysis is based on the driving power and dependence power. This driving power and dependence power is calculated from the final reachability matrix. The MICMAC analysis is completed by drawing simple two-dimensional graphs in Figure 4.
The factors that affect ME are classified into four clusters.

- The first cluster consists of autonomous factors, and these factors have weak driver power and weak dependence. They are relatively disconnected from the system with which they have few links but strong links.
- The second cluster consists of the dependent factors, and these factors have weak driving power but strong dependence power.
- The third cluster has linkage factors, and these have strong driving power and strong dependence power. These factors are unstable, and any action on these factors will affect others and feedback effects on them.
- The fourth cluster includes independent factors, and these have strong driving power but weak dependence power. A factor with very strong driving power, called the 'key factor,' falls into independent or linkage factors. The driving and dependence power of each of the factors are calculated.

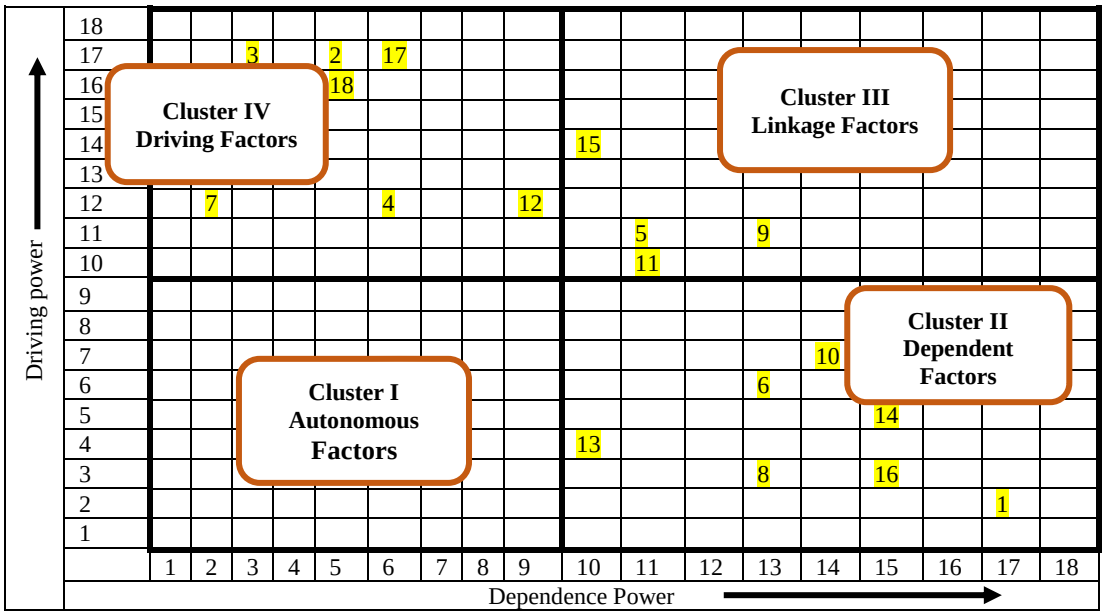

Figure 4. MICMAC analysis and clustering of factors (driving and dependence Power Diagram)

6. Results and Discussions

ISM model obtained from eighteen factors included inputs required for its development from academia, industry, marketing experts like traders, wholesalers, retailers, etc., showing their hierarchical levels (Figure 3). In this research, it was found that strong drivers at the bottom-most level of the structural model, namely, lack of industrial and business approach in farming (17), lack of government control and assistance in the marketing system (2) and, lack of education or low education levels of farmers (18). These three key factors have mutual coordination and interaction, and help to influence each other, drive all other remaining elements in the ISM model, and demand maximum attention of policymakers. Strong drivers may act as the root cause of all the remaining factors. They would help decision-makers to best utilize the resources, especially in the development of the agriculture economy. So, when formulating the plan or corrective action regarding boosting farmers' share and ME, the government should prioritize introducing private partnerships in this sector.

Further, three factors on the top row of the structural model are lack of skilled and trained labourers for various operations at farm and marketplace (14), long marketing channel and too many intermediaries (1), and lack of utilization of secondary agricultural resources (16). The rest of the fifteen factors drive these three factors. In India though, the workforce (labour) is large, but they are not skilled and trained enough for efficient handling of the product, so the wastage occurs, affecting the marketing cost. Further, it is found that the stumbling blocks that affect ME in the mango supply chain are a long marketing channel. Due to the long marketing channel, many intermediates are involved in it and contribute a significant part of the profit share in the value chain. Hence, the policymaker should encourage the farmers and recommend them to use the direct marketing models. Another crucial factor is the lack of utilization of secondary agriculture resources, which indirectly helps generate another way of income source for a farmer. Secondary agriculture helps for multiple benefits such as adding value in the supply chain, creating job opportunities, and better use of agro resources. Also, it improves the farm economy, builds rural agro-industries, increases international trade, helps to enhance the living standard of rural people, makes agriculture internationally competitive, etc. The advisory committee should analyse various constraints like technical and financial, along with multiple opportunities in this sector, and suggest several recommendations to start a much-needed small scale industry for boosting the Indian economy (TESCA Report, 2008). Therefore, the policymakers should collectively develop strategies to reduce the involvement of marketing agents in the supply chain and create awareness among the people about marketing activity by providing education and training.

