

Supply chain analysis of fresh fruits and vegetables (FFV): Prospects of contract farming

Analýza nabídkového řetězce čerstvého ovoce a zeleniny: perspektivy smluvní zemědělské produkce

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Abstract: The paper examines the factors that lead farmers to participate in the contract farming in the Peninsular Malaysia. The primary data was collected through a survey using a questionnaire on the total of two hundred and eight farmers from various states in Malaysia. The study utilizes the stratified sampling method. Both descriptive and inferential statistics were used to analyze the data. The survey identified forty-one contract farmers. Factor analysis was carried out to identify the factors that lead farmers to participate in the contract farming. Based on the analysis, five factors were identified as the reasons for contracting, namely, market stability, and access to marketing information and technology, transfer of technology to improve farming practices, access to inputs and indirect benefit. Contract farming or contract arrangements can be a valuable source of an additional income and knowledge that can be employed to enhance the productivity of the entire farming enterprise.

Key word: supply chain, contract farming, contract farmers, factor analysis

Abstrakt: Práce se zabývá zkoumáním faktorů, které vedou farmáře k tomu, aby participovali na smluvní zemědělské produkci na Malajském poloostrově. Primární data byla získána formou dotazníkového výzkumu u celkového počtu 208 farem z různých států Malajsie. Autoři pracovali s metodu stratifikovaného vzorku, při analýze dat s deskriptivní a inferenční statistikou. Výzkum identifikoval čtyřicet jedna farmářů v hospodařících v systému smluvní produkce. K identifikaci faktorů, jež vedou farmáře k tomu, aby participovali v systému smluvní zemědělské produkce, pracovali s faktorovou analýzou. Na základě této analýzy bylo identifikováno pět faktorů, jež vedou ke smluvní zemědělské produkci, a to zejména tržní stabilita, přístup k marketingovým a technologickým informacím, transfer technologií ke zlepšení systému hospodaření, přístup k inputům a nepřímé benefity. Smluvní zemědělská produkce nebo smluvní uspořádání mohou být cenným zdrojem dodatečného příjmu a informací, které se mohou využít k dalšímu zvýšení produktivity celého zemědělského podniku.

Klíčová slova: nabídkový řetězec, smluvní zemědělská produkce, smluvní farmáři, faktorová analýza

One of the results of globalization and trade liberalization is the influx of multinational companies into the local retail sector through the establishment of “super retailers” (or hypermarkets) with different supply chain management practices (Fatimah et al. 2006).

The rise of highly consolidated and concentrated retail chains in some parts of the world has been shown to change the market structure, competition, the buyer-supplier relationships, price levels to consumers and producers, marketing efficiency, the product growth

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and innovations. While the evidences are not consistent between countries, its impact on developing economies like Malaysia is yet to be verified. Some of the observed impacts of the rise of the consolidated retail chains in developing economies include: marginalization of small market intermediaries and farmers, lower prices both to farmers and producers and introduction of market innovations such as new services, products and retailing technology.

The diffusion of the new supply chain management (SCM) and its demand on the high quality produce has not been smooth. There are evidences to show that small farmers are not able to meet the strict quality requirement of these retail chains. For instance, in Malaysia the Giant Supermarket Chains had 200 vegetable suppliers in 2001, but by 2003 this was down to 30 (Reardon et al. 2003). Likewise in Thailand, the number of vegetable suppliers to the Top Supermarket (Ahold chain) fell from 250 to 60. The new supply chain management (SCM) system focuses on the consumers' preferences and needs, high quality packaging and branding system, efficient logistics and procurement, high value-added products and lower operating costs. With the current structural problems that are prevailing in the small farm sector, it posts the questions as to the ability of the small farmers to meet the rigid demands of the buyers i.e., large retailers. One possible mechanism for improving the livelihood of rural smallholders is to link the farmers to the market and to provide them with the benefits of economic liberalization via the contract farming. Through contractual arrangements, agro-industry can assist smallholders to shift from the subsistence or traditional agriculture to the production of export-orientated, high-value products.

Contract farming is an intermediate production and marketing system that spreads the production and marketing risks between the agribusiness and smallholders. It can be regarded as a means of reducing high transaction costs that result from the failure of the market and/or government to provide the required inputs (e.g. credit, insurance, information, infrastructure and factors of production) and the lack of market institutions.

