

# Distribution channels of vegetable industry in Indonesia: impact on business performance

Distribution channels of vegetable industry

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## Abstract

**Purpose** – The purpose of this paper is to analyse the distribution channels of vegetable sectors in Indonesia, its economic impact on the performance of vegetable sales and the factors affecting marketing channels selected by producers.

**Design/methodology/approach** – The study employed qualitative and quantitative methods. A market survey was qualitatively conducted at producer, intermediary, wholesaler, hotel and food processing company as well as retailer levels. Producer survey was quantitatively conducted at the farm level, by interviewing 556 randomly selected farm households. Structural equation modelling was employed to accomplish the objectives of the study.

**Findings** – Marketing channels for vegetables in Indonesia was complex and relatively long. Farmers decided to select particular channels because of business circumstance and their knowledge. Distance and gentleman's agreement with traders limited farmers to choose the desirable marketing channel. Marketing channels affect business performance in terms of high sales and profit.

**Research limitations/implications** – This study only pays attention to the supply side of vegetables. The effect of marketing channels also encumbers the consumers, which are beyond this study. Other studies are expected to highlight the consumer side.

**Originality/value** – This study focused on smallholder agribusiness players. This study uses two surveys as data sources: market survey and producer survey. The market survey serves as vital information to design producer surveys.

**Keywords** Agribusiness, Business impact, Structural equation modelling, Intermediary, Vegetable farming, Marketing margin

**Paper type** Research paper

## 1. Introduction

Production of vegetables, along with other agricultural products is the backbone of the Indonesian economy. The sector is resilient and absorbs more than half of the workforce and provides a significant contribution to the national income of the country (BPS, 2016). Market supply and demand determine the dynamics of the Indonesian vegetable production.



In general, the existing vegetable market system in Indonesia has developed well. Vegetable products and producer regions conveyed to consumers concentrated in big cities and other urban areas. However, some cases indicate that there are still various problems faced in horticulture trading, mainly if it is associated with the development prospects and efforts to increase income at the farm level. There is a diversity according to regions and commodities that are regulated. In general, collectors function to collect vegetable commodities. Inter-island dealers/traders function to carry out the physical function of transferring commodities from the production areas to the consumption areas. Wholesale buyers/sellers/wholesalers operate in the central markets in the consumption areas, or for some commodities directly to consumers through supermarkets. Finally, the retailers in the consumption area themselves make a transaction with the consumers.

The variation in the general pattern is in the form of new branches such as collectors at the second-tier market in the production area and the presence or absence of linkages between venture capital traders (which are then to producer farmers) with large/inter-island traders. It seems that the general problems faced in vegetable market supply in the current system are that the producer farmers are still in a weak and disadvantageous position. Price changes at the consumer level or retailers cannot immediately signal to producer farmers is a reliable indicator. In other words, transmission prices are not going well, where the average price change at the producer level is lower than the average price change at the retail level.

### *1.1 Demand-side of vegetables*

Foods still hold a significant share of the average per capita expenditure of low-income communities of Indonesia (Pangaribowo, 2012). Consumption of fresh produce is increasing as more Indonesians adopt healthier lifestyles. The share of food expenditure on fruit and vegetables is the second highest after bread and cereals (White *et al.*, 2007). Promoting the consumption of vegetables supported the accomplishment of one of the Millennium Development Goals (Keatinge *et al.*, 2012), and currently, it still meets the component of Sustainable Development Goals (Korenromp and Wüstefeld (2015). Generally, nutrition and impact on weight are more important than value for money, ease of preparation and taste. For vegetables, while the diet and weight benefits are very positive factors, taste, cost and ease of preparation affect consumption (Darian and Tucci, 2013). Wendt and Lin (2011) suggest that the effect of vegetable consumption on a diet varies significantly across the type of vegetables and food preparation. This condition is mostly because fresh foods are more widely available, and consumers can store food at home. The 2010 Dietary Guidelines for Americans reveals that eating fruits and vegetables, instead of higher-calorie intakes can assist children and adults achieve and maintain a healthy weight (USDA and USDHHS, 2010).

Demand for healthy and organic foods is increasing at the global level (Ditlevsen *et al.*, 2019; Gagliardi, 2015; McCarthy, 2016; Smithers, 2018). Consumption of vegetables as one of the healthy foods is also increasing, though at a slower rate than other agricultural products. Better logistics in the vegetable value chain make fresh food more readily available to consumers. Urban consumers are becoming healthier and more convenient and more aware of food safety issues. This concern has opened up opportunities for the modern retail sector to offer product lines such as organic vegetables, which are pre-packed and supplied by specialised local producers. Wendt and Lin (2011) support the statement and call for incorporating more vegetables into meals, both at home and away from home, to ensure healthy diets. Lusk and Norwood (2009) indicate that it is much less costly to produce nutrients from plant-based sources compared to animal-based sources. The implication is that people will usually shift their food consumption patterns from animal-based sources to plant-based sources when there is a shortage of animal-based sources.

1.2 Supply side of vegetables

In Indonesia, vegetable production year-round is in the two main production seasons. Wijayanto *et al.* (2014) highlight the pattern of vegetable productivity in Java that reveals a sigmoid shape, meaning that the product supply tends to fluctuate. Webb *et al.* (2012) mention that variations in weather, planting and other factors can overwhelm seasonal output effects. Indonesian vegetable production does not exhibit a solid seasonal pattern. The primary season starts from March with harvest running from late April to early June, and another season begins in August with harvest running from September to as late as early November. Monthly nationwide chilli production, for instance, averaged by month from 2000 to 2013, ranged from 60,000 to 150,000 tonnes with a peak in April and a nadir in September.

At the national level, the production of vegetables increased during the last decade (see Figure 1). Chilli showed the highest growth rate. Production of chilli increased from about 1m tonnes in 2007 to nearly 2m tonnes in 2017. The increase in production is primarily to substantial improvements in irrigation infrastructure and the use of better cultivars over the period. Other vegetable crops also increased steadily because of the same factors as chilli. Chilli was the highest in terms of acreage and volume of production among the vegetables grown in Indonesia.

Previously according to White *et al.* (2007), production of vegetables grew at a rate of 8 per cent per annum, which was from 6.9m tonnes in 2001 to more than 9m tonnes in 2005. The production covered almost 1m hectares with an average yield of 9.6 t/ha. Chilli production accounted for 20 per cent of the land currently used for vegetable production but produced only 12 per cent of the total vegetable output due to low average yields. Meanwhile, cabbage and potato used only 6.3 and 6.8 per cent, respectively, of vegetable land and provided much higher productivity, resulting in significant production volumes. The main vegetables and productivities are chilli (4.7 to 6.4 t/ha), cabbages (22.4 t/ha), potato (16.4 t/ha), tomato (12.6 t/ha) and shallot and onions (8.8 t/ha).

