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A Marketing Information System for Citrus Crops in the Lattakia Region, R. A. Syria

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Declaration

I, Haiyan Sulaiman do hereby solemnly declare that the work entitled: "A Marketing Information System for Citrus Crops in the Lattakia Region, R. A. Syria", and the results reported here in were carried out solely by me under the guidance and supervision of doc. Ing. Jan Banout, Ph.D., and Co-supervision of doc. Dr. RNDr. Tomáš Ratinger, of the Faculty of Tropical AgriSciences and further declare that this work has not been submitted to any other university and/or research institution for consideration and/or award of a degree and/or academic qualification.

In Prague 6 - Suchdol, 2nd of May 2017

Signature……

Ing. Haiyan Sulaiman

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Agricultural Marketing Information Services	AMIS
Marketing Information System	MIS
Food and Agricultural Organization	FAO
Syrian Economic Committee	SAC
Central Bureau of Statistics	CBS
Department of Agricultural Economics	DAE
Ministry of Agriculture and Agrarian Reforms	MAAR
Millennium Challenge Account	MCA
Catholic Relief Services	CRS
International Fund for Agricultural Development	IFAD
International Institute for Tropical Agriculture	IITA
Forum for Agricultural Research in Africa	FARA
International Development Research Centre Canada	IDRC
The Syrian Citrus Board	SCB
Supreme Agricultural Council	SAC
Information and Communication Technologies	ICTs
Agricultural Marketing Office	AMO
National Agricultural Marketing Council	NAMC
Food and Agricultural Organization	FAO
Millennium Development Goals	MDG
United States Department of Agriculture	USDA
International Statistical Institute	ISI
Non-Governmental Organizations	NGOs
Extension Services Offices	ESO
World Trade Organization	WTO
Citrus Board Directorate	CBD

Abstract

Syria is a Mediterranean country where agriculture plays a key role in enhancing the national economy through its multiple contributions to the economic and social development processes. Citrus represents one of the most important crops in the Syrian Arab Republic, consumed both as a fresh fruit and/or a citrus juice. Citrus production provides an important source of income for more than 35,000 Syrian farming families located in the coastal governorships of Lattakia and Tartous. However, citrus farmers in Syria have been facing some urgent problems influencing their production, such as a lack of sufficient access to information sources on (i) markets particularly in rural areas, (ii) relevant sources of such information to citrus producers, and (iii) about the situation at local markets and their trends. Furthermore they lack a suitable storage and sorting facilities, face insufficient financial support and training, which also represent detrimental barriers for small-scale citrus farmers. Therefore, most farmers cannot find the right markets at the right time with the result that frequent fluctuations in citrus supply and demand and significant differences in prices across the local markets regularly occur. This is why an effective Marketing Information System (MIS) needs to be created for the region, particularly to eliminate the high fluctuation in citrus prices during the marketing season, issuing from the existing information asymmetry across markets and stakeholders. Research combined the analysis of secondary data gathered from government and administrative institutions with primary data gathering during the period between 2012-2013 among 400 citrus farmers and 100 market agents and their evaluation. Results documented price fluctuation of citrus products at markets in study area in order to create effective market information system. Secondly, value-chain analysis and added value distribution among farmers was documented. Lastly, a prototype of Marketing Information System was tested with special regard to income increase. This research considers the implementation of a Marketing Information System as a complementary tool for the post-war reconstruction of citrus producing districts in order to take advantage of information and communication technologies such as mobile phones to improve the position of the farmers in local, national, as well as export markets.

Key words: farmers, sources of information, markets, supply and demand, fluctuation, Lattakia, Syria.

Abstrakt

Sýrie, země na pobřeží Středozemního moře, je místem, kde zemědělství hraje klíčovou roli v národní ekonomice díky mnohonásobnému přispění k ekonomickému a sociálnímu rozvoji. Citrusy jsou důležitou plodinou v Syrské arabské republice; konzumují se jako ovocné plody a rovněž v podobě ovocných džusů. Pěstování citrusů znamená významný zdroj příjmů pro více než 35, 000 farmářů hospodařících v pobřežním guvernérství Lattakia a Tartous. Mezi hlavní problémy, jimž pěstovatelé citrusů v Sýrii čelí, patří: nedostatečný přístup k informacím týkajících se zemědělství, nedostatek informačních zdrojů vztahujících se k pěstování citrusů a informací vztahujících se k situaci na místním trhu a aktuálním tržním trendům, dále nedostačující skladovací prostory a třídící zařízení. Také neuspokojivá finanční podpora a zaškolení znamená pro drobné pěstovatele citrusů překážku. Z těchto důvodů není většina farmářů schopna se uplatnit na trhu v pravý čas, což má za následek časté kolísání v nabídce a poptávce a rozdíly v cenách na místních trzích. Z výše uvedených důvodů je třeba v regionu vytvořit Obchodní informační systém, který by eliminoval kolísání mezi poptávkou a nabídkou a výskyt rozdílů v cenách napříč místním trhem, který vzniká kvůli informační asymetrii mezi všemi zúčastněnými stranami na trhu s citrusy. Tento výzkum byl prováděn v období 2012-2013. Výzkum považuje Obchodního informačního systému jako doplňkový nástroj poválečné rekonstrukce citrusových oblastí, který umožní využívat informace a komunikační technologie jako jsou mobilní telefony za účelem zlepšení postavení citrusových farmářů na trhu národním, ale také na místních a vývozních trzích.

Klíčová slova: zemědělci, zdroje informací, trzích, nabídka a poptávka, kolísání, Lattakia, Sýrie.

Content of the thesis

1. Introduction

Syria is a Mediterranean developing country characterized by a Mediterranean climate of rainy winters and hot summers separated by two short transitional seasons (autumn and spring). Agriculture plays a key role in enhancing the national economy through its multiple contributions to the economic and social development processes of the country as measured by Gross Output (GO), GDP, and employment, as well as its effects on non-agricultural activities such as marketing, processing and the provision of the raw materials necessary for the agro-industry, its influence on the trade of non-agricultural commodities and services, its role in attaining food security and its impact on sustaining the environment.

Citrus**,** which originated in the Himalaya an area and near South-Central China, spread to the Mediterranean basin only later and in different periods of recorded history (Andrews, 1961) finding ideal conditions for growth in the area, so that today the Mediterranean basin is one of the most important production areas in the world, covering about 12% of the surface area and concentrating 18% of production and exporting more than half of the overall citrus fruits exchanged in the world (FAOSTAT, 2012).

Citrus fruit is characterized by fragrant flowers and edible juicy fruit. Citrus is an important crop in the Syrian Arab Republic, consumed both as fresh fruit and as citrus juice. Citrus production provides an important source of income for more than 35,000 Syrian farm families located in the coastal governorships of Lattakia and Tartous, where it grows on the coastal plain (zone 1 in the Agro Ecological Classification of Land Use) (CBS, 2012). Syria's citrus accounted for some 5% of the value of national agricultural output, 1.3% of GDP, 20% of the value of national fruit and vegetable exports, and about 0.9% of the total world production which was about 125 million tons of citrus fruits (CBS, 2012).

In recent years, a small proportion has been exported, and from 1 to 2% has been used for processing into juice that has been consumed mainly within Syria. Today, the

most important commercial types include oranges, grapefruit, lemons, tangerines and to a lesser extent, tangelos. Oranges account for the greatest value in terms of production, followed by grapefruit, lemons and tangerines.

2. Literature review

In this literature review, I tried to update my understanding of Agricultural Marketing Information Systems and their significance for citrus marketing in the Lattakia region. Research methods used in previous works were identified; these were helpful in finding answers to our questions on the topic. Also, the questions that needed to be asked were inferred, and the findings of other authors were used in comparison with our own research findings. Agricultural marketing covers the services involved in moving an agricultural product from the farm to the consumer. It includes many interconnected activities, such as planning production, growing and harvesting, grading, packing, transport, storage, agro- and food processing, distribution to the available markets, advertising and sale. Some definitions would even include "*the acts of buying supplies, renting equipment, (and) paying labour*", arguing that marketing is everything a business does. Such activities cannot take place without the exchange of information and are often heavily dependent on the availability of suitable finance (FAO, 2000).

2.1 The importance of Marketing Information System

Transfer of state-sponsored marketing countries, and especially those who are in transition from a planned economy to liberalization and privatization, has caused a reduction in government control on producer and consumer prices, a decrease in government subsidies such as inputs and the encouragement of the private sector to investment more with the liberalization of the market and a reduction in export taxes. So, to accommodate this new environment and to create a competitive market as is the case in Western states, government support should be provided. This is true, even for countries in which the private sector has always played a thriving role in agricultural marketing; there is a need for official support such as infrastructure provision, marketing extension and Marketing Information Services (MISs) which help farmers link to the market.

Shepherd (1997) said the provision of efficient market information has positive benefits for farmers, traders, policy makers and governments. The role of marketing information systems role in improving rural livelihoods, market participation and rural growth in the least developed countries was confirmed by other studies (see e.g. Alemu, 2006; Boughton et al., 2007; Islam, 2010).

Historical market information is a very important source material for research and policy making, for example in price analysis and writing reports to determine seasonal market trends, forecasts for production and prices and in evaluating the market in general, which can then help in planning production storage, and dealing with delays in the harvest; and, on the other hand, up-to-date information helps farmers and traders shift production from surplus to deficit markets, which helps mitigate against variations in prices between markets (Alemu, 2006). Thus, historical information is important in conducting temporal arbitrage while, on other hand, current information is critical to spatial arbitrage (Shepherd, 1997).

When traders are fully informed about prices, they have an advantage over farmers who cannot access market information. Thus, providing market information to farmers would give them better bargaining power to negotiate with traders and lead to them receiving significantly higher prices (Courtois and Subervie, 2015). In addition, market information helps reduce information asymmetry between actors in the supply chain (Gunupudi and Rahul, 2011). With an increased flow of market information through the value chain, fair prices can be achieved for all actors, while, on the other hand, we note there is no extreme profit or loss because all the actors are aware of the latest prices (Furuholt, 2011).

A market information system, considered as a public service, requires that information be provided for free (Chogou and Gandonou, 2012), which means that it needs the support of government organizations to make it sustainable and promote the infrastructure necessary in rural areas to ensure access for the farmers to information linking them to the market (Magesa et al., 2014), which in turn helps these organizations create transparent relations with the farmers, encouraging them to take collective action with increasing numbers of agricultural cooperatives in the world, market information systems can help these cooperatives in sharing their plans,

strategies and information with farmers and, on other hand, these cooperatives can have more competitive opportunities in the market with the availability of market information (Teodosio, 2007).

Market information helps make the market system both more effective and competitive and improves its management by facilitating the organization of market processes with real data on the volume of supply, the volume of trade and pricing (Dagar, 2015). A market information system is the best way to acquaint farmers with information and communication technology by providing information services for them through these means and encouraging relationships with extension offices which provide training and other help (Kizito, 2011).

A market information system can help us achieve a cleaner environment and mitigate waste problems in the markets by disseminating current prices and advising farmers to use vegetable or fruit residues as a source of organic fertilizer (Awasthi, 2007).

2.1.1 Citrus production, fresh consumption, processing, export and import from the global perspective

Citrus production is one of the most important agricultural sectors worldwide. The long-term successful international commercialization of citrus production is, however, extremely difficult due to an array of factors including complex export barriers, unbalanced conditions in international markets due to oligopolies, hurdles to competition in certain areas, such as regional subsidies, as well as the expense of exportation and storage, with high capital inputs. Of these, the deeply cyclical nature of production plays a pivotal role as it hampers the year-round incomes of the producers. In terms of value, citrus fruits are the number one fruit crop in international commerce and thus are commodities of key developmental importance.

The production of citrus fruit on a global level saw continuous and unprecedented growth in the final decades of the 20th century, mainly due to the increase in the number of fields under cultivation and changes in consumer preferences towards more convenience- and health-oriented food consumption, and thus to increasing incomes.

There are two differentiated markets in the sector: the fresh citrus fruits market[1] and the processed citrus products market, mainly orange juice. Improvements in pricing levels, quality, promotional capacity and the technology used in processing, storage and packaging have boosted citrus juice production and the international juice trade (UNCTAD, 2011).

Citrus fruits are produced globally and according to FAO data, in 2015, 140 countries produced citrus fruits. However, the greatest part of this production is concentrated in a few areas. Most citrus fruits are produced in the Northern Hemisphere, accounting for around 70% of total citrus production, including Brazil, the Mediterranean region, China and the United States, representing more than two thirds of global citrus fruit production. The processing of citrus fruits accounts for almost one third of total citrus fruit production as more than 80% is used for the production of orange juice. With just two main players, the State of Florida in the United States and the State of São Paulo in Brazil, the orange juice market is of an oligopolistic nature, as the production of orange juice by these two players makes up 85% of the world market. The EU is the largest importer of orange juice, accounting for over 80% of world orange juice imports (FAO, 2015).

According to the FAO, the consumption of fresh oranges is declining in developed countries and is being replaced by citrus juice consumption, as well as being affected by improvements in transportation and storage favouring the availability of substitute fruits. Exports of fresh citrus fruits represent roughly 10% of total citrus fruit production. Another reason for this could be the subsidies provided to growers in developed countries.

Figure 1 shows that Brazil is the major producer of citrus, followed by China and United States. Also, China, the European Union and Brazil are ranked in the first three places in terms of the domestic consumption of fresh citrus fruit, while the United States, Brazil and the European Union are the major producers of processed citrus fruit. The major exporting countries are South Africa followed by Egypt and the

[1]Up to 98% of citrus consumption in Syria is in the fresh fruit form.

USA, while the European Union, Russia and Saudi Arabia are the major importers of citrus fruit.

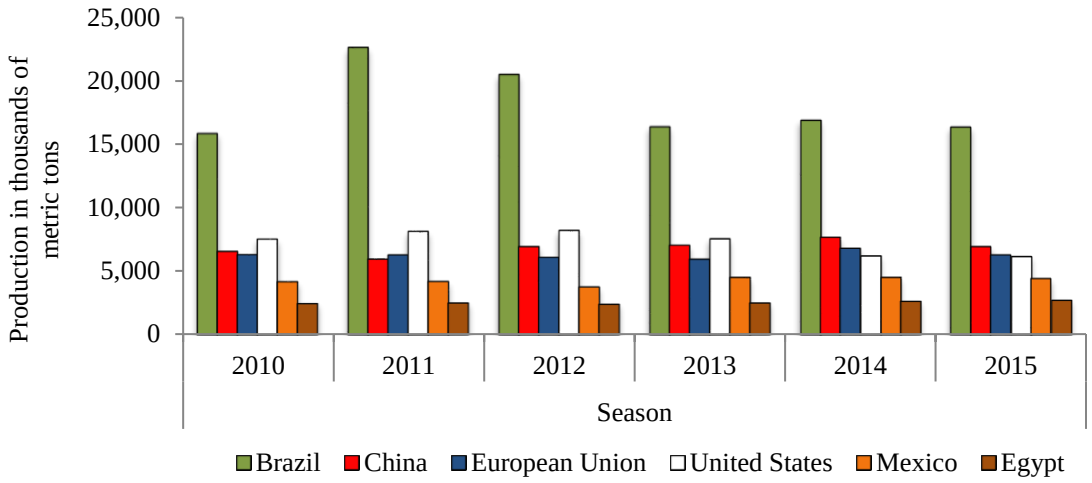


Figure 1. Six largest world producers of fresh oranges
Source: FAO (2015)

2.1.2 Citrus production, fresh consumption, processing, export and import in the Mediterranean

The Mediterranean basin is one of the most important areas in the world for citrus production, covering about 12.2% of the surface area (1.07 million hectares in 2009-2010), and concentrating 18.3% of the production (22.5 million tons), and exporting more than half of the overall citrus fruits exchanged in the world. Two thirds of the productive area for citrus fruits in the Mediterranean basin is concentrated in just four countries: Spain (27.2%), Italy (16.2%), Egypt (14.6%) and Turkey (10.3%). Generally, in the Mediterranean countries, harvested citrus production is based mainly on orange varieties (58.6% of the total) and secondly, to a less important extent, on small citrus fruits (tangerines, mandarins and clementine's) (23.2%), while the extent of lemons and limes is relatively small at 13.6% (FAOSTAT, 2012).

In the Mediterranean countries, such as Syria, citrus fruits are produced primarily for fresh fruit consumption. Export sales occur from approximately mid-October to mid-June and represent a vital source of hard currency for these economies. Destination markets are the United Kingdom, Germany, France, Ukraine and Russia for Turkey, France for Tunisia, the Gulf Arab States and Eastern Europe for Egypt, and Russia,

Holland, France, United Kingdom and Canada for Morocco (EuroMedCitrusNet, 2007).

2.1.3 Citrus production in the Syrian Arab Republic

In 2009/2010 Syria ranked in 17th position in world citrus production, producing 1,093,000 tons (FAO, 2009). Table 1 document that Syrian orange production increased from 689,751 in 2009 to 792,227 tons in 2013.

Table 1.Orange production in the Syrian Arab Republic

Year	Harvested area (ha)	Yield (kg/ha)	Production (tons)
2013	25,764	307.5	792.2
2012	25,207	215.1	542.2
2011	24,565	298.8	734.0
2010	23,187	288.5	668.9
2009	22,666	304.3	689.8

Source: own compilation based on CBS statistics data (2014)

This increase can be explained by the introduction of new varieties into production. Lemon and Lime production (Table 2) show similar tendencies; they increased from 140,647 in 2009 to 153,825 in 2013.

Table 2. Lemons and limes production in Syrian Arab Republic

Year	Harvested area (ha)	Yield (kg/ha)	Production (tons)
2013	7,250	215.3	153.8
2012	7,152	206.3	147.6
2011	6,962	232.1	161.6
2010	6,780	209.8	142.3
2009	6,456	217.9	140.7

Source: own compilation based on CBS statistics data (2014)

2.1.4 Citrus Marketing in the Lattakia Region

In the Lattakia region, there are four wholesale markets: Lattakia, Jablih, Al-Haffi, and Al-Qurdaha, with production from citrus orchards of 54%, 23%, 12% and 11%, respectively (CBD, 2012). Most of the fruits are sold in the Lattakia wholesale market, usually at the highest prices, suggesting that some additional volume of citrus fruit could be marketed there. With its extensive agricultural background, the Lattakia region is an important exporter of agricultural products such as cotton, cereals, fruit,

eggs, vegetables, and tobacco. Citruses account for about 26.25% of the total agricultural exports from the Lattakia region.

2.2 Theory of Marketing Information Systems

According to FAO (2000), agricultural marketing can be defined as "*a series of services involved in moving a product from the point of production to the point of consumption*". Kotler and Armstrong (2007) described AMIS as *"an efficient tool providing past, present and projected information relating to internal operations and external intelligence*". Nickels (1978) in his book on the Principles of Marketing states that information is a key to increasing the marketing success of all involved and defined AMIS as follows: "*A market information system (AMIS) is an important tool used by modern management to aid in problem solving and decision making*". As pointed out Barzel (1997) the flow of goods from producers to consumers and the reverse flow of revenue/income is a set of transactions (exchange of property rights), which are not without costs in the real word. These costs are associated with information as to the properties and prices of goods and AMIS could empower small farmers ensure fair distribution of incomes in the market chain and reducing transaction costs for the benefit of actors. Kotler's (1988) definition understands an AMIS as more than a system of data collection or a set of information technologies: "*A marketing information system is a continuing and interacting structure of people, equipment and procedures to gather, sort, analyse, evaluate and distribute needed, timely and accurate information for use by marketing decision makers to improve their marketing planning, implementation, and control*". The FAO (1995) defines an AMIS as "*a process of gathering, processing, storing and using information to make better marketing decisions and to improve marketing exchange*". Figure 2 presents a basic AMIS architecture as presented by (Kotler, 1997). Shepherd (1997) defines an AMIS as follows: "*A market information system (AMIS) is a service that involves the collection on a regular basis of information on prices and, in some cases, quantities of widely traded agricultural products from rural assembly markets, wholesale and retail markets, as appropriate, and dissemination of this information on a timely and regular basis through various media to farmers, traders, government officials, policy-makers and others, including consumers*".

As described in the definitions above, marketing information should be understood as "*all the data that can help those involved in production and sales to identify and meet clients' needs*". Thus, marketing information is critical to the success of any business since, in order to market goods or services effectively, the seller needs solid information about what the buyer wants. Similarly, to ensure that the most effective production and distribution methods are being used, producers need to know what their options are. Tollens (2006) says that: "*A performing market information system (AMIS) is a key accompanying measure to market liberalization*".

There are many types of marketing information that can be useful in business decision-making as mentioned by Shepherd (2007): *marketing information makes the market more transparent so that business people can make informed choices about production and sale*". Users who implement an AMIS should find that they are better able to (i) make informed marketing decisions, (ii) negotiate with others in the marketing chain, (iii) organize production and sale, and (iv) facilitate group discussion and decision-making on the market prices.

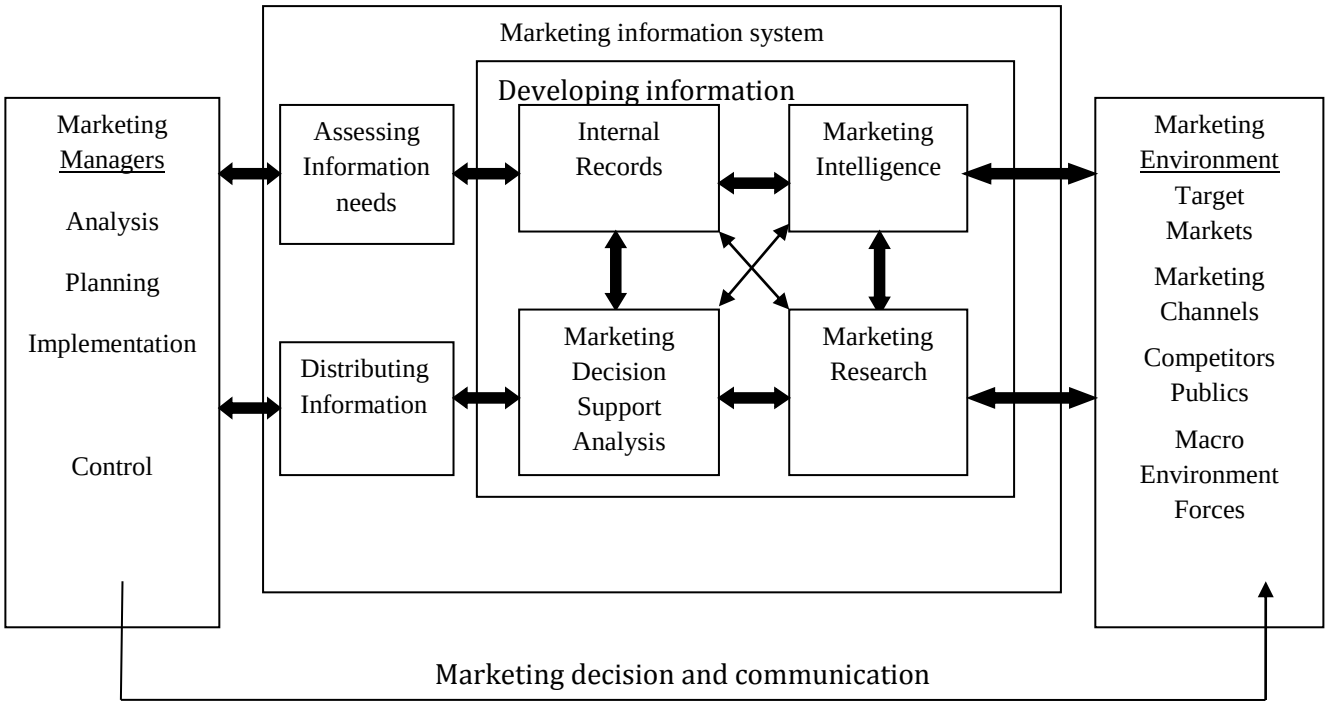


Figure 2. The basic architecture of the Marketing Information System

Source: Kotler, 1997.

Greater access to information seems to help farmers make better decisions concerning: transportation and logistics; price and location; supply and demand; diversification of their product base; and access to inputs.

2.3 Existing information systems in developing countries and their description

2.3.1 Insight into the history of AMIS

In the United States and abroad, the creation of the U.S. Department of Agriculture (USDA) touched the lives of millions of people. During its early years, the USDA was concerned primarily with agricultural production. By the early 1900s the Department became increasingly involved in the marketing of farm products.

