



Review

Antecedents of Livelihood Development Using Cold Chains in the Horticultural Sector of the Emerging Markets: A Systematic Literature Review

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Abstract: Diversification into horticulture has become the primary source of livelihood for smallholders. The study analyses trends, theories, settings, constructions, research methods, and findings based on Keynes' "confidence theory", the absolute income hypothesis, and the human development index. Using the Theory, Constructs, Characteristics, and Methodology (TCCM) framework, the paper offers a Systematic Literature Review of 67 scholarly research papers with fifty or more citations published between 2000 and 2021 in EBSCO, Scopus, Web of Science, and Google Scholar databases. The study advocates that a Cold Chain must be considered with the intervention of contract farming, government, cooperative or farmer-producer organisations to reap maximum benefits from horticultural production during the off-and-on seasons rather than selling to opportunistic intermediaries. The study also has important implications for future researchers and policy-makers but, most importantly, offers motivation to the investors for safe investment decisions in the cold chain infrastructure development for higher returns to producers cutting across their geographical, sociological, or economic contexts.

Keywords: cold chain; supply chain; horticulture; livelihood development; emerging market



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1. Introduction

The global human population of 7.7 billion in 2019 is projected to rise to 9.7 billion in 2050 and 11 billion in 2100 [1], posing a formidable challenge before the supply chains meet the demand for food for such a rapidly burgeoning population. Even though 1.3 billion tonnes of food is getting wasted every year in the pre-harvest, post-harvest, and processing stages, global food production will still experience a 60% increase by 2050 to satisfy rising population needs [2,3]. The limited access to cold chain management (CC) is primarily responsible for inadequate food distribution in impoverished countries escalating the hunger issue to a new level each year. According to the Global hunger index (GHI), the top hungriest countries in the world include Somalia, Yemen, the Central African Republic, Chad, the Democratic Republic of Congo, Madagascar, Liberia, Haiti, Timor-Leste, and Sierra Leone. The GHI further projected those 47 countries, in particular, will fall below the hunger line by 2030. Horticulture is a primary area of growth for those countries; as resources are limited, the management of Cold Chain (CC) would play an integral role in meeting food demands by overcoming the SC gap [4]. Due to insufficient cold chain (CC) amenities, food waste in developing countries such as India amounts to \$12.33 billion, or roughly 40% of total production [5,6]. Food safety has become more complex as population demand for quality food has increased, requiring stakeholders to be more worried about CC to preserve quality, particularly in the horticulture segment. There are inadequate data to show how CC in horticulture supports livelihood development in emerging markets; notable countries are India, Mexico, Brazil, Russia, South Africa, Pakistan, Saudi Arabia,

and Indonesia. Despite horticulture's growing importance for food safety and nutritional security and as a cause of livelihood development, it is still in its infancy in developing countries due to its status as a subsistence livelihood. In addition, diversification into horticulture can contribute to the sustainable development of smallholders [7]. However, quality and wastage issues associated with the existing horticultural supply chain from producer to consumer make it more vulnerable to high returns. State-of-the-art literature is associated with this context focusing on the horticulture impact on smallholders' livelihoods, but this review bridges the gap in the SC by highlighting the importance of the CC or CC infrastructure in the sustainable development of smallholders in the horticultural sector. This paper is a pioneering effort to retrospect the two important livelihood parameters, i.e., CC and horticulture, in emerging markets.

This study seeks to conduct a Systematic Literature Review (SLR) of the relevant literature that directly or indirectly helps conclude how CC in horticulture helps producers' economic and livelihood development in emerging markets by incorporating all of the papers from various angles. We examined 67 studies published in ABDC-indexed journals and cited them at least fifty times to avoid overly replete studies. Therefore, we have structured our review as follows: review methodology is discussed in Section 2, Section 3 reviews the literature in this issue, Section 4 sets the agenda for future research, and Section 5 is dedicated to discussion to give insights on theoretical underpinnings based on prior research and providing implications for decision-making. Finally, we summarise our findings in the conclusion section.

In this paper, the primary purpose is to summarise scholarly work on the CC in horticulture for livelihood development into four central inquiries:

RQ1: What are the extant theories?

RQ2: Which research trends are the most prevalent over time, sampled country, population, and content?

RQ3: What were the significant trends in methodology, design, data collection, and data analysis techniques?

RQ4: What are the gaps in the existing research, and what is the scope for future research?

2. Materials and Methods

We have conducted a comprehensive systematic literature review together with a framework-based review that identifies current research gaps and offers future directions by classifying the Theory, Constructs, Characteristics, and Methodology (TCCM) of the extant literature [8,9]. In this study, firstly, we limited our search paradigm between 2000 and 2021 to all-inclusive. The paper selection criteria were set to consider the papers listed in ABDC (2019), indexed in Google Scholar, and having 50 and more citations to include the maximum number of quality papers in the study. The ABDC 2019 journal list was considered because of its robustness and independence from regional bias making the ABDC Journal Quality List an excellent assessment tool for evaluating research productivity and quality [10] and also utilised three of the largest abstracts and citation systems of indexed documents, i.e., Google Scholar, Web of Science, EBSCO, and Scopus. Table 1 displays the long and short search terms that were used for data retrieval so that maximum studies can be included in the study.

Table 1 displays the search terms that were used for data retrieval. To ensure that crucial literature for consideration in this review is not missed, an extensive search in title, abstract, and keywords was run using a wide array of appropriate search terms. We searched those sources extensively and limited the search to English-only articles, yielding 1746 items. After removing duplicates ($n = 543$) in the first inclusion criteria, 1203 articles were left for review. Upon reading the titles and abstracts, 854 studies were excluded for not being relevant to the study. About 349 papers were considered for complete review. Based on the coverage of the review, CC in livelihood development was the only theme included as part of the inclusion and exclusion criteria. A total of 46 studies were included due to their

relevance or scope to the subject of study; these provided pertinent information regarding TCCM of CC in horticulture impacting the livelihood development of smallholders.

Table 1. Data Source and Keyword Search for data extraction, Source: The Authors.