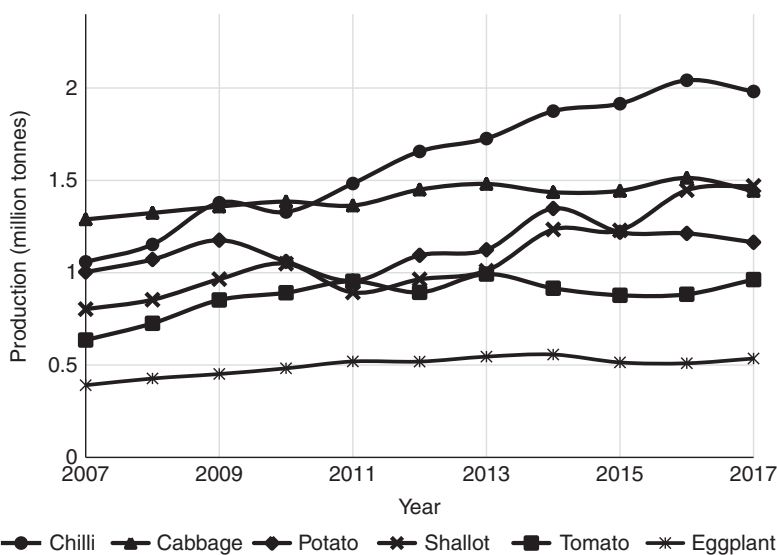


Figure 1. Trend of vegetable production in Indonesia

Source: BPS (2018)

Despite the significant growth of vegetable production in Indonesia, its global share of the vegetable industry is quite low. Improvements in cultivation practices, availability of improved crop varieties, and improvement in irrigation infrastructure are some of the reasons for the recently observed increase in vegetable production. There is room to expand vegetable production in Indonesia by promoting a commercial mindset among farmers who have yet not adopted this approach to agriculture.

### *1.3 Problem statement and objective of the study*

There is still a problem that is hypothesised to inhibit the process of market participation by smallholder vegetable farmers in the vegetable producing regions of Indonesia. The problem perceived by farmers relates to marketing issues (Purnomo *et al.*, 2018). The market is still inefficient where the market has not absorbed harvested products, and this inefficient market leads to transaction costs. Marketing margin is considered one of the transaction costs, which cause a gap between the consumer price and the producer price (Wohlgenant, 2001). Okoye *et al.* (2016) and Osebeyo and Aye (2014) find that the existence of transaction costs discourages farmers to participate in profit-oriented farming. As the inclusion of smallholder farmers in more profitable markets could improve household welfare and reduce poverty among rural households Mmbando *et al.* (2017), a high marketing margin provides a consequence of reduced welfare. Given the very perishable nature of vegetables, along with the risks and potential sales volume of particular channels (LeRoux *et al.*, 2009), a right selection of marketing channels is needed to maximise overall firm performance. From the supply side, the objective of this study is to analyse the distribution channels of vegetable sectors in Indonesia, its economic impact on the performance of vegetable sales and the factor affecting marketing channels selected by farmers.

## **2. Literature review**

The main pathway of agribusiness is a movement from a semi-subsistence agricultural society to a more diversified agrarian economy involving high-value crops, leading to a food secure economy with improved living standards. When vegetables serve as a cash crop, vegetable industry leads to a profitable business. Smallholders mostly practice intensive vegetable farming, and most development economists consider commercialisation of this activity as a central feature of the development process. The progression starts with broad-based agricultural development, causing a high purchasing power by millions of small farmers. These farmers spend and recycle cash through the economy, motivating demand and employment growth in non-farm sectors. Urban and rural labour forces provide a market for each other, which, in turn, increases the demand for food and other farm products (Jayne *et al.*, 2011).

The central to the process of agricultural commercialisation is the marketing of farm products. Many development economists consider commercialisation as an essential feature of the development process. It shows a promising pathway from a semi-subsistence agrarian community to a more differentiated with high-valued commodities and confident food economy with improved livelihood (Mariyono *et al.*, 2019). Transaction costs are the main restriction for farmers to market the produces (Osebeyo and Aye, 2014), along with other business and household characteristics (Mariyono, 2019).

Many factors of marketing issues determine the success of the vegetable industry. The determinants include behaviours of farmers in selling the products, marketing constraints, number of traders and access to market information. Farmers access many available sources of market information. Neighbouring farmers and local traders were the most preferred sources of market information, particularly for the current market price of vegetables. Farmers commonly sell the harvested products to their customers, but there exists a flexible arrangement between the customers and farmers. The farmers peddle the

products immediately after harvesting due mainly to the perishability of the products. They attempt to obtain prevailing market prices within three days before harvesting and to get reasonable prices by negotiating with buyers. Shortly speaking, the main drivers for farmers to participate in sales and marketing are the growth of farming and a reduction in production costs (Rezaei *et al.*, 2018).

Since a long time ago, prices volatility has obtained a significant concern that provides essential consequences for anticipating and opportunity pricing, and risk management, among other financial and economic complications (Baillie and Myers, 1991; Bessembinder and Seguin, 1993; Stephen, 1985). Power and Turvey (2010) suggest that many factors cause volatility of prices for agricultural commodities, and there remains much work to resolve in the future extensions. Agricultural marketing performance becomes an important subject because of its ability to trade harvests and reduce the risk associated with price fluctuation (Huang and Huatuco, 2016). When marketing activities perform correctly, the productions are absorbed by the market at a reasonable price. Failure in marketing leads to price fluctuation. From the supply side, the price fluctuation is unfavourable to producers. The main features of agribusiness are the fact that producers react to respond to the current market prices now, and they will gain the results a couple of months later. For vegetable produce in particular, which is commonly perishable, the timely decision of marketing needs a precise action once they start harvesting the farm. If the price is highly volatile, farmers are discouraged from participating in the business because they face a difficult prediction of the price when the harvesting season comes.

Farmers require to make a timely decision on where they should market the products once their farming is in the harvesting phase. With the existing marketing channels, farmers decide to access one of the channels based on several determinants. Failure in selected the channels leads to sub-optimal consequences. Marketing distribution is demonstrated principally by relational agreement between producers and their customers. It also underlines a vertical integration by some purchasers, and growers selling on informal markets. The outcomes of marketing distribution are mainly attributable to the absence of effective standards and legal systems (Bhattarai *et al.*, 2013). Wang *et al.* (2014) show that decentralised supply chains in different market arrangements do better than integrated chains when product substitutability reaches a certain acceptable level. The customers and suppliers have insufficiently or virtually no function in the processes of product development, inventory management and demand management. The level of participation of customers and suppliers varies across different sectors and also across different processes of the supply chain (Sahay, 2003).

In the high-valued vegetable sector, distribution channels vary, which are dependent on the economic scale of farming and marketable intention. There is the prerequisite for the distribution channels to market the commodities produced by farmers at a rate that would compensate for their endeavours and continue to keep them running their business. Farmers take high risks coming from the seasonality and perishability of the agricultural commodities (Imam *et al.*, 2014). Additionally, market transactions in large vegetable marketplaces entail the most significant importance of transparency. Modekurti (2016) shows the motivations that customers posit at distant places, and the quantity of sales is very high.