The emergence of contract farming as an institution for facilitating market exchange is not a recent phenomenon. For decades, contract farming has been used as a supply chain governance strategy in response to the market and institutional failures that characterize the agricultural sector in different stages of development. While contract farming itself has been around for a long time, its importance as a tool for transforming the subsistence to commercial farmers and thus contributing to the poverty reduction has

only been reviewed in the recent years. Therefore, this study examines the marketing practices of fresh fruits and vegetables in the Peninsular Malaysia especially on contract farming in the context of the new supply chain management.

LITERATURE REVIEW

Contract farming is frequently mentioned as a substitute for poorly functioning or absent markets. Contract farming is an agreement between a farmer and a firm – either a simple verbal commitment or one based on written documents – where the farmer produces a fresh or partially processed product and the firm is committed to buying it under certain stipulated conditions (Glover and Kusterer 1990; Grosh 1994). Contract farming serves as an economic institution operating between spot markets and vertical integration (Grosh 1994; Key and Runsten 1999), and arises as a response to the selective or simultaneous market failures for credit, insurance, information, factors of production or products (Key and Runsten 1999). Contracts are one of the various ways of coordinating economic activities between a farmer and a processing firm, thus enforcing a certain type of the supply chain management for the given commodity (Hobbs 1996).

There are a number of types of contractual arrangements which can differ in the conditions of price and payment, the services provided, the quality and production requirements and the input supply provisions (Grosh 1994). The choice of a contract depends on the characteristics of the parties and the market where they interact.

The effectiveness of contract farming can be considered from the perspective of the farmer and of the trading firm. Firms can use a variety of institutional arrangements to obtain raw products for processing or marketing, relying on different degrees of vertical co-ordination and the related governance structures. One extreme is the *spot market*, where the transaction takes place among several actors and the price is set during the transaction. The firm does not participate at all in the production process and all other aspects of the transaction (i.e. quality, quantity, and timing) are non-negotiable. In this situation, there is no real supply chain management (Hobbs 1996). The other extreme position is the full *vertical integration*, where there is a continuous flow of products and information during different stages of the supply chain and the transactions follow a corporate-based scheme rather than a negotiating party's scheme. Here, the firm has a complete control over production.

Contract farming takes an intermediate position allowing the firm to participate and thus to exert different levels of control over the production process without formally owning or operating the farms. It is mainly a way to distribute the activities in the supply chain and the corresponding risk between the firm and farmers. The farmer bears most of the production risks and the firm most of the processing and marketing risks. The exact allocation of risk depends on the specifications of the contract. The firm chooses an optimum contract considering the transaction costs and profit (Key and Runsten 1999), depending on the prevailing market uncertainty related to the transaction, the degree of the asset specificity (influencing its bargaining position), the frequency of the transactions (Hobbs 1996), and the monitoring costs surrounding the production process (Singh 2002).

In general, contracts can be classified into three categories which are not mutually exclusive: (1) Market specification contracts, (2) production management contracts and (3) resource providing contracts (Minot 1986; Williamson 1991; Hobbs 1996; Key and Runsten 1999; Singh 2002). *Market specification or procurement contracts* are simple pre-harvest agreements where the firm commits to provide a market outlet for the farmer (Hobbs 1996). Usually, there are stipulated the conditions regarding price, quantity, quality, and timing (Singh 2002). The farmer reduces the market and price uncertainty and transfers it to the firm without losing the control of the production process (Hobbs 1996). *Production management contracts* require the farmer to adopt specific growing practices, input regimes and post-harvest management practices under the technical supervision of the firm. *Resource-providing contracts* require the firm not only to provide a market outlet for the farmer's production, but also to deliver specialized input packages and supervision to the production process. Hence, the firm obtains a full control of the farm and the farmer almost becomes an employee.

Resource-providing contracts are the closest situation to the full vertical integration (Hobbs 1996; Key and Runsten 1999; Singh 2002). The selection of any of these contractual forms varies according to the type of commodity, the characteristics of the agents, and the market conditions for the given period of time (Hill and Ingersent 1982; Key and Runsten 1999). However, there are many different variants of contracts that can be derived from the aforementioned three main categories, and empirical analyses have focused on the specific situations rather than on a generic contract institution (Singh 2002).