Data Source	Keyword Search
EBSCO, Scopus, Web of Science, and Google Scholar	"Horticulture and cold chain for livelihood" OR "Cold chain for livelihood" OR "horticulture for livelihood development" OR "SC of Horticultural produc*" OR "Supply chain of agricultural produc*" OR "Fruits and agricultural Supply chain in livelihood development" OR "perishable agricultural produ*" OR "Perishable agriculture for livelihood development" OR "fruits and vegetables in livelihood development"

"Produc*" has been used here instead of search keywords like "product, production and produce" individually, so "*" used for that purpose.

Furthermore, by scanning the references of the complete papers, 21 pertinent pieces of literature were identified and manually added after reviewing the abstracts. The complementary search helps determine whether any studies were not included in the primary data search [11]. Finally, 67 papers were included for analysis that were pertinent to the scope of the review, as illustrated in Figure 1.

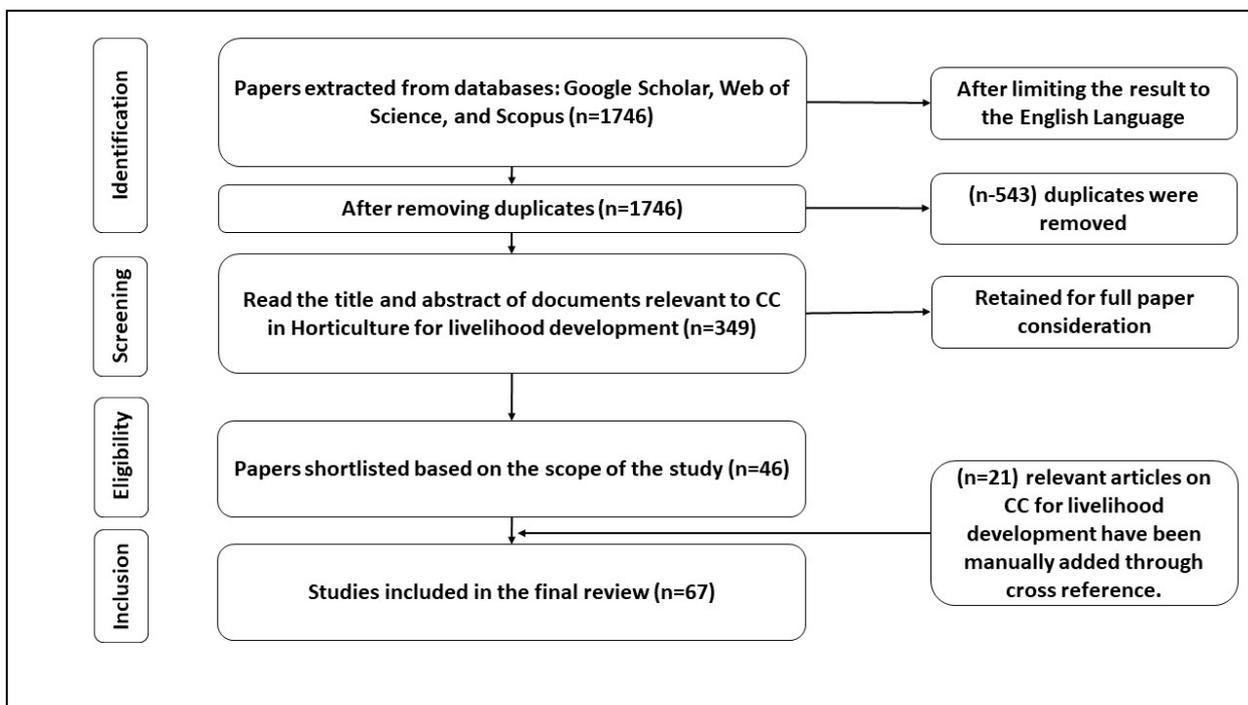


Figure 1. Search and Selection Criteria, Source: The Authors.

3. Results

This section aims to convey an overview of the CC for livelihood development in horticulture. The extant theories conceived, tested, or applied during research are also presented. Further, this study encompassed analysing current literature to identify yearly trends in publication, trends in a sample country or region where research was conducted, and stressed constructs of this research study.

3.1. Extant Theories Employed

Previous researchers have proposed many theories to predicate their study of CC in horticulture to investigate important factors for developing livelihoods and provide a context for empirical research. Table 2 shows the types of theories identified in the literature between 2000 and 2021. We found that contingency theory has been given maximum

prominence since it increases efficiency performance and facilitates the identification of cold chain logistics risks whenever firms adapt their strategy to the conditions or environment [12]. Reardon [13] emphasised the importance of the theory of specialisation in the planning of F&Vs SC, which talks about specialised production areas for easy access to Fruits and vegetables [13]. Barrientos [14] discusses how consumers should be provided with information on quality conventions when a product's quality cannot be determined through either price or observation in horticulture SC [14]. Resources dependence theory (RDT) and Resource-based theory discuss how internal and external factors are essential in making strategic and tactical decisions, mainly environmental aspects [12,15,16]. An alternative, Hotelling's lemma theory, suggests that the supply of a good is related to the maximum profit of producers, which can be attained through well-designed F&Vs SC [17]. In his study, Suzuki [18] relied on contract theory to explain how producers and organisations construct and develop legal agreements for full or partial integration for economic development [18]. The green theory emphasises using sustainable SC technologies that reduce costs and maximise profit [19]. The stakeholder theory states that for sustainable SC, organisations should focus on the benefit of the whole instead of just their benefit [20,21]. Every theory talks about the theoretical implication of factors on CC in horticulture for livelihood development. However, in today's scenario, Keynes's Confidence theory discusses the practical importance of investment of private and Government organisations in CC for economic growth. As part of confidence theories, which may include RDT and contingency theories, i.e., resources (cold supply chain resources) have a substantial capacity to adjust with respect to the environment, as well as maintain an efficient flow of money and goods between producers and consumers (Hotelling's lemma theory), leading to sustainable practices (Green theory). On the other hand, investment (Confidence theory) may be beneficial and lead to contract and product specialisation (theory of contract and specialisation) for the producer with easy access to advanced technological inputs.

Table 2. Theories Employed, Source: The Authors.