Zhang *et al.* (2017) identify that farmers principally selected cooperative, wholesalers and farmers' markets to sell their products, which accounted for 96.57 per cent of total sales. The most critical factors that undoubtedly influence the probability of selecting to sell vegetables at a cooperative, rather than at the farmer's market, are vegetable farm-scale, price agreement and slow sales. Many efforts to improve the vegetable markets lead to an efficient market. For instance, supermarkets play essential roles in linking farmers to markets through direct transaction while enhancing cultivation practices of participating

farmers to improve the product quality (Srimanee and Routray, 2012). The continued growth of the vegetable business requires farmers to convey the marketing procedural system. The goal is achievable when farmers acquire the right price for their products. Buyers obtain high-quality goods at desired prices, which further encourage more consumers from other regions to participate in the process that stimulates an increase in demand for such goods (Modekurti, 2016).

Another alternative distribution channel is contract farming. This channel is different from the other because both producers and buyers have made a transaction previously cultivating the crops. Previously, contract farming is perceived as an instrument for generating new market opportunities henceforth increasing revenues for smallholder farmers. However, critics debate the possibility of contract farming to overcome risks to small-scale farmers, thus benefiting large-scale farmers at the sacrifice of smallholder farmers. Mwambi *et al.* (2016) find that involvement in this arrangement is not adequate to enhance the income of the farm household. Sachan *et al.* (2005) perceive that contract farming scheme as a pessimistic setting in the marketing of agricultural commodities. A question still exists about the well-organised implementation of the arrangements to encourage spill-over impacts on other farm households. A study by Wang *et al.* (2011) indicates that by farmers' attitude toward risk, gender, yield, farm-scale and availability of labour determined contract farming.

In contrast to the common belief that contract farming is a risk management instrument for risk-averse farmers, the risk-lovers tend to use the scheme instead of risk averters. Labour-intensive farms that employ woman-headed households tend to avoid the contracts. In contrast, large-scale farms are more likely to participate in the scheme. These suggest that the primary motivation of farmers to engage contract farming is not market price risk management, but looking for better opportunities and reduction of the marketing transaction cost.

One crucial issue in the distribution channels is the marketing margin that burdens producers and consumers. The higher the level of marketing channels, the higher the revenue collected by players, meaning that the longer the marketing channels, the higher the marketing margins that burden the market (Tuffour and Dokurugu, 2015). In the market, the change in demand is more important than the change in supply that affect the marketing margin variation, and this is more significant in labelled commodities than common ones. The coefficients of marketing costs and their importance are generally higher in conventional commodities than in labelled commodities (Carambas, 2005). A study suggests high margins in Malawi accumulated to agents at the assembly level. Profit taken by the intermediaries is much higher than that collected by the producers. On average, the intermediaries manage higher quantity than producers, thus generating their total margin high as a proportion of the farmers' margin. Such high margins are frequently attributable to high perceived transaction risks in the isolated areas that often limit competition. As such, only a few traders with transportation facilities can reach remote areas where they gain rents from a monopolistic advantage (Mango *et al.*, 2015). Tuffour and Dokurugu (2015) study three different marketing channels that coincide in the supply chain. At an annual basis, farmers achieved a profit margin of 45.42 per cent, wholesalers recorded a profit margin of 79.93 per cent, and retailers had a profit margin of 89.83 per cent. It is understandable that retailers attain the highest incentives in the supply chain at the highest efficiency.

### 3. Research methods

#### 3.1 Theoretical framework

The agricultural marketing system engages many players (Hingley and Lindgreen, 2002; Kohls and Uhl, 2002). The marketing chain starts at the farm level. When products leave the farm, they can be consumed directly by households, but it usually proceeds through other steps of the marketing process. After leaving the farm, the products undergo sorting,

assembly, packaging and transportation to reach the final consumer and may require substantial processing steps. Various market intermediaries, such as dealers and storehouses, are involved. Kohls and Uhl (2002, p. 7) define marketing as: “The performance of all business activities involved in the flow of food products and services from the point of initial agricultural - production until they are in the hands of consumers”.

In micro-economic theory, the producers and consumers meet and make a transaction in the market. If the market is efficient, the equilibrium price of the product paid by consumers is the same as that received by producers. The price represents a win-win solution for both producers and consumers. However, when intermediaries play in the market as rent-seekers, the equilibrium point changes. By using a fundamental concept of supply and demand theories (Nicholson and Snyder, 2016; Pindyck and Rubinfeld, 2017), Figure 2 shows the effect of intermediary rent-seeking on the market equilibrium. The rent-seeking generates a level of marketing margin, which is the difference between retail and farm price of a given farm product (Wohlgenant, 2001).

In the plane of the price (P) and quantity (Q), there is a supply curve (S) and a demand curve (D). Both curves intersect at an equilibrium point (E), at which price and quantity are  $P_0$  and  $Q_0$ , respectively. At the equilibrium condition, the total economic benefit gained from the market is the highest, which is shown by the sum of consumer surplus ( $AEP_0$ ) and producer surplus ( $BEP_0$ ). Because intermediaries exist through marketing channels, now suppose a certain level of marketing margin (M) applies. The marketing margin is considered a transaction cost along with depreciation and transportation costs. The cost causes the price received by producer decreases from  $P_0$  to  $P_P$ , the price paid by consumer increases from  $P_0$  to  $P_C$ , and the level of sales drops from  $Q_0$  to  $Q_1$ . The area of PCFGPP shows the level of income gained by intermediaries from the market. The consumer and producer surpluses decrease to  $AFP_C$  and  $BGP_P$ . The existence of the marketing margin leads to a welfare loss (WL) shown by the shaded area of EFG. The WL is the reduction of consumer and producer surpluses not gained by the intermediaries. Thus, the presence of marketing margin reduces market efficiency leading to the low welfare of the whole community. From the explanation, the higher marketing margin gives more burden to both producers and consumers and eventually leads to a higher WL. The share of the burden is dependent on the elasticity of supply and demand curves (Wohlgenant, 2001).

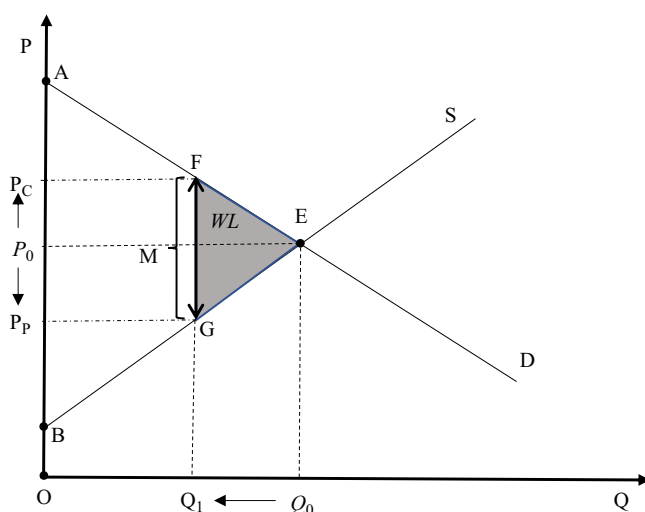


Figure 2. Marketing margin in the market equilibrium

In the Indonesian agricultural sector, including vegetables, the role and existence of intermediary agents are dominant (Purnomo *et al.*, 2018). Based on the harvested areas, wholesale traders set the prevailing market price at end-user. Farmers have low bargaining power, and they play as price takers. Marketing margin exists because of intermediaries (or middlemen) in the market. The level of marketing margin is hypothesised to be affected by the dimension of distribution channels. The longer the distribution channel, the higher the applicable marketing margins since every channel collects a reasonable margin based on the current market condition. Thus, the level of marketing margin varies, and every channel receives a different level. Farmers indirectly perceived the effect of distribution channels on the marketing margin as the prevailing farm-gate price when the farmers sell the products.