While the firm decides on its organizational strategy, the farmers, in turn, can choose to engage in a

contract or to sell the harvest by some other way. The decision of farmers to accept a contract typically depends on their attitude towards risk and on the specific market failures that they face. Since the contract guarantees the farmer an outlet, marketing risks are reduced.

Contracts have the potential to provide the mechanisms for the incorporation of small and low income farmers into the market economy (Glover 1984; Key and Runsten 1999). However, several authors argue that contracts could also lead to the market segmentation and exclusion, thus generating more negative than positive effects on farmers (Glover and Kusterer 1990; Grosh 1994; Little 1994; Porter and Phillips-Howard 1997; Torres 1997; Siddiqui 1998).

Contract farming reduces marketing risk and stabilises the farmers' income, and, in this sense, the agribusiness partner provides a form of insurance (Featherstone and Sherrick 1992; Watts 1994; Jackson and Cheater 1994; Runsten and Key 1996; Flaskerud and Klenow 1999; Martin 1999; Sofranko et al. 2000). Marketing risk is reduced as a result of the agribusiness contract to purchase the output of the farmer and the income is stabilized because of the repetitive nature of required deliveries and payment. At the same time contracts may simplify production and marketing decisions thus improving the farmer's effectiveness. The reduction of marketing risk through the demand assurance embodied in a contract is also appealing to farmers producing products where the markets are thin (Hudson 2000).

DATA COLLECTION AND METHODOLOGY

The survey was conducted over the period April 2007–July 2007 in the Peninsular Malaysia, in seven states where the production of fresh fruits and vegetables is important (Kedah, Kelantan, Terengganu, Pahang, Perak, Selangor and Johor). A semi-structured questionnaire was designed to collect the primary data. The total of two hundred and eight fresh fruit and vegetable (FFV) farmers were personally interviewed. There were forty-one farmers which engaged in the contract arrangements. This paper will focus on these forty-one contract farmers. The Descriptive Analysis and Factor Analysis were carried out to analyze the data in detail.

RESULTS AND DISCUSSION

The empirical results and discussions are presented in the following two subsections. In the first subsec-

tion, the descriptive analysis was used to summarize the profile of respondents. The next section provides an analysis on the actors that motivate the contract farmers to engage in contractual arrangements.

Descriptive analysis

Two hundred and eight farmers were interviewed, of which forty-one farmers were involved in contract farming. Table 1 shows the demographic profile of the contract farmers from seven selected states. Table 1 illustrates that more than one third (36.6%) of the farmers were in the age category between

41–50 years. 26.8% of the farmers were from 31–40 years old category, while about 17.1% of the farmers were from the age category of less than or equal to 50 years. The finding shows that about 63.4% of the farmers from the age category of 31–60 were actively involved in farming in the Peninsular Malaysia. In terms of gender, 38 (92.7%) were male and 3 (7.3%) were female. Regarding their ethnic structure, 30 (73.2%) were Malay farmers, 8 (19.5%) were Chinese farmers, 2 (4.9%) were Indians.

In terms of education, the findings showed that 2 (2.4%) of the farmers have never been to school, 12 (29.3%) of them passed primary education, 21 (51.2%) of them went to secondary school and 6 (14.6%) of them had tertiary education. A total of 37 (90.2%) farmers were involved in full time farming, while 4 (9.8%) of them were part-time farmers.

In terms of experience, 12.2% of them had been involved in farming for 1–10 years. 31.7% were involved for 11–20 years. Only about 2.5% of the farmers had been farming for more than 41 years. About 31.7% of the respondents were involved in farming for 11–20 years.

In terms of the types of contract, the majority of the farmers were involved in marketing contract and about 26.8% of the farmers involved in production contract. A total of 73.2% of the farmer dealt verbally with the sponsors and 26.8% of the respondents signed formal contract arrangements.

Factor analysis

Factor analysis was used to examine the interrelationship among the explanatory variables. Factor analysis refers to a variety of statistical techniques whose common objective it is to represent a set of variables in terms of a smaller number of hypothetical factors. The basic assumption of factor analysis is a linear combination of the factors that are not actually observed.