About that time, what is now called the Livestock and Seed Program came into existence as the Livestock, Meats, and Wool Program, a part of the Bureau of Markets. The Office of Markets (the precursor of the Agricultural Marketing Service) was established in 1913 and laid the foundation for today's poultry and egg market news, standardization, and grading activities. These reporting bodies still disseminate market reports in a variety of ways: printed reports, facsimile services, automated telephone answering services, newspapers and magazines, trade publications, radio, television, and over the Internet (USDA, 2013).

The establishment of International Fund for Agricultural Development in 1977 was one of the major outcomes of the World Food Conference in 1974. The most important objectives of IFAD projects are to achieve better access of rural farmers to the markets, and to link these farmers with traders and processors by building effective market information systems (IFAD, 2003).

By the year 1980, the Science and Education Administration of US Department of Agriculture created a new system called ‘Green Thumb’, which collected information from different sources such as private companies, Extension specialists and agents; this information was received by a minicomputer at the University of Kentucky and

disseminated daily agricultural information from microcomputers located in country extension offices via home telephones and TV (Warner and Clearfield, 1982). These systems were not extended to Africa until the wave of market liberalization in the 1980s when most governments in the region stopped fixing prices via their Cereal Marketing Boards.

The successful collection and dissemination of quality information relating to the outlook for a food market cannot be realized in a timely manner without the full participation of the food market information providers and analysts. Building on and complementing existing systems, improvements in market information and transparency can be achieved through a collaborative food market data initiative.

An AMIS helps to enhance food market information, which in turn may enforce the collaboration and negotiation between producers, exporters and importing countries, commercial enterprises and international organizations. Such actions will help improve transparency and increase confidence in markets, reduce risks and provide more wealth to developing countries by improving the dissemination of necessary food market information (AMIS, 2013).

2.3.2 Steps in market information system design

The first step in designing an effective AMIS is the analysis of the basic characteristics of the actual market prices (Ramesh et al., 1997; Bouchitté et al., 2012). Another important step in the design of an AMIS is how to distribute, interpret and use the collected and processed information (Simon, 1977; Rao, 1985). This information should highlight changes in prices over time and it is generally more effective to point out trends reflecting rising and falling prices (Galtier and Egg, 1998; Demiryrek et al., 2008). Each market surveyed should have its own trend lines to show how prices in that market vary over the year. In a good AMIS, prices on different markets can be compared and analysed, to determine factors affecting prices.

However, it is important to study some experiences of AMIS creation and implementation in developing countries, before designing and implementing an AMIS for citrus crops in the Lattakia region, Syria.

The amount of time needed to accomplish each step depends on the particular situation. In some cases, groups will self-select; that is, they will request help for a specific purpose. In such cases, the facilitator may be able to assess the appropriateness of the group's request rapidly and then move directly to Step II to begin a participatory assessment of the community and its AMIS needs (FAO, 2000).

The needs of different communities will vary enormously. Identifying the AMIS participants will distinguish between two categories, operators and users. The operators are the people who actually make the AMIS work by their active involvement in designing the system and collecting and analysing information. These people will typically be organized into some sort of group to carry out the activities of the AMIS. The users are the people who use the information generated by the AMIS. They may do nothing more than glance at a notice board once a week in order to decide where to sell their produce (FAO, 2000).

An AMIS can be oriented toward the needs of small homogeneous groups or to larger groups with more diverse interests. "*It can service individual producers who have a loose affiliation as well as highly formal associations*", said Rahman (2003).

In order to design the most effective AMIS, it is essential that the participants and the facilitator have a good understanding of the strengths and weaknesses of their group. The assessment phase should not be long and drawn out. Long delays in starting the activities of the AMIS risk causing local interest to fade. It will not be possible to have information about every aspect of the local situation right at the beginning. What is important is to ensure that when new and relevant information is collected at a later point, it is integrated into the ongoing planning process. Thus, *"... any AMIS will have to be adapted and refined as it progresses and new information is taken into consideration*", Goyal (2010).

In most situations, Goyal also recommended that "*the information needed at this stage can be gathered in about three to five days*". The same technique can often be used to gather information on several different subjects. The participants and facilitator should choose the technique that they feel most comfortable with and that they think would be most effective in a given situation. Some may prefer to conduct a

series of focus group discussions and individual interviews with different members of the community. Others may prefer using a more diverse range of tools to gather information (Egyir et al., 2010; Staatz et al., 2010).

McNamara et al. (2011) admitted that ever since people have grown crops, raised livestock and caught fish, they have sought information from one another. What is the most effective planting strategy on steep slopes? Where can I buy the improved seed, or feed this year? How can I acquire a land title? Who is paying the highest price at the market? How can I participate in the government's credit program?

2.3.3 Agricultural Marketing Information Services (AMIS)

For many years, the FAO and other organizations involved with the development of agricultural marketing have advocated the establishment of Agricultural Market Information Services (AMIS) as a means of increasing the efficiency of marketing systems and promoting improved price formation (Shepherd, 1997). In the USA for example, the USDA's Agricultural Marketing Service offers an array of valuable services that give buyers and sellers of agricultural products a competitive advantage in the global market place (USDA, 2013).

An AMIS can benefit all the market chain, for example the consumer by giving him information about the products and services that have an effect upon his intention to purchase. Any attempt to apply such "intention to purchase" methods to forecast demand for proposed products or services must determine some way to convey product information to the potential consumer. Indeed, what the prospective consumer knows about the product or service is what he may infer from the information given to him by the researcher (Armstrong and Overton, 1971).

Easier access to information on markets and especially prices allows farmers get better prices within their existing trading relationships and to make better choices in terms of where they choose to sell their products. To make an AMIS more economically sustainable and effective, one has to provide basic information on prices and market conditions free to all the target participants and extension services (the results of historic data and analysis). Extension services that are provided to the target

group of farmers via these services must help them make important decisions. They might include answering specific queries or providing information on crop decisions and advice on pesticides for the farms. Some field workers can also be employed to help farmers interpret the information received from these extension services (Dinar, 1996; Davis, 2008; Labonne and Robert, 2009).

2.3.4 Information asymmetries and price fluctuations in agricultural markets

Information asymmetry arises when some party in a transaction gains advantage from having preferential access to information. In agricultural markets this asymmetry exists in the transactions between the various actors in market chains, government and policy makers (Gunupudi and Rahul, 2011) and also informational asymmetries can give rise to adverse selection in the markets (Akerlof, 1970).

Price fluctuation is a common feature of any functioning agricultural market (Addoh, 2010; Tothova, 2011). However, in under developed countries it may be both very large and volatile and may have a negative impact on the consumer's food security, the farmer's income and a country's economy (Ferris, 1998).

Elamathi (2013) says: "*... a good marketing system is one where the farmer is assured of a fair price for his produce and this can happen only when the following conditions are obtained: The number of intermediaries between the farmer and the consumer should be small; the farmer has proper storing facilities so that he is not compelled to indulge in distress sales; efficient transport facilities are available; the malpractices of middlemen are regulated; farmers are free from the control of village money lenders and regular market information is provided to the farmer*".

When farmers get better access to the price information they receive higher prices and price dispersion reduces across markets via an increased reliance on direct selling in the markets, without depending on middlemen (Goyal, 2010; Aker, 2010). The point is to avoid the information asymmetry, so farmers should keep searching about the information on market prices especially to compare prices in different markets which vary within days and weeks (Tadesse and Bahiigwa, 2015).

Having market information provides advantages for an agent, but lacking it makes his position weak and vulnerable. Measuring the spread in vertical price relationships - marketing margins - is the one of the most important indicators of the behaviours of the value chain from consumers to producers (Warsanga, 2014). If margins are too high, it indicates that the flow of information is hampered (Mitra et al., 2014) and the extent of information asymmetry and searching (Fafchamps, 2004) and the system (value chain) operates inefficiently (Phiri et al., 2013). Deepak et al. (2007) viewed marketing intermediaries in developing countries as parasites, taking advantage of farmers' weak bargaining power and poor economic conditions; marketing intermediaries harass and cheat them in different ways.

Intermediaries who purchase products at the farm-gate, commonly referred to as middlemen, provide important marketing services particularly to small farmers in developing countries who would incur high transaction costs if they had to transport small amounts of their produce to sell them in the market centres, thereby constraining the adoption of suitable and economically attractive land use systems (Bingen et al., 2003).

According to Thapa et al. (1995) and Shrestha and Shrestha (2000), traders and middlemen cheat farmers by taking advantage of their lack of knowledge of market prices, their poverty and weak bargaining power arising from illiteracy and low social status. Marketing intermediaries such as middlemen and traders are still viewed as exploiters of uneducated farmers by both national and international policymakers as reflected in publications such (MOA, 1998; Pradhan, 1998; Banskota and Sharma, 1999; Chapagain and Phuyal, 2003).

Seeking to answer the question of whether intermediaries are exploiting farmers would require an assessment of the marketing functions performed by market functionaries and analyses of marketing costs and benefits (Sidhu, 1997).

In the absence of an efficient marketing system, farmers are deprived of satisfactory income, eventually discouraging them from venturing into the cultivation of commercial crops such as fruits (Ervin and Ervin, 1982; Blaikie, 1985). Farmers may lose interest in citrus production due to low income attributed to an inefficient

marketing system (Shrestha and Shrestha, 2000; MDD, 2001). Initiatives in market information are mostly part of a broader strategy in developing countries that many governments are actively engaged in, in order to develop agricultural marketing and agribusiness processes (Clay, 2004).

2.3.5 Functioning of AMISs in developing countries

Shepherd and Schalke (1995) studied the vegetable marketing system in Indonesia. Indonesia was chosen for study because, outside of Western countries, it has one of the world's most developed market information services. The Indonesian AMIS can serve as an example of how to set up and run a successful AMIS. Tologbonse et al. (2008) in Nigeria recommended that "*the extension agent be encouraged by intensifying efforts to train and retrain them in the aspect of interpersonal skills and effort be made to emphasize and popularize the use of mediated information sources and extension research methodology in order to increase the extension coverage area which is likely to increase the farmers assess to needed information*". In Malaysia, Hassan et al. (2012) showed that television is seen as less credible in terms of providing information at the right time, and is unable to provide all the necessary information. In the case of Pakistan, Naveed et al. (2012) pointed out that Pakistan's farmers obtain their agricultural information mainly from other persons such as interpersonal friends, relatives and neighbours. The other sources of information such as agricultural extension, mass-media, both print and electronic were used less than expected. Also, he concluded that it is necessary to construct an information infrastructure based on farmer needs in Pakistan.

Mahmood and Sheikh (2005) reported that the mass media are playing a very significant role in creating awareness and disseminating knowledge about the latest agriculture technologies among farmers. The mass media have, similarly, increased the flow of knowledge and information and have provided valuable output in recent years. Buren (2000) says that the main reason of the popularity of television among the masses is that it's simply. People propose to choose the easiest way for get information and learning the simplest way that can be found. In television educational programs about health, education as well as about agriculture development. Khan et al. (2010) showed that information about inputs from a diversity of sources of

information and the use of these sources rated as a feature of personal preference rather than farm size, other structural characteristics or socioeconomic status. Abbas et al. (2003) studied a set of 180 sugarcane farmers in a survey at farm level by means of a structured interview to identify the sources of information used by these farmers. He concluded that the majority of farmers (small and medium) acquired information primarily from other farmers, while the large farmers mostly obtained information on sugarcane production from the research institutions, agricultural departments, from sugar factories and the mass media. Taj et al. (2009) run a survey among farmers to learn what the ways to obtain information about new agricultural developments were used by these farmers. The results revealed that their major sources of information were the mass-media and other helpful farmers regardless of gender, families and friends, as opposed to agricultural extension department representatives. In Faisalabad, Sadaf et al. (2005) studied women farmers' need for information from agricultural extension services in agricultural areas such as: poultry and livestock production, sowing, transplanting, plant protection, drying and storage of crop production. Abbas et al. (2003) studied the dissemination of sugarcane production information in the Faisalabad region among farmers using electronic media, in a group of 180 respondents, randomly selected and interviewed. The authors found that the majority of the sugarcane farmers (91.1%) acquired information from friendly farmers, from extension department staff (26.1%), electronic media (22.8%), and the press (11.1%) of the farmers studied, 67% had their own television and radio, 56% watched and listened to agricultural television and radio programs, so, there were clearly benefits from television and radio transmissions and farmers were satisfied with the 8-9 pm timing of these transmissions by TV and radio broadcasters. Likewise in Faisalabad, Chaudhry et al. (2008) in a survey of 120 women farmers, randomly selected, using interviews to identify women farmers, links too many sources of information about new agricultural technologies. Survey results established personal interactions with friends (71%), the mass media such as TV (65%), radio (45%), neighbours (69%), families (68%) and newspapers (40%) were the major sources of information, whereas sources of information such as the agriculture department (0%), pesticide traders (2.3%) and private agencies (2.6%) were minor sources of information for rural women farmers. Farooq et al. (2007) in Hyderabad evaluated the role of newspapers in agricultural information dissemination between literate farmers via an interview and randomly selected sampling. The results showed that

newspapers, books, journals, magazines, posters, friend's farmers and television (81%) were the major sources of information for all the respondents, while the extension field workers (67.5%) and Radio (75%) played a secondary role. In a discussion about the current status and future potential of electronic media to be an important source of agricultural information, interviews conducted in the district of Faisalabad by Khan et al. (2010) found that farmers' awareness of various electronic media-based agricultural programs and contacts was very low; however, results concerning their future preferences to use these means to disseminate market information showed improving trends compared with the current use of electronic media.

From the above mentioned research it can be concluded that visual and audio mass media are an adequate tool to disseminate agricultural marketing information for illiterate people. In Bangladesh, Rahman (2003) reported a wide price variation between markets where cultivators received low prices because of a deficiency of market information. In Nepal, Shrestha and Shrestha (2000) reported that the information service served the needs of the policy producers rather than the farmers and agricultural traders. Izamuhaye (2008) conducted an exploratory survey on orange farming systems in the Tanga Region, Tanzania. Data collection was based on a questionnaire and interviews as well as on secondary sources. Oranges are marketed through two main channels: domestic and export chains. The main actors in the orange chain include, among others, the farmers, the local hawkers, local brokers, the local wholesalers and Kenyan traders. The local wholesalers as well as the Kenyan traders influence the orange chain more than the others. The results showed that the sale of oranges is mainly conducted at the farm gate (95%); some farmers (5%) wishing to achieve economies of scale themselves perform the role of traders and transport produce outside of the Tanga Region. Sale is not conducted on any contractual basis. Hence most farmers are ready to sell produce to better payers. Diarra (2004) in the study on Mali's experience with AMIS showed that a restructured AMIS in 1998 was more successful than the AMIS established in 1989. The new system's benefits for farmers included increased share on the consumer price, bargaining power and new information on emerging markets. For traders, the facilitation of new entrants, the extension of the market geographically, the opening of the guinea livestock market and the facilitation of arbitrage. For consumers, the

levelling and reduction of margins between markets, a reduction in prices of 15-20% and the introduction of better market information. For Policy makers, a voiding bad policies and a better understanding of the reasons for the higher prices in recent years (market integration).

According to the National Horticulture Board (NHB) of India launched a scheme for the development of the marketing of horticultural produce, realizing that a sound system of marketing, putting the latest and most accurate information on prices and arrivals on the Internet, was important for the effective disposal of highly perishable horticultural crops. The NHB has been catering to this need since 1988 with 33 marketing information centres located all over India called NHB NET. These centres collected market information and sent it to a coordinating cell for publication in monthly bulletins (Anonymous, 2007). In Sri Lanka Gunatilke (2003) reported that the private sector plays a major role in marketing, production and development of farmer living standards, whereas the state sector plays a supportive role. In India, Ramamritham et al. (2000) developed a system for providing information on agricultural pricing to the rural population, at IIT Bombay, as part of Media Lab Asia activities. The system, called Ask for the Price, includes innovations in interface design and in data provision. This system is an online application accessible via a web browser, to obtain information on agrarian product prices on the wholesale markets. Also in India, Dhankar (2003) studied Argil Marketing information system network (Agmarknet) and concluded that information collected and disseminated by conventional methods caused delays in communicating the information to different target groups, and affected their economic interests. So, it was failing to provide market information equally to market users such as producers, traders and consumers. In conclusion, information dissemination by conventional methods to different target groups produces delays; therefore, modern tools (cell phone, internet network, etc.) were the most effective methods for an AMIS to function fairly and efficiently. YanBo and BuYibio (2003) studied AMIS in China' and observed that the major sources of information for farmers were other farmers, broadcasting and television. De Silva et al. (2012) carried out a study in Sri Lanka, and concluded that government organizations produce. Some valuable information needed by farmers and is available in different formats for different locations. But the essential information did not reach

the farmers on a real-time basis. Due to information insufficiency farmers cannot make the correct decisions on their farming processes (Hevner et al., 2004).

Another study was conducted by Irivwieri (2007) in Ethiopia, to determine the information needed by illiterate female farmers. The information needed by these woman farmers was technical/scientific, commercial, social/cultural and legal. The author showed that there were difficulties in delivering scientific ideas to these female farmers, due to the high illiteracy rates among them. A survey in four developing countries including Sri Lanka was conducted by Lokanathan and Kapugama (2012) on the information needed by farmers. They concluded that information on crop selection, growing and selling were the main types needed. They proposed a new model to enable farmers to make optimal decisions concerning these farming processes. Broadcasting agricultural commodity prices by radio in Nepal and Sri Lanka has been a successful project for providing information to the farmers (De Silva et al., 2012). In conclusion, all AMIS mentioned above take into consideration all available information on production and marketing processes, and aim to reduce production costs and improve farmer benefits. However, they differ from each other in their choice of information dissemination channels and tools. It seems to be that the more accurate and timely the information was received, the more functional the AMIS.

2.3.6 The role of ICTs in the Market Information System

In the design and implementation of an MIS**,** Information Communication Technology (ICT) is therefore one of the possible solutions, and in recent times it has allowed previously unbelievable possibilities to improve agriculture, especially in developing countries (Mehra, 2010). Jensen (2007) documented that ICTs have an evidently positive effect on farmer's income growth in developing and developed countries. In Kerala, India, he evaluated the effects of the introduction of mobile phones in the fishing industry and he found that by improving fishermen' and traders' access to market information, the introduction of mobile phones improved arbitrage opportunities and resulted in reduced waste and price dispersion across geographic markets. Similar results were observed by Klonner and Nolen (2010) as well. Aker (2010) studied price dispersion across Nigerian markets, a factor that is common in

developing countries. Using novel market and trader-level data. In her paper, she provides estimates of the impact of mobile phones on price dispersion across grain markets in Niger. The introduction of a mobile phone service between 2001 and 2006 explains a 10 to 16% reduction in grain price dispersion. The effect is stronger for market pairs with higher transport costs. There are some studies, for example in Niger and India, about the role of cell phones in mitigating price variations and creating equilibrium among markets (Jensen, 2007; Aker, 2008) also, providing wholesale price information through the internet to farmers contributed to enhancing the functioning of the markets (Goyal, 2010). It seems that online information about markets supplied via the Internet and cell phones is an efficient tool to be used in the dissemination of marketing information; however in the case of the Lattakia region it is necessary to verify the capability of the Lattakia infrastructure to support the transmission of such marketing information before considering the Nigerian and Indian AMIS examples. Mobile phones have contributed to increasing farmers' income. According to a study by Kyeong and Bellemare (2013) in the Philippines, prices that agricultural producers receive for their cash crops had increased between 5 to 7% because of owning a mobile phone at the household level. Csótó (2010) says that: "*information technology is regarded as mediating channels (sic) and a vehicle for new services*". At the same time, it is important to implement new modern marketing technologies (Kandakov, 2011) and know-how transfer in rural areas to reduce a lack of variety in the sources of information.

AMIS information on the market price of agricultural commodities is disseminated by SMS services through cellular telephones in many countries, such as South Korea, Vietnam, India, Thailand and Indonesia. Many of these services are owned and operated by the private sector (Islam and Gronlund, 2010). In the Philippines, Labonne and Chase (2009) studied mobile phone impact on commercial farmers and subsistence farmers. Farmers in the Philippines used mobile phones to improve income and build confidence and improve relationships with trading partners. The results of the study found significant benefits for commercial farmers but little benefit for subsistence farmers, as measured by improvements in consumption of 11-17%. In Malaysia, Shaffril et al. (2009) found that mobile phone use increased the profits of smaller agribusinesses and farms run by young owner/managers, especially when the entrepreneurs used their mobile phones for more than two years. In Bangladesh,

Minten et al. (2011) reported that circa 80% of farmers have mobile phones, and about 60% agree their trading transactions by phone. Approximately 30% of potato farmers and 70% of rice farmers contact multiple traders by phone to discover prices and marketing opportunities. In India, Svensson and Yanagizawa (2009) showed that a World Bank project coordination office negotiated recently to broadcast 100,000 SMS messages at USD 0.4 cents each and stated that "*even if the mobile phone's main purpose is social communication among the community (approximately 60-70% of calls are to friends and family and 5-10% of calls for business), it is also an important marketing too*". It was established that open-source software which can be downloaded on a laptop computer to send directed SMS messages to a database of mobile phone owners may be extremely effective (Aker, 2008). This new technology offers the possibility of delivering information on market prices directly to farmers' mobile phones, enabling the farmers appreciate their produce's value and increase their market negotiation status. If governments undertake to enter into using this method, a strategic issue will be the lowering of the unit price of each SMS message (Graham and Jayaraman, 2010). Minten et al. (2011) recorded that knowledge of how to achieve economic benefits using a mobile phones is a skill that takes some time to develop; however, Shaffril et al. (2009) showed that younger users are typically better able to exploit the mobile phone for business benefits. In Bangladesh, China, India, and Vietnam, Minten et al. (2011) showed that at that time approximately 80% of farmers possessed mobile phones and used them to talk with various traders to establish market demand and prices. More than 50% decided sales prices and activities by phone, thus the use of phone contacts is driving changes in marketing systems. Labonne and Chase (2009) found that Filipino farmers who used mobile phones improved income and built trust with trading partners. Also in Malaysia, mobile phone use was linked to increased profits among younger owner/managers of farms and smaller agribusinesses, especially with growing experience in the use of the technology (Shaffril et al., 2009) and farmers who use mobiles can also save on transport costs (Overa, 2006), which is an effect especially strong in the rural areas (Muto and Yamano, 2009), with ICTs deemed to have a demonstrably positive effect on income growth in developing and developed countries (Jensen, 2007). Farmers that use mobile phones can also save on transport costs (Overa, 2006); this benefit is greater in rural areas (Muto and Yamano, 2009). While mobiles can inform farmers

where they must travel to market their crops, data suggests that rich farmers have an advantage in their ability to use this information (Fafchamps et al., 2008).

Farmers (as well as other stakeholders in the supply chain) increasingly use ICT, particularly mobile phones, to reduce their costs, increase the prices they receive, and where possible acquire market knowledge that improves supply-chain efficiencies and adjusts supply more closely to changing demand (Aker, 2010). Aker and Mbiti (2010) found that mobile phones have spread from urban centres to rural areas as well as from the wealthy to the poor in developing countries. Moreover, mobile phones are often the only form of telecommunication to be found in the rural areas of developing countries (Donner, 2009). Many individuals and households throughout the developing world have thus "leapfrogged" fixed-line telephone technology altogether in order to directly adopt mobile phone technology. Farmers who own mobile phones can simply call potential trading partners instead of taking the time to visit them. Mobile phone technology can stimulate market activity, especially in areas with poor transportation infrastructure. This leads to a more efficient allocation of resources, which in turn allows economic policies to have their intended effects by reducing price distortions (De Janvry et al., 1991). In developing countries studies such as the above mentioned, have been carried out to disseminate agricultural knowledge to the farmer by linking the farmers with agriculture experts via mobile phone whenever farmers had problems with their farming. Most of these new technology applications targeted farmers in rural villages. These studies validated the effectiveness of linking stakeholders to get the necessary information on time (Patel et al., 2008).