S. No	Theory	Origin	Example Citations
1	Theory of Specialisation	[22]	[13]
2	Convention theory	[23]	[14]
3	Resource-based theory	[24]	[12,15,16]
4	Hotelling's lemma theory	[25]	[17]
5	Contract theory	[26]	[18]
6	Green theory	[27]	[19]
7	Stakeholder theory	[28]	[20,21]
8	Contingency theory	[29]	[12]

3.2. Yearly Publication Trends and Publications across Journals

Figure 2 depicts the number of articles published on CC in horticulture for livelihood development each year for this study from 2000 to 2021. Only in the last two decades has the emergence of CC research been observed with the advancement of technology such as Radio Frequency Identification (RFID), Internet of Things (IoT), Blockchain, etc., (2000–2021) in the horticultural sector despite the use of CC dating back to the 1908s in other fields. Out of 67 articles, the year 2011 has eight articles, and the years 2008, 2009, and 2018 each had six studies considered for review in this paper, followed by five numbers in 2015, four numbers each in 2007, 2012, 2016, 2017, and 2020, and remaining had a few numbers of papers. The trends of publications across the years have been increasing, i.e., between 2000 and 2005 it is 10, and between 2006 and 2010 it is 17 and 20 for both 2011–2015 and 2016–20, respectively. A span of one year is not enough to identify the trend of the research conducted in the concerned field. In addition, due to the exclusion, and inclusion criteria of the SLR, a good number of published works have been rejected for further analysis. A group of five-year time intervals starting from 2000–2005 to 2016–2021 can give us a clear picture of the increasing trend of quality publications; however, research in the sector was

worst affected in the year 2019–20 and 2020–21 as a result of which very limited quality published works are available. No paper has been considered from the year 2021, as the exclusion inclusion criteria were not allowed to adopt any one of them. In the coming years, organisations or institutions are expected to conduct more research in horticulture SC for livelihood or economic development, mainly in emerging markets.

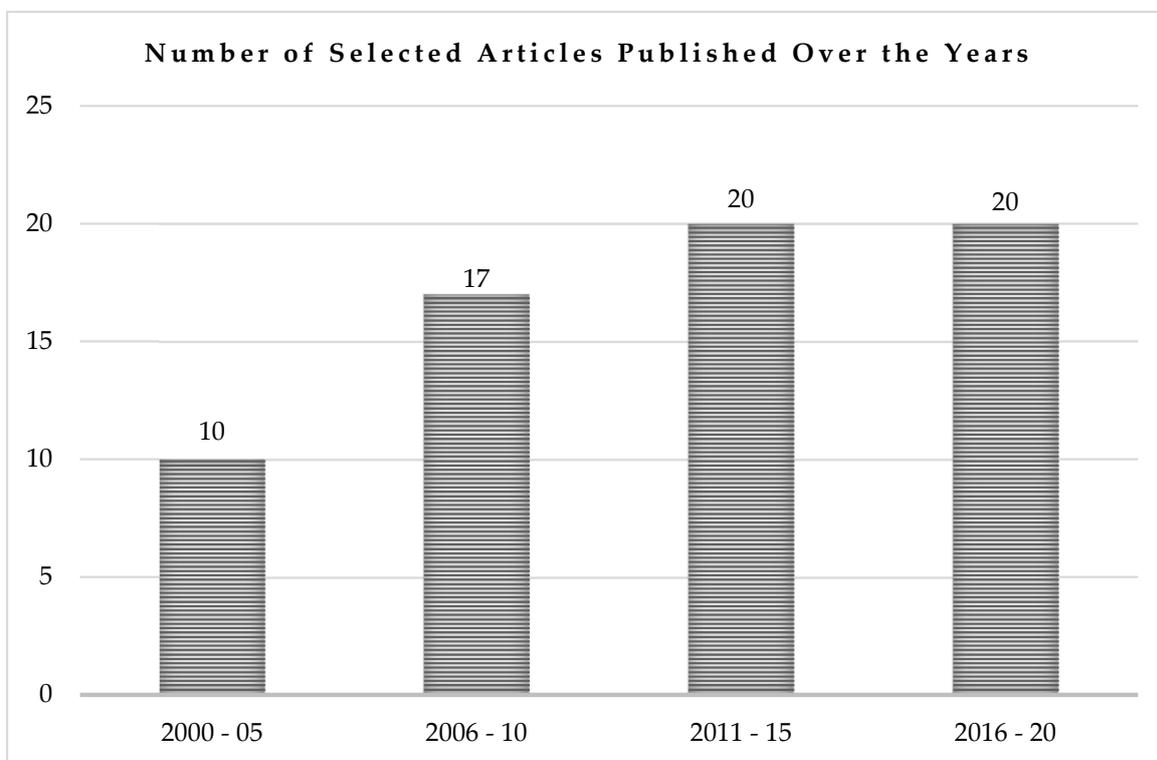


Figure 2. Distribution of Selected Articles between 2000 and 2021 (No article from 2021 was selected), Source: The Authors.

The journal ‘World Development’ published six papers, the journal ‘J. of Production Economics’ published five papers, and the journal ‘Int. J. of Physical Distribution and Logistics Management’, the journal ‘British Food Journal’ published four papers each, and three each from ‘Food Policy, Industrial Management & data system, Int. J. of Information Management, J. of Cleaner Production, and Int. J. of SC Management’ were chosen for this study analysis. The remaining published articles were considered in smaller cases, as shown in Table 3. Most of the articles published in these journals focus on developing or improving livelihoods for people in emerging markets for the horticultural sector through high productivity and efficient SC. As CC is the only system that bridges the gap and increases the producer’s income in the consumer’s price in the horticulture industry, it will advance the research on its practical implications in the next few years [30].

Table 3. Number of Articles across journals, Source: The Authors.