The factor analysis of the 18 statements was conducted using the principal component method. The criterion for the number of factors to be extracted was that the eigenvalue of each factor had to be equal or higher than one. The extracted factors were then rotated by the varimax method. Each of 18 statements was assigned to the factor which had the highest correlation.

Measure of sampling adequacy

Table 2 illustrates the Bartlett's test of sphericity and the Kiaser-Meyer-Olkin (KMO) test of sampling adequacy which were initially performed on the data

Table 1. Demographic profile of the respondents

Variables	Frequency (<i>n</i> = 41)	(%)
Age		
21–30	5	12.2
31–40	11	26.8
41–50	15	36.6
51–60	7	17.1
> 61	3	7.3
Gender		
Male	38	92.7
Female	3	7.3
Ethnic origin		
Malay	30	73.2
Chinese	8	19.5
Indian	2	4.9
Others	1	2.4
Education level		
No education	2	4.9
Primary	12	29.3
Secondary	21	51.2
Tertiary education	6	14.6
Farming status		
Full time	37	90.2
Part time	4	9.8
Number of years of farming		
1–10	5	12.2
11–20	13	31.7
21–30	13	31.7
31–40	8	19.5
> 41	2	4.9
Type of contract		
Production	7	17.1
Marketing	34	82.9
Types of contract arrangement		
Formal	11	26.8
Verbal	30	73.2

Table 2. KMO and Bartlett's test

Kaiser-Meyer-Olkin measure of sampling adequacy	0.689
Bartlett's test of sphericity	
Approx. Chi-square	619.313
Degrees of freedom	171
Significance	0.000

and confirmed the appropriateness of conducting the Principle Component Analysis (PCA) (Tabachnick and Fidell 2001). The Bartlett's test for sphericity showed that the correlation matrix was at an appropriate level to perform the factor analysis on the data for each scale, with all scales reaching the significance level of $P < 0.000$. The KMO measure provides a value between 0 and 1. Small values for the KMO indicate that the factor analysis of the variables may not be appropriate,

since the correlations between the variables cannot be explained by the other variables (Norušis 1993). Values higher than 0.6 are considered satisfactory for the factor analysis. The KMO test for our set of the predetermined variables reached the values of at least 0.689. Once the sampling adequacy was confirmed, the factor analysis can be carried out as a proper analysis.

In order to categorize the items in terms of the smaller set of cross-cutting themes, that are any underlying latent constructs, the data were subjected to the Principle Component Analysis (PCA). A total of five of the identified factors had the eigenvalues exceeding one, collectively accounting for 76.8% of the variation across the sample.

The factor loadings were subsequently subject to the varimax rotation. The resultant factor loadings are reported in Table 3. The factor analysis uncovered five broad reasons for contracting. These are described and interpreted in turn below.

Table 3. Summary of factor analysis on respondent's reasons for contracting

Factors and sub-variables	Sub-variables loading	Variance (% of explained) eigenvalues
Market stability		39.824
Reduce marketing risk	0.856	
Secure income	0.853	
Gain access to market	0.801	
No need to worry about marketing of produce	0.788	
Improve quality of produce	0.749	
Buyers normally undertake to purchase all produce	0.608	
Access to marketing information and technology		14.830
Easy access to marketing information	0.776	
Access to managerial, technical and extension services	0.770	
Introduction to appropriate technology to upgrade agricultural commodities	0.673	
Transfer of technology to improve farming practices		9.991
Efficient use of farm resources	0.869	
Skill transfer such as record keeping	0.862	
Access to inputs		6.850
Gain access to loans or credit to finance production inputs	0.846	
Inputs and production services are supplied by the buyer	0.697	
Reliable supplies of inputs	0.650	
Guaranteed minimum prices	0.543	
Indirect benefits		5.324
Protect farmers from incurring losses	0.873	
Access to new market opportunities	0.684	
Improve method of applying chemicals and fertilizers	0.597	

Factor 1 – Market stability: The issues that loaded most heavily on this factor, which explained 39.8% of the variation, were “reduce marketing risk”, “stable income”, “gain access to markets”, “no need to worry about marketing of produce”, “improve quality of produce” and “buyers normally undertake to purchase all produce”. *Reduce marketing risk* has the highest factor loadings (0.856). This is followed by *secure income* (0.853), *gain access to market* (0.801), *no need to worry about marketing of produce* (0.788), *improve quality of produce* (0.749) and *buyers normally undertake to purchase all produce* (0.608). It appears that most of the farmers were risk averse; therefore, contract farming gives the security in terms of the secured market for their produce. Beside that, the poor performance of the traditional marketing systems and the marketing risk made the secure income from contract farming especially appealing.