2.3.7 AMIS connections with consulting services

The aim of an Agricultural Marketing Information Service (AMIS) is to improve agricultural stakeholders' ability to access, gather, analyse and use information to better respond to market needs. With the advance of Information and Communication Technologies (ICTs) in developing countries, the income- generating opportunities offered by AMISs have been in greater demand among international development organizations, non-governmental organizations (NGOs) and businesses alike (AMIS, 2013). Consultants play a crucial role by helping farmers in make their decisions rather than making decisions for them, which leads to improvements in consultant-

client relationships (Coutts et al., 2007), agricultural information and knowledge delivery services including extension and consultancy, which are in turn responsible for providing highly accurate, specific and timely information for the farmers in the rural areas (Lwoga et al., 2011). In recent years, several developing countries have established government-sponsored marketing or agribusiness units. South Africa, for example, started the National Agricultural Marketing Council (NAMC) as a response to the deregulation of the agriculture industry and the closure of the previous marketing boards in the country. India has the long-established National Institute of Agricultural Marketing (NIAM). There is the National Agricultural Marketing Development Corporation (NAMDEVCO) in Trinidad and Tobago. The exchange of information across international exchanges and internal market places would enable an AMIS to produce comparative analyses of local and international commodity prices and would also provide benefits to traders, exporters and other stakeholders (Saflain, 2012). To have high-functioning marketing systems it is necessary to back up the private sector by effective government support services with appropriate policies and legislative frameworks. Such back up measures may include the improvement of market infrastructure, the support of market information flows and the enabling of agricultural extension services, so they can advise farmers in marketing decisions; however, training is needed in all stages and levels of marketing (USDA, 2013). In a study, the Overseas Development Institute (ODI) showed that clients serviced by advisory services should, in addition to farmers, include input providers, processors, traders and producer organizations (Christoplos, 2008). Poor support by agricultural extension services, municipalities that operate markets inefficiently and poorly-run export promotion bodies could damage marketing significantly (Goyal, 2008).

2.3.8 AMIS and the funding perspectives

Today AMISs, which exist in developing countries, are funded through countries national budgets and their activities are carried out by local ministries through marketing departments. The FAO survey found numerous AMISs that had been established by donors, but which had subsequently run into problems once the donors had left, for example the most important problem facing market information systems in Malawi is the delay in securing funds affecting ICT-based AMIS projects in

Malawi (Katengeza, 2012). Several existing services, currently operated with donor support, would appear likely to follow the same route. Free computers, fax machines, cars and motorbikes can be very attractive, until they have to be replaced. Recognizing the very real problem of low Government salaries in many countries, donors have also often had to pay salary supplements to AMIS staff (Shepherd, 2007).

There are a lot of examples of governmental funding for AMISs in Africa. Firstly, in 1991 the government of Mozambique designed an Agricultural Market Information System which started to disseminate agricultural prices for the main crops cultivated in the country (Pimentel, 2009), after that by the year 1992 came the establishment of the Ethiopian Grain Trading Enterprise which played a crucial role in achieving stabilized prices for producers and consumer (Negassa, 1997), and in 1993 came the establishment of the Agricultural Marketing Information Centre in Zambia which was designed to gather, sort, analyze and disseminate market information on agricultural produce (Mwanaumo, 1999).

In Sri Lanka for example, vegetable wholesale prices are broadcast on a commercial radio station and this program is sponsored by a private fertilizer company. Donors with some participation in AMIS establishment and development include the Food and Agricultural Organization (FAO), which has a unit focusing on agricultural marketing support, including via the development of market information (Shepherd, 2000). Another example of an AMIS is from Laos which was funded via the FAO for 2001 and 2002 (Islam and Gronlund, 2010).

2.3.9 The role of management in the AMIS development process

The role of management is to move an organization towards its purposes or goals by assigning activities organization members need to perform. If management ensures that all the activities are designed effectively, the production of each individual worker will contribute to the attainment of the organizational goals. Management seeks to encourage individual activity that will lead to reaching organizational goals and to discourage individual activity that will hinder the accomplishment of the organization objectives (AMIS, 2013).

Typically, the management process includes the following steps: planning, organizing, staffing, coordinating, directing, and controlling the management control system. Farm management includes the making and implementation of decisions involved in organizing and operating a farm for maximum production and profit. Farm management draws on agricultural economics for information on prices, markets, agricultural policy, and economic institutions such as leasing and credit (Jensen, 2007). All organizations exist for certain purposes or goals, and managers are responsible for combining and using organizational resources to ensure that their organizations achieve their purposes. Knowledge sharing, exchange and dissemination are elements of knowledge management. The central purpose of knowledge management is to transform information and intellectual assets into enduring value (Metcalfe, 2005). The basic idea is to strengthen, improve and propel the organization by using the wealth of information and knowledge that the organization and its members collectively possess (Milton, 2003). It has been pointed out that a large part of knowledge is not explicit but tacit (Schreiber et al., 2000). In some cases, the facilitator will work with an existing organization (a farmers group or women's association) which provides the operators for the AMIS. In locations where people have requested marketing assistance, there is often a local organization that has defined as one of its goals the improvement of the marketing of the goods produced and/or traded (Goyal, 2008), an expert facilitator can use a discussion about the marketing of products to gather information about marketing knowledge and interest, possible sources of market information and community organization as well as other topics of interest, there are many techniques that may be used to collect information (Aker, 2010).

2.3.10 AMIS and data collection processes

Building technical and institutional capacity in countries to collect information on market outlook and to improve the quality of data are important components of an AMIS. Efforts in capacity building are focus on (FAOSTAT, 2012; AMIS, 2013):

(i) Defining best practices and methodologies for agricultural market data collection and analyses; providing training sessions to enhance data collection capacity and assist in the development of enhanced methodologies.

(ii) Identifying, designing and implementing special projects to strengthen data collection. One of the outcomes of the 2007 International Statistical Institute Conference on Agricultural Statistics was a consensus regarding the challenges of applying statistics to issues in agricultural development.

The purpose of the Global Strategy is to provide a framework for national and international statistical systems that enables them to produce and to apply the basic data and information needed to guide decision making in the twenty-first century (IBRD/WB, 2011). The concept is of a master sample framework to be extended to include a data management system for all official statistics related to agriculture. All data collection is to be based on sample units selected from the master sample framework and integrated into the survey framework. The survey framework also takes into account all additional data sources that need to be included in the integrated statistical system, including administrative data, agribusiness and market information systems, community surveys, remote sensing, and consistent input from expert data collection (FAOSTAT, 2012).

However, there are two sources of information for AMIS, primary data which must be collected on a regular basis in the field, while secondary data are usually available in Statistical Offices, the Agricultural Directorate and Agricultural Research organizations (Daneshjo, 2014). Delays in collecting, processing, and disseminating price information can reduce the current ability and credibility of AMISs, the transmission of information via private or public radio has faced many problems with unsuitable times for broadcasting and a lack of access by the rural farmers (Shepherd, 1997), for example in Cambodia, AMIS information is disseminated every day at 6:00 pm, whereas in Laos it appears only weekly on a radio program (Islam and Gronlund, 2010). But recently the spread of modern communications which can help in collecting the information from the markets, processing these data and disseminating them for the beneficiaries has led to reduction in these problems (Shepherd, 1997).

2.3.11 AMIS infrastructure components

The structure of an AMIS should allow the effective performance of two important functions, namely the collection and analysis of food market information, and the

ability to issue global food price surge alerts, with the coordination of international policy responses in the event of an international food price surge. This will necessitate the participation of both agricultural market experts and policy makers. To assist in the carrying out of these functions, an international forum is already being established, run by a Secretariat.

The Secretariat, involving ten international and inter-governmental organizations will have the capacity to regularly collect, analyse and disseminate food market information. The Secretariat is to be formed by the following international organizations and entities: the FAO, IFPRI, IFAD, the IGC, the OECD, UNCTAD, the UN High Level Task Force (UN-HLTF), the World Bank, the WFP and the WTO. The Secretariat, housed in the FAO headquarters in Rome, will support all the functions of the Forum and the Information Group of AMISs.

The Global Food Market Information Group will assemble technical representatives from all participating countries to provide reliable, accurate, timely and comparable food market data; and the Rapid Response Forum, composed of Senior Officials from the capitals of participating countries, will encourage the coordination of policies and the development of common strategies (FAOSTAT, 2012).

3. Aims of the thesis

3.1 Main objectives

The main objective of the thesis is to analyse the impact of the provision of market information on sales and incomes of citrus farmers and to draw policy recommendations. The plausibility of the aim is justified in the literature review where the theoretical reasons are shown for it due to lowering costs of acquiring information, as well as empirical evidence of many studies on the positive effects of marketing information systems on improved rural livelihoods, farmer income growth and market participation in the least developed countries.

3.2 Specific objectives

Specific objectives of the thesis are to:

(i) evaluate the overall citrus market in the Lattakia region;
(ii) analyse information needs (gaps) of actors in the citrus value chain (particularly farmers) in relation to their characteristics and position in the marketing and the regional infrastructure relevant to the market;
(iii) design a prototype of Agricultural Marketing Information System (AMIS) for the citrus sectors in Lattakia;
(iv) test and validate the functionality and effects of the proposed AMIS (a prototype) in the real situation (AMIS experiment) and to survey the opinions of stakeholders/beneficiaries in the Lattakia region on it; and,
(v) propose improvements to the organisation and governance of the market,
(vi) explore implementation possibilities/barriers for the proposed AMIS.

3.3 Research hypotheses

1. There is a fluctuation of citrus prices in the Lattakia region markets.

2. Citrus farmers in the Lattakia region receive a lower value share compared to market agents (middlemen).
3. Small producers (households) who receive improved market information from the AMIS are more likely to sell their citrus products in competitive crop markets (i.e. with higher price).
4. The provision of market information shifts the sales to the later season.

4. Methodology

In line with the research objectives and these hypotheses, a literature review and data from different official sources of information in Syria were collected. The current situation on citrus markets in the Lattakia region was assessed together with the necessity for the creation and implementation of an AMIS for citrus products in this region and in this context the methodology was structured to test the MIS's functionality. The methodology is adequate and can show important results despite the available data being limited; this leaves an opportunity for future research to expand the methodology based on further data.

To the best of our knowledge, this study is one of the first focused on access to proper market information by farmers in Syria or in any other Arab society. We believe that it should stimulate further studies documenting and discussing the potential and real benefits of the value of market information to farmers in the region.

The methodology addressed five points:

1. A comprehensive market assessment and an analysis of market price trends, by using of appropriate econometric models to predict citrus prices.
2. Creation of an initial questionnaire to determine what types of information were needed by citrus farmers and what the farmers' ability to receive and deal with that information was, via an investigation of the economic and social characteristics of the AMIS’s potential beneficiaries.
3. A simple prototype of AMIS which solves identified information gaps.
4. The way how to test the proposed AMIS's functionality (referred as AMIS experiment).
5. The analysis of effects/results of the AMIS experiment to verify the central proposition (hypothesis) of the research that timely and pertinent information improves the performance of the marketing system for the benefit of citrus producers.

4.1 Analysis of the citrus market in Lattakia region

4.1.1 Descriptive analysis

The current information, data collected on the citrus fruit Lemon autochthon, were used as an example of the analytic potential of an AMIS for citrus fruits in the Lattakia region, covering:

- Production quantities and markets
- Import / export statistics and trends
- Domestic consumption
- Prices: collected daily data, on citrus wholesale prices will be transformed to average weekly and monthly prices.

To characterize the markets, four indicators were applied to the data set and used for the assessment of the characteristics of the markets; it is very important to analyse the prices and find appropriate models to provide important information for the farmers and the entire market chain of the Lemon autochthon. So, four indicators were applied to the data set and used for the assessment of Lattakia market price dynamics:

- arithmetic mean
- volatility (variance)
- coefficient of variation
- standard deviation.

4.1.2 The autoregressive integrated moving average ARIMA model to forecast prices of the citrus Lemon Autochthon

A time series modelling approach was used in most studies as the benchmark to predict prices in the future. Numerous studies have shown this method is effective compared to other methods.

Mishra and Singh (2013) say that: "*the econometric model ARIMA is a time series which was introduced by Box and Jenkins (1970). The model is one of the most popular methods for forecasting. In an ARIMA model, the estimated value of a variable is supposed to be a linear combination of the past values and the past errors*". Generally, a non-seasonal time series can be modelled as a combination of past values and errors, which can be denoted as in ARIMA (p, d, q).

Seasonal Autoregressive Integrated Moving Average (SARIMA) Model

SARIMA (p.d.q) (P.D.Q) s

$$"\emptyset_p(B)\Phi p(B^s)(1\text{-}B)^d(1-B^S)^D_{Zt} = \delta + \theta\_q(B)\Theta_Q(B^s)a_t$$

$$\emptyset_p(B)=\{\phi_1, \phi_2, \ldots \ldots \ldots \phi_p\}$$

Autoregressive parameters

$$\phi_p(B) = 1 - \phi_1 B - \phi_2 B^2 \ldots \ldots \ldots - \phi_p B^p$$

$$\theta_q(B)=\{\theta_1, \theta_2, \ldots \ldots \ldots \theta_q\}$$

Moving Average Parameters

$$\theta_q(B) = 1 - \theta_1 B - \theta_2 B^2 \ldots \ldots \ldots - \theta_p B^q$$

B Back displacement parameters where:

$$BZ_t = Z_{\ t-1}$$

$$B^2 Z_t = B(BZ_t) = BZ_{t-1} = Z_{t-2}$$

$$B^m Z_t = Z_{t-m}$$

$$time\ series\ \ \{Z_t\} = \{\ldots \ldots Z_{-1}, Z_0, Z_1, Z_2 \ldots \ldots\}$$

Where the values:

Autoregressive seasonal factor

$$\Phi_P(B^s) = 1 + \Phi_1 B^s + \Phi_2 B^{2S} + \ldots \ldots + \Phi_p B^{ps}$$

$$\Theta_Q(B^s) = 1 + \Theta_1 B^s + \Theta_2 B^{2s} + \ldots \ldots + \Theta_Q B^{Qs}$$

$a_t \sim$ WN $(0,\sigma^2)$

White Noise series: (I.I.D) Independent Identically Distributed

The proposed model for this series is: SARIMA (2,1,0) × $(1,0,1)_{12}$

$$(1-\phi_1 B-\phi_2 B^2)(1-\Phi_1 B^{12})(1-B)z_t=(1-\Theta_1 B^{12})a_t(1-\phi_1\mathrm{B}-\phi_2 B^2-B+\phi_1 B^2+\phi_2 B^3-\Phi B^{12}+\phi_1\Phi B^{13}+\phi_2\Phi B^{14}+\Phi B^{13}-\phi_1\Phi B^{14}-\phi_2\Phi B^{15})z_t=(1-\Theta_1 B^{12})a_t$$

By calculation it was found:

$$z_t=(1+\phi_1)Z_{t-1}+(\phi_2-\phi_1)Z_{t-2}-\phi_2 Z_{t-3}-\Phi Z_{t-12}-(\phi_1\Phi+\Phi)Z_{t-13}+(\phi_1\Phi-\phi_2\Phi)Z_{t-14}+\phi_2\Phi Z_{t-15}+a_t-\Theta_{a_{t-12}}$$

4.2 The assessment of information needs of participants in the citrus market in the Lattakia region

4.2.1 Study area characteristics

The Lattakia region (Fig.3), which contains four major districts (Lattakia, Al-Qurdaha, Al-Haffi and Jablih), was selected as the target area due to its citrus fruit production, which is up to 920 thousand tons per year, in addition to the main constraints faced by citrus farmers in marketing their products and the lack of information for citrus farmers.

The Al-Haffi district with the centre in Al-Haffi city with a wholesale market, about 27 kilometers distant from Lattakia. It consists of 17 municipalities with 96,012 inhabitants with villages and areas such as: Rabia, Defil, Alzenqokah, Pabana, Qadisiyah, Slenfeh, producing 72 thousand tons of citrus fruit a year (CBS, 2012).

The Al-Qurdaha district with Al-Qurdaha city as the main centre and its forty-nine villages produce 125 thousand tons of citrus fruit a year. It is situated 30 kilometres away from Lattakia city.

The Lattakia district with administrative centre Lattakia has one hundred and twenty-seven villages. Citrus fruit production in the Lattakia governorship is up to 574 thousand tons yearly.

The Jablih district with centre town of Jablih is a Syrian port on the Mediterranean Sea, it has an airport: "Humaimam". Jablih is situated 28 km south of Lattakia (35.37N, 35.94E) and has the following town ships: Alkotailbeh, Ras Al-Ain, Ain Shkak, Al-Dalih, and the villages: Al-Hoiz, Al-Burjan, Humaimam, Dwyer Babda, Al-Humam, Ain Al-Sharkiah. It produces 149 thousand tons of citrus fruit per year (CBS, 2012).

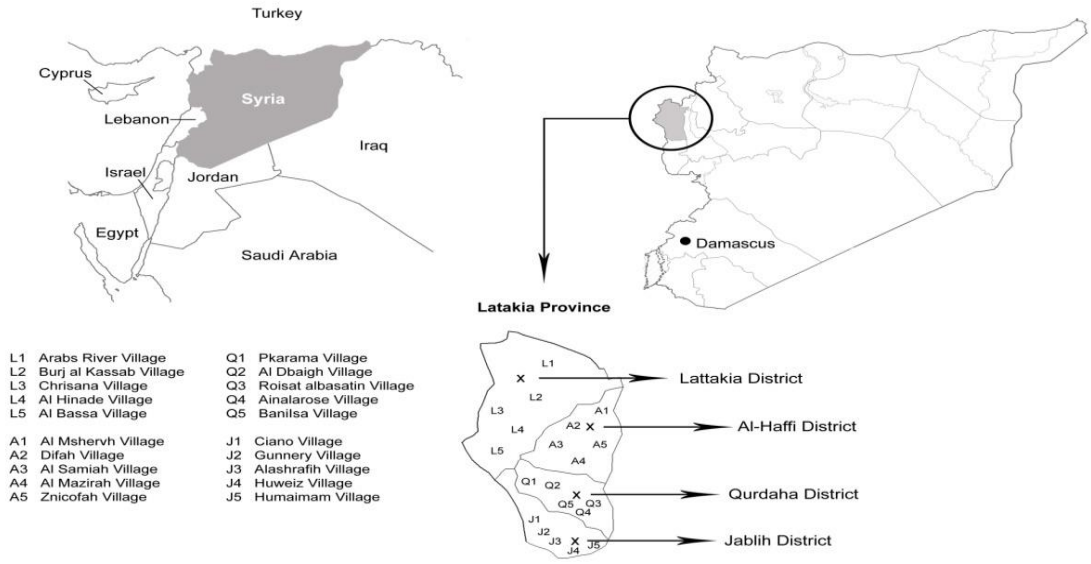


Figure 3. Lattakia region

Source: own compilation

4.2.2 Questionnaire design, data collection and analysis

Data were collected between June and August 2012 among 400 farmers from all above mentioned districts and 100 market agents from the agrarian markets in the Lattakia region. Taking into consideration that no AMIS exists so far in the Lattakia region, we used structured questionnaires as a tool to assess the current situation of the citrus market. The questionnaire data was recorded by direct interviews with randomly selected respondents.

Questionnaires were designed and addressed to 400 citrus farmers from 20 randomly selected villages in the four Lattakian districts, i.e. five villages from each. 20 respondents in each village were selected randomly, from farmer records. These respondents were asked to respond to questions related to:

(i) their economic and social characteristics and farm size
(ii) citrus production process, cultivated varieties, annual income from citruses, production quantities, domestic citruses consumption, methods of marketing of the production, source of market information and types of information needed in addition to their capacity for using ICT

Total number of 100 citrus traders (middlemen, wholesalers, retailers) was selected randomly from the four markets in the Lattakia region. The respondents were asked to respond to questions related to:

(i) their economic and social characteristics, type of trade, annual income, and source of income
(ii) prices and rates of trading, communication tools used with farmers, and capacity to use ICT

The both questionnaires can be found in the Annex 3:143.

The number of questionnaires was determined according to the variety of the respondents. A preliminary sample of 50 farmers was interviewed to test the questionnaire outline and understand ability for the respondents.
Direct interview was a main tool used for data collection. In order to get better insight into the situation in citrus market in Lattakia region, observations, discussion with key informants or attendance at the meetings were also applied. It is worth of mentioning that there were no constraint of languages as the Arabic language was the mother tongue of all the respondents as well as the interviewer.

The data collected from the respondents were stored, tabulated, graphically represented analysed using the Statistical Package for the Social Sciences 18" (SPSS 18) to calculate the standard deviations and variances, along with maximum and minimum values, as tools to measure volatility. An ANOVA test was performed, to

test the significance of differences between dependent variables and independent ones. Finally, we calculated the value share of each actor in citrus chain. Thus, the results of data analysis showed, information asymmetry, differences between citrus farm gate and wholesale prices and profiled the local citrus fruit economy and offered an assessment of the following: interest in marketing knowledge and the available infrastructure and management capacity to carry out an AMIS.

4.3 Agricultural Marketing Information System model development, creation process and its structure

4.3.1 Conception of the Agricultural Marketing Information System

There were two steps in the conception of the proposed AMIS:
The first step consisted in a proposal for two databases:
- A database of citrus products, and
- A database of citrus producers.

The methodology of the AMIS creation includes algorithm specification and database programming in My/SQL and Microsoft Access programs, system input and output definition.

The second step in the creation of a functional marketing operator consists of the connection of the two separate databases in the final conception of the information system:

1- Database of Citrus Products: Covers 6 citrus products/varieties (Lemon Autochthon, Tangerines, Jaffa, Clementine, Valencia and Grapefruit). The records include information on produced and marketed quantities, prices (farm gate and central market), and production relevant information as seedling resources, phytopathology, irrigation methods, and pesticide resources.
2- Database of Citrus Producers: It covers information as personal information, property types, area of farmland, income, production and varieties
3- Market Research Database: Includes predicted (expected) and real minimum and maximum prices, expected and real supply and demand in the four studied markets. Basically these data based on 4.1 methods.

The three databases to be compiled into one central data base called the Agricultural Marketing Information Database, thereafter disseminated to beneficiaries, as depicted in (Fig.4).

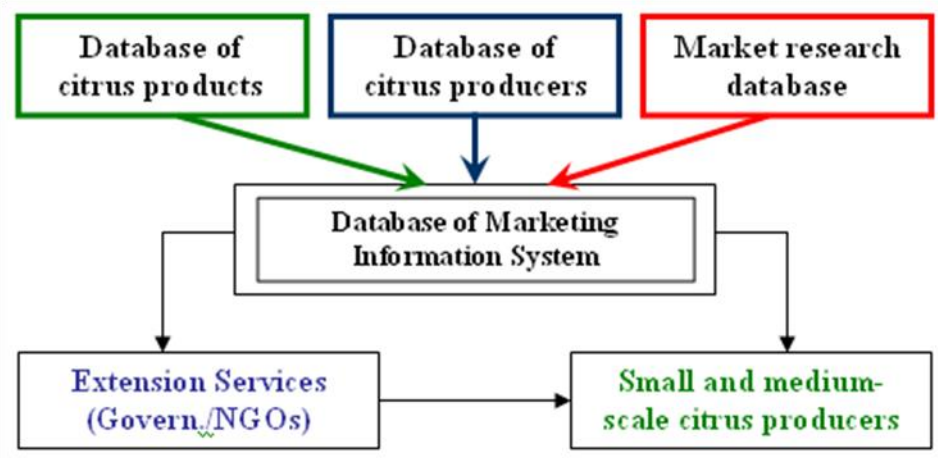


Figure 4. Data flow in the Marketing Information System
Source: Own compilation (2014)

4.3.2 Detailed description of the databases

To create the AMIS Database, the following steps need to be taken. First to create a database of citrus farmers in Lattakia region, secondly to develop a database of citrus products sold by these farmers, and, thirdly, database that would serve as a baseline for marketing research was created as well.

Creation of database of citrus farmers in Lattakia region

According to data obtained from the extension services office, there are farmers' records for each administrative sector, and the farmers' database created from this will contain:

A- farmer number (ID identifier): a primary key to facilitate search and archiving.
B-name and surname;
C- national serial number;
D- estate (property) number;
E- the administrative sector for each cooperative: here a field (Foreign key) contains the number of the sector, that will be created later in a separate database which will

contain the number and the name of the sector key database, so that this field (Sector number) can be used in processing the link between the two databases. Then the variety databases will be created that contain a field for the variety number as a key for the data and the name of the product.

Finally, a database to link the farmers and the variety databases (called: the cultivated variety databases) will be created. It contains the farmer's number, the variety number, the cultivated area, production of /number of bearing trees and the total number of trees.

Database of citrus products sold

A database of weekly prices for varieties in the market is to be created to include: product number, market number, year, month, the first week's prices, the second week's prices, the third week's prices, and the fourth week's prices.
Here, the primary keys are the number of the product, the market number, the year number, the month number.
Then a market database is to be created, to contain the number and the name of the market only. This is linked with the weekly prices for citrus varieties in the market via the market number.
Thereafter, a database of production quantities is created, which contains: The variety number, year number, month number, quantity produced, local consumption per month, exports and imports per month. The primary keys here are the product number, month No. and year No.
The production cost database will contain the year number and the prices of: organic and mineral fertilizers, pesticide, seedlings, irrigation, land preparation, grading and sorting, packaging and transportation.