Journal	No of References	Percentage
Agricultural Economics	2	2.99
Agricultural Economics Research Review	1	1.49
Agriculture and Human Values	2	2.99
American J. of Agricultural Economics	1	1.49
Asia Pacific J. of marketing logistics	1	1.49

Table 3. *Cont.*

Journal	No of References	Percentage
Annals of Operations Research	1	1.49
British Food Journal	4	5.97
Computers and Operations Research	1	1.49
Development Policy Review	1	1.49
European J. of Operational Research	1	1.49
Expert Systems with Applications	2	2.99
Food Policy	3	4.48
Global J. of Flexible Systems Management	1	1.49
Harvard Business Review	1	1.49
IIMB Management Review	1	1.49
Industrial Management & Data Systems	3	4.48
Int. J. of Information Management	3	4.48
Int. J. of Operations & Production Management	1	1.49
Int. J. of Physical Distribution & Logistics Management	4	5.97
Int. J. of Production Research	1	1.49
Int. J. of Retail & Distribution Management	1	1.49
Int. J. of Production Economics	5	7.46
J. of Agribusiness in Developing and Emerging Economies	1	1.49
J. of Business Logistics	1	1.49
J. of Cleaner Production	3	4.48
J. of Development Studies	1	1.49
J. of Operations Management,	1	1.49
Maritime Policy & Management	2	2.99
Omega	1	1.49
Production Planning & Control: The Management of Operations	1	1.49
Supply Chain Management: An Int. J.	3	4.48
Technological Forecasting and Social Change	1	1.49
Int. J. of Logistics Management	4	5.97
Transportation Research Part E	1	1.49
World Development	6	8.96
Total	67	100

3.3. Sample Country and Population

In total, 38 of the 67 studies under review drew their papers from individual countries, sixteen studied multiple countries, and 13 studies were ‘not country-specific, as shown in Table 4. When the authors write ‘no country-specific’, they suggest that those papers generalise concepts or theories or review papers. After further investigating the geographical region of the samples used for the studies, most studies have been conducted in Asia ($n = 26$). The majority of horticultural SC research has been undertaken in emerging markets to strengthen their economic performance and develop living standards for their producers due to a meagre per capita income. Maximum studies were conducted in India

($n = 19$) because, besides being an emerging market, it is also an agrarian country where the horticulture industry experiences maximum wastage, i.e., approximately 40% of total production [5,6]. Farmers are getting a discriminatory price for their produce; this is why maximum studies have been undertaken to enhance the SC by implementing CC in the horticulture industry. Many successful case studies can be seen in supermarket industries conducted in developed countries such as the U.S. and U.K. From there, the successful model of CC can be implemented in emerging markets subject to cost constraints. After manually reviewing the study sample populations, it was found that most of them used smallholders as samples (regardless of age group or population cohort). Fewer studies on women, professionals, or government employees have been conducted in horticulture, indicating a research gap between smallholders and all stakeholders for the overall development of that field.

Table 4. Sample Country, Source: The Authors.

		Sample Country		
		Single Country ($n = 38$)	Multi-Country ($n = 16$)	No Specific Country ($n = 13$)
Continent Region	Countries	Number of Publications		
America	US	15		
	Brazil	1		
	Carolina	1		
Europe	UK	7		
	Iceland	1		
	France	1		
	Italy	3		
	Netherland	2		
	Slovenia	1		
	Germany	3		
	Denmark	1		
Asia	India	19		
	Taiwan	3		
	Jordan	1		
	Korea	1		
	China	1		
	Japan	1		
Australia	Australia	4		
Africa	Kenya	1		

3.4. Trends in Research Design, Method, Data Collection Techniques, and Analysis Approaches

The studies in this section have been manually categorised according to the research design, the research method, the data collection approach, the data analysis approach, the context, and the factors listed in Tables 5 and 6.

1. An empirical study is a research article written and analysed based on observed, experimented with, or measured phenomena.
2. Conceptual studies describe the theoretical development of a concept, framework, or idea.
3. A quantitative study is a type of research based on the statistical, numerical, or mathematical analysis of survey or secondary data.
4. A qualitative study is a research article that gathers and analyses non-numerical data, such as focus groups, interviews, first-hand information, and so on.

Table 5. Research Methodology and Design, Source: The Authors.

Title	Research Methodology						Design			
	Empirical (17)	Conceptual (17)	Literature Review (17)	Case Study (23)	Mixed (2)	Viewpoint (16)	Survey (5)	Quantitative (10)	Qualitative (46)	Mix (11)
[7,12,13,31–35]						✓			✓	
[36–43]				✓					✓	
[44–46]	✓			✓				✓	✓	
[47,48]				✓		✓			✓	
[49,50]	✓			✓						✓
[51]					✓					✓
[52,53]			✓			✓			✓	
[54]				✓		✓			✓	
[55]							✓		✓	
[16,21,56,57]		✓	✓						✓	
[58]							✓		✓	
[59]		✓		✓	✓				✓	✓
[17,18]	✓						✓	✓		
[60]	✓	✓		✓				✓	✓	
[61]	✓	✓						✓		
[19,62]	✓	✓								✓
[63]				✓				✓		
[6,64]		✓		✓					✓	
[65,66]	✓			✓				✓		
[67]				✓					✓	
[68]		✓						✓		
[20]	✓			✓						✓
[69,70]						✓			✓	
[71]			✓	✓						✓
[72]	✓	✓								✓
[12]	✓						✓			✓
[73]	✓					✓				✓
[15,74–82]			✓						✓	
[83–85]		✓							✓	

Seventeen of the 67 studies use empirical data, 17 conceptual data, 17 literature reviews, 23 case studies, 2 mixed studies, 16 viewpoints, and 5 survey data. Ten studies use quantitative research designs, 46 use qualitative methods, and 11 examine both qualitative and quantitative methods (Mixed), as seen in Table 5. To explore the topic in-depth and to identify the determinants of horticulture and CC in livelihood development, qualitative methods were used rather than quantitative methods. Archival, qualitative, case study, survey, and laboratory data collection were used for data collection. As mentioned in the prior chapter, research on CC in horticulture has been on the rise, with most papers appearing in the last two decades. In general, qualitative research methods are more common than quantitative approaches. When research relies exclusively on individual perceptions without comprehensively combining numerical data, the conclusions may be biased, inconsistent, and unclear. As a result, additional quantitative investigations are needed to create relevant and reliable indicators. The studies analysed data using descriptive, mathematical, regression, simulation, structural equation modelling (SEM), and factor analysis (FA). A structural interpretative model (ISM) allowed the identification of factors and relationships among them. An evaluation of cold chain logistics risks in the supply chain was conducted using qualitative data collection techniques and a descriptive analysis technique. SEM/FA was used with qualitative and quantitative designs in one study to test a model to measure the relationship between cold chain logistics risks, supply chain resilience as moderators, and firm performance [12]. Based on the confirmatory measurement method, SEM is a comprehensive way to evaluate psychological models. Some studies may have taken advantage of regression and simulation methods to test horticultural SC models or factor relationships among them. Cold chain logistics risks, firm performance, supply resilience, wastage, quality, and growers’ and processors’ incomes are the main factors for considering CC in horticulture for livelihood development. Correlation has also been used in various methodologies, such as descriptive analysis, ANOVA, simulations, and mathematical modelling. Focus group discussions and participatory rural assessment were the most notable qualitative approaches for identifying the genuine problem of smallholders in their environment, referring to Table 6.