3.2 Analytical model

This study proposed a model of analysis as represented in Figure 3 to accomplish the objectives. The central to the analysis is the marketing channel in the vegetable sector. Producer’s characteristics, along with the access to credit and use of telephone, determine marketing channel selected by farmers. Simultaneously, the access to credit, use of telephone and distribution channel affect directly and indirectly income through the mediation of the sales and price of the product.

In mathematical terms, the model was expressed using multiple simultaneous equation models as follows:

$$Y_1 = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_4 X_4 + \alpha_5 Y_2 + \alpha_6 Y_3 + \varepsilon_1, \tag{1}$$

$$Y_2 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon_2, \tag{2}$$

$$Y_3 = \delta_0 + \delta_1 X_1 + \delta_2 X_2 + \delta_3 X_3 + \delta_4 X_4 + \varepsilon_3, \tag{3}$$

$$Y_4 = \gamma_0 + \gamma_1 Y_1 + \gamma_2 Y_2 + \varepsilon_4, \tag{4}$$

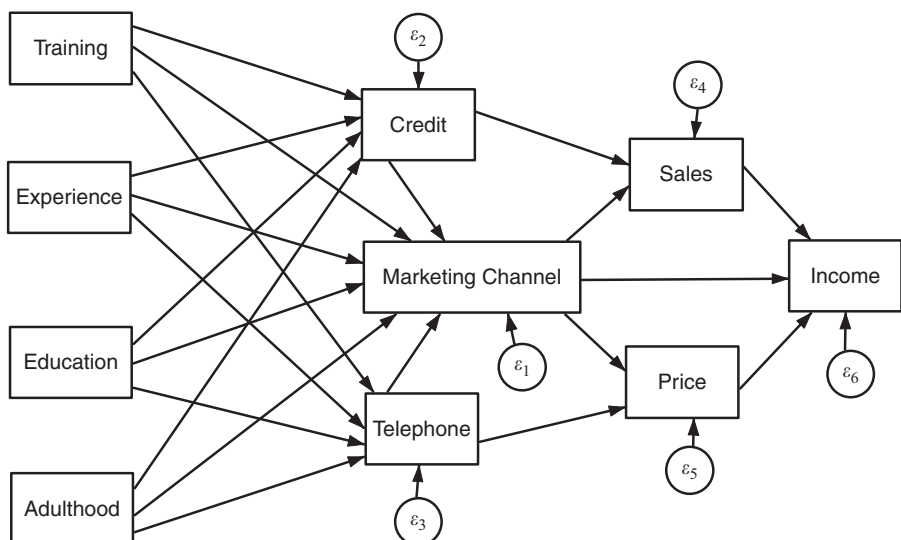


Figure 3.  
Proposed framework  
of path analysis model



$$Y_5 = \kappa_0 + \kappa_1 Y_1 + \kappa_3 Y_4 + \varepsilon_5, \quad (5)$$

$$Y_6 = \lambda_0 + \lambda_1 Y_1 + \lambda_2 Y_4 + \lambda_3 Y_5 + \varepsilon_6, \quad (6)$$

where  $Y_1, Y_2, Y_3, Y_4, Y_5$  and  $Y_6$  is endogenous variable representing distribution channel, credit, telephone, sales, price and profit, respectively;  $X_1, X_2, X_3$  and  $X_4$  is exogenous variable representing training, experience, education and adulthood, respectively;  $\alpha_i, \beta_i, \delta_i, \gamma_i, \kappa_i$  and  $\lambda_i$  is coefficient to be estimated; and  $\varepsilon_i$  is error term. The exogenous variables are independent because such variables were given and personally embedded in the growers. This study searched possible relationships among variables such that many variables considered endogenous. The complex equations were simultaneously estimated using structural equation modelling (SEM). SEM performs test models with multiple endogenous variables (Alavifar *et al.*, 2012) is preferable to other usual methods because it reduces bias and multicollinearity (Tang and Folmer, 2016).

The paper proposed a testable hypothesis as follow:

$$H_0. \alpha_i = \beta_i = \delta_i = \gamma_i = \kappa_i = \lambda_i = 0$$

$H_1$ . The  $H_0$  is not true.

The null hypothesis means that all paths (represented by arrows) do not affect the corresponding variable. The alternative hypotheses mean that at least one path statistically has a significant effect on the corresponding variable. The test of hypotheses was measured at a minimum of 90% confidence interval. The study utilised STATA ver. 13 to estimate the proposed model (StataCorp, 2013).

### 3.3 Study sites and data collection

This study employed a cross-section data set gathered from a series of field surveys. The total number of observations is 556 farm operations. The location included Bali, East Java, Central Java and West Java. These provinces are the centre of vegetable production in Indonesia, where more than half of the national production of vegetables comes from the regions (BPS, 2018). The samples of respondents were selected using a method of purposive-stratified random sampling. Farming scale and diversity of crops grown by farmers stratified the samples. Farmers who operated vegetable farming at least once a year was considered the population members that have the same opportunity to be the samples of the study. The surveys used structured questionnaires to guide data collection, which ran in 2012–2015. The use of questionnaires ensured data collection on the track. The questionnaires for both market and household surveys were developed by taking the market and producers into account. Before developing the questionnaires, preliminary observations were conducted at both market and farm levels. These observations were aimed at gathering essential information that would be used to develop relevant variables.

Farm-level data were collected using individual interviews augmented with qualitative data elicited through market surveys with selected local collectors or intermediaries, wholesalers, food processing companies, supermarkets/restaurants and retailers. At a village level, a market survey was conducted during harvesting time. The medium to large local collectors at village and sub-district levels were consulted to get information on buying and selling the products, as well as the volume and target market. From the report of local collectors, the wholesalers and food processing companies were identified. Similar information was collected from selected wholesaler and food processing companies. The data also were obtained from supermarkets/restaurants. Retailers markets were visited to get prices paid by consumers.

Before analysis, data were validated to make the unit of measurement uniform. Table I shows the definition, measurement and summary statistics of variables.

Exogenous independent variables are given, and they already embedded. Four characteristics of farmers include training in agricultural issues, experience in vegetables, formal education and adulthood. The justification for selecting such characteristics is as follows.

Agricultural training equips farmers with practical knowledge and technical skills. Participation in training enhances human capital. Several studies confirm that this variable is an important factor in affecting farmers' decision to adopt improved agricultural practices. Training with a high frequency of extension contacts provides more revelation to knowledge and leads to rapid technology adoption (Asrat *et al.*, 2010; Kafle, 2010; Ntshangase *et al.*, 2018). Furthermore, agricultural training influences the level of technology adoption (Mauceri *et al.*, 2005; Remya and George, 2015; Yang *et al.*, 2008). In Thailand, the farmer's knowledge is an important factor affecting a farmer's ability to apply good agricultural practices (Athipanyakul and Pak-Uthai, 2012).