Database of marketing research

This database includes: year number, month number, market number, maximum and minimum price, monthly average (calculated attribute), the minimum and maximum prices in the first half of the month, and the minimum and maximum prices in the second half of the same month; then these are separated to facilitate field (range) or

modification, as well as the minimum and maximum expected price; supply and demand are included.

Links included were:
1- Farmer and sector are linked via the sector field;
2- Farmer and the varieties are linked via the database of farmer varieties:
Product and market are linked via the price database, relationship (1);
Product and market are linked via the market research database, relationship (2)
The product alone is linked via the quantity database.

The main stakeholders in the Agricultural Marketing Information System were: farmers, traders, the Ministry of Agriculture, the Agricultural Directorate, extension services and agricultural pharmacies.

4.3.3 Data collection and dissemination

The data were collected from:

- The General Commission for Agricultural Research (Lattakian Centre); about production inputs (varieties, seedling, phytopathology, fertilizers recommendation, machinery and soil analysis);
- The Lattakian Chamber of Agriculture; about quantities of exported and imported citrus fruit, price bulletins at international markets;
- The Agricultural Directorate of Lattakia (Economics Directorate), about the daily dynamics of minimum and maximum prices on the local markets (Al-Qurdaha, Al-Haffi, Jablih and Lattakia markets);
- The Agriculture Extension Services from the citrus pilot area, about farmer characteristics (household gender, household size, cultivated area, etc.), production inputs (seedlings, phytopathology, fertilizers, machinery, etc.), citrus products (grading, sorting, packaging and transporting).

An AMIS system so designed would be able to disseminate the obtained information about marketing and prices. The author (student) would cooperate with the marketing department at the Agricultural Directorate in Lattakia city to fax the information to

the Extension Services Offices (ESO), who in turn would disseminate the information to AMIS beneficiaries by means of telephone, meetings and interviews in the extension offices. This should support better decision making and improve the choice of the right market at the right time.

4.3.4 Technical implementation (programming)

After the design, these structures were created using the Access program and MY/SQL. Thus, an appropriate programming language was chosen to be able to relate and process databases and display the results in the designed interfaces. The programming language is C #, CSHARP.

4.4 The experimental implementation of an Agricultural Marketing Information System in the Lattakia region

The Marketing Department at the Lattakia Directorate of Agriculture would be the administrator of the AMIS thus created; it would operate and update the systems and disseminate the information (supply, demand, prices and market research) by fax to its extension offices. So we tried to use a simple prototype of AMIS for applying an experiment on citrus farmers which should demonstrate the benefit of the provision of timely and pertinent information for farmers to justify the creation of AMIS by the government later.

4.4.1 Test AMIS functionality

AMIS functionality and hypothesis testing was achieved via a comparison of two groups (an informed and non-informed group) of homogenous farmers (as possible). The groups were selected randomly from the pilot areas, from the farmer records. Each group consisted of 100 farmers, selected randomly from 2 villages in each district (Chrisana, Borg al kasab, Babana, Al-Hamubshy, Acharashir, Al-hoyez, Ayn Al-Arus and Bani Issa villages for Lattakia, Al-Haffi, Jablih and Al-Qurdaha districts respectively), whose citrus fruit production was marketed in one of the four studied markets. The informed group of farmers would receive, on a regular basis,

information concerning citrus (actual and predicted prices, supply and demand, price trends, market conditions, production management, post-harvest management, and weather conditions); however, the non-informed group would not receive any information. To ensure, that no leakage of "preferential" information to non-informed farmers took place, the villages were selected as far as distance allowed from each other to avoid a deformation of data. The householders (farmers) in each group were asked to fill in a form during one citrus marketing season.

The data obtained were subjected to statistical analysis for the mean, percentages, frequency, and an analysis of variance (ANOVA) to show any significant differences between the prices received or quantities sold by the two groups of farmers (informed and non-informed), according to this formula (Tadesse and Bahiigwa,2015):

$$Y_{\iota J\kappa} = \mu + \beta_J + \gamma_\iota + \delta_\kappa$$

where:
Y stands either for P=price or Q=quantity
$\mu\ldots$ = the intercept
βj....= the coefficient for the markets
γ_i...= the coefficient for the information treatment
δ_k...= coefficient for the seasons

Note that the season was treated as repeating observations, because the error terms are not necessarily independent.

5. Results and discussion

5.1 Citrus market analysis

Main findings of this chapter were published in following scientific journals:

- Haiyan Sulaiman, Karel Malec, Mansoor Maitah. Appropriate tools of marketing information system for citrus crop in the Lattakia Region, R. A. Syria. *AGRIS on-line Papers in Economics and Informatics*, 2014, 6 (3): 69-78.
- Haiyan Sulaiman, Tomas Hes, Alexander Kandakov. Marketing Information System in Citrus Fruit Pricing: A Case Study of Lattakia, Syria. *Mediterranean Journal of Social Sciences*, 2015, 6 (5): 286-297.
- Haiyan Sulaiman, Tomas Doucha, Alexander Kandakov. Characteristics of citrus fruit price developments on the Latakia markets, the Syrian Arab Republic, as preconditions for a functional marketing information system. *Engineering for Rural Development*, 2014, 13: 554-559.

5.1.1 Price developments, trends and statistic indicators for the four studied markets and main varieties

Based on materials gathered from CBS (2012), four wholesale markets in the Lattakia region, e.g. Lattakia, Jablih, Al-Haffi, and Al-Qurdaha, included production from the citrus orchards of 54%, 23%, 12% and 11%, respectively. Most of the fruit was sold on the Lattakia wholesale market, usually with the highest prices, suggesting that some additional volume of citrus fruits can be marketed there. There are different cyclic patterns in prices for the citrus varieties, Pomilo and Lemon Autochthon, monitored during the last three years.

Price developments for the Pomilo variety

It proved to be the case that the Lattakia wholesale market in general has the highest weekly prices for the Pomilo variety in 2010. Next year, 2011, the citrus weekly prices tended to a similar pattern to 2010. The Lattakia wholesale market showed the

highest prices and the Al-Qurdaha market the lowest ones. No distinct peaks can be recognized.

The same is true for 2012 weekly prices. Statistic indicators for the annual trends in prices for the Pomilo variety in the period of 2010-2012 for the wholesale markets under consideration are presented in Table 3. Table 3 shows the high dispersion (volatility) of Pomilo annual prices around their mean, with an asymmetric distribution, fluctuating (shifting) from the right side (lowering) to the left one (increasing). The amplitude (standard deviation) ranged from 2.89 to 6.47. Also Kurtosis indicates a "peaked" distribution in some cases and a "flat" distribution in the others. Maximum prices were 2 or 3 times higher than minimum ones. It would be a challenge for the AMIS to smooth out these differences in prices to the benefit of farmers. The prices of citrus varieties were calculated in Syrian pounds (SP).

Table 3. Characteristics of annual trends for the Pomilo prices 2010-2012

Market	Year	Mean	Standard deviation	Minimum SP / kg	Maximum SP / kg	Variance	Kurtosis	Skewness
Jablih	2010	21.45	2.89	10.94	25.44	8.35	3.68	(1.32)
	2011	22.66	3.46	17.00	30.00	11.94	(0.63)	0.48
	2012	23.44	5.73	12.63	38.00	32.84	0.25	0.47
Qurdaha	2010	21.41	3.41	11.17	26.75	11.65	1.32	(0.85)
	2011	19.02	6.47	9.74	34.83	41.90	(0.16)	0.98
	2012	19.80	4.83	11.44	28.15	23.30	(1.33)	0.12
Lattakia	2010	25.62	4.27	13.50	33.38	18.20	1.14	(0.81)
	2011	25.38	4.63	14.82	34.50	21.40	(0.31)	0.08
	2012	24.09	5.65	10.63	34.36	31.87	0.22	(0.68)
Haffi	2010	24.36	3.14	15.39	29.64	9.86	0.80	(0.44)
	2011	21.53	3.32	13.59	28.83	11.03	(0.06)	0.15
	2012	21.20	3.10	15.02	26.71	9.60	(0.72)	(0.22)

(): Values in parentheses are negative.

Source: Own calculations, 2012 based on data of Agricultural Directorate in Lattakia

Price developments for the Lemon Autochthon variety

In 2010 the weekly price variation amplitude between the markets studied amounted to 11.4-76.5 SP/kg. In general, the Lattakia wholesale market showed the highest

prices. Price peaks are evident during July-October, which coincides with non-harvesting periods of the other citrus varieties. The weekly prices in 2011 tended similarly to those in 2010, with the highest prices during June-September. The variation amplitude between markets was 9.9-84.4 SP/kg.

As usual, the Lattakia wholesale market had the highest prices and the Al-Qurdaha market the lowest ones. In 2012 the weekly prices tended to a pattern, somewhat different than those monitored during 2010 and 2011. The variation amplitude between markets was 9-100.6 SP/kg and the variation magnitude was extended towards the maximum prices more than towards the minimum prices. Table 4 (for the annual prices) shows the high dispersion (volatility) of the prices around their mean, with an asymmetric distribution, fluctuating from the right side (lowering prices) to the left one (increasing prices). The amplitude (standard deviations) ranged from 12.47 to 19.12. Also, Kurtosis indicates a "peaked" distribution in some cases and a "flat" distribution in the others. Maximum prices were 2 or 6 times higher than minimum ones.

Table 4. Characteristics of annual trends for Lemon Autochthon prices 2010-2012

Market	Year	Mean	Standard deviation	Minimum SP / kg	Maximum SP / kg	Variance	Kurtosis	Skewness
Jablih	2010	25.47	17.32	11.00	62.78	300.07	(0.08)	1.21
	2011	24.46	14.67	12.44	68.00	215.09	1.66	1.53
	2012	34.95	16.69	12.00	82.00	278.63	(0.38)	0.34
Qurdaha	2010	25.95	15.98	11.66	64.09	255.32	0.57	1.34
	2011	20.96	14.29	9.64	62.92	204.24	1.47	1.58
	2012	26.32	12.47	9.01	53.28	155.58	(0.82)	0.36
Lattakia	2010	30.85	19.12	14.63	76.50	365.61	0.58	1.36
	2011	29.44	17.83	16.00	84.38	318.09	2.06	1.64
	2012	35.22	18.12	15.38	100.63	328.39	2.41	1.37
Haffi	2010	28.83	18.49	13.02	71.14	341.97	0.56	1.36
	2011	25.39	15.99	12.06	69.06	255.58	0.56	1.30
	2012	33.07	15.22	12.29	83.04	231.60	0.95	0.67

Note: Values in parentheses are negative.

Source: Own calculations, 2012 based on data of the Agricultural Directorate in Lattakia

Citrus fruit prices differed across the wholesale markets studied, where the Lattakia wholesale market showed the highest prices and the Al-Qurdaha wholesale market the lowest ones. The differences between the markets also increased during the period of 2010 - 2012. These differences could be influenced by various factors, such as the lack of market information and a continuous information asymmetry, the influence of large retail chains in Lattakia city, the purchasing power of the population, transport to other cities, and the rate of annual inflation due to currency depreciation. In addition, the different harvesting periods of the fruit varieties affect prices, due to surpluses in supply in January – April and a shortage of supply in the summer periods. This relates especially to lemon varieties, which recorded the highest dispersion of citrus prices (the standard deviation ranged from 12.47 to 19.12), followed by Pomilo varieties (the standard deviation ranged from 2.89 to 6.47).

Based on the results presented relating to the main price characteristics of the citrus fruit markets in the Lattakia region, it should be emphasized that an Agricultural Marketing Information System can be developed as an instrument to help small farmers find proper markets and information about seasonal price trends. The results suggest that for the elimination of the information asymmetry and improvement of the market position of small citrus producers in the Lattakia region it is important to distribute real and current market information through a Marketing Information System to the farmers and thereby improve their decision-making in marketing their goods.

In 2010 the monthly price variation amplitude among the studied markets amounted to 11.4-76 SP/kg for Jablih and Lattakia market respectively. In general, the Lattakia wholesale market showed the highest prices. Price peaks are evident during July – October, which coincides with non-harvesting periods of the other citrus varieties. Monthly prices in 2011 tended similarly to 2010, with the highest prices during June – September. The variation amplitude between markets was 9.6– 83 SP/kg for Qurdaha and Lattakia market respectively. As usual, the Lattakia wholesale market had the highest prices and the Al-Qurdaha market the lowest ones. In 2012 and 2013 the weekly prices tended to a pattern, somewhat different than those monitored during 2010 and 2011.

The variation amplitude between markets was 9–100 SP/kg for Qurdaha and Lattakia market in 2012, respectively. Table 5 for the annual trends of prices shows the high dispersion (volatility) of prices around their mean, with asymmetric distribution, fluctuating from the right side (lowering prices) to the left one (increasing prices). The amplitude (standard deviations) ranged from 14.72 (Qurdaha 2013) to 20.77 (Lattakia 2013). Maximum prices were 2 or 6 times higher than minimum ones. These results are similar to Enders (2004) finding that: "In a volatile commodity price regime, there are periods of high volatility and periods of tranquility". Also, Negassa et al. (2003) found that "the volatility in commodity prices can change over a certain period of time". The prices of citrus varieties were calculated in Syrian pounds (SP).

Table 5. Mean, standard deviation, variance, minimum and maximum prices of Lemon Autochthon fruit, in Lattakia region wholesale markets during (2010-2013).

Market	Year	Mean	Standard deviation	Minimum SP / kg	Maximum SP / kg	Variance
Jablih	2010	28.83	16.73	11.42	70.00	279.93
	2011	29.75	17.96	12.44	80.00	322.74
	2012	34.44	21.11	12.00	90.00	445.70
	2013	33.96	20.14	15.00	88.00	405.71
Qurdaha	2010	25.95	14.92	11.50	68.00	222.65
	2011	26.81	16.52	9.64	78.00	273.24
	2012	29.03	16.70	9.01	80.00	279.09
	2013	27.46	14.72	12.65	77.00	216.71
Lattakia	2010	31.50	16.93	14.63	76.00	286.89
	2011	32.47	18.26	16.00	83.00	333.69
	2012	36.81	21.97	15.38	100.00	482.95
	2013	35.63	20.77	17.00	105.00	431.69
Haffi	2010	28.83	15.29	13.02	70.00	234.06
	2011	31.39	18.04	12.06	80.00	325.63
	2012	30.57	15.29	12.29	81.00	234.00
	2013	33.30	18.85	15.00	87.00	355.64

Source: Own calculations, 2013 based on data of the Agricultural Directorate in Lattakia

Figure 5 below depicts annual trends and fluctuations in Lemon Autochthon mean prices in 2010-2013. The Jablih market is described by the linear regression equation $y = 2.008x + 26.72$, indicating a positive (ascending) trend in lemon marketing prices.

This linear equation predicts prices with a validity of 81.8% (deterministic coefficient $R^2 = 0.818$).

The Qurdaha market is described by the linear regression equation y = 0.675x + 25.62, indicating an ascending trend in lemon marketing prices. This linear equation predicts prices with a validity of 44.8% (deterministic coefficient $R^2 = 0.448$), which suggests a considerable volatility of prices on the Qurdaha market.

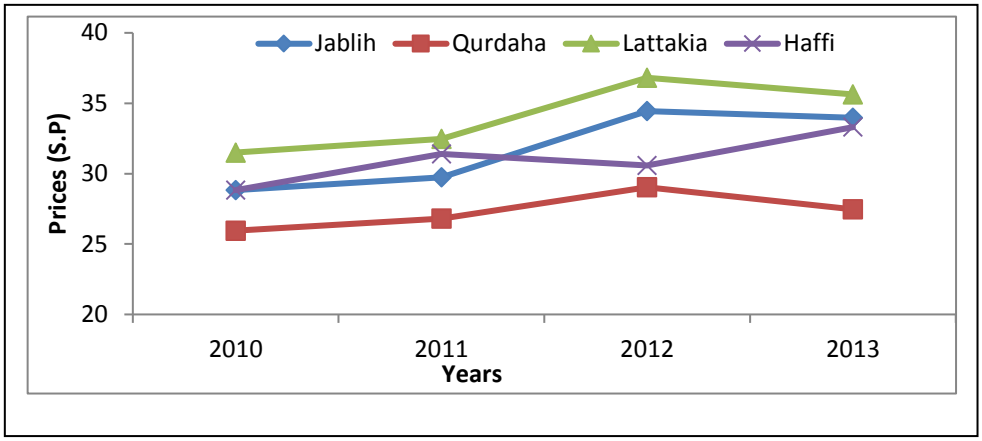


Figure 5. Annual trends and fluctuation for Lemon Autochthon mean prices in Lattakia region wholesale markets during (2010-2013).

Source: Own calculations, 2013 based on data of the Agricultural Directorate in Lattakia

The Lattakia market is described by the linear regression equation y = 1.673x + 29.92, indicating a positive trend in lemon marketing prices. This linear equation predicts prices with a validity of 73.2% (deterministic coefficient $R^2 = 0.732$). The Haffi market is described by the linear regression equation y = 1.259x + 27.87, indicating a positive trend in lemon marketing prices. This linear equation predicts prices with a validity of 76.6 % (deterministic coefficient $R^2 = 0.766$).

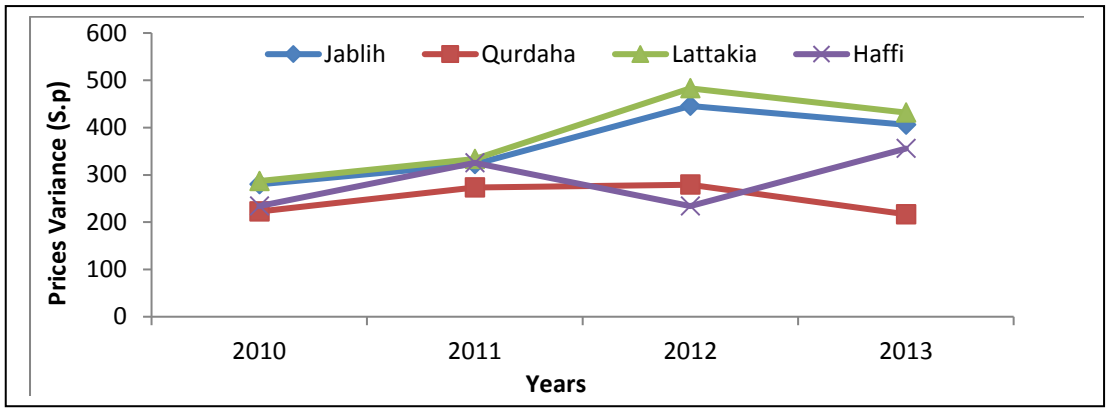


Figure 6. Annual fluctuation for Lemon Autochthon variance in prices 2010-2013

Source: Own calculations, 2013 based on data of Agricultural Directorate in Lattakia

In Figure 6, "Autochthon" Lemon price variance throughout 2010-2013 in the Lattakia region represents significant differences in prices between years and markets, which ranged between 216.7 to 482.9 SP for the Qurdaha market (2013) and the Lattakia market (2012) respectively.

5.1.2 The Autoregressive Integrated Moving Average ARIMA Model to Forecast Prices of the Citrus Lemon Autochthon

Data were available with daily prices for several varieties of lemon traded at local markets. It was necessary to transfer the data to MS Excel. Then the data were changed to the monthly average prices of Lemon Autochthon on the Lattakia market for the years 2010-2013. There were 48 observations with an average of 33.31 and a minimum value of 16 recorded in the year 2012 and a maximum value of 83.7 recorded in the year 2013, and a dispersion of the values of this series with an average standard deviation value of 19.05, which gives an idea of the degree of non-homogeneity of the sample of data. A SARIMA model was created in SW Minitab using monthly data described above.

Table 6. Lemon Autochthon monthly prices 2010-2013 (in SP/Kg)

YEAR / MONTH	2010	2011	2012	2013
January	17.10	17.70	16.00	23.30
February	21.50	19.80	17.00	26.00
March	18.40	19.80	19.60	25.90
April	18.60	20.10	28.10	26.30
May	28.20	22.60	48.00	29.70
June	34.30	37.80	57.70	49.60
July	65.80	42.40	47.80	55.70
August	53.40	63.80	65.50	83.70
September	60.60	57.30	60.10	75.20
October	17.10	16.30	17.10	21.40
November	18.00	18.40	19.30	24.20
December	17.30	17.40	18.30	20.00

Source: Agricultural Directorate in Lattakia (2014)

There are three stages of modelling as suggested by Box and Jenkins to find a suitable ARIMA model. They are identification, diagnostics, estimation and checking.

Model identification

The time series were analysed using statistical software (MINITAB). In different seasons of the year over the four years from 2010 to 2013, there were 48 observations based on monthly prices. The seasonal component is illustrated in figure 7, where the horizontal axis represents time and the prices are on the vertical axis.

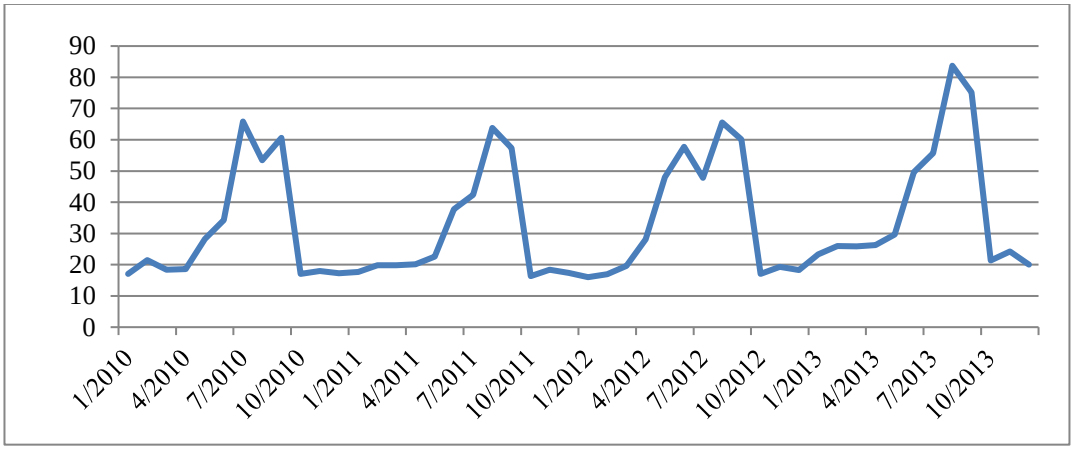


Figure 7. Prices of Lemon Autochthon in Lattakia 2010-2013 (in SP/kg)

Source: based on data of the Agricultural Directorate in Lattakia

The seasonality which is obvious in figure 7 is caused by the fluctuation of supply of Lemon Autochthons in Lattakia. These oscillations are repeated regularly and in the same part of each year. The prices decrease after the time of harvest, when there is high saturation of the market and the opposite before the harvest, when prices reach the maximum because of the lack of stocks. The following chart shows the auto-correlation function of the sample to build an appropriate model:

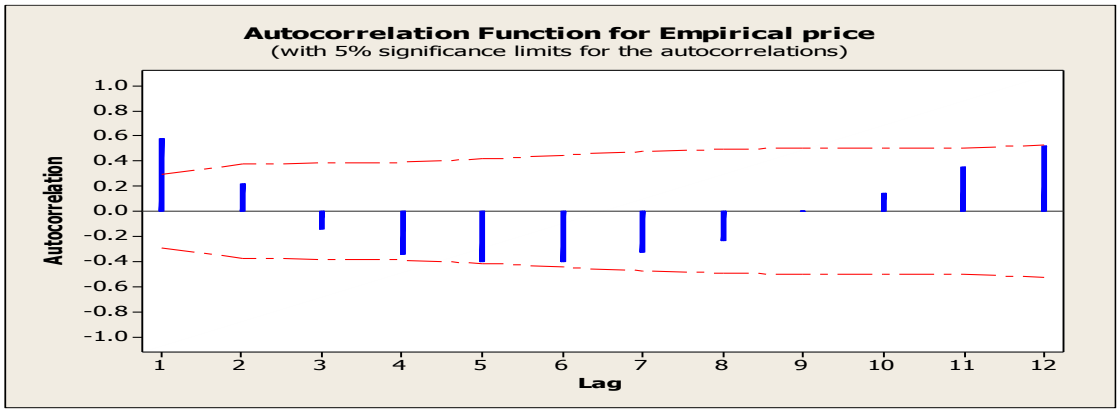


Figure 8.ACF of Lemon Autochthon prices

Source: processed in SW Minitab, based on data of the Agricultural Directorate in Lattakia

The parameters of the model can be obtained from figure 8, which shows that the correlation between the values and the previous values remains within the deviation and this chart can be seen as a model for the required sinus damping to find the parameters of the model. Partial self- correlation is represented in figure 9.