Table 6. Data collection and analysis techniques and Constructs, Source: The Authors.

Collection of Data	Data Analysis Methods	Constructs	Example Citations	
Archival	Descriptive	Competitor, Management vision, Customer demand, and Suppliers' sustainable initiatives	[7,14,31,68]	
			[19]	
Case study	Descriptive	Stakeholders, Corporate sustainability, and Cost-saving initiatives	[15,36–39,41,42,67]	
			[20]	
Qualitative	Descriptive	Food characteristics, Uncertainty in SC, IT, Operational capability, Consumer behaviour, Market infrastructure, policy, and regulation	[6,7,13,16,21,32–35,53,56,57,69,70,74–85]	
			[62]	
			Commitment, Communication, Product quality, Satisfaction, Leadership, Training, Environmental factors, Relationship, and Financial backing	[64]
			High cost, quality, safety, Education, Intermediaries, Improper tracing, infrastructure, and commitment	[52]
Survey	Descriptive	Storage facilities, Product handling, Packaging, Processing facilities, Link between farmers and processing units, Backward-forward integration, Link between institution, industry, Government, Marketing channel, record-keeping, tracking, and tracing, knowledge of post-harvest technologies, quality seeds, processing technologies, market demand, and intermediaries	[40,48,55]	
			[73]	
Qualitative	Mathematical	Transportation and production parameters, Perturbations and SC performance	[44]	
Case study/Qualitative	Descriptive		[6,47,54]	
Case study/Survey	Descriptive	Membership, Distance, Age, Land, and Experience of farmer	[49]	
Case study/Qualitative	Descriptive	Innovation and Performance	[51]	
Laboratory	Mathematical/Simulation		[45]	
Survey/Qualitative	Descriptive		[58]	
Case study/Survey	ANOVA		[59]	
Survey	Regression	Traceability and testing pesticide residue program	[17]	
Case study/laboratory	Descriptive	Time and Temperature	[50]	
Case study/Qualitative	Descriptive	Supply chain resilience (SCRES), Supply chain vulnerability (SCV), Supply chain risk management (SCRM)	[60]	
Survey	Regression	Demand, Education, Pineapple production, and Experience	[18]	
Laboratory	Simulation	Product temperature and Ambient temperature	[61]	

Table 6. Cont.

Collection of Data	Data Analysis Methods	Constructs	Example Citations
Case study	Simulation		[63]
Case study/Laboratory	Simulation		[65]
Case study/survey/ Qualitative	Descriptive		[71]
Laboratory	Simulation	Speed, Temperature, and Cost	[72]
Case study	Mathematical	Related humidity, Gas concentration, Temperature	[66]
Survey/Qualitative	SEM/FA	CC logistics risks (CCLRs), SC resilience (SCR), Firm performance	[12]
Survey	FA	Branding, Effective-transportation, Safety, Quality, Sustainability, Logistics Competitiveness, Risk, Technology, Market-accessibility, Govt. Regulations, Transparency, Consumer Satisfaction, Price Stability, and Consumer Income	[46]

4. Discussion

The significance of the Sustainable Development Goals (SDG) is to reduce hunger, promote economic development, alleviate poverty, and create livelihoods, which can be achieved through the rise of the horticulture sector. FAO (2019) reported that the global horticulture trade is twice that of food grains. This would increase income and employment opportunities, particularly in emerging markets such as India and China, having the largest horticulture production [7,52,86]. Due to poor infrastructure and farming methods in emerging markets, organisations and farmers face difficulties meeting products' safety and nutritional quality to meet global standards [44,46,76]. However, logistical risks to long-term global supply can be attributed to factors such as product quality, packaging, weather conditions, and profit maximisation behaviour of supply chain partners associated with distance. When the distance is longer, there are higher consumer costs, lower farm gate prices, and poorer economic development. In this scenario, CC acts as supply chain resilience by avoiding, recovering, and improving current disruption points to retain the quality as well as improving the triple bottom line benefits [13,16,38–40,56,60,80]. This is consistent with the study by Arunrat et al. [87], who found that reducing external raw materials by producing from co-products and recirculating inside farms can reduce GHG emissions and increase farmers' profits. Chen and Wu [88] also recommended that low-carbon sustainable development of the logistics industry should be formulated to reduce GHG emissions. Ageron et al. [19], Tseng et al. [20], and Kitinoja [4] noted that CC is essential to maximising the profit and reputation of a firm, while a lack of infrastructure decreases customer satisfaction. That is why it can be seen that there is a shift from traditional marketing through internal and external integration of stakeholders to serve the high-value competitive global market resulting in high profit and elimination of intermediaries [15,17,21,52,84]. For instance, in India, where horticulture accounts for 30 percent of agricultural GDP, farmers can gain economic and livelihood advantages by getting the actual price for their crops through CC intervention [7,43,89]. In addition, to supply attributes nowadays, customers pay attention to on-demand attributes for F&Vs, location of purchase, food safety indicators, and manufacturing region. At the same time, public-private partnership produces high productivity and higher income through planned cultivation, quality control, post-harvest management, and effective decision-making throughout the SC process [31,54,55,58,59,64,79]. It is essential to consider CC in Perishable SC, which is greatly influenced by factors such as temperature breakdown, traceability, contamination, and storage [57,68,72,78,81,90,91]. In addition, it has been found that the maximum quality