It was observed that factors namely, lack of farmers' association and organization (3), lack of transparency in the market and available information system (4), and lack of transportation and poor road infrastructure (7). These factors have strong driving power and significantly influence the structure and lead to other factors in the middle level. They have strong implications on both policymakers as well as researchers. The government and NGOs should motivate and encourage people to form cooperative associations and help them to create transparency in marketing activity. In the intermediate

level (second, third, fourth and fifth level) there are six factors, namely, nature of produce like perishability (shelf life of fruit) and seasonality (8), small landholding capacity and subsequent low volume of produce (13), lack of traceability, grading, standardization, and quality control procedure (10), wastage due to absence of cold chain, cold storage, and warehouse facility (6), lack of linkage with new marketing model like supermarket, retail market, etc. (9), and lack of introducing innovative marketing channels like direct marketing (5). These factors have strong dependence power and have a significant influence on top-level components. These factors need to be considered while deciding the strategic plan, and they have an impact on marketing and the effective functioning of the supply chain. There are nine factors at the bottom portion of the segment (level six to level nine). All these nine factors have a considerable effect on the efficient functioning of the mango supply chain.

MICMAC analysis in Figure 4 shows the power of matrix, cluster I (autonomous factors) highlighting autonomous elements, as there are no such autonomous/independent factors. These factors have weak driving power and weak dependence. The absence of autonomous factors in this study indicates that all the eighteen factors considered are concerned with ME and should be involved. Hence, a policymaker cannot ignore the importance and participation of these eighteen factors in the ME of mango supply chain.

Cluster II (dependent factors) consist of seven factors that have weak drivers but strong dependence such as lack of traceability, grading, standardisation, and quality control procedures (10), wastage due to absence of cold chain, cold storage and warehouse facility (6), lack of skilled and trained labour for various operations at farm and market place (14), small landholding capacity and subsequent low volume of produce (13), nature of produce like perishability (shelf life of fruit) and seasonality (8), lack of utilisation of secondary agriculture resources (16), and long marketing channel and too many intermediaries (1). Since these seven factors are seen at the top of the ISM model (Figure 3), therefore, these are important factors. Their strong dependence indicates that they require all other factors to maximise or improve the ME of the mango supply chain. The policymaker should give importance while handling these factors. Besides addressing these factors, policymakers should also understand the dependence of these factors on the lower level of the ISM model.

Cluster III (linkage factors) comprises the elements that have strong driving power and a strong dependence relationship. Any change or action taken on these factors will affect the others and also a feedback effect on themselves, and these influence themselves to a greater extent. There are four such factors which are included in this category, lack of linkages between industry, institution and private organization (15), lack of introducing innovative marketing channels like direct marketing (5), lack of linkages with new marketing models like supermarket, retail market, etc. (9) and lack of direct linkage with retailers, processors, exporters (11).

Cluster IV (driving factors), most significant, have strong driving power, and weak dependence power falls in this category. There are seven such factors which are lack of farmers' association and organization (3), lack of government control and assistance in marketing system (2), lack of industrial and business approach in farming (17), lack of education or low education levels of a farmer (18), lack of transportation and poor road infrastructure (7), lack of transparency in the market and available information system (4) and, poor post-harvest management practices (12). These factors have strong driving power but weak dependence control and requires more attention from decision-makers while formulating policies. The policymakers have to address these factors very cautiously as these are the root cause of the issue, which negatively impacts ME. These factors are the most important factors that influence the other factors appearing at the top of the ISM hierarchy in the overall marketing management.

7. Advantages, Limitations and Managerial Implications

The present study discussed the various factors and formulated the ISM model that has an impact on ME. This model is ideally suitable for policymakers for taking appropriate decision helps to design agriculture marketing policy favourable for farmers. Along with benefits, this model has its limitations. The following section discusses the advantages, limitation and managerial implication of the proposed study.

7.1 Advantages

The ISM model development process is systematic, and computer programming can form a pair-wise contextual relationship between the factors affecting ME. Therefore, the model created here is a structured model or graphical representation of the various factors that can more effectively communicate with other practitioners involved in research activity. The use of the ISM technique increases the quality of interdisciplinary and social communication within the context of the problem situation by focusing the attention of the researcher/practitioner on one specific question at a time.

It is helpful for the government and society to encourage the young people/generation to create awareness and adopt new technology and perspective towards farming as a profession.