Factor 2 – Access to marketing information and technology: The issues that loaded most heavily on this factor, which explained 14.8% of the variation, were “easy access to marketing information”, “access to managerial, technical and extension services” and “introduction to appropriate technology to upgrade agricultural commodities”. *Easy access to marketing information* has the highest factor loadings (0.776). This is followed by *access to managerial, technical and extension services* (0.770) and *introduction to appropriate technology to upgrade agricultural commodities* (0.673). The farmers indicated that they can gain an easy access to the fresh produce marketing information regarding price and production and marketing practices. Besides they even receive extension services from the buyer in terms of planting the crops. This primarily ensures proper crop husbandry practices. Contracting was seen to provide a reliable and up-to-date source of agronomic advising.

Factor 3 – Transfer of technology to improve farming practices: The issues that were loaded most heavily on this factor and which explained 10.0% of the variation were “efficient use of farm resources” and “skill transfer such as record keeping”. *Efficient use of farm resources* has the highest factor loadings (0.869) followed by *skill transfer such as record keeping* (0.862). Farmers also indicated that they were taught how to utilize the farm resources and record keeping. Farmers indicated that participating in contract farming helps them to improve the farming practices which they can apply to increase their farm production.

Factor 4 – Access to input: The issues that were loaded most heavily on this factor, which explained 6.9% of the variation, were “gain access to loans or credit to finance production inputs”, “inputs and production services are supplied by the buyer” and

“reliable supplies of inputs and “guaranteed minimum prices”. *Gain access to loans or credit to finance production inputs* has the highest factor loadings (0.846). This is followed by *inputs and production services are supplied by the buyer* (0.697) and *reliable supplies of inputs* (0.650) and *guaranteed minimum prices* (0.543). Farmers indicated that through contract farming, they easily can get access to inputs such as the seeds, fertilizers and pesticides.

Factor 5 – Indirect Benefits: The issues which loaded most heavily on this factor and which explained 5.3% of the variation, were “protect farmers from incurring losses”, “open new markets” and “improve method of applying chemicals and fertilizers”. *Protect farmers from incurring losses* has the highest factor loadings (0.873). This is followed by *access to new market opportunities* (0.684) and *improves method of applying chemicals and fertilizers* (0.597). Farmers indicated that contract farming safeguards them from market volatility.

Reliability analysis

Before any conclusive discussion on the factor which has been generated by the factor analysis can be done, a reliability test needs to be conducted. The Cronbach's alpha is an index of reliability associated with the variation accounted for by the true score of the “underlying construct”. The construct is the hypothetical variable that is being measured (Hatcher 1994).

From the analysis, the internal reliability for all the five factors has been tested and the alpha scores for each factor are presented in Table 4. The reliability test for the factor shows that the final range for the alpha score is more than 0.7 to 0.9. It meets the Peter (1979) and Churchill and Peter (1984) criterion, where those reliability levels that are lower than 0.5 might be acceptable in social sciences which means that those statements should be retained in the scale.

Table 4. Internal reliability analysis on factors that engage farmers in contract farming

Factor	Alpha scores	Number of item
Market stability	0.896	6
Access to marketing information and technology	0.845	3
Transfer of technology to improve farming practices	0.903	2
Access to inputs	0.798	4
Indirect Benefit	0.705	3

CONCLUSION

The paper has identified five factors that lead farmers in the Peninsular Malaysia to participate in contract farming of fresh fruits and vegetables (FFV) in the context of the new supply chain. These are market stability; access to marketing information and technology; transfer of technology to improve farming practices; access to inputs; and indirect benefit. From the findings, the evidences show that contract farming can help the farmers to gain a better knowledge in the cultivation practices; it can easily obtain access to the marketing information; to market their produce more easily; and it utilizes the farm resources. At the same time, contract farming or contract arrangements can be a valuable source of knowledge that can be employed to enhance the productivity of the entire farming enterprise.

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