losses occur during the harvesting and retailing phases. Here, affordable technology makes it easy for enterprises to use such technical applications in the supply chain to decrease or regulate the cost, errors, time delay, and quality. Online monitoring systems, such as wireless sensor networks (WSN) in conjunction with RFID and data loggers, present a solution to traditional data collection, processing, and decision-making problems in real-time and helps in redesigning the supply chain. RFID assists in determining whether a product's price should be high or low based on how well the product is performing at the time of purchase rather than pre-existing supermarket pricing [45,61,65]. Reefer vehicles use RFID and GPS technologies for product identification, visibility, tracking, and real-time value in various transportation stages; ensuring cleanliness, safety, and intact quality to increase customer value [33,34,42,47,92,93]. RFID and IoT (Internet of things), as well as machine learning, help to achieve ASC sustainability by reducing lead time in inbound and outbound logistics issues such as routing issues, fleet management, demand-supply forecasting, early detection of product quality and safety issues, and increasing supply-chain relationships [35,70,74,75,82]. Blockchain technology (BT) was used to make the ASC more sustainable through real-time system authenticity. Out of BT enablers, traceability, visibility, and transparency benefit the supply chain by eliminating intermediaries, delivering reliable data, and reducing costs by removing third-party verification [53]. Gardas [73] and Gokarm [62] suggest that challenges such as climatic variables influence the cost of energy in CC logistics [62,73]. Dolan and Humphrey [36], and Mahajan et al. [67] stated, Situation-Actor-Process (SAP) and Learning-Action-Performance (LAP) applications can reduce wastage in CC during the SC process. Arduino et al. [48], and Rodrigue and Notteboom [69] stressed that temperature control is critical to preserving product quality in bulk and reefer containers regardless of the cost and time involved in moving fruit and vegetables while moving for global operations.

The rise in income causes a surge in demand for frozen goods in temperature control systems, known as cold chains. For instance, in Asian, American, and African countries, the new agri-food SC system integrated with a CC has resulted in a modern retailing and procurement strategy to reduce the overall loss [13,51]. Although the initial investment in CC is considerable, if we do not invest in CC infrastructures as Keynes's 'confidence theory' suggests, it will be contrary to the absolute income hypothesis and human development index concept. It is necessary to prioritise these concepts in the emerging market context for the better economic stability of small and marginal growers. So, with careful development and management of CC infrastructure and processes through power conservation, stock damage reduction, selling new stock, and partnerships, the producer can earn a higher return than the traditional SC of perishable products.

Agricultural products SC are considered crucial for developing rural livelihoods by increasing income, lowering costs, and ensuring sustainable development for own consumption and future consumption. Whereas Information and Communications Technologies (ICTs) serve as a factor of production by providing real-time information, creating competitive advantages, and assisting the coordination of all activities in the SC [85]. Several compelling examples can be drawn from various sectors of the economy where farmers turn to cooperatives and aggregators to supply specific market opportunities using technology, which directly or indirectly enhance economic prospects, support livelihoods, and streamline services [77]. According to Ngugi [32], horticultural crops should be prioritised through research and development and infrastructure development in arid and semi-arid land of rural areas to contribute to livelihood development and poverty reduction [32]. Suzuki [18] asserts that smallholder farmers in emerging markets should access the global market through effective government policy and legislation related to horticulture, which will yield a higher return than the local market, improving smallholders' livelihoods [18]. A successful SAFAL India (Safe Fresh Natural) model has been proposed by Mittal [41]; CC is a part of that model to improve operations in the horticulture sector and provide a better standard of living for smallholder farmers. Based on harvesting conditions, Ahumada and Villalobos [50] proposed a business model that allows farmers to maximise their

revenue through planning production and distribution. Clark and Inwood [71] suggested ways to improve, expand, and rethink the delivery of F&V from rural areas to urban areas through a regional distribution system to encourage higher-income production. In addition, Wang [63] developed a model that considered the price of perishable products in real-time instead of assessing them based on their expiration date [63]. A simulation model could be used to distribute food grains in the public distribution system while not compromising quality. Otherwise, growers will lose their crops if the chain from farmer to consumer is disrupted [83].

Figure 2 shows the contexts, important variables, and future directions, which would help future researchers to work on developing the livelihood in the horticultural sector. The maximum number of studies were in the context of fruits and vegetables, emerging markets, sustainable SC, temperature, and export from less developed countries to high-income countries through CC. For F&Vs, a specialised SC has been emphasised for the easy flow of products from producer to consumer with less waste and intact quality, i.e., cold chain. Weinberger and Lumpkin [7] stated in their research that horticulture (fruits and vegetables) could help in reducing the poverty and hunger of growers [7]. The developed nations are the leading destinations for emerging markets to export horticultural products at a higher value, which can help to eradicate poverty with higher income [31]. The context of sustainability emerged as a prominent supply chain issue in many studies in tandem with environmental, social, and economic aspects. In the emerging market context, temperature, performance, quality, traceability, safety, and export have been given maximum priority to reap maximum profit from the horticultural output. Confidence Theory [93], Absolute Income Hypothesis [94], and Human Development Index [95] talk about the investment in the cold chain in the horticultural sector, which would increase the income and purchasing power results and the well-being of the producers. Human Development Index would result in livelihood outcomes, i.e., income generation, employment generation, SC performance, and livelihood development [7,21,51,69].

It is essential to assess the effect of CC in horticulture on livelihood development in the context of economics, society, the environment, and production, service, and performance sustainability in emerging markets for both short- and long-term benefits [96]. The commercialisation approach to the rural horticultural sector will increase employment opportunities [97] in this already labour-intensive industry. If CC investment increases, the horticultural sector will grow faster and gain in the long run by cutting SC costs and waste to benefit from economic and livelihood development and poverty eradication [98].