Experience in vegetable farming reflects skills of the farmers related to vegetable farming practices. Vegetable farming is considered more complicated than for cereal crops. A farmer with more experience in vegetable production is expected to commercialise farming activities at a higher level. Experience also influences farmers to commercialise farming (Mariyono, 2019) and access credit (Mariyono *et al.*, 2019).

Education level reflects rationality. Educated farmers lead to more rational decision-making. Many studies have used this variable to explain the adoption of agricultural technologies (among others: Pivoto *et al.*, 2018; Wang *et al.*, 2006).

Adulthood, which is symbolised by age, represents emotional and physical ability. Typically, age exhibits a non-linear effect on technology adoption. Positive impact occurs at certain productive ages and becomes negative after a critical point when farmers are getting older (Mishra and El-Osta, 2016).

Endogenous independent variables consist of marketing channel, credit, telephone, sales and price. These variables depend on some variables and simultaneously affected other variables. The distribution channel is the place where farmers sell the products. In Indonesian vegetable market, there are several levels, which depend on the commodities, season and location.

Variables	Description	Unit	Mean	SD
<i>Exogenous independent variables</i>				
Training ( $X_1$ )	Participation in agricultural training programme	Binary: 1 = yes; 0 = no	0.21	0.41
Experience ( $X_2$ )	Experience on vegetable farming system	Year	16.83	11.51
Education ( $X_3$ )	Length of formal education of household head	Year	8.33	2.98
Adulthood ( $X_4$ )	Age of household head	Year	42.37	11.56
<i>Endogenous independent variables</i>				
Marketing channel ( $Y_1$ )	Level of distribution channel selected by farmers to sell the products	Numeric	3.43	0.64
Credit ( $Y_2$ )	Farmers' access to loan for farming purposes	Binary: 1 = yes; 0 = no	0.20	0.40
Telephone ( $Y_3$ )	Usage of mobile-phones in farming business activities	Binary: 1 = yes; 0 = no	0.29	0.46
Sales ( $Y_4$ )	Proportion of vegetables sold for profit	Percentage [0%,100%]	68.04	23.56
Price ( $Y_5$ )	Farm-gate price received by farmers	Ordinal: 1 = low, 2 = fair, 3 = high	2.36	0.74
<i>Endogenous dependent variables</i>				
Income ( $Y_6$ )	Profit gained from a hectare of farming	Million IDR	4.94	4.86

**Table I.**  
Conceptualisation,  
measurement and  
summary statistics of  
selected variables

**Source:** Data analysis using STATA ver. 13

The lowest level is village collectors, and the highest level is wholesale traders. There are middlemen or intermediaries between the villages and wholesale traders.

Credit plays a vital function in agribusiness. Access to credit allows farmers, regardless of whether rich or poor, to obtain adequate cash to support intensive commercial agriculture. This variable is of interest to particular research in the commercialisation of agriculture around the world. Flexible access to credit is a significant determining factor of commercialisation (Kafle, 2010; Kumar, 2009; Raut *et al.*, 2011; Zeller *et al.*, 1997), with a strong positive influence on technology adoption (Mariyono *et al.*, 2019).

Use of telephones enables farmers to access information related to vegetable-based agribusinesses. With access to complete market information, farmers can conduct their business management activities. The effect of telephone usage on the commercialisation of agriculture has been studied by Bresnayan (2008), who indicate that the use of telephones leads to more excellent prospects for technology adoption.

The volume of sales is an indicator of production performance. The higher the sales, the more income the producers will get. The highest level of sales is 100 per cent, where the total harvested products sold in the market. However, the high level of sales is not a necessary condition for high revenue, since the price of products also contributes to revenue.

Price determines the economic return of unit production. Price is perceived as economically feasible when it offsets the unit cost of production. In this study, the price was in ordinal form. It was perceived low when it was much below the average price; fair when it was about the average, and high when it was much higher than the average. Using this ordinal measure was reasonable because the price varied across commodities, harvesting seasons and locations.

The endogenously dependent variable in this study is profit. Profitability firm is the ultimate economic performance of production activities. The production activities will continue to operate if the profitability is positive.

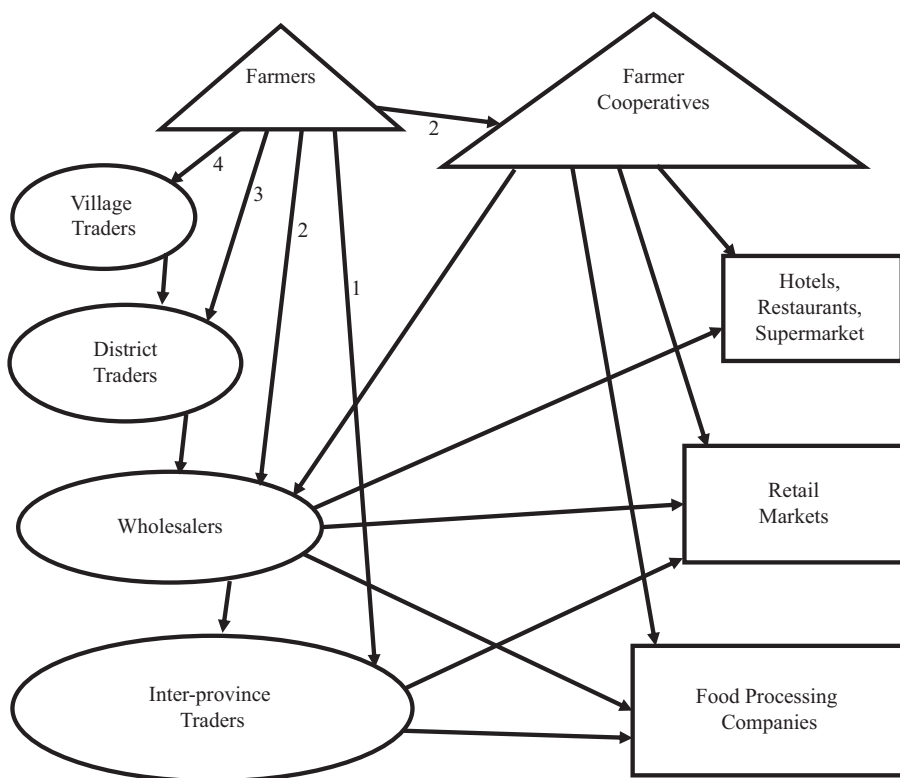
## 4. Results and discussion

### 4.1 *Distribution channels of vegetables*

Based on the market surveys in East Java in Bali, the main vegetables marketed by farmers included chilli, shallot, tomato, eggplant, cabbage, potato, yard-long bean and other leafy vegetables such as coy-sum, amaranth and water spinach. Figure 4 presents the distribution channels of vegetable products in the studied areas.

Figure 4 shows three leading players in the vegetable market. Producers (symbolised with triangles), which included farmers and farmer groups; intermediaries (symbolised with ovals) which consisted of traders at village and district levels, wholesalers and inter-county provinces; end-users (symbolised with rectangles), which comprised hotel/restaurant and supermarket, retail markets and food processing industries. Qualitatively, the larger the size of symbols, the higher the volume of products traded by the business players. The arrows indicated the flow of vegetables in the market.