The ISM serves as a learning tool to encourage practitioner by understanding the meaning and significance of eighteen factors and their contextual relation and decide the key factors helpful for taking appropriate decision for the policymaker. This model has more concrete stages of processing the details related to various problems or issues, such as deciding long-term strategic planning to enhance the ME of the mango supply chain. Thus, this model helps the policymaker at various stages in the supply chain to improve ME and farmers' profit. Also, this model helps to encourage the practitioner to analyze issues or problems in the mango supply chain and explore the adequacy of a proposed list of factors for illuminating a specified situation relevant to this problem.

7.2 Limitations

In this study, experts from various domains like industry engaged in fruit processing, farmers, wholesalers, retailers, an APMC officer, bankers, and academicians were consulted for acquiring valuable opinions/suggestions. The interview is conducted based on a structured and semi-structured questionnaire. The various inputs received from these experts are highly dependent on their judgements. However, it is only a subjective judgment, and any bias by the person judging the factors influencing the ME of the mango supply chain might affect the final outcomes. In this study, eighteen factors have been considered that affect ME. The least affected factors or problems, which can influence the ME of the mango supply chain, have not been considered in the development of the ISM model. As, increase in the number of factors, increases the complexity of the ISM methodology. The ISM model was developed in this study based on the Indian context. Appropriate modifications are needed to apply it to other developing countries and compared to draw necessary inferences.

7.3 Managerial Implications

The ME plays a vital role in mango supply chains and influences the farmers' socio-economic development, living standard, and life. This research provides a systematic framework to guide the mango supply chain practitioner and decision-makers. This study will help to understand the various issues in the mango supply chain like post-harvest processing, distribution of mango to the customer, cold storage, market infrastructure, transportation infrastructure etc. This model empowers the practitioner at various stages in the supply chain to identify the factors and develop strategic planning suitable for enhancing ME. While preparing agricultural marketing policies, the government must have considered these factors for the betterment of farmer. The institutions should provide help and regular training to farmers, encourage research activities in farming and marketing and establish organization-friendly policies beneficial for farmers. The government should encourage the farmer to form a cooperative association that helps to provide necessary bargaining power and help to accumulate higher prices from a wholesaler or retailer and achieve competition among buyers. The government facilitate proper road infrastructure, cold storage, warehouse facility, good transportation network, market infrastructure etc., that enhance to maintain the quality of mango during supply chain. Also, policymaker encourage farmer and supply chain member by giving subsidies where it deems necessary.

Private companies should collaborate with the government to create employment opportunities, develop the market and boost the rural economy. This study has substantial practical implications for both practitioners as well as academicians. The practitioners need to identify various factors more cautiously during supply chain implementation in their organizations. The top policymakers need to formulate a strategy for executing these factors obtained through ISM model analysis. This paper may assist various stakeholders involved in supply chain management to understand the current scenario of mango products and their supply chain and also be helpful to policymakers/government for the evaluation of new and existing policies. Policymakers can use the findings of this study to analyze/simulate the cause and effect on ME and formulate the policies by which the mango supply chain will be more resilient, which will help boost farmers' profit.

8. Conclusion and Future Scope

Marketing efficiency is the most critical consideration in the marketing of the fruit supply chain, which influences overall market functionaries. In this paper, eighteen factors in the ME of the mango supply chain have been identified, and by using their pairwise interrelationships, the ISM model has been developed. Also, by using MICMAC analysis, the three crucial factors have been found which have strong driving power. The government and policymakers should encourage people by providing education, training, and assistance in the marketing system. But, first, it is necessary to change the approach of people towards agriculture as a profession. From the literature survey and recent news in the tabloids, we

have seen the suicide cases of farmers. This research will help decision-makers, policymakers, and regulatory agencies implement and enforce policies to thoroughly and successfully understand the problems faced by the farmers. The appropriate strategies, and accordingly, implementing proper planning would help to increase the farmers' profit/income in terms of consumer money in the mango supply chain. The findings of this paper are relevant to the problem of marketing and in the distribution network of horticultural products in India. In the ISM model and MICMAC analysis, weightage is awarded based on the experts' opinions from various fields. The model proposed here for the eighteen factors is a realistic representation of the problem for decision-makers. It will help to decide how the eighteen factors should be prioritised within the mango supply chain.

It has been found that good market infrastructure, grading and standardization of produce, access to market information has ensured market development and value addition in the mango supply chain. It will help change the attitude of farmers from nonmarket participation to formal marketing and industrial business approach towards horticulture. The factors that are likely to be considered for participation in the formal market include; proper road infrastructure, suitable transport facility, good market infrastructure, and guaranteed market value addition for their produce. The need of the hour is for expansion in direct marketing that will help boost production and profit/income. This study will help policymakers and government agencies to understand the issue and accordingly formulate a long-term strategic plan. Finally, it has been found that government guidelines/control, fruitful policies, support and utilization of core technologies are the most crucial consideration which helps to increase the effectiveness of the mango supply chain. Consequently, the implementation of effective policies will result in substantial improvement in farmers' and customers' profit. The model developed in this research is based on subjective judgement of a few experts from various fields. This theory can be used to develop a model that can be tested analytically and validated statistically by using Structural Equation Modeling (SEM).

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