4.1. Cold Chain and Emerging Market (EM)

Emerging markets are the key goldmines for economic growth, with investors having in-depth knowledge of the market. As in the developed market, EM's consumption of horticulture products is constantly changing depending on quality and safety [55]. Horticulture is presently developing as an emerging industry for economic growth through reducing poverty, creating official and informal jobs, and improving livelihood development [7]. Due to agricultural products' nature and short shelf life, traditional SC must be rebuilt using CC, causing the quality and market price to decline continually. To keep the quality throughout the SC, the CC can act as a catalyst to extend the shelf-life [47]. CC in horticulture is a significant aspect of EM economic growth since it meets domestic and global demand during peak and off-season without pricing negotiations. Public-private partnership in the CC of horticulture makes the sector organised. The progress will be seen in poverty reduction and livelihood development and the overall development of IT, finance, waste management, and logistics sectors. Due to a lack of cold chain amenities (storage, cooling facility, infrastructure, and processing facility) for major producers and exporters in EMs such as India, CC in horticulture is nascent. Approximately 20–30% of total agricultural output and about 70% of fruits are being wasted during pre-harvest, processing, packaging, transportation, and marketing of products, so it is asserted to strengthen ASC sustainably to meet increasing food demand [6]. Tanzania's SHOP (Smallholder Horticulture Outgrower

Promotion) project served as an impetus for the producers of F&Vs through Supplier Development Programs (SDP). This project included a variety of facilities for productivity enhancement, market linkage, and infrastructure development (warehouse, cold storage, and logistics), which increases smallholder income and employment generation. Emerging markets should emphasise implementing projects or models such as SHOP and ITC to develop farmers' livelihood and sustainability.

4.2. Limitations and Recommendations of the Study

According to this study, articles with fifty or more citations are considered essential and valuable between 2000 and 2021. In contrast, few articles that contribute to a field are undiscovered, and new publications may not display their true potential at the time. Although we tried to ensure the search terms covered as wide a range as possible, a few studies might have been missed due to the lack of relevant terms while searching. However, it only considers studies published in English, which may have revealed diverse perspectives about the cold chain (CC) and horticulture for livelihood development in emerging markets (EMs) through other languages. These limitations would recommend authors work on getting a clear and distinct picture of this scenario within a high time period, and not being limited to only high citation papers or any journal ranking.

4.3. Agenda for Future Research

Over the past few years, we have found substantial contributions to CC research in horticulture, but the literature's consolidation has revealed profound gaps in the subject. We posit in this section a set of future research questions (FRQs) that may serve as the basis for future theory development and further research in the area of CC in horticulture to improve livelihoods, as shown in Figure 3. As illustrated in Figure 4, diversification into horticulture significantly contributes to livelihood development through the intervention of CC, whether initiated by contracts, governments, cooperatives, or farmer-producer organisations (FPOs).

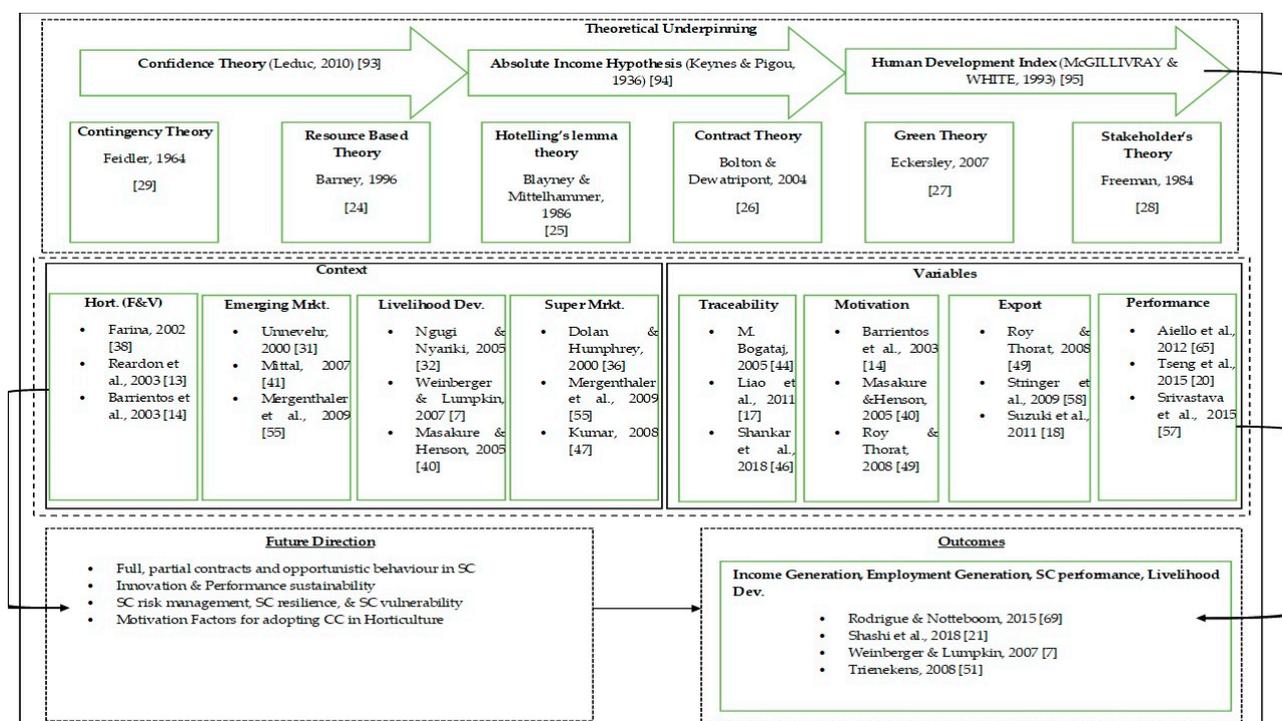


Figure 3. Context, Future Direction, and Outcomes, Source: The Authors.