In general, producers consisted of individual farmers and farmers cooperatives. Farmers cooperatives mostly established in Bali regions. Intermediary included inter-province traders, wholesalers, district traders, village collectors or local traders. The end-users sorted in three main groups: hotel and restaurants, retailers and food processing industry. From the supply side, the producers faced four different levels of marketing channels. Level one, when farmers were able to sell their products directly to inter-province traders. Level two, three or four when farmers sold the products to the wholesale market, traders at a district level or local collectors at the village level, respectively. The higher the number of marketing channels, the more intermediaries the product must pass through. This distribution channels mostly happened in East Java, where the end-users of vegetables were retail markets and food processing industry. In Bali, the distribution was entirely different from that in East Java. Farmers have established cooperatives to fill a very segmented demand for high-quality products. These include hotels



**Figure 4.**  
Distribution channel  
of vegetable industry  
in Java and  
Bali, Indonesia

and restaurants and supermarkets. Farmers who supplied their products through cooperatives were considered face level two of the marketing channels.

The consequences of distribution channels, every intermediary collected a certain level of margin. On average, the total margin at reasonable condition was about 35 per cent. The higher the level of marketing channels, the more margin the intermediaries will collect. For example, when the price of chilli at farm-gate level was IDR 10,000/kg, local collectors took IDR1,250/kg; district traders collected IDR1,000/kg; wholesalers collected IDR750/kg and inter-province markets collected IDR500/kg. When the price was very high, the percentage margin increased, and vice versa. Compared to the vegetable market in Sri Lanka, the total margin in Indonesia is slightly lower. It accounts for about 45 per cent (Sandika, 2011).

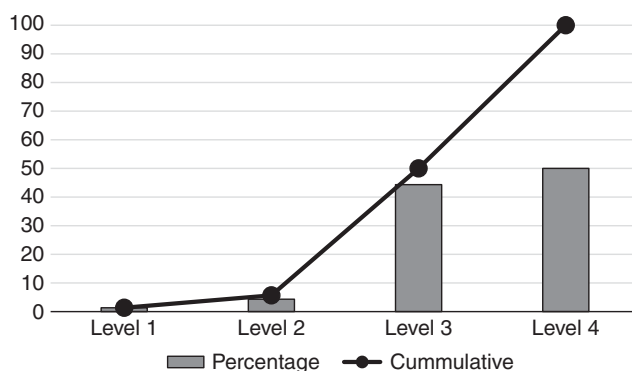
Similarly, when the producer price and retail prices increase, the margin decrease and vice versa. It is clear that when the retail price and producer prices rise, the middlemen try to control the market prices by reducing their marketing. It may support to protect the consumers directly because producer price and retail prices ordinarily increase because of low supply of the production of vegetables and/or high demand. When the prices drop, they try to get more benefits by increasing their margin as a rational business player (Sandika, 2011).

Farmers had a chance to access the wholesaler and inter-province markets, and they would get the price at wholesale price. However, usually, wholesalers needed a plentiful supply of chillies, and they usually were supplied by big farmers and local traders. The numbers of purchase depend on balanced supply and demand. Mostly, farmers sold their products to local collectors because they were distant from markets, and they did not have transportation facility to sell directly to markets. Since distance will affect transaction costs, access to asphalt roads is

also an important factor for participating in modern marketing channels (Sahara *et al.*, 2015). Before selling, they usually checked the supply and prevailing price in the market, such that they knew in what price they should sell. Farmers sell the products directly to big collectors because of the close location and traders' trust in the market.

Figure 5 shows the proportion of marketing channels opted by farmers. About 95 per cent of farmers traded their products to marketing channels at level three and level four. Farming location (or distance) and farming scale were the cause of the selection of marketing channels. It was sporadic that farmers supplied directly to the low number of marketing channels or end-users. Just approximately 5 per cent of the farmers sold to the low level of marketing channels. There was an unwritten regulation in the market that individual farmer was not allowed to sell the products to end-users. In West Java, where the producers close to the capital cities of Indonesia, farmers committed verbal agreements rather than written agreements with dedicated wholesalers. The deals covered price, payment period, quantity, product specification, and seed/other inputs provided on credit (Sahara and Gyau, 2014). The end-users were mostly supplied with products from wholesalers and inter-province markets. Wholesalers play roles as intermediaries by organising teams of traders to collect products from farmers and selling to supermarkets. They perform the business by selling specific or very few products to different players from different marketing channels. Alternatively, they sell a wide variety of products to players from a particular marketing channel (Hernández *et al.*, 2015). In some cases, they make agreements with supermarkets and along with their traders are responsible for managing farmers by providing them with the required information on preferred timing, quality, shape, varieties, colour and sizes, while providing farmers with assistance related to management production practices.

In Bali, cooperatives supplied the products to the end-users. This is a good point because the marketing of agricultural products through cooperative was considered the optimistic situation (Sachan *et al.*, 2005). Based on the cluster analysis, Darian and Tucci (2013) suggest that marketing strategies need modification for different segments of end-users. For a particular segmented market, modern channels provide a significant contribution to household income (Zhang *et al.*, 2014). Modern marketing channels include supermarkets, hypermarkets and hospitality industries. Slamet *et al.* (2017) find that when farmers have direct access to modern marketing channels, they got high prices. However, market share for the fresh horticultural products in the supermarket is meagre and highly competitive. Only a small fraction of farmers can enter in the segment. Ghezán *et al.* (2002) argue that the weak capacity of farmers to meet the requirements of supermarkets and their bargaining power are the constraints in attempting to participate in the supermarket channel. This particular segment fits the consumer preferences, of which the wholesale market was the most preferred place to



**Figure 5.** Marketing channels opted by farmers

purchase fresh agriculture produce, followed by supermarket, hypermarket, the night market and the farmer-market (Rozhan *et al.*, 2013). Indonesian medium income class prefer to purchase fresh vegetables in this specific segmented market (Purnomo, 2018).

The farm-gate prices received by farmers were based on the distance of the farming to the main marketing channels, the volume of the produce at the time of the transaction, the availability of a specific marketing channel outlet or ability to access the channel in the farmer's community. Both farmers and traders accepted the price based on the volume of supply in the market. Usually, when farmers would like to harvest, they observed the supply in their areas to estimate the amount to be harvested. On the other hands, when the traders wanted to purchase, they selected areas where there was a harvesting season of particular products to get low prices. Behavioural constellation between farmers and traders resulted in a transaction. The prices agreed by both producers and buyers reflected the fair prices at each level of the marketing channel.

4.2 Structural equation modelling of distribution channel

The goodness of fit indicates that the proposed model fits adequately. The model of analysis shows high goodness of fit, which accounts for about 0.91. This means that the proposed model of vegetable distribution channels in the study sites the overall relationship among selected variables can explain 91 per cent. Every equation that constructs the model also shows the significant level at 0.01. As well, the residuals are very small or close to zero (see: Appendices).