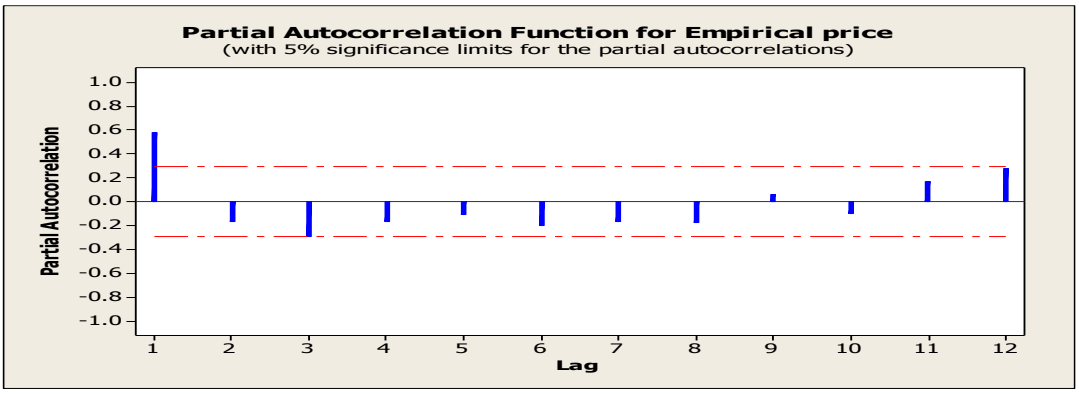


Figure 9.PCF of Lemon Autochthon prices

Source: processed in SW Minitab, based on data of the Agricultural Directorate in Lattakia

If the time series were random, large amounts of data would be correlated with each other close to zero, if the correlation does not head towards a reasonable rate of zero,

it indicates instability in the data. Figure 9, shows that a link between the value and the previous value regardless of any changes, so we can conclude that the time series is stable. It is clear that the autocorrelation function geometrically decreases after one slow degree, and this is a guide to the stability of the time series. The fact that the first delay in the red line cuts the blue line can be taken advantage of in building the model.

A comparison was made between the numbers of the SARIMA models to choose the best model. The predicted data should be closer to the real values. The values of MSE and MAE were the tool adopted to provide information about the most appropriate model.

Table 7. The value of MSE and MAE for the SARIMA models considered

MODEL	SARIMA (2,1,0) × (1,0,1)	SARIMA (2,1,1) × (1,0,1)	SARIMA (2,1,0) × (2,0,1)	SARIMA (2,1,0) × (2,1,1)
MSE	69.99	70.23	72.20	70.73
MAE	53.20	55.69	55.98	53.75

Source: processed in SW Minitab, based on data of the Agricultural Directorate in Lattakia

From the table above, it was found that the values of MSE and MAE of the SARIMA model (2, 1, 0) × (1, 0, 1) are the smallest compared with the other values. This indicates that it is the most suitable model for the given time series. This model should be able to predict reliable future values.

Estimation of parameters and model diagnosis

The best model was found to be the multiplier seasonal model SARIMA (2,1,0) × $(1,0,1,)_{12.}$ This indicates model is based on the ranking for the model AR, MA on a form of the autocorrelation function which matches the values of the autocorrelation coefficients with partial autocorrelation for the time series taking into account the seasonal differences, which can be found in figures (8) and (9).We can clearly see that the autocorrelation function (ACF) and partial autocorrelation function (PCF) gradually decrease (behaving like sine functions) which indicates that the best model

is the multiplier seasonal model of the type SARIMA (2,1,0) $\times(1,0,1)_{12}$. The Parameters of the model are then thus following:

Table 8. Estimated parameters

Type	Coefficient	SECoef	T	P
AR 1	-0.3692	0.1532	- 2.41	0.020
AR 2	-0.1607	0.1528	- 1.05	0.299
SAR 12	0.9937	0.0181	54.99	0.000
SMA 12	0.8248	0.1724	4.78	0.000
Constant	-0.0070	0.2933	- 0.02	0.981

Source: processed in SW Minitab, based on data of the Agricultural Directorate in Lattakia

Thus the values equal:

$$\phi_1 = -0.1607$$

$$\phi_2 = -0.1607$$

$$\Phi = 0.993$$

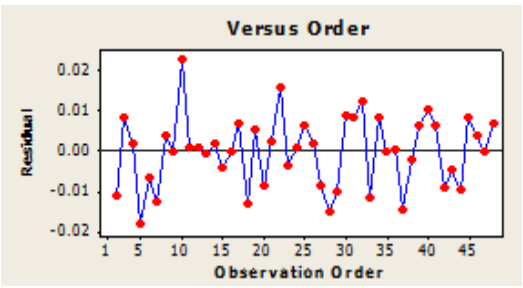
$$\Theta = 0.824$$

Via compensation, we find that the equations of the model are:

$$z_t = 0.6308z_{t-1} + 0.2085z_{t-2} + 0.1607\, z_{t-3} - 0.9937\, z_{t-12} - 0.6268\, z_{t-13} - 0.2072\, z_{t-14} - 0.1597\, z_{t-15} + a_t - 0.8248\, a_{t-12}$$

- Verification (Checking) of the model

The residuals were examined to verify the suggested form of the model. The normality of distribution, its independency and homoscedasticity were tested.



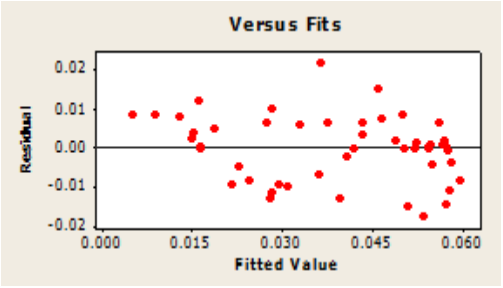


Figure 10.Residuals vs. the order of the data **Figure 11.**Residual vs. the fitted values

Source: processed in SW Minitab, based on data of the Agricultural Directorate in Lattakia

SARIMA (2, 1, 0) × (1, 0, 1)

Figure 10 shows the residuals versus the appropriate values. There is neither a trend nor specifically oriented residuals. This fact also indicates that an appropriate form of model was chosen; there is no visible orientation of residuals in figure 11either, which indicates that the residuals are independent and random.

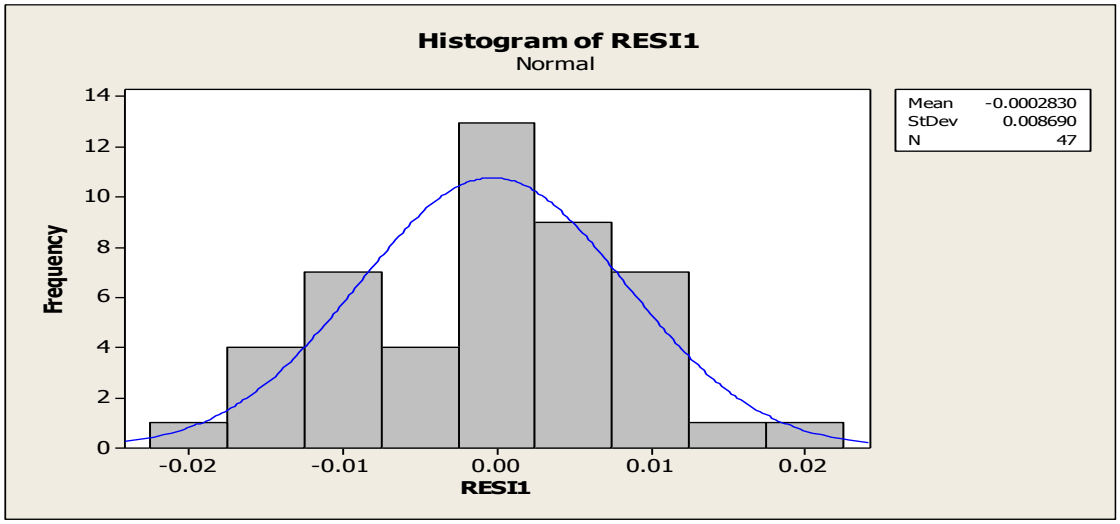


Figure 12. Histogram of residuals

Source: processed in SW Minitab, based on data of the Agricultural Directorate in Lattakia

Figure 12 is a histogram of residuals superimposed with a normal distribution curve and this shows that the residuals have a normal distribution.

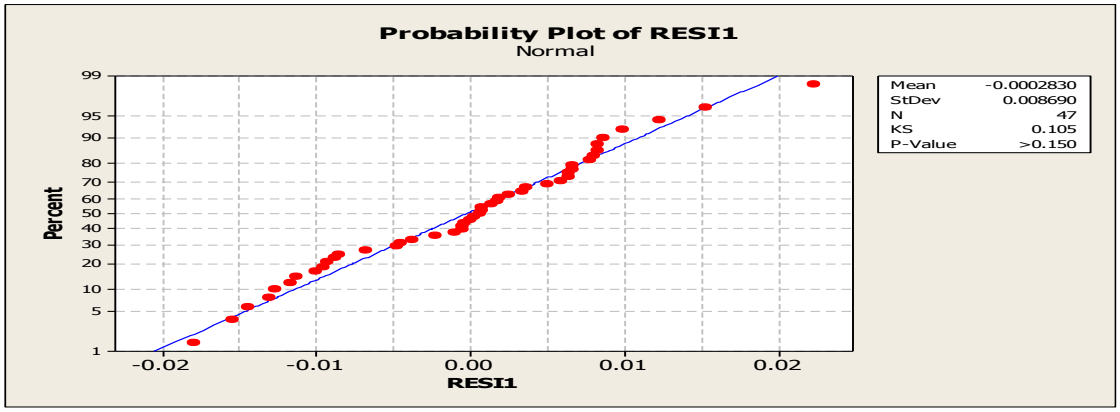


Figure 13. Distribution of residuals

Source: processed in SW Minitab, based on data of the Agricultural Directorate in Lattakia

Figure 13 shows the normality of the distribution of residuals using this model. There are not outliers. And according to the Kolmogorov - Smirnov test for residuals, we

find the P-value to be greater than 0.05 and therefore accept the null hypothesis that means the residuals are subject to a normal distribution.

Using the SARIMA model thus developed, the prices for Lemon Autochthon for the four years from 2014 until 2017 were predicted. The results are presented in Table (9). Figure 14 shows a comparison of the predicted (ex post forecasting) and real values for the years 2010 – 2013. There it is obvious that the series for the predicted periods follow the same behaviour as the original series.

Table 9. Predicted prices via the ARIMA model in SYP/Kg

YEAR / MONTH	2014	2015	2016	2017
January	23.62	26.16	30.33	37.18
February	25.48	28.11	32.54	40.04
March	26.07	28.80	33.44	41.39
April	27.52	30.33	35.25	43.87
May	31.39	34.13	39.49	49.39
June	44.42	45.85	51.82	65.11
July	47.19	48.51	54.96	69.78
August	56.24	56.25	63.26	81.32
September	57.59	57.85	65.53	85.45
October	23.23	26.85	32.54	42.26
November	25.85	29.70	36.01	47.22
December	22.57	26.38	32.34	42.58

Source: own calculation, based on data of the Agricultural Directorate in Lattakia

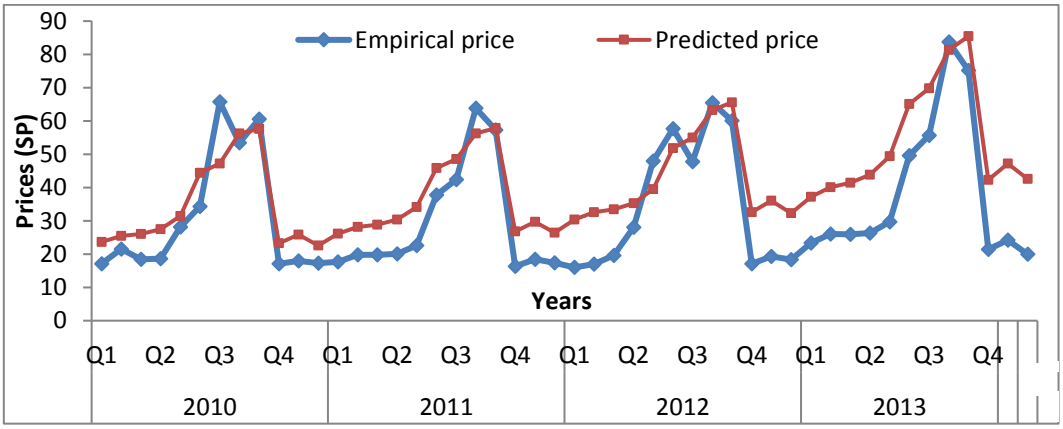


Figure 14. Empirical monthly prices of Lemon Autochthon compared with the predicted prices in SP/Kg Source: own calculation, based on data of the Agricultural Directorate in Lattakia

The best model was found to be the multiplier seasonal model of the type SARIMA $(2, 1, 0) \times (1, 0, 1)_{12}$ which was chosen in order to determine the course of the prices for the next 4 years. This showed that any significant changes would not occur in Lemon Autochthon prices until the end of 2017. If the increase in prices of inputs is taken into account due to Syria currently suffering from rapid inflation, in reality we get a decrease in the incomes of citrus growers, which may result in a number of farmers unwilling to continue producing citrus.

According to the results obtained, it can be stated that the SARIMA model is able to predict the prices of citrus on the Lattakia market and it should be taken into account when any Agricultural Marketing Information System is created.

5.2 Characteristics of citrus farmer and citrus maker agents: Identification of information needs

There was a high dispersion (volatility) of citrus prices observed on the Lattakia region markets. These prices also differed significantly between local wholesale markets. In turn, these findings may suggest that farmers in the region have difficulty to choose the right market at the right time to sell their citrus fruits. So, the objectives of this paragraph is to present the identified major marketing constraints faced by citrus farmers in the Lattakia region, analysis of the citrus market chain and information needs in order to suggest a "potential AMIS" reducing information asymmetry and improving the bargain position of the producers in the district in the citrus supply chain.

To get good insight in the citrus market in the Lattakia region, a questionnaire survey was conducted with the main market participants (producers, middlemen, retailers, wholesalers). The questionnaire is described in 4.2. In the following paragraphs some factors such as: citrus price volatility on markets; citrus logistics input prices; the significance in differences between citrus prices among the regional markets; citrus production costs and farmer's transport assets and means of communication, will be assessed.

5.2.1 Citrus farmer characteristics

Farmers' characteristics (age, gender, and educational level) are important in understanding the differences in marketing information asymmetry and selecting channels for the dissemination of market information. Citrus farmers' characteristics in the Lattakia region are shown in Table 10.

Table 10. Citrus farmer's characteristics in the Lattakia region

Items		District			
		Lattakia	**Al-Haffi**	**Al-Qurdaha**	**Jablih**
Age	**Upto 25**	15.0%	12.0%	13.0%	17.0%
	31-35	13.0%	18.0%	16.0%	14.0%
	36-40	11%	15 %	15%	12%
	41-45	19%	22%	24%	23%
	46-50	34.0%	26.0%	27.0%	28.0%
	50>	8.0%	7.0%	5.0%	6.0%
Gender	**Male**	80.0%	84.0%	81.0%	86.0%
	female	20.0%	16.0%	19.0%	14.0%
Education level	**Illiterate**	3.0%	2.0%	4.0%	1.0%
	primary	21.0%	17.0%	23.0%	23.0%
	Secondary	55.0%	65.0%	52.0%	48.0%
	Higher education	14.0%	12.0%	15.0%	20.0%
	University	7.0%	4.0%	6.0%	8.0%

Sources: Own calculation based on questionnaire data

The ages of citrus farmers

The citrus farmers were divided into five groups of up to 25 years, 31-35 years, 36-40 years, 41-45 years, 46-50 years and a group of >50 years. From the data in Table10, we can see that more than two thirds of the farmers were aged between 31 and 50 years and no significant differences (Table11) were noted between them vis-à-vis districts. This age range would be regarded as middle aged, and middle-aged farmers are more likely to take advantage of information and communication technologies,

thus they were expected to be more enthusiastic to improve their economic situation (Usman et al., 2012).

From the point of view of gender

Table10 shows that male farmers made up 80%, 84%, 81%, and 86% of respondents, while female farmers were 20%, 16%, 19%, and 14% of the total number of farmers in Lattakia, Al-Haffi, Al-Qurdaha and Jablih districts respectively. From the above data, males are four times more frequent than female farmers. This fact may ease the process of market information dissemination and AMIS implantation, due to the traditional weakness of the female social position, as compared with male. However, the differences in male farmer numbers in the above-mentioned districts are not significant (Table 11), and cannot explain information asymmetries between districts.

Citrus farmers' educational levels

These were divided into five groups: (Table10) illiterate citrus farmers, primary school, secondary school, higher than secondary school and university. This data shows that the majority (more than two thirds) of farmers are in two groups (primary and secondary school), and no significant differences exist within each group according to district (Table 11). It is important to note the small numbers of illiterate farmers, which may ease the dissemination process of market information and these results agree with information from the Bureau of Statistics that refer to a 2% illiteracy rate in the Lattakia region, distributed only among older age groups (CBS, 2012). This means that from a theoretical as well as from a practical point ofview the farmers are well prepared and have enough knowledge to receive marketinformation and get the benefits of this information.

We have studied the normality distribution of the questionnaire data in addition to some statistical tests like equality of variances, all of these results can be found in the Annex1: 139.

Table 11 shows that the differences of citrus prices and their significant differences between local wholesale markets cannot be attributed to farmers' ages, gender or education levels.

Table 11.ANOVA Test for farmers' characteristics

Items	Sum of Squares	df	Mean Square	F	Sig
Age of citrus farmer	3.760	3	1.253	0.241	0.913
Gender	.228	3	.076	1.655	0.531
education level	.447	3	.149	2.225	0.18
***results is significant at P<0.05**					

Sources: Own calculations based on questionnaire data

Citrus farmers' communication assets in the Lattakia region

As to citrus farmers' means of communication in the Lattakia region (TV, radio, mobile phone, personal computer and internet), these are important in understanding the differences in marketing information asymmetries and selecting channels for the dissemination of market information. About 95% of the farmers have radio, 88% of the farmers have TV, just 35% have a personal computer but about 93% of the farmers have mobile phones while about 35% have access to the internet. So, this result may indicate the inability of disseminating market information online, via the internet, and indicates that most of the farmers have radio, TV and mobile phones, so these can best be used to transmit market information to AMIS beneficiaries.

Table12. Percentages of citrus farmers who have communication tools in the Lattakia region

Communication tools	District			
	Lattakia	Al-Haffi	Al-Qurdaha	Jablih
Radio	97	96	95	92
TV	91	85	88	87
Personal computer	39	42	37	44
Cell Phone per family	93	91	94	95
Internet	39	28	36	40

Sources: Own calculation based on questionnaire data

It is important to say that the mobile phone is the best means of disseminating information because it is faster and easier to buy at a lower price. These facts were concluded by several studies: more than 90 percent of the population in most countries is served by a mobile phone signal which can be used to receive market information (Egyir, 2010). Aker (2008) found that the mobile phone reduced search cost and increased both traders' and consumers' welfare.

From the above data, at least 60% of farmers do not have access to internet, and no significant differences within each group are found by district (table 13). This result may indicate the inability of disseminating market information online, via the internet.

Table 13. An ANOVA test for citrus farmers communication assets in the Lattakia region

Items	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Radio apparatus	.140	3	.047	.980	.341
TV appliances	.187	3	.062	.578	.725
Personal computer	.290	3	.097	.398	.882
Cell phone apparatus	.088	3	.029	.460	.799
Access to the Internet	.887	3	.296	1.288	.232
***results is significant at P<0.05**					

Sources: Own calculations based on questionnaire data

The above result indicates that most farmers have radio, TV appliances, or cell phones, so that they can be used for transmitting market information to potential AMIS beneficiaries. As said above, it is worth noting that the mobile phone is the best means to disseminate information because it is faster and easier to buy with the lower price. These facts were concluded by several studies:

Mobiles are being used to help raise farmers' incomes, making agricultural marketing more efficient, lowering information costs, reducing transport costs, and providing a platform to deliver services and innovators (Annerose, 2010). SMS-based services are likely to cost considerably less than sending out mobile extension officers and be more accessible than internet-based services (Muto and Yamano, 2009).

Citrus farmers' transport assets in the Lattakia region

Many authors found that means of transport are essential for receiving market information, by increasing a farmer's mobility. So, citrus farmers' transport assets in the Lattakia region (cars, motorbikes and bicycles) could be important for alleviating the differences in marketing information asymmetry and selecting channels for the dissemination of market information. These are calculated in Table 14.

Table 14. Percent's of citrus farmers who have transport in the Lattakia region

Communication and transport means	**District**			
	Lattakia	**Al-Haffi**	**Al-Qurdaha**	**Jablih**
Car	27	21	23	24
Motorbike	40	54	59	53
Bicycle	25	29	27	30

Sources: Own calculations based on questionnaire data

It can be said that citrus farmers transport assets in the Lattakia region can assure sufficient mobility for farmers to obtain information from local agricultural units and markets.

Table 15. An ANOVA test for citrus farmers' transport assets in the Lattakia region

Items	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig**
Car	.188	3	.063	.343	.795
Motorbike	1.970	3	.657	2.655	.148
Bicycle	.148	3	.049	.243	.866
***results is significant at P<0.05**					

Sources: Own calculation based on questionnaire data

Table 15 shows no significant differences between farmers having various means of transport (cars, motorbikes, or bicycles) by district. It can be said that citrus farmers' means of transport in the Lattakia region can assure sufficient mobility for farmers to obtain information from local agricultural units and markets. So, it can be said, that market information asymmetry is related to other factors rather means of transport.

5.2.2 Characteristics of business for the farmers

Citrus farmer's income per year in the Lattakia region

The income per year may affect the interest of farmers in citrus production/marketing; therefore, the answers of farmers to this item were tabulated in Table 16 which shows that:

Table 16. Citrus farmer's income/year and source of income (SP/year)

Items		Districts in percents			
		Lattakia	**Al-Haffi**	**Al-Qurdaha**	**Jablih**
Income/year	**<200.000**	3	8	7	6
	200.000-300.000	9	26	23	28
	350.000-400.000	57	55	65	60
	>400.000	31	11	5	6

Sources: Own calculation based on questionnaire data

Citrus farmers' incomes per year were divided into four groups (<200.000, 200.000-300,000, 350,000- 400,000 and >400,000 SP/year). From the above data, more than two thirds of farmers are in two groups (200.000-300.000) SP/year income and 350.000-400.000 SP/year income farmers), and no significant differences exist within each group by district.

Cost of production components in Lattakia region

Differences in citrus production component costs/year/ha (saplings, manure, fertilizer, labour, pesticides/chemicals and irrigation) are important in understanding the differences in marketing information asymmetry. Table 17 shows that:

Table 17. Mean cost of variable inputs (SP/year/ha)

Items	District	Mean	Std. Deviation	Minimum	Maximum
Saplings	**Jablih**	390.1	100.4	129.0	858.0
	Al-Qurdaha	376.5	104.3	129.0	642.0
	Al-Haffi	232.4	118.3	87.0	429.0
	Lattakia	147.9	44.9	87.0	258.0
Chemicals	**Jablih**	4369.6	315.7	3100.0	5220.0
	Al-Qurdaha	3793.8	175.0	3200.0	4160.0
	Al-Haffi	3072.8	153.9	2640.0	3400.0
	Lattakia	2594.0	153.1	2310.0	3060.0
Seasonal labour	**Jablih**	3478.3	210.1	2500.0	4000.0
	Al-Qurdaha	3095.9	146.8	2600.0	3380.0
	Al-Haffi	2526.9	122.1	2160.0	2800.0
	Lattakia	2132.9	120.2	1960.0	2520.0
Manure	**Jablih**	7949.4	631.8	6660.0	9660.0
	Al-Qurdaha	6876.8	825.7	5660.0	8340.0
	Al-Haffi	6919.0	1166.4	4660.0	8340.0
	Lattakia	7591.4	383.1	7000.0	8500.0
Fertilizer	**Jablih**	9052.1	353.5	6132.0	9300.0
	Al-Qurdaha	6075.2	752.2	5568.0	8898.0
	Al-Haffi	5789.7	74.7	5528.0	5900.0
	Lattakia	5131.3	1193.5	2864.0	5860.0
Irrigation	**Jablih**	2000.0	0.0	2000.0	2000.0
	Al-Qurdaha	2000.0	0.0	2000.0	2000.0
	Al-Haffi	2000.0	0.0	2000.0	2000.0
	Lattakia	2000.0	0.0	2000.0	2000.0

Sources: Own calculation based on questionnaire data

Sapling costs (SP/year/ha): from Table 17 it can be seen that the mean of sapling unit cost ranged from 147,9 to 390.1 SP., in Lattakia and Jablih respectively, these differences in sapling unit cost are due to the differences between sapling acquisition from governmental and private sectors respectively. However, the questionnaire data showed that farmers replace around of 3 trees/year/ha, so, the means of total sapling costs (ha/year) were 390.1, 376.7, 232.4 and 147.9 (SP/year), for Jablih, Al-Qurdaha, Al-Haffi and Lattakia respectively. These differences in mean sapling total

cost between the districts is significant at P<0.05 (Table 18), and may be attributed to information asymmetry, about sapling nurseries prices and quality.