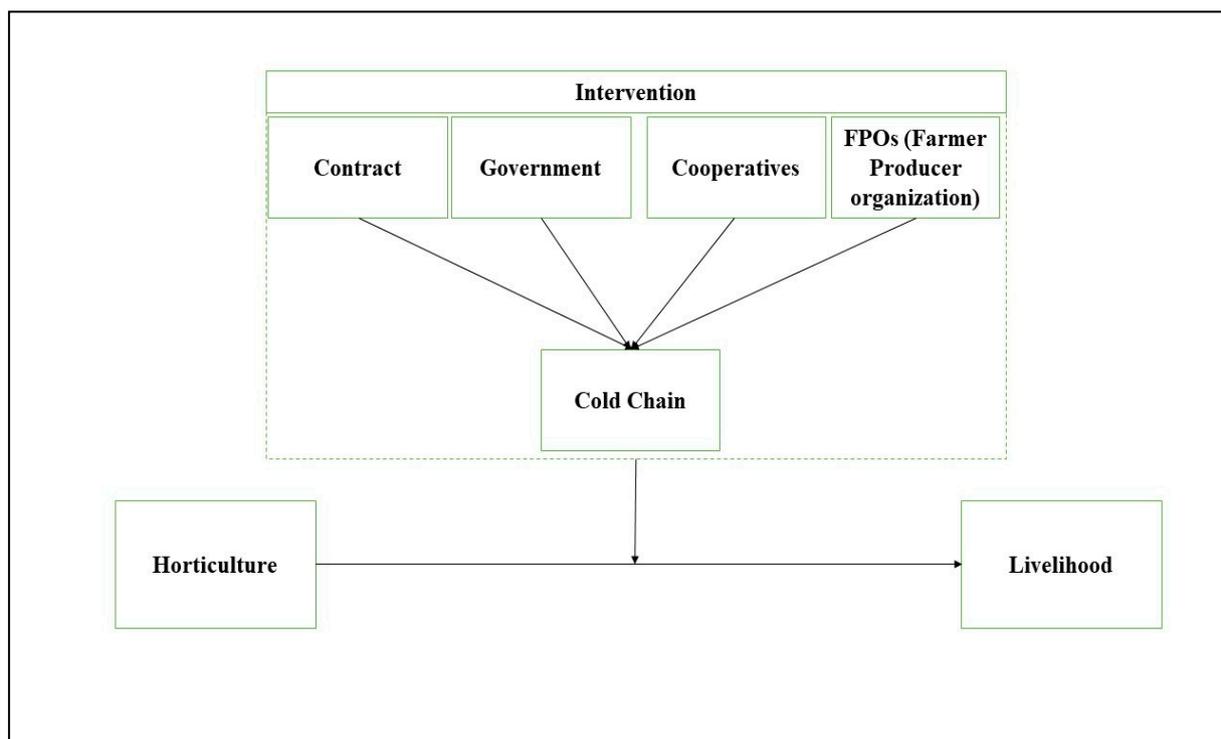


Figure 4. Interventions in Horticulture for livelihoods, Source: The Authors.

CC and horticulture and their role in livelihood development are the subjects of this research. There is no concrete evidence to support the notion that CC in horticulture can aid in poverty alleviation, economic development, or livelihood development. As a result, separate papers on CC and horticulture were considered to demonstrate how CC helps farmers' livelihoods. Rather than being a single discipline, this field can be determined to be multidisciplinary. Articles with diverse scopes and purposes may be analysed to reach a predefined objective in all subjects. Based on the review findings, three research gaps have been recommended for further investigation:

FRQ1. What are the most significant barriers to incorporating CC into horticulture for livelihood development in emerging markets?

Joshi [52] points out that using fuzzy interpretative structural modelling (FISM) to identify thirteen CC inhibitors is the main reason for not implementing CC in emerging markets such as India. Countries may have other inhibitors depending on their geographic, socioeconomic, or political circumstances. Further, Ali [12] talks about four CC logistics risks in the Australian scenario [12,52]. From a methodological perspective, it suggested that all significant inhibitors of CC should be identified in specific contexts and measured with quantitative or empirical techniques rather than only relying upon qualitative research to assess their impact on livelihood development in horticulture.

FRQ2. How can horticulture CC interventions be motivated through a public-private partnership?

There are numerous motivational factors for implementing CC in horticulture from the perspectives of governing bodies, organisations, growers, and consumers. When horticulture farmers are linked to contracts and partnerships, whether by government, private, or cooperatives, they can reap the benefits of lower transaction costs, global market coverage at a higher value than the domestic market, risk distribution, higher bargaining power, and achieving sustainability [40,49]. Furthermore, civil society should exert pressure on SC partners, motivating them to maintain high food safety standards from the farm to the consumer [14]. As we discussed in a previous section, Keynes's 'confidence theory' [95] is extremely important for motivating organisations or governments to invest in CC to increase farmers' income and result in higher living standards for horticulturists.

In addition, it has been emphasised to go for partial and full contracts in the supply chain, making the horticultural SC more efficient and decreasing the SC partners' opportunistic behaviour [35,40]. SC risk management and SC resilience reduce the SC vulnerability of the farm, but emphasis must be given to vulnerability and performance enhancement [60].

FRQ3. What impact does CC have in horticulture, other than cost, on farmer livelihood development and sustainability in emerging markets?

A CC in horticulture helps achieve sustainability in getting the actual price for agri-products, thereby improving the standard of living for the farmers [35]. Stakeholders must evaluate the influence of CC in horticulture on livelihood development in the context of economics, society, the environment, production, service, and performance sustainability within emerging markets for both short-term and long-term benefits. It is also essential to determine how information technology can assist with sustainability. It is important to note that collaborative innovation is a critical component of attaining sustainability in the SC, whether technological or process-based, and the SC routing must be minimised to reduce the cost and the wastage in the horticultural SC [99,100].

5. Conclusions

The findings of an extant literature review provide an area of future research for theory development, context, characteristics, and methodology. The objective of this study was to provide Keynes's 'confidence theory' for infrastructure development in emerging-market contexts to strengthen horticultural SC, resulting in less waste, increased quality, and increased income for growers. Through the intervention of private and government players, CC bridges the gap in the traditional unorganised horticultural supply chain without having any minimum support price (MSP) as staple crops. Additionally, community-based organisations, i.e., Farmer Producer Organisations (FPOs), are on the rise today for the benefit of their members. As a result of these private and public players, it makes the horticulture SC organise and makes the flow of economic agents efficient. These sustainable practices in horticulture also fulfil SDG 2030 agenda directly to SDG1 (End Poverty), SDG2 (End Hunger), SDG3 (healthy lives), SDG4 (Learning opportunities), SDG5 (Empower women), SDG8 (Economic growth), (Resilient infrastructure) and SDG12 (Sustainable consumption and production). Keynes's confidence theory researchers are encouraged to conduct empirical or quantitative research for practical application in the methodology section rather than simply discussing the theory or conceptual development based on the geographical, socioeconomic, and political context. RDT, contingency, Hotelling's lemma, Green, contract and specialisation theories are the most influential theories in the sector's development, theoretically or empirically. The constructs of CC related to livelihood development are also applicable across regions, allowing for generalizability and empirical relationships.

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