Figure 6 shows the significant impact of marketing channel on the performance of farm; and significant factors determining farmers to select the available channels. Marketing channel affected the price and sales. When farmers peddled their products to a high level of marketing channel, they obtained a low price. Simultaneously, the volume of sales was also lower than if they sold the products to a low level of marketing channel. This is understandable because the higher the level of marketing chains, the more margin middlemen collect. Sales led to high income generated from the farming business. This means that marketing channel provided a significant economic impact on business performance. Kamboj and Rahman (2015) suggest that price, sales and distribution are significant measures of market capability with mainly positive and significant impact on firm performance. Further implications in identified 38 different measures of firm performance were market share, sales,

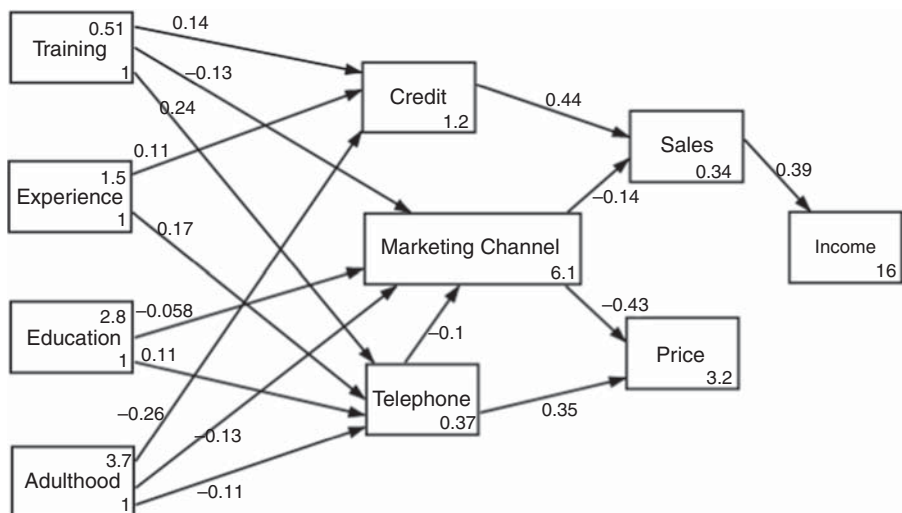


Figure 6. Significant paths of estimated model

profitability and return of investment. This finding also fits the statement of Hassan *et al.* (2017) that farm prices had a reverse relationship with marketing margins, whereas retail prices had a direct association with overall marketing margins. It suggests that stabilised prices are the prerequisite to controlling marketing margins.

Sales and price were influenced by access to credit and the use of telephone, respectively. Access to credit can improve sales because farmers used credit for productive actions. Mariyono *et al.* (2019) show that farmers used credit to finance enhanced technology, such that the productivity of farming increases. Farmers used a telephone to contact more than one buyer and to access market information. Farmers used the telephone to contact traders and this results in a high level of marketing channels. This finding also fits a study of Giziew (2013) showing that sales is influenced by household personal, demographic and socio-economic, communication and situational factors.

Training, education and adulthood affected farmers' decision to select marketing channels. Trained, educated and old farmers decided on selecting profitable marketing channels. This is understandable because the farmers' characteristics represent the quality of human capital. This finding fits studies showing that age and education have a positive impact on the farmer's choice of market channels (Sahara *et al.*, 2015; Slamet *et al.*, 2017; Zhang *et al.*, 2017). Simultaneously, the farmers' characteristics encouraged farmers to access credit and utilise the telephone, except for adulthood. Old farmers were reluctant to access credit and to use a telephone in their business.

The standardised number adjacent to the respective path shows the importance of significant factors (presented by the path or arrow). The most significant determinants in the model were a credit that affected sales; sales that determined income; and telephone that influenced the price. The most significant farmers' characteristics were adulthood that impacted access to credit; and training that affected the use of the telephone. Table II shows the actual marginal effects of each variable on other variables.

For variables measured numeric scale, the marginal effect represents the change in a unit of dependent variables as a result of a unit change in the independent variable. For example, a unit increase in marketing channel leads to five percentage points of sales. For variables measured in binary scale, the interpretation of marginal effect is the difference between category one and zero. For example, farmers who accessed credit have 25 percentage points higher than those who did not do. Note that the magnitude of marginal effect does not represent the importance because it sensitively depends on the measurement unit. The standardised coefficients indicate the significance of the effect[1].

Market impact resulting from distribution channel can arise because the price needs to move to attract other players to buy or sell the goods (vegetables in this case). From the supply side, the presence of distribution channel leads to market impact, that is, that is the effect that market participants have when they sell goods. The extended marketing channels simultaneously reduce price and trade. In the short run, Kyle's (1985)  $\lambda$  resulting from a change in price over a change in the volume of business, determines the market impact. Based on the estimated model, an increase in marketing channel leads to a change in price by 0.0432 points and a change in sales by 0.1411 points, and thus the market impact of marketing channel is about 0.3062. The meaning is that the producers reduced the trade when marketing channels become prolonged, as the price received by producers decreases. Note that market impact also arises because professional players may allocate themselves to turnover from knowledge that a large player (or group of agribusiness players) is active one way or the other. Some financial intermediaries have such low transaction costs that they can earn profit from price movements that are too small to be relevant to the majority of business players. The financial institutions need to manage the market impact to control the pace of its activity. For example, by keeping its activity below one-third of daily turnover, to avoid troublemaking the price.

Variables	Coefficient		z-value	Sig.
	Actual	Standardised		
<i>Marketing channel ←</i>				
Credit	0.0265	0.0165	0.50	ns
Telephone	-0.1421	-0.1006	-3.02	***
Training	-0.2020	-0.1280	-4.14	***
Experience	-0.0013	-0.0232	-0.66	ns
Education	-0.0126	-0.0582	-1.84	*
Adulthood	-0.0071	-0.1280	-3.63	***
Constant	3.9363	6.1266	31.59	***
<i>Credit ←</i>				
Training	0.1362	0.1381	4.67	***
Experience	0.0040	0.1139	3.32	***
Education	-0.0017	-0.0123	-0.39	ns
Adulthood	-0.0089	-0.2564	-7.76	***
Constant	0.4977	1.2397	7.85	***
<i>Telephone ←</i>				
Training	0.2650	0.2372	8.32	***
Experience	0.0069	0.1746	5.18	***
Education	0.0169	0.1105	3.60	***
Adulthood	-0.0044	-0.1121	-3.32	***
Constant	0.1668	0.3668	2.29	**
<i>Sales ←</i>				
Marketing channel	-5.1603	-0.1411	-5.14	***
Credit	25.5647	0.4366	17.51	***
Constant	80.5751	3.4280	21.29	***
<i>Price ←</i>				
Marketing channel	-0.0495	-0.0432	-1.68	*
Telephone	0.5681	0.3515	12.86	***
Constant	2.3651	3.2169	18.25	***
<i>Income ←</i>				
Marketing channel	-0.0230	-0.0163	-0.56	ns
Sales	0.0149	0.3874	9.09	***
Price	0.0051	0.0041	0.09	ns
Constant	14.0771	15.5407	33.6	***
Observations	556			
Overall $R^2$	0.91			
	$\chi^2$ of overall test for $H_0: \alpha_i = \beta_i = \delta_i = \gamma_i = k_i = \lambda_i = 0$		1,648.50	***
<b>Table II.</b> Estimated model of analysis	<b>Notes:</b> Variables followed by ← denote dependent variables. *, **, ***Significant at 10, 5 and 1 per cent levels, respectively			