Manure costs (SP/year/ha): significant differences in total manure cost between districts (Table 18) are found, where the highest total costs were in Jablih (7949.4) and lowest ones were in Al-Qurdaha (6876.8). This significant difference may indicate that farmers cannot choose the right vendor, and need this information to reduce production costs.

Chemical fertilizer costs (SP/year/ha): significant differences in total fertilizer cost were found between districts, where the highest total costs were in Jablih (4369.6) and lowest ones were in Lattakia (2594.0). These differences can be attributed to the fact that farmers are accustomed to use liquid mineral fertilizer which is imported and sold by particular agents; however, their prices differ substantially from one store to another. On one hand, the framers may need to be informed about mineral fertilizer prices in each store and on the other hand the farmers should be advised to use solid fertilizers which are imported by the government and sold by agricultural banks and cooperatives so as to avoid trader abuse.

Labour costs (SP/year/ha): Table 18 shows significant differences in total labour costs between districts, where the highest total labour costs were in Jablih (3478.3) and lowest ones were in Lattakia (2132.9).

Table 18. Mean differences of production input costs (logistics) according to districts

Unit cost	Sum of Squares	df	Mean Square	F	Sig.
Manure(SP/m^3)	3943155.23	3	1314385.08	232.74	.000
Fertilizer(SP/tone)	127428576.00	3	42476192.00	188.13	.000
Labour(SP/day)	1349475.00	3	449825.00	635.50	.000
Chemicals(SP/kg)	1046038.00	3	348679.33	115.99	.000
Sapling(SP/seedling)	455506.44	3	151835.48	148.05	.000

Sources: Own calculation based on questionnaire data

These results may indicate that citrus farmers either don't apply herbicides correctly, or manpower is not sufficient to fulfill the demands of the agricultural process, indicating that it would be necessary to carry out in-depth research to clarify the issues involved.

Pesticide/chemicals (SP/year/ha): significant differences in total pesticide/chemical costs between districts are shown in Table 18, where the highest total costs of pesticides were in Jablih (4369.6) and lowest ones were in Lattakia (2594.0). This result may be understood as due to differences in pesticide prices between different vendors who exploit naive farmers or it may be caused by the amount of pesticides added annually per hectare by farmers. Therefore, farmers must be informed about chemical prices in different stores and be aware of how and when to apply these chemicals.

Irrigation costs (Syrian pounds/year/ha): the cost of water is fixed by the Syrian Ministry of Irrigation (2000 SP/ha), so there are no significant differences in total irrigation costs between districts.

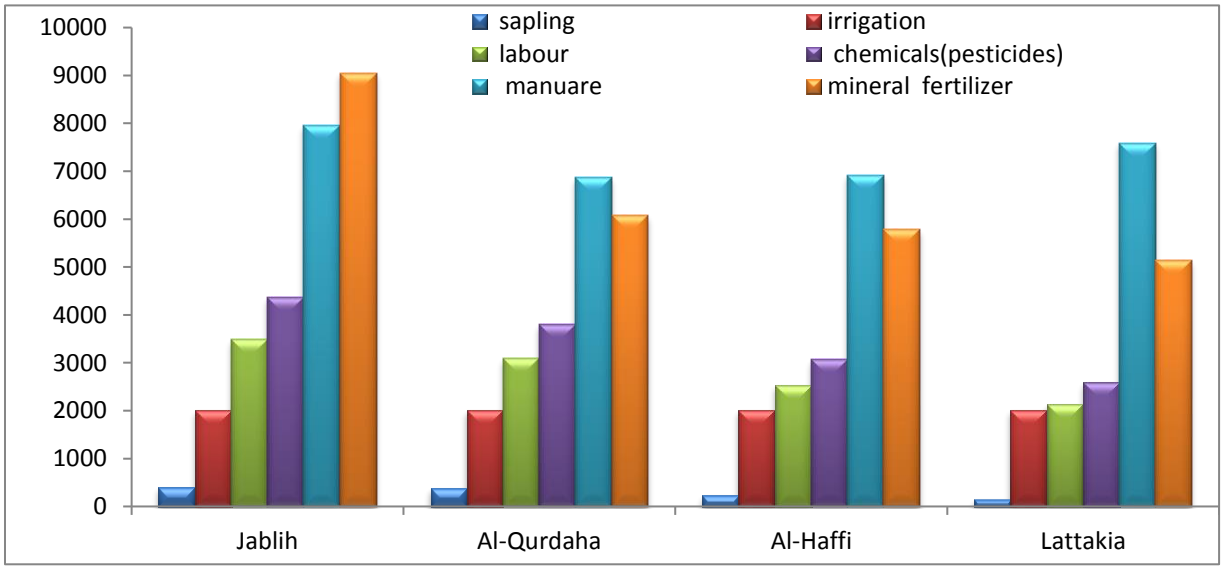


Figure 15.Mean of production logistics costs (SP/ha/year)

Sources: Own calculations based on questionnaire data

Fig. 15 shows that mineral fertilizer is the highest input in the production process, followed by manure, pesticides and saplings, with irrigation coming in last position.

Total cost of inputs (SP/ha/year): Fig. 16 shows that Jablih has the highest input (27,239.5) costs in the production process, followed by Al-Qurdaha (22,218.1), whereas Al-Haffi (20,540.7) and Lattakia (19,597.49) ranked in third and fourth places respectively.

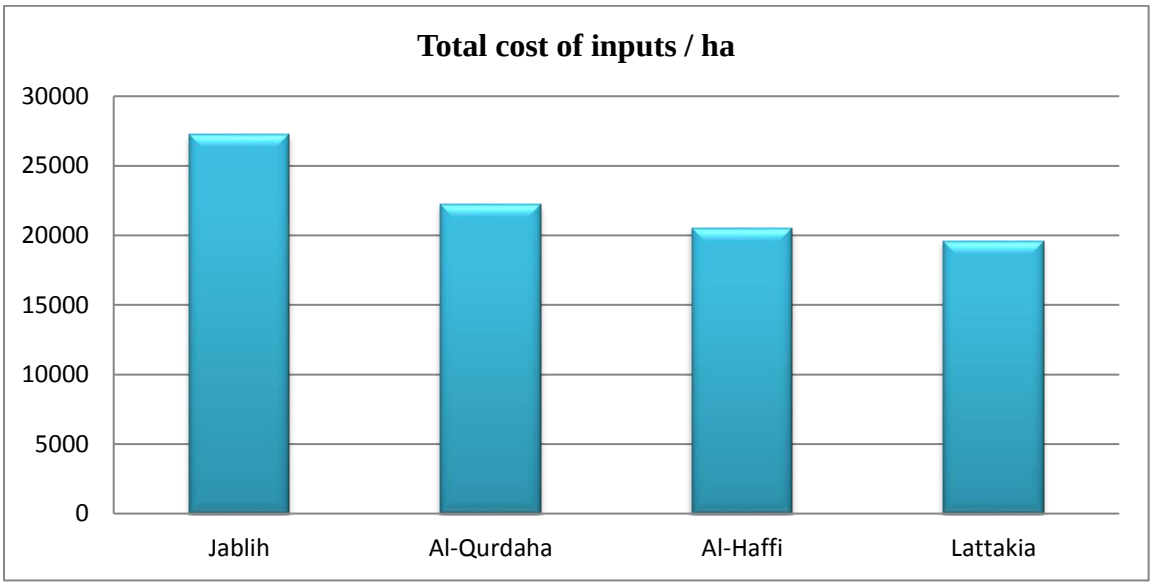


Figure 16. Total cost of inputs in the Lattakia region (SP/ha/year)

Sources: Own calculation based on questionnaire data

Production of citrus types in the Lattakia districts (Mt/ha):

Table 19 presents production averages for the main citrus types in the Lattakia districts as reported by the farmers questioned. Generally speaking, Jablih district had the highest production per ha for all types, followed by Lattakia and Al-Qurdaha, however Al-Haffi had the lowest production. Grapefruits had the highest production numbers, whereas lemons have the lowest production in all districts, as compared with all other types of citrus fruit.

Table 19. Citrus fruit production in different districts in the Lattakia region (Mt/ha)

District	Grapefruit	Valencia	Clementine	Jaffa	Lemon Autochthon
Jablih	135	54	60	37.5	33
Lattakia	120	45	51	30	27
Al-Qurdaha	114	39	45	27	21
Al-Haffi	102	30	36	24	12

Sources: Own calculations based on questionnaire data

Average prices of citrus types at the farm-gate (SP/year)

Table 20 shows average prices for citrus types in the Lattakia region districts (SP/year) as follows:

Table 20. Average prices of citrus types at the farm-gate (SP/year)

Average price of:		Mean	Std. Deviation	Minimum	Maximum
lemon	**Jablih**	28.76	17.12	11	80
	Al-Qurdaha	25.92	15.52	10	78
	Al-Haffi	29.61	16.55	12	80
	Lattakia	31.44	17.38	15	83
Jaffa	**Jablih**	12.88	4.50	8	27
	Al-Qurdaha	15.65	5.64	10	34
	Al-Haffi	13.04	2.65	9	19
	Lattakia	13.14	4.32	8	28
Clementine	**Jablih**	18.85	4.06	13	26
	Al-Qurdaha	22.86	5.15	15	32
	Al-Haffi	18.61	4.24	13	26
	Lattakia	19.22	4.13	13	27
Valencia	**Jablih**	23.16	5.83	15	36
	Al-Qurdaha	28.67	7.65	19	45
	Al-Haffi	22.58	5.00	16	35
	Lattakia	23.81	5.93	16	36
Grapefruit	**Jablih**	6.14	1.66	4	12
	Al-Qurdaha	7.59	2.12	6	15
	Al-Haffi	6.10	1.51	4	12
	Lattakia	6.26	1.69	4	12

Sources: Own calculations based on questionnaire data

Lemon prices: the highest average prices were in Lattakia (31.44) followed by Al-Haffi (29.61), Jablih (28.76) and Al-Qurdaha (25.92). These prices have a high volatility ranging from 10 (Al-Qurdaha) to 83 SP. (Lattakia).

Jaffa prices: the highest average prices were in Al-Qurdaha (15.65), followed by Lattakia (13.14), Al-Haffi (13.04) and Jablih (12.88). These prices have a high volatility ranging from 8 (Jablih and Lattakia) to 34 SP. (Al-Qurdaha).

Clementine prices: the highest average prices were in Al-Qurdaha (22.86) followed by Lattakia (19.22), Jablih (18.85) and Al-Haffi (18.61). These prices have a high volatility ranging from 13 (Lattakia, Jablih, Al-Haffi) to 32 SP. (Al-Qurdaha).

Valencia prices: the highest average prices were in Al-Qurdaha (28.67) followed by Lattakia (23.81), Jablih (23.16) and Al-Haffi (22.58). These prices have a high volatility ranging from 15 (Jablih) to 45 SP. (Al-Qurdaha).

Grapefruit prices: the highest average prices were in Al-Qurdaha (7.59), followed by Lattakia (6.29), Jablih (6.14) and Al-Haffi (6.10). These prices have a high volatility ranging from 4 (Lattakia, Jablih, and Al-Haffi) to 15 SP. (Al-Qurdaha).

An ANOVA test was performed to test the significance of the differences between the prices (SP/year) of citrus types in the Lattakia region (Table 21).

Table 21. An ANOVA test for average prices of citrus types at farm-gate (SP/year)

Average price of:	Sum of Squares	df	Mean Square	F	Sig.
Lemon	1585.03	3	528.34	1.903	.002
Jaffa	521.62	3	173.87	8.929	.000
Clementine	1200.27	3	400.09	20.446	.000
Valencia	2337.32	3	779.10	20.369	.000
Grapefruit	153.01	3	51.00	16.390	.000
***results is significant at P<0.05**					

Sources: Own calculations based on questionnaire data

All citrus types showed significant differences in prices by districts. This finding may suggest that farmers in the region cannot choose the right market at the right time to sell their citrus fruit. So, an AMIS is necessary to reduce these differences in market prices.

Gross return on citrus fruit production (SP/ha):

Gross returns on citrus fruit per ha. (SP/ha) were calculated based on citrus farmers' answers to questionnaire items concerning the quantity produced per hectare (Mt/ha) and the average prices of fruit (SP/Kg). The results were tabulated (Table 22).

Table 22. Gross return on citrus production (SP/ha) in different districts

Citrus type	District	Price (Kg)	Prod. Mt / ha	Gross return
lemon	**Jablih**	28.76	33	949080
	Al-Qurdaha	25.92	27	699840
	Al-Haffi	29.61	21	621810
	Lattakia	31.44	12	377280
Jaffa	**Jablih**	12.88	37.5	483000
	Al-Qurdaha	15.65	30	469500
	Al-Haffi	13.04	27	352080
	Lattakia	13.14	24	315360
Clementine	**Jablih**	18.85	60	1131000
	Al-Qurdaha	22.86	51	1165860
	Al-Haffi	18.61	45	837450
	Lattakia	19.22	36	691920
Valencia	**Jablih**	23.16	54	1250640
	Al-Qurdaha	28.67	45	1290150
	Al-Haffi	22.58	39	880620
	Lattakia	23.81	30	714300
Grapefruit	**Jablih**	6.14	135	828900
	Al-Qurdaha	7.59	120	910800
	Al-Haffi	6.1	114	695400
	Lattakia	6.26	102	638520

Sources: Own calculations based on questionnaire data

Lemon gross returns (SP/ha): the highest average gross returns were in Jablih (949,080), followed by Al-Qurdaha (699,840), Al-Haffi (621,810) and Lattakia (377,280). These gross returns have a high volatility ranging from 377,280 (Lattakia) to 949,080 SP. (Jablih) Table 22. This difference in gross return between districts can be attributed to the differences in land suitability for lemon production.

Jaffa gross returns (SP/ha): the highest average gross returns were in Jablih (483,000), followed by Al-Qurdaha (469,500), Al-Haffi (352,080) and Lattakia (315360). These gross returns have a high volatility as ranging from 315,360 (Lattakia) to 483,000 SP. (Jablih).

Clementine gross returns (SP/ha): the highest average gross returns were in Al-Qurdaha (1,165,860), followed by Jablih (1,131,000), Al-Haffi (837,450) and Lattakia (691,920). These gross returns have a high volatility ranging from 691,920 (Lattakia,) to 1,165,860 SP. (Al-Qurdaha).

Valencia gross returns (SP/ha): the highest average gross returns were in Al-Qurdaha (1,290,150), followed by Jablih (1,250,640), Al-Haffi (880,620) and Lattakia (714,300). These gross returns have a high volatility ranging from 714,300 (Lattakia,) to 1,290,150 SP. (Al-Qurdaha).

Grapefruit gross returns (SP/ha): the highest average gross returns were in Al-Qurdaha (910,800), followed by Jablih (828,900), Al-Haffi (695,400) and Lattakia (638,520). These gross returns have a high volatility ranging from 638,520 (Lattakia,) to 910,800 SP. (Al-Qurdaha).

The averages for citrus types of gross returns at the farm-gate (SP/year) showed that Valencia citrus fruits have the highest gross return as compared with the other types, so farmers may be advised to cultivate this type instead of Lemon and Jaffa citrus fruit types in the future.

Net return of citrus fruit (SP/ha):

Net returns on citrus fruit per ha (SP/ha) were calculated based on this basis:

Net Returns on Citrus Fruit = Gross return – Total Production Costs. (SP/ha)

Table 23. Net returns on citrus production (SP/ha) in different districts

		Total cost of logistics	Rent Ha	Harvest cost	Net return
lemon	**Jablih**	27239.54	100000	66000	755840.5
	Al-Qurdaha	22218.19	100000	54000	523621.8
	Al-Haffi	20540.7	100000	42000	459269.3
	Lattakia	19597.49	100000	24000	233682.5
Jaffa	**Jablih**	27239.54	100000	75000	280760.5
	Al-Qurdaha	22218.19	100000	60000	287281.8
	Al-Haffi	20540.7	100000	54000	177539.3
	Lattakia	19597.49	100000	48000	147762.5
Clementine	**Jablih**	27239.54	100000	120000	883760.5
	Al-Qurdaha	22218.19	100000	102000	941641.8
	Al-Haffi	20540.7	100000	90000	626909.3
	Lattakia	19597.49	100000	72000	500322.5
Valencia	**Jablih**	27239.54	100000	108000	1015400
	Al-Qurdaha	22218.19	100000	90000	1077932
	Al-Haffi	20540.7	100000	78000	682079.3
	Lattakia	19597.49	100000	60000	534702.5
Grapefruit	**Jablih**	27239.54	100000	270000	431660.5
	Al-Qurdaha	22218.19	100000	240000	548581.8
	Al-Haffi	20540.7	100000	228000	346859.3
	Lattakia	19597.49	100000	204000	314922.5

Sources: Own calculations based on questionnaire data

Lemon net returns (SP/ha): the highest average net returns were in Jablih (755,840.5), followed by Al-Qurdaha (523,621.8), Al-Haffi (459,269.3) and Lattakia (233682.5). These net returns have a high volatility ranging from 233,682.5 (Lattakia) to 755,840.5 SP. (Jablih). (Table 23).

Jaffa net returns (SP/ha): the highest average net returns were in Al-Qurdaha (287,281.8), followed by Jablih (280,760.5), Al-Haffi (177,539.3) and Lattakia (147,762.5). These net returns have a high volatility ranging from 147,762.5 (Lattakia) to 287,281.8 SP. (Al-Qurdaha).

Clementine net returns (SP/ha): the highest average net returns were in Al-Qurdaha (941,641.8), followed by Jablih (883,760.5), Al-Haffi (626,909.3) and

Lattakia (500,322.5). These net returns have a high volatility ranging from 500,322.5 (Lattakia,) to 941,641.8 SP. (Al-Qurdaha).

Valencia net returns (SP/ha): the highest average net returns were in Al-Qurdaha (1,077,932), followed by Jablih (1,015,400), Al-Haffi (682,079.3) and Lattakia (534,702.5). These net returns have a high volatility ranging from 534,702.5 (Lattakia,) to 1,077,932 SP. (Al-Qurdaha).

Grapefruit net returns (SP/ha): the highest average net returns were in Al-Qurdaha (548,581.8), followed by Jablih (431,660.5), Al-Haffi (346,859.3) and Lattakia (314,922.5). These net returns have a high volatility ranging from 314,922.5 (Lattakia,) to 548,581.8 SP. (Al-Qurdaha).

The averages for citrus types of net returns at the farm-gate (SP/year) are represented graphically in Figure 17, which shows that Valencia citrus fruits have the highest net returns as compared with the other types, so farmers may be advised to cultivate this type instead of Jaffa citrus fruit types in the future.

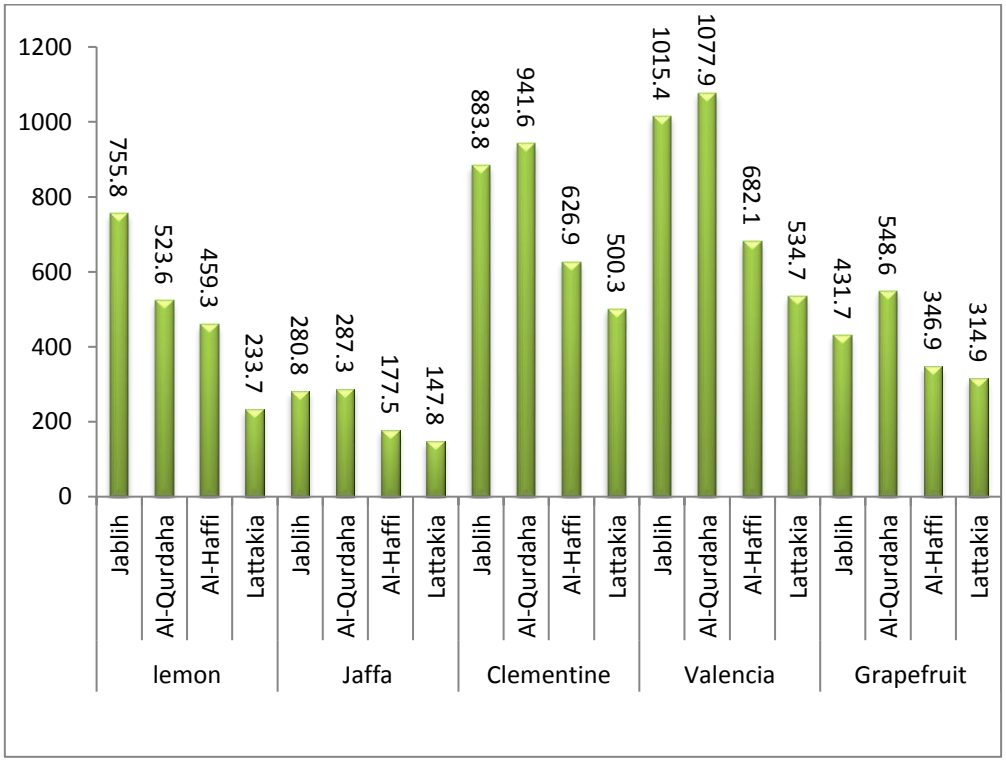


Figure 17. Net returns on citrus production (SP/ha) in different districts

Sources: Own calculations based on questionnaire data

5.2.3 Farmer behaviour in the market

Grading and packaging citrus fruits production

The grading and packaging of citrus fruit production may improve citrus marketing prices and farmers net returns. Citrus farmers' answers to questionnaire items concerning grading and packaging show that 47%, 51%, 58% and 59% of farmers in Jablih, Al-Qurdaha, Al-Haffi and Lattakia respectively, package and sort their production before selling it to the markets.

Sharif et al. (2005) say there are generally great differences between prices paid by the consumer and those received by producers. Due to lack of this grading (sic) and standardization, various intermediaries are getting more than their due margins. The unjustified share is because of monopoly in the market by commission agent (sic), and small scale of market retailers are operating with him (sic). Therefore, farmers must be informed about how to grade and package their citrus fruits, whereby they can improve their prices on the markets. This information can be disseminated by an AMIS.

Major buyers of citrus fruit production

Lower numbers of mediators in the selling process should contribute to higher profits for farmers (Sharif et al., 2005). An AMIS which tells farmers where to sell their fruit may also be helpful in reducing the number of these "parasite intermediaries".

Citrus farmers' answers to questionnaire items concerning major buyers of citrus fruit production are represented graphically in Figure 18. This figure shows that 75%, 83%, 81% and 81% of citrus fruit farmers in Jablih, Al-Qurdaha, Al-Haffi and Lattakia respectively sell their production to "farmer collectors"; 9%, 5%, 7% and 3% of citrus fruit farmers in Jablih, Al-Qurdaha, Al-Haffi and Lattakia respectively sell their production to "road head collectors"; 15%, 8%, 9% and 15% of citrus fruit farmers in Jablih, Al-Qurdaha, Al-Haffi and Lattakia respectively sell their production to "wholesalers" and 1%, 4%, 3% and 1 % of citrus fruit farmers in Jablih,
Al-Qurdaha, Al-Haffi and Lattakia respectively sell their production to "retailers".