In summary, the distribution channels have a vital function in the development of vegetable farming as one of the main obstacles to market development is the relatively low accessibility at the local communities. Market development is dependent on how farmers will select and distinguish optimal distribution channels for their products. For smallholders, it is strongly advocated to keep a closer connection with the end-users, directly using distribution channels, without the intervention of intermediaries such as peasant markets and shops at the farm gate. If large farms that produce crops requiring special storage facilities, the use of indirect distribution channels, through which can be traded large quantities of goods is highly recommended. These types of marketing channels include specialised organic shops, supermarkets, food processing companies and other



various mediating traders (Atănăsoaie, 2011). Suitable selection of distribution channels enables farmers to get reasonable prices leading to high profit, and this leads to the improved well-being of the farmer households. A study shows that strong relationship of farmers with consumers adjacent to markets and wholesalers nearby to towns positively affects the welfare of farming households, which is indicated by increased consumption expenditure per capita relative to brokers at the farm gate (Mmbando *et al.*, 2017). Srimanee and Routray (2012) suggest that many policy gaps still exist to protect the areas of participation between public and private sectors and the interests of the farmers in expanding their benefits. Through appropriate interventions that improve the development of private traders and consequently enhancing the structure of markets, some of the margins are possibly captured by the traders could be passed on to the producers thereby improving the farm-gate prices. However, this situation relates to the quantity and quality of public goods, such as access roads and other infrastructure facilities. The current study is expected to fill the gap, particularly for the producer side.

## 5. Conclusion and policy implication

High-valued vegetables play an essential role in the Indonesian economy and public health sectors because the commodities serve as the complement foods consumed daily and in a fresh form. The economic value of vegetables is significant, and the nutritious contents of the vegetables are essential for human health. Daily sufficient consumption of vegetables supports Sustainable Development Goals that have been ratified by many countries, including Indonesia. For the supply side, high-valued vegetables have generated sufficient incomes for producers because intensive farming of vegetables is more profitable than other cereal crops. Shifting from subsistence farming to profit-oriented vegetable farming helps rural people improve their welfare resulting from high income generated from intensive farming. However, there is a marketing issue that restricts producers to obtain optimal income from farming. The issue relates to the inefficient market in terms of long distribution channels in the vegetable market.

This study finds long supply chains in the marketing of vegetables triggered market inefficiency. There were four different levels of intermediaries identified in the distribution channels. They are local collectors, district traders, wholesalers and inter-province traders. Each level of intermediaries applied a certain economic margin throughout the supply chains starting from producers to final consumers. The final consumers of raw vegetables comprised supermarkets, retailers and hotel/restaurant and food processing companies. The total margin collected by intermediaries was about 35 per cent. The existence of the intermediate agents influenced the performance of vegetable farming. The farming performance, measured with the total sales, farm-gate price and income, moderated when the producers marketed vegetables through local collectors. They received the prices lower than the average, and this condition lowered sales because they were discouraged from producing more. Automatically, the income generated from vegetable farming also declined. In the majority, producers delivered their vegetables to local collectors and district traders. Farmers perceived the distance from the big market as the cause of why they marketed the produce to local collectors.

There was a considerable opportunity to improve the performance of the business by providing special training for producers. The training, along with the use of telephone, affected farmers to select better marketing channels. Facilitation of credit and use of telephone assisted producers increased their sales and price, respectively. Since the remoteness from the wholesale markets was the primary cause, an appropriate policy to be formulated is to improve services and facilities of transportation that reduce the transportation costs. It will be a wise policy if the government establishes agribusiness centres in every potential region that produces vegetables. This policy should be supplemented with a strong regulation that

controls local collectors who operate in the agribusiness stations, such that the market impact in the sector does not go extreme. The existing cooperatives at the farm or village level need to be revitalised to replace the local collectors. Since the cooperatives belong to farmers, the marketing margin collected by the cooperatives can be set at a reasonable level, and eventually, the share of profit gained by the cooperatives goes back to farmers and the cooperative members.

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### Note

1. In the standardised measures, every variable can be easily comparable to each other. The standardised coefficient has a standard deviation as its unit (Freedman, 2009).

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**Appendix 1. Statistical information**

Dep. variables	Fitted	Predicted	Residual	$R^2$	mc	mc <sup>2</sup>
Marketing channel	0.717	0.264	0.453	0.368	0.607	0.368
Credit	1.756	0.689	1.067	0.392	0.626	0.392
Telephone	1.985	0.070	1.915	0.035	0.188	0.035
Price	0.532	0.157	0.376	0.294	0.542	0.294
Sales	530.71	419.97	110.736	0.791	0.890	0.791
Income	0.845	0.607	0.238	0.718	0.847	0.718
Overall				0.911		

**Notes:** mc is correlation between dependent variable and its prediction; mc<sup>2</sup> is the Bentler–Raykov squared multiple correlation coefficient

**Source:** Output of statistical analysis

**Table AI.**  
Equation-level goodness of fit

**Appendix 2**

Observed	$\chi^2$	df	$p > \chi^2$
Marketing channel	216.93	6	0.000
Credit	217.14	4	0.000
Telephone	13.21	4	0.004
Price	159.32	2	0.000
Sales	1,429.87	2	0.000
Income	893.08	3	0.000

**Source:** Output of statistical analysis

**Table AII.**  
Wald tests for equations

Appendix 3

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Fit statistic	Value	Description
<i>Likelihood ratio</i>		
$\chi^2$ (18) for model	231.70	Model vs saturated
$p > \chi^2$	0	
$\chi^2$ (38) for baseline	1,880.16	Baseline vs saturated
$p > \chi^2$	0	
<i>Population error</i>		
RMSEA	0.075	Root mean squared error of approximation
90% CI, lower bound	0.082	
upper bound	0.108	
pclose	0	Probability RMSEA $\leq$ 0.05
<i>Information criteria</i>		
AIC	20,100.05	Akaike's information criterion
BIC	20,305.57	Bayesian information criterion
<i>Baseline comparison</i>		
CFI	0.901	Comparative fit index
TLI	0.835	Tucker–Lewis index
<i>Size of residuals</i>		
SRMR	0.058	Standardized root mean squared residual
CD	0.911	Coefficient of determination

**Table AIII.**  
The goodness of fit statistics

**Source:** Output of statistical analysis

Appendix 4

No.	Variables	1	2	3	4	5	6	7	8	9	10
1.	Marketing channel	0.001									
2.	Credit	0.004	0								
3.	Telephone	0.006	0.055	0							
4.	Sales	0.094	-0.013	0.046	-0.073						
5.	Price	0.003	0.081	0	0.034	0					
6.	Income	0.001	-0.011	0.085	-0.043	0.215	-0.015				
7.	Training	0	0	0	0.053	0.082	0.052	0			
8.	Experience	0	0	0	-0.015	-0.758	-0.012	0	0		
9.	Education	0	0	0	0.121	-0.084	-0.024	0	0	0	
10.	Age	0	0	0	0.018	0.094	-0.017	0	0	0	0
	Mean residuals	0	0	0	0	0	0	0	0	0	0

**Table AIV.**  
Covariance and mean residuals

**Source:** Output of statistical analysis



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