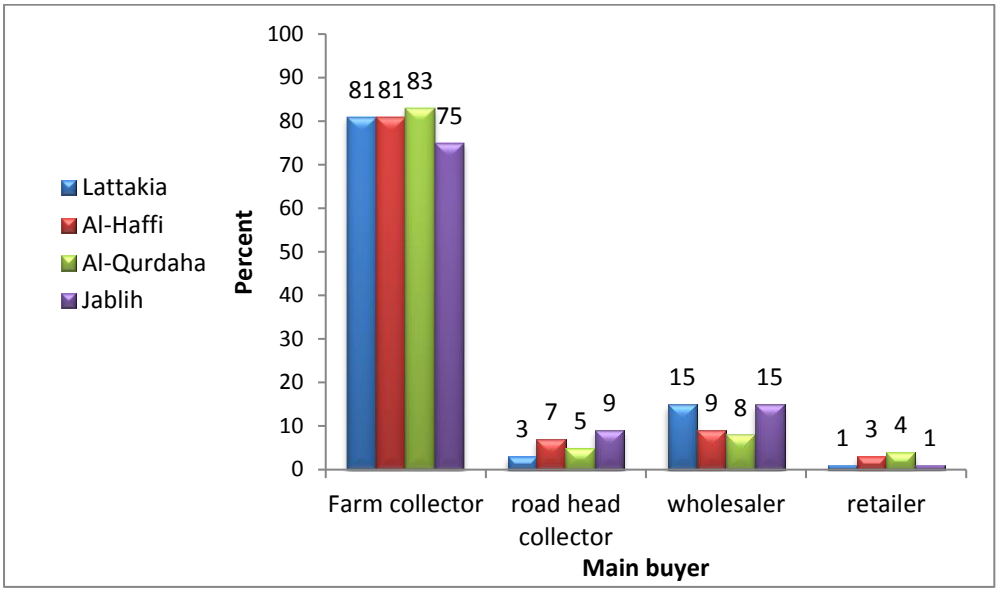


Figure 18. Major buyers of citrus fruit production

Sources: Own calculations based on questionnaire data

A functional AMIS is necessary to increase the number of the citrus fruit transactions between farmers and wholesalers, rather than selling to collectors or contractors.

Citrus fruit farmers contractual agreements

Citrus farmers' answers to questionnaire items showed that most citrus farmers in the Lattakia region contract their production as shown in Figure 19. Where72%, 76%, 83% and 80% of citrus fruit farmers in Jablih, Al-Qurdaha, Al-Haffi and Lattakia respectively contract their production. However, 28%, 41%, 28% and 23% of citrus fruit farmers in Jablih, Al-Qurdaha, Al-Haffi and Lattakia respectively contract their production of the "beginning of the season", and 72%, 59%, 72% and 77% of citrus fruit farmers in Jablih, Al-Qurdaha, Al-Haffi and Lattakia respectively, contract their production of citrus just before harvest time. Lack of capital to invest in the production process forms the main reason for "pre-harvest contracts" which in turn cause a substantial loss in farmers' profits. Therefore, a functional AMIS should improve farmers' accesses to credit, by offering information about potential banks and their credit facilities and conditions, in addition to helping the farmers in the marketing process which means reducing the marketing risk by submitting important information about when and where they can sell their products.

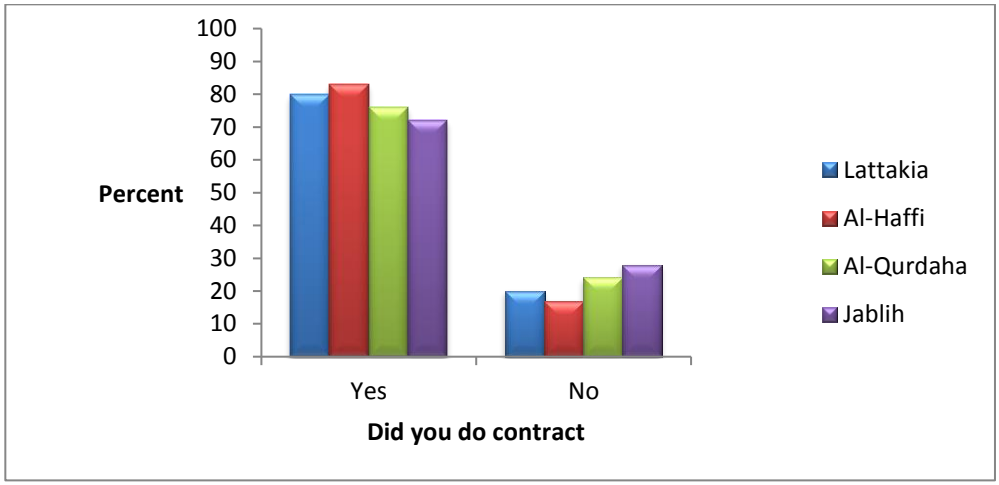


Figure 19. Citrus fruit farmer's contractual agreements

Sources: Own calculations based on questionnaire data

Who decides on the price of citrus fruit?

Questionnaire data revealed that buyers decide the prices of citrus fruit in more than two thirds of cases (Fig. 20) this fact indicates the weakness of the farmers' position in the bargaining process, where only 36%, 24%, 21% and 24% of farmer's bargain on citrus prices with buyers in Jablih, Al-Qurdaha, Al-Haffi and Lattakia respectively. This result may suggest that farmers don't know citrus prices and accept the offers made by traders. This is precisely why an AMIS is necessary to inform farmers about citrus prices, which in turn would improve the farmers' position in the bargaining process.

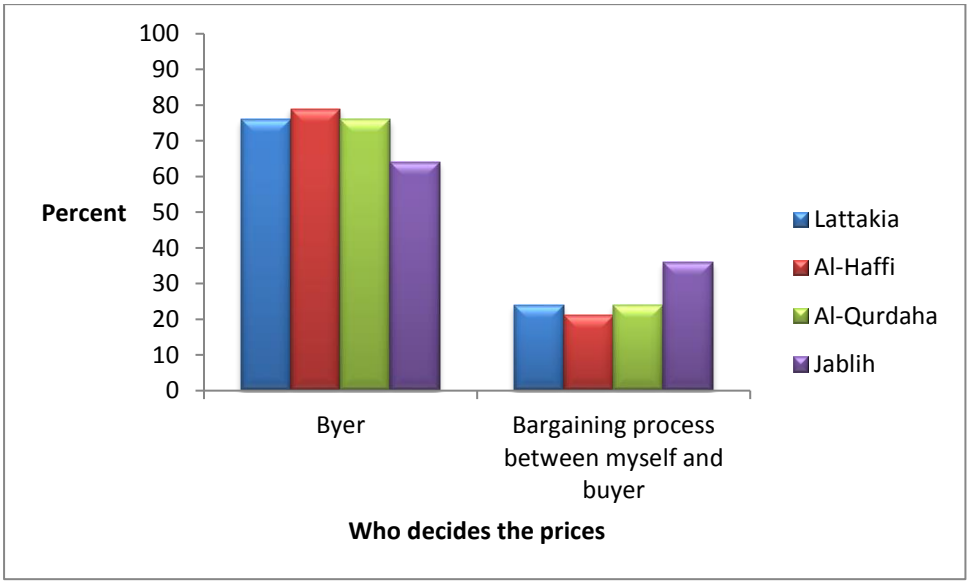


Figure 20. Who decides the prices of citrus fruit?

Sources: Own calculations based on questionnaire data

The types of market information needed by farmers

The majority of the farmers participating in our survey (>90%) lack information on prices, as well as supply and demand forecasts. This information is vitally important for a vibrant market, providing, as it does, essential improvements in the farmers' position in the market chain. Only a marginal share of respondents (5%) expressed their preference for information about input prices, weather and agricultural technology. These results suggest that the main problem of citrus farmers in the Lattakia region is linked to marketing and the absence of time-related and reliable information on prices. Thus, there is a need to think about the importance of mobile phones in information dissemination to the farmers in the Lattakia region because these services offer greater flexibility with two way direct communication by SMS and voice, which TV and radio, for example, cannot do. As seen in many developing countries the mobile phone has become one of the most important information and communication technologies and helps farmers get better access to market information (Furuholt and Matotay, 2011; Minten et al., 2011).

Sources of market information

In spite of being sufficiently equipped with ICT, particularly mobile phones, a majority of the citrus farmers depended on their neighbours as their source of market information, according to the citrus farmers' responses. Here we can find that 88% to 92%, of citrus farmers in the study area get market information from their neighbours whereas 3% to 7% used mobile phones to acquire market information, usually from middlemen. This high share of "neighbour based" market information corresponds to the findings from the Middle Belt region of Nigeria, where agricultural marketing information was delivered to the farmers by their friends, family and neighbours (Orbunde, 2010). Similar results were also observed in Pakistan, where farmers obtain their agricultural information mainly from informal sources, such as friends, relatives and/or neighbours (Naveed et al., 2012), such as in Faisalabad region, where almost all local sugar cane producers (91.1%) acquired their core information from friends, despite a high rate of ownership (>75%) of radios and/or televisions (Abbas et al., 2003), which corresponds to the mass media equipment among the households included in the survey in the Lattakia region. One of the reasons behind citrus farmers

in Lattakia turning to their neighbours to receive market information is the absence of any guaranteed source of correct and timely information even though farmers are equipped with sufficient technology to potentially access such market information. Only a minor share of interviewed farmers (5%), used mobile phones to get information from alternative sources, i.e. directly from traders in the central markets or other middlemen. In South Asian countries, such as Bangladesh, China, India and Vietnam, approximately 80% of farmers possessed and used mobile phones to receive important market information (Minten et al., 2011).

As to the access to market information

Almost 95%, 93%, 94% and 87% of the farmers in Jablih, Al-Qurdaha, Al-Haffi and Lattakia respectively had insufficient degree of access to market information which means that they did not have the ability to negotiate with the trader and had a disadvantage in their bargaining power, on the other hand just 3%, 3%, 2%, 5% of the farmers in Jablih, Al-Qurdaha, Al-Haffiand Lattakia respectively had sufficient access to market information. For this reason, in addition to poor access to market information and information asymmetry, all of the farmers depended on the middleman to market their production and did not assume the risk of going to the market.

This is obvious as they rely particularly on insufficient information gained from the neighbours, and from middlemen whose interest is to hide information on prices in the central markets. We found that neither the government nor any other organizations produced the information needed by farmers. Thus, most of the citrus farmers remained in the hands of middlemen. This corresponds to the situation documented, for example, in Malawi (Katengeza et al., 2010), where the majority of farmers do not take the risk of bringing the produce to the distant markets due to the lack of information and rather sell their produce at the farm-gate, to the middlemen. The provision of market information by a service that would be independent of middlemen should help the farmers reduce the risk of any wrong decision made on when and where they should sell.

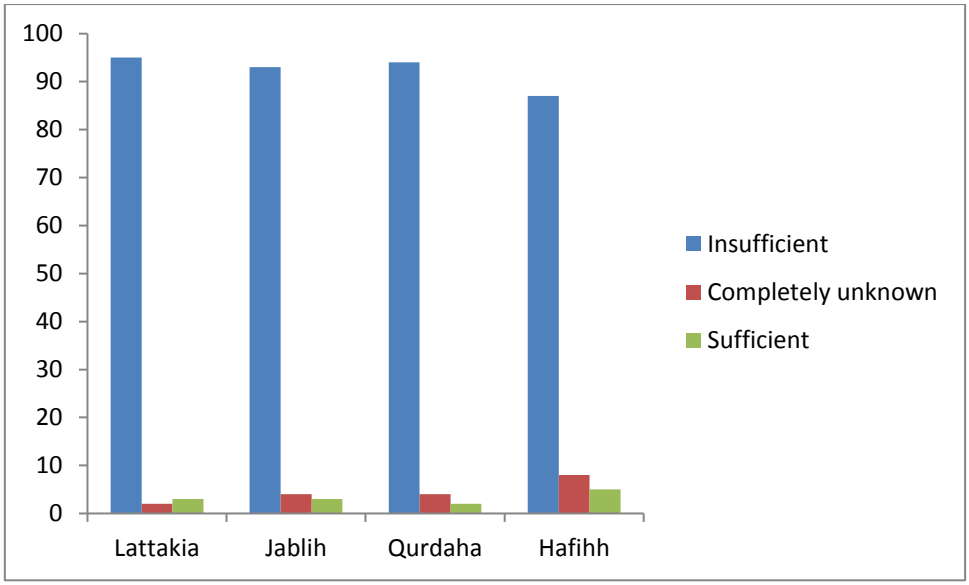


Figure 21. Access to the market information

Sources: Calculations based on own questionnaire

As to citrus farmers' organizational memberships

The survey showed that the farmers approached were members of various farmers' organizations. A majority of them (85%) were members of agricultural cooperatives, while smaller shares of respondents were members of an agricultural chamber (about 15%), and of agricultural syndicates (a union) (8%). Farmers' membership of various organizations might lead us to the expectation that farmers are provided with various types of information such as on citrus prices, quality requirements and overall demand, as well as getting access to technical and financial support. We might likewise think that these serve as outlets for citrus crops and as a place where all the farmers – who are members of these organizations – bring their production and sell it in the form of collective marketing. This expectation can be supported by studies like Roy and Thorat (2008) who found that transaction costs were reduced by marketing cooperatives for grapes in India, strengthening the bargaining power of smallholders with foreign traders. However, our data do not reveal any such positive role of producer organizations, and also not in the area of the provision of market information, which could support farmers' decision making in terms of selling the product at the right market and time and at a higher price. In the other words, the answers of the members of the government-supported groups of producers do not exhibit better access to market information. We can find the same situation in

neighbouring countries like Lebanon, where farmers also suffer from the absence of extension services and tangible government intervention in the support of the agricultural sector (Naspetti et al., 2016). Obviously, there is a need to explain the role of the current cooperatives in more detail. They were encouraged by the government in the 1980s with the aim of improving the provision of credits and inputs to farmers. In the early days, it seemed collective action functioned well but it failed to mature into joint marketing activities. In consequence, the cooperatives (their management boards) have gradually lost the support of their members. The high figures of participation in these cooperatives in the government documents hide the real situation. They picture government-organized cooperatives as working well, while the study reveals that one of the biggest problems faced by citrus farmers in the Lattakia region is a lack of confidence in local governance due to the unfairness of the allocation of benefits among cooperative members. Thus, an improvement in market access and fairness in the distribution of revenue including an AMIS can hardly be built on the ability of the farmers to take collective action; instead the system requires public intervention, which can set up an information service and systematically build confidence among the farmers in it, gradually involving them in its organization and funding. The launch of any AMIS should concentrate on providing all the needed information about the market and prices as proposed by Gyau et al. (2014). There is a need to promote farmers' access to the market and dissolve the scepticism and fear of participation in collective action after such poor operational experience in the current cooperatives. Farmers should perceive the benefits from the start while being increasingly integrated into the system.

5.2.4 Role of socio-demographic characteristics on the access to the market information

Thus, the objective of our survey is to investigate the access of Lattakia citrus farmers to market information, as a factor impacting on price formation as a key element for improving their business and farm income. In addition, there were sub-objectives which included the effect of gender and membership in the governmental producers' organization on access to market information and finally to identify the information needed by farmers and the available equipment for the dissemination of information among the farmers. Some of those objectives can be formulated in statistical

hypotheses. The hypotheses referring to the different access to market information according to gender and membership in agricultural cooperatives can be formulated as follows:

H^1_0: There is no difference in gender in how the groups of citrus producing farmers get market information to achieve better commercial results expressed through a higher price of the produce sold.

It is assumed that women are disadvantaged in contacts with middlemen, who are usually men, we have noted in our study area a male majority among the farmers and particularly the middlemen in Syria.

H^2_0: There is no difference between the group of citrus producers organized in government supported marketing cooperatives, or extension offices and the group of citrus producers that are not organized at such a level in access to information about citrus production and marketing.

Government cooperative help to link farmers with market for both accessing to input and selling the products, in addition to smooth out or reduce the role of middlemen in marketing agricultural products, which lead to make the supply chain shorter and providing fair price to the farmers (Ortmann and King, 2007; Siddique, 2015).

The central issue stems from the supposition that there are groups which can benefit from the implementation of an AMIS in much more advantageous ways than other groups in the marketing cycle and that might deepen differences between these groups if that view is correct, then the implementation of an AMIS should take into account such stratification of the local population and complement the implementation of an AMIS with other measures (e.g. training courses) for example by extension services
Hypothesis H_1 which suggested no gender differences in respect to the means of access to market information cannot be confirmed at significance level of 5% ($p=0.051$) (Table 24). This result is in accordance with Nyamba and Mlozi (2012), who showed that gender had statistically significant ($p<0.05$) association with the ownership and the use of mobile phones to receive agricultural information.

Table 24. Access to the market information affects commercial results (n=300): Fisher's Exact Test

	Men (n=231)	Women (n=69)
Farmers receiving the information via world of mouth		
Production sold for low market price	190	47
Production sold for high market price	30	15
Farmers receiving the information via mobile phone		
Production sold for low market price	8	5
Production sold for high market price	3	2

Sources: Own calculations based on questionnaire data

As gender was identified as a significant indicator influencing the acquisition of information, strategies should be targeted at both males and females, and that in a proper way, e.g. modifying messages according to local cultural factors, such as that males are greater flexibility when it comes to using mobile phones and receiving proper information about the markets and prices, while females tend to share less valuable information among themselves and/or from their relatives. In that way, the research indicated that female producers have an unequal position in the sale of their produce in traditional Arab societies. Thus, a government-supported information service, with its independence from middlemen, could empower female farmers in bargaining over the prices for their produce.

Furthermore, our study concludes that general constraints for effective information dissemination, such as the high cost and/or low availability of technical facilities are not the main challenge as Lattakian farmers are sufficiently equipped with mobile phones (93%) and these offer a sufficient technical basis for an effective AMIS. Farmers possess ICT means at present, but their potential has not been fully recognized yet and thus they remain unused AMIS.

Hypothesis H_2 is confirmed (p=0.000) lower than the 5% probability value (Table 25), which emphasizes that a high percent of citrus producers organized in government organizations did not receive supporting information provided by the government agencies, so that there is no positive effect of government initiated organizations or extension offices on the level of information received. These results contradict Bijman and Wollni (2009), who found an important role for producer organizations in rural

development, especially in strengthening the capacity of smallholder farmers to access the markets.

Table 25. Support information provided by farmers organizations (n=351): Fisher's Exact Test

	Extension offices (n=12)	Word of mouth (n=339)
Source of received information on market and production		
Organized Farmers	7	330
Non-organized farmers	5	9

Sources: Own calculations based on questionnaire data

Nevertheless, we have already pointed out bad experiences with the current cooperatives may undermine new collective action and thus some government intervention is needed for the development of an AMIS with the support of all stakeholders, including any private companies who supply the required facilities, such as cell phone operators or the broadcasting industries. On the other hand, we could not ignore the power of collective action. Farmers ought to be involved from beginning and control over the AMIS should be handed over to them once trust in it and their self-confidence builds up again.

5.2.5 The results of the citrus market agents questionnaire

Characteristics of citrus market Agents

Characteristics of citrus market agents (age, gender and education level) are important for selecting the potential channels for disseminating market information. Characteristics of citrus market agents in the Lattakia region are shown in table (26).

Age of citrus market agents

From the above data in table 26, more than two thirds of market agents are in two groups (41-55 and >55 years), which may suggest that they have significant

experience in citrus marketing deals and an additional advantage in bargaining prices with citrus producers.

Table 26. Citrus market agent's characteristics in the Latakia region

Items		District			
		Lattakia	**Al-Haffi**	**Al-Qurdaha**	**Jablih**
age	**Up to 25**	4	8	4	8
	25-40	16	16	12	12
	41-55	48	40	56	52
	>55	32	36	28	28
Gender	**male**	100	100	100	100
	female	-	-	-	-
Education level	**Illiterate**	-	-	-	-
	primary	8	4.0	4.0	12.0
	Secondary	16.0	48.0	32.0	40.0
	Higher education	32.0	24.0	48.0	40.0
	University	44.0	24.0	16.0	8.0
Period of practicing citrus commerce	**>15**	68.0	72.0	84.0	60.0
	10-15	12.0	24.0	8.0	8.0
	5-10	12.0	4.0	8.0	24.0
	<5	8.0	-	-	8.0

Sources: Calculations based on own questionnaire

The gender of citrus market agents

Table 26 shows that, all market agents are men, which is similar to many cases in less developed countries. It is assumed that women are disadvantaged in contacts with middlemen, who are usually men, and from top to bottom of the value chain there are unequal opportunities between males and females in developing countries as regards decision-making processes (Fafchamps and Quisumbing, 1996; United Nations, 2013). A similar situation exists also in our study area with a male majority among the farmers and particularly the middlemen in Syria.

The educational levels of citrus market agents were divided into five groups (Table 26). This data shows that more than half of the market agents were graduates from an

institute higher than secondary school or from a university. It worth noting that there were no illiterate agents which may ease the disseminating process of market information. The agents' characteristics are similar in all districts, so that educational levels don't form an obstacle for AMIS creation and implementation in any region.

Citrus market agents' communication assets in the Lattakia region

Citrus market agents' communication assets in the Lattakia region (TV, radio, mobile phone, and internet) are important in the dissemination of market information. They were tabulated in table 27 which shows that market agents have all means of communication.

Table 27. Percentages of citrus market agents who have communication tools in the Lattakia region

communication tools	District			
	Lattakia	Al-Haffi	Al-Qurdaha	Jablih
Radio	96	92	96	92
TV	92	100	92	96
Mobile Phone	96	92	96	96
Internet	84	80	88	84

Sources: Own calculations based on questionnaire data

This result may indicate the ability of disseminating market information online, by internet, or by any other means.

Citrus market agents' transport assets in the Lattakia Region

Means of transport are essential for receiving market information, by facilitating market agent mobility. All citrus market agents have various means of transport in the Lattakia region (cars, motorbikes and bicycles). For example, motorbikes and bicycles are suitable for near markets or to visit the farmer in the region which leads to savings in transport costs and allows going off-road, while they can use cars for distant markets and to meet farmers in the other regions (table 28).

Table 28. Percentages of citrus market agents who have various transport means in the Lattakia Region

Transport means	District			
	Lattakia	Al-Haffi	Al-Qurdaha	Jablih
Car	92	88	92	92
Motorbike	84	84	84	88
Bicycle	80	88	80	92

Sources: Own calculations based on questionnaire data

To test the hypothesis of independence between categorical factors or characteristics. Chi square tests is suitable and commonly used. The contingency tables of chi-square test can be found in the Annex2:142.

5.2.6 Characteristics of business for the citrus market agents

Citrus market agents' financial sources and amount of income per year in the Lattakia region

Financial resources and the amount of income per year are tabulated in table 29, which shows:

Table 29. Citrus market agents' income/year and source of income

Items		Districts in percentages			
		Lattakia	Al-Haffi	Al-Qurdaha	Jablih
Income/year	**<2.000000**	8.0	-	-	-
	2.000000-3.000000	4.0	4.0	8.0	4.0
	3500.000-4.000000	4.0	4.0	4.0	4.0
	>4.000000	84.0	92.0	88.0	92.0
Sources of income	**Trade of crop production**	76.0	72.0	80.0	76.0
	Job	24	28.0	20.0	24.0

Sources: Own calculations based on questionnaire data

Citrus market agents' income per year in Lattakia region

Citrus market agents' income per year were divided into four groups (<2,000,000; 2,000,000-3,000,000; 3,500,000-4,000,000 and >4,000,000 SP/year). It is worth noting, most market agents have an income of more than 4 million/year. This income per year is very high, and may suggest a possible exploitation of "naive" producers in the region; therefore, a functional AMIS is necessary to support the farmers' position in the negotiation of citrus prices.

Citrus market agents sources of income per year

Citrus market agents' sources of income per year were divided into two groups (Trade of crop production and Job) from the data; market agents mainly gain their income from trade in crop production (see Table 29).

5.2.7 Citrus market agents behaviour in the market

Marketing practices used by citrus market agents in the Lattakia region
Mode of buying citrus fruit

Table (30) shows four channels (at the farm gate, via "pre-harvest" contracts, wholesaler and all of the above) for buying citrus fruit. These results show that "pre harvest" contracts were in first place of the different modes of buying citrus fruit and accounted for more than 40% of cases. In fact, citrus farmers are forced by lack of finance to sell their production of citrus fruit as early as possible (at the beginning of the season), and the "middleman" in such cases, may double his profits.

Table 30. Marketing practices used by citrus market agents in the Lattakia

Items		Districts in percentages			
		Lattakia	Al-Haffi	Al-Qurdaha	Jablih
Manner of buying citrus fruit	Farm gate	12.0	20.0	24.0	20.0
	Contractor	40.0	48.0	36.0	36.0
	Wholesaler	28.0	20.0	20.0	20.0
	All of them	20.0	12.0	20.0	24.0
Method of communication with farmers	Fixed line	4.0	4.0	4.0	4.0
	Mobile phone	16.0	16.0	12.0	12.0
	Direct contact	32.0	24.0	24.0	20.0
	All of them	48.0	56.0	60.0	64.0

Sources: Own calculations based on questionnaire data

We believe that improving farmers' access to information about when and where to sell, and if he can obtain credit and financial support, these will decrease the number of unjust "pre harvest" contracts and will improve the market chain's functionality on the one hand and farmers' income on the other. In addition, the more informed farmers are, the fewer middlemen there will be in market.

Marketing margin and the producer's share

Marketing margin (M) is the difference between the net price received by the farmer (P_f) and the price paid by the consumer (retail price P_r) (Phiriet al., 2013):

$M= P_r – P_f$

Marketing margin shows the effectiveness of the marketing system as it indicates the efficiency of intermediaries between the grower and consumer in respect of the services delivered and the remuneration received by them (Sapkota, 2008). The first task in measuring market margin is to describe the structure of the market chain, starting at the farm gate and transporting the product through the various intermediaries until it reaches the final consumer (Smith, 1992).

The Producers' share is the price received by the farmer expressed as a percentage of the retail price that is price paid by the consumer. We can express it as follows (Phiri et al., 2013):

$P_s = (P_f/P_r) \times 100$

Where: P_s is producers' share, $P_{f:}$ farm gate price and $P_{r:}$ retailers' price. An increase in the share of the producer is the sign of rise in the efficiency of the marketing system in favour of producer/farmers, and vice-verse. A reduction in the share of the producer indicates that the middlemen are gaining a larger share. It also identifies the manner in which the length of a market chain has negative effects on the profits of the farmers. Where the chain was longer, this indicated that the middleman received high profits.

Added value is the amount of value that each actor in the chain adds. It is the difference between the price the actor pays for the produce, and the selling price. Value share (VS) can be calculated by dividing the added value (AV) by the final price (P_r) and then multiplying by a hundred to express it as percentage. We can express this as follows (Omar et al., 2014):

$VS = (AV /P_r) \times 100.$

According to the farmers' responses, as well as using our own observations of the local citrus markets, we can specifically focus on the benefit of shortening the marketing chain (i.e. excluding middlemen) and how an AMIS could help do this. In a long chain, the revenue for lemon type Autochthon is spread among citrus farmers with a share ranging between 40% and 52%, middleman (15.8% to 32.6%), wholesalers (10.5% to 17.6%) and retailers who got 11.8% to 24% of the revenue.

Table 31. Value share in the Lattakia region, long chain (SP/Kg)

Citrus type	market	Selling Price				Share in profit %			
		farmer	middleman	Wholesaler	retailer	farmer	middleman	Wholesaler	retailer
lemon	Jablih	20.8	35	40.5	49.0	42.4	28.9	11.2	17.3
	Qurdaha	19.0	34.5	39.5	47.5	40	32.6	10.5	16.8
	Haffi	21.7	36	41.6	50	43.4	28.6	11.2	16.8
	Lattakia	23.5	37.5	43	52.5	44.8	26.7	10.5	18
Jaffa	Jablih	11.5	19	22.5	27	42.6	27.7	12.9	16.7
	Qurdaha	14.3	22.5	26	29.5	48.5	27.8	11.9	11.8
	Haffi	11.6	19.5	23.5	28.5	40.7	27.7	14	17.5
	Lattakia	11.7	20	24.5	30	39	27.6	15	18.3
Clementine	Jablih	16.7	25	31.5	37	45.1	22.4	17.6	14.9
	Qurdaha	17	25.5	29	36.6	46.4	23.3	9.6	20.7
	Haffi	16.4	22	27.6	35.5	46.2	15.8	15.7	22.3
	Lattakia	18.7	28.7	32.9	37	50.5	27	11.4	11.1
Valencia	Jablih	20.5	31	35.5	41.5	49.4	25.3	10.8	14.5
	Qurdaha	21.0	30.5	35.7	40.5	51.8	23.5	12.8	11.8
	Al-Haffi	19.9	29	34.6	39.5	50.4	23	14.2	12.4
	Lattakia	21.2	31	36.8	40.8	52	24	14.2	9.8
Grapefruit	Jablih	5.5	8.3	9.5	12	45.8	23.3	10	20.8
	Qurdaha	5.6	8	9.5	12.5	44.8	19.2	12	24
	Haffi	5.4	8	9.75	12.5	43.2	20.8	14	22
	Lattakia	6	9	11	13	46.2	23	15.4	15.4

Sources: Own calculations based on questionnaire data

Table 32. Value share in the Lattakia region, short chain (SP/Kg)

Citrus types	Market	Selling Price			Share in profit %		
		farmer	Wholesaler	Retailer	farmer	Wholesaler	retailer
Lemon	Jablih	25	32.5	47.0	53.2	15.9	30.9
	Qurdaha	23.5	32.5	44.5	52.8	20.2	27
	Haffi	24.7	33.6	45.5	54.3	19.6	26.2
	Lattakia	25.5	34.5	47.5	53.7	18.9	27.4
Jaffa	Jablih	13.5	19.5	27	50	22.2	27.8
	Qurdaha	15.5	20.5	27.5	56.4	18.2	25.4
	Haffi	14.8	19.5	28	52.9	16.8	30.4
	Lattakia	15.7	20.5	29	54.1	16.6	29.3
Clementine	Jablih	18.5	24.5	34	54.4	17.6	28
	Qurdaha	19	25	34.5	55.1	17.4	27.5
	Haffi	19.5	25.6	35	55.7	17.4	26.9
	Lattakia	20.5	27.9	36	56.9	20.6	22.5
Valencia	Jablih	22.5	29.5	39.5	57	17.7	25.3
	Qurdaha	22.0	28	38	57.9	15.8	26.3
	Haffi	21.9	28.5	37.5	58.4	17.6	24
	Lattakia	23.5	30	37	3.5	17.6	18.9
Grapefruit	Jablih	6.5	9	11	59.1	22.7	18.2
	Qurdaha	6.6	8.6	11.5	57.4	17.4	25.2
	Haffi	6.4	9	11.5	55.6	22.6	21.8
	Lattakia	7	9.5	12	58.3	20.8	20.9

Sources: Own calculations based on questionnaire data

In a short chain, the revenue was divided only between farmers with an increased share of 50% – 59.1%, wholesalers (15.9% to 22.7%) and retailers (20.9% to 30.9%). The average marketing margin (retail price – farm gate price) was found to be 29 Syrian pounds (SP) per kg in a long chain and 22 SP/kg in the short chains whereas the producers' share was 44.8% in long chains and 53.7% in the short chains in the Lattakia market for the lemon type Autochthon (Figure 22). The study also noted very similar results for the other citrus crops and markets. Comparing these figures and

also relating them to the other studies like Kafle (2007), who found 55% as the producers' share in mandarin orange marketing in the Kaski district of Nepal, or Gangwar and Singh (1998) reporting similar producers' share in oranges under Indian conditions, we can see that middlemen considerably increase the marketing margin leaving citrus farmers in Lattakia worse off. The call is for a reduction in the power of middlemen: either by taking them out of the marketing chain completely (which might be unrealistic), or by equalizing the position of farmers by providing them with pertinent and timely information. Sabir, et al. (2010) concluded that by reducing the number of intermediaries in the chain, not only did the purchasing price to the consumers decrease but also the producers received higher prices in Pakistan. Based on these findings, collective marketing seems to be a good alternative, as a result of which farmer groups could sell their products directly to the wholesaler, which would lead to an overall more efficient marketing system. As a result, to be engaged in collective marketing, saving on the costs of marketing and having a stronger negotiation position with the traders would create considerable benefits for the citrus farmers in Lattakia. The fact that most of the farmers were organized in associations and cooperatives might create good preconditions for collective marketing and these collective forms (cooperatives) could also be integrated into any future AMIS.

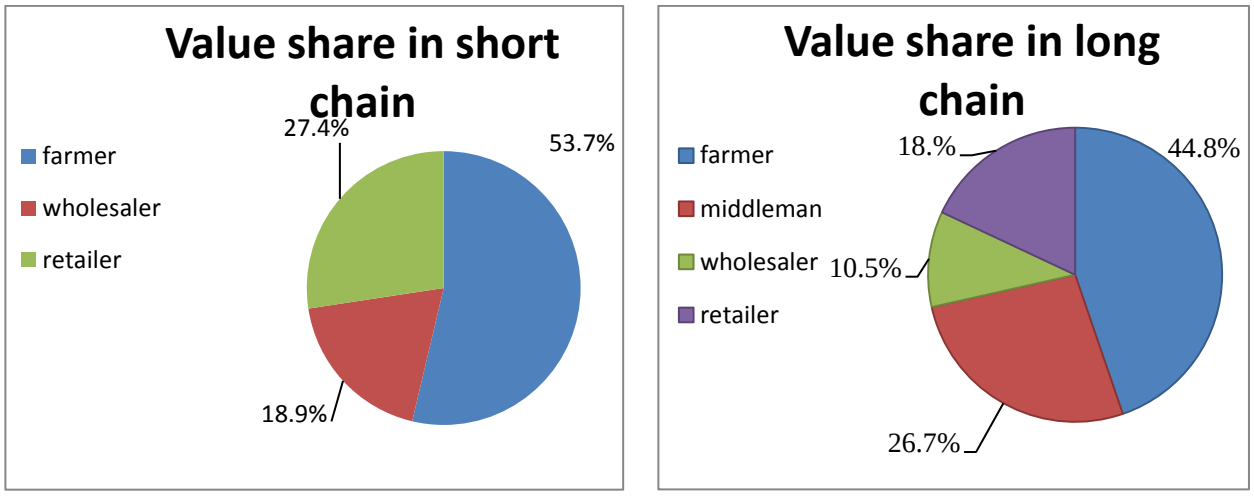


Figure 22. Comparison of Value share in short chains and long chains

Sources: Own calculations based on questionnaire data

Pre-harvest contractors (intermediaries): These usually visited the farmer in October/November and negotiated the total value of whole orchards with the producer. Contracts were made based on the number of fruiting trees, tentative fruit per tree counted on a sample basis regardless of the size and other quality factors of the fruit. The main functions of pre-harvest collectors were to visit the orchards of the farmers and fix a price and make a contract with them, giving them 5-10 percent of the total sales payment in advance and later the rest of the agreed amount, paid in installments after the harvesting and selling of the fruit. Pre-harvest contractors in that location do the harvesting, grading, packaging and transporting of the fruit from production site to market.

Wholesalers: The main function of the wholesaler is transporting, assembling, and sorting according to grade, along with storage and the dissemination of the citrus.

Retailers: Purchase citrus from the wholesaler and transport and sell to the consumer. Some retailers also purchase citrus directly from the producers and sell them to the consumers.

5.3 AMIS Model Development and Operation

Firstly, we collected data from the Marketing and Statistical Departments of the Agriculture directorates as well as the agricultural extension offices in the province and this data included:

1- Data on weekly prices for citrus varieties in the four markets during the period 2010-2013.
2- The citrus production, consumption, export and import quantities in the four districts during the same period.
3- Production costs including numbers, year, organic and mineral fertilizer prices, the price of pesticides, seedling prices, the cost of irrigation, and the cost of land preparation, the cost of sorting, grading and staging costs, the cost of transport, packaging.
4- Data on the farmers: (number, farmer-name, national number-property, sector by Assembly, cultivated area, the total number of trees).

After inputting this data to an Excel file, we exported the data to an Access file to create interconnected tables in a relational database so we could bring the relevant data stored in the different tables together to be summarized and further analyze the data.

5.3.1 Conception of the Agricultural Marketing Information System

There are two steps in the conception of the AMIS:
The first step consisted in a proposal for two databases:
- A database of citrus products, and
- A database of citrus producers.
The methodology of AMIS creation includes algorithm specification and database programming in My/SQL and Microsoft Access programs, system input and output definition.

The second step in the creation of a functional marketing operator consists of the connection of the two separate databases in the complete conception of the information system.

5.3.2 AMIS database

After we create an empty database in the Access program, we import data by going to the file menu, selecting the get external data option after which that we create the required databases:

First: Database of farmers

According to data obtained from the extension services office, there are farmers' records for each administrative sector and the farmers' database so created contain :
A- farmer number (ID identifier): a primary key to facilitate search and archiving.
B- name and surname;
C- national serial number;
D- estate (properties) No.;
E- the administrative sector for each cooperative: here a field (Foreign Key) contains the number of the sector, to be created later in a separate database which contains the number and the name of the sector key database, so this field (sector No.) can be used in processing the link between the two databases. Then the variety database, that contains a field for the variety No. as a key for the data and the name of the product, is created.
Finally, a database to link the farmers and the variety database (called: the cultivated variety database) is created. It contains the farmer's number, the variety number, the cultivated area, production of /number of bearing trees and the total number of trees.

Second: Database of citrus products

A database of weekly prices for varieties in the market is created to include: Product number, market number, year, month, the first week's prices, the second week's prices, the third week's prices, and the fourth week's prices.

Here, the primary keys are the number of the product, the market number, the year number, the month number.

Then a market database is created, to contain the number and the name of the market only. This is linked with the weekly prices for citrus varieties in the market via the market number. Thereafter, a database of production quantities is created, which contains: the variety number, year number, month number, quantity produced, local consumption per month, exports and imports per month. The primary keys here are the product number, month number and year number
the production costs' database will contain the year number and the prices of: organic and mineral fertilizers, pesticide, seedlings, irrigation, land preparation, grading and sorting, packaging and transportation.

Third: Marketing research database

This database includes: year number, month number, market number, maximum and minimum price, monthly average (calculated attribute), the minimum and maximum prices in the first half of the month, and the minimum and maximum prices in the second half of the same month; then these are separated to facilitate field (range) and modification, as well as the minimum and maximum expected price; supply and demand are included.

Links to be included are:
1- Farmer and sector are linked via the sector field;
2- Farmers and the varieties are linked via the database of farmer varieties:
Products and markets are linked via the price database, relationship (1);
Products and markets are linked via the market research database, relationship (2);
The product alone is linked via the quantity database.

After the design, these are created using the Access program and MY/SQL. Thus, an appropriate programming language needed to be chosen to be able to relate and process databases and display the results in the designed interfaces. The programming language chosen was C #, CSHARP.

Table 33. An example of citrus production costs in the Access program

ProductionCosts

Field Name	Data Type
pc_ID	AutoNumber
pc_year	Short Text
pc_Ploughing	Short Text
pc_Weeding	Short Text
pc_Trough	Short Text
pc_G_P_WC	Short Text
pc_Irrigation_Costs	Short Text
pc_Chemical_Controlling	Short Text
pc_Organic_Fertilizer	Short Text
pc_Chemical_Fertilizer	Short Text
pc_Harvesting	Short Text
pc_Sorting_Packing	Short Text
pc_Loading_unloading	Short Text
pc_Crops_Transporation	Short Text

Source: Author's compilation, 2014

Exporting Access data to MY/SQL, we have five steps:

- When you open an Access database or an Access project, a Database window appears. It displays shortcuts for creating new database objects and opening existing objects.
- Click the name of the table or query to export, and then in the file menu, select export.
- In the export object type the object name into the dialog box, in the save as type box, select ODBC databases.
- In the export dialog box, enter a name for the file (or use the suggested name), and then select ok.
- The select data source dialog box is displayed; it lists the defined data sources for any ODBC drivers installed on your computer. Click either the file data source or machine data source tab, and then double-click the connector/ODBC or connector/ODBC 3.51 data source to define a new data source for connector/ODBC.

Table 34. An example of farmer database

#	Name	Type
1	far_ID	int(11)
2	farm_name	varchar(255)
3	farm_unit	varchar(255)
4	National_id	varchar(50)
5	estate_no	varchar(50)
6	t_area	int(11)
7	t_num	int(11)

Source: Author's compilation, 2014

Table 35. An example of production

#	Name	Type
1	pc_ID	int(11)
2	pc_year	varchar(255)
3	pc_Ploughing	varchar(255)
4	pc_Weeding	varchar(255)
5	pc_Trough	varchar(255)
6	pc_G_P_WC	varchar(255)
7	pc_Irrigation_Costs	varchar(255)
8	pc_Chemical_Controlling	varchar(255)
9	pc_Organic_Fertilizer	varchar(255)
10	pc_Chemical_Fertilizer	varchar(255)
11	pc_Harvesting	varchar(255)
12	pc_Sorting_Packing	varchar(255)
13	pc_Loading_unloading	varchar(255)
14	pc_Crops_Transporation	varchar(255)
15	pc_Guarding	varchar(255)
16	pc_P_Organic_Fertilizer	varchar(255)
17	pc_P_Chemical_Fertilizer	varchar(255)
18	pc_Containers	varchar(255)

Source: Author's compilation, 2014

Table 36. An example of production quantities database

#	Name	Type
1	pa_ID	int(11
2	pa_year	int(11
3	pa_variety	int(11
4	pa_month	int(11
5	pa_market	int(11
6	pa_total	doubl
7	pa_exports	doubl
8	pa_imports	doubl

Source: Author's compilation, 2014

Table 37. High and min price database

#	Name	Type
1	mk_id	int(11)
2	mk_year	int(11)
3	mk_month	int(11)
4	mk_product	int(11)
5	mk_market	int(11)
6	mk_h_p_p_m	decimal(19,4)
7	mk_m_p_p_m	decimal(19,4)
8	mk_avg_price	decimal(19,4)
9	mk_h_p_p_h_m	decimal(19,4)
10	mk_m_p_p_h_m	decimal(19,4)
11	mk_h_p_p_h_m2	decimal(19,4)
12	mk_m_p_p_h_m2	decimal(19,4)
13	mk_pred_high_price	decimal(19,4)
14	mk_pred_min_price	decimal(19,4)

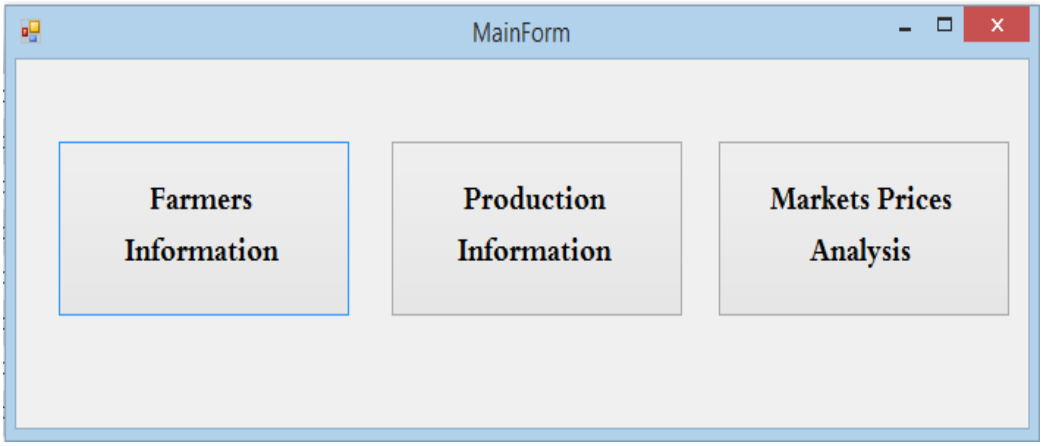
Source: Author's compilation, 2014

Prerequisites

- Install **Visual Studio** 2008 or Visual Studio 2010
- Install MY/SQL database on your local machine
- Install XAMPP control panel 3.1.0
-

After the design phase, these are created using the Access program and MY/SQL. An appropriate programming language was chosen to be able to relate and process databases and display the results in the designed interfaces. The programming language chosen was C #, CSHARP. You first need to use C# that uses MY/SQL right click. After you've installed the MYSQL server, the MYSQL Administrator and the MYSQL Connector, you need to create a new console application, and add a reference to the MY/SQL connector program interfaces:

An example of the Home interface



Source: Author's compilation, 2014

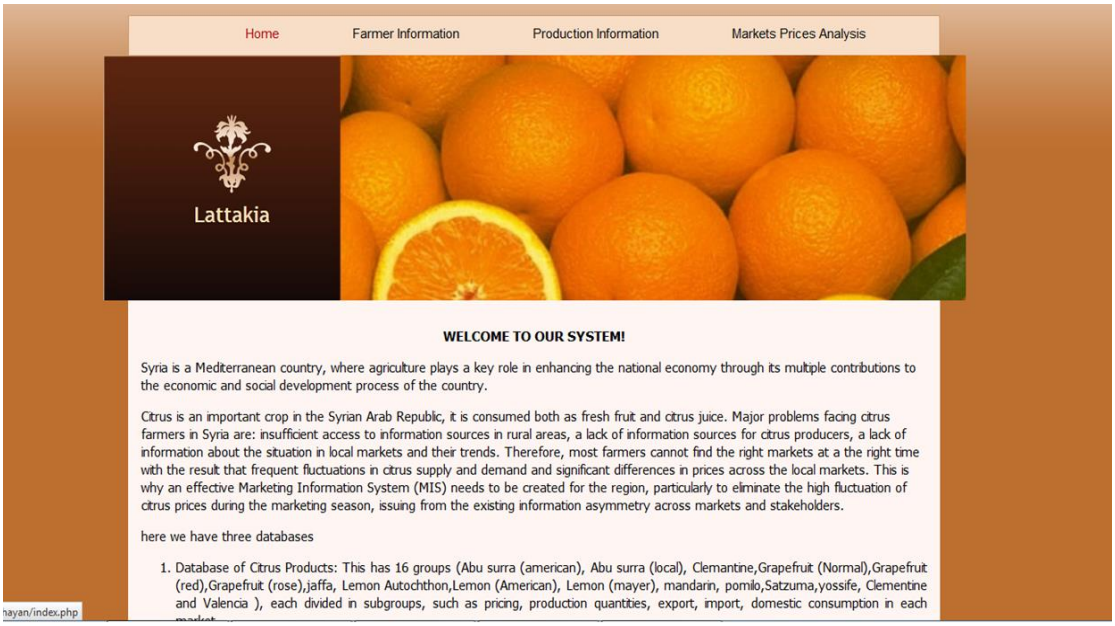
- Officially, **XAMPP's** designers intended it for use only as a development tool, to allow website designers and programmers to test their work on their own computers without any access to the Internet.
- XAMPP 3.1.0 for Windows and Linux, Mac OSX, including:
- Apache
- **MY/SQL**
- FileZilla
- Mercury
- Tomcat
- **XAMPP Control Panel** 3.1.0 (from hackattack142)

- Run the XAMPP application and it will automatically install Apache server, MYSQL database, and FileZilla. After installing, check whether these services are running or not.

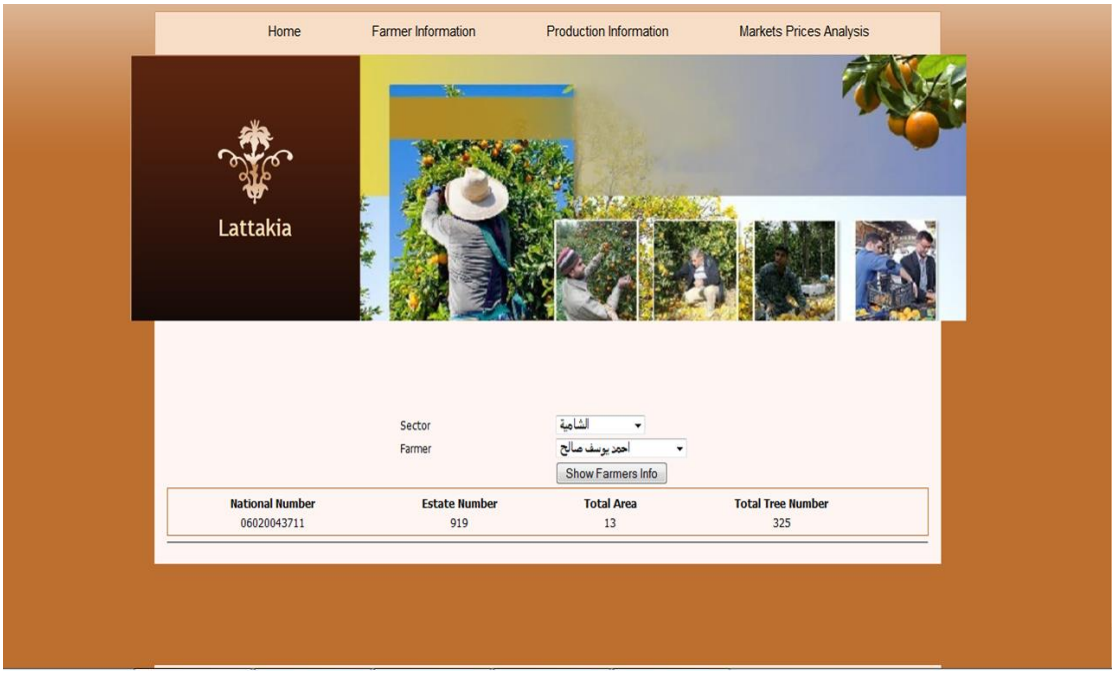
Using the same databases we create a web site that displays the previously assembled statistical data.

The following are examples of possible interfaces and web pages:

1- The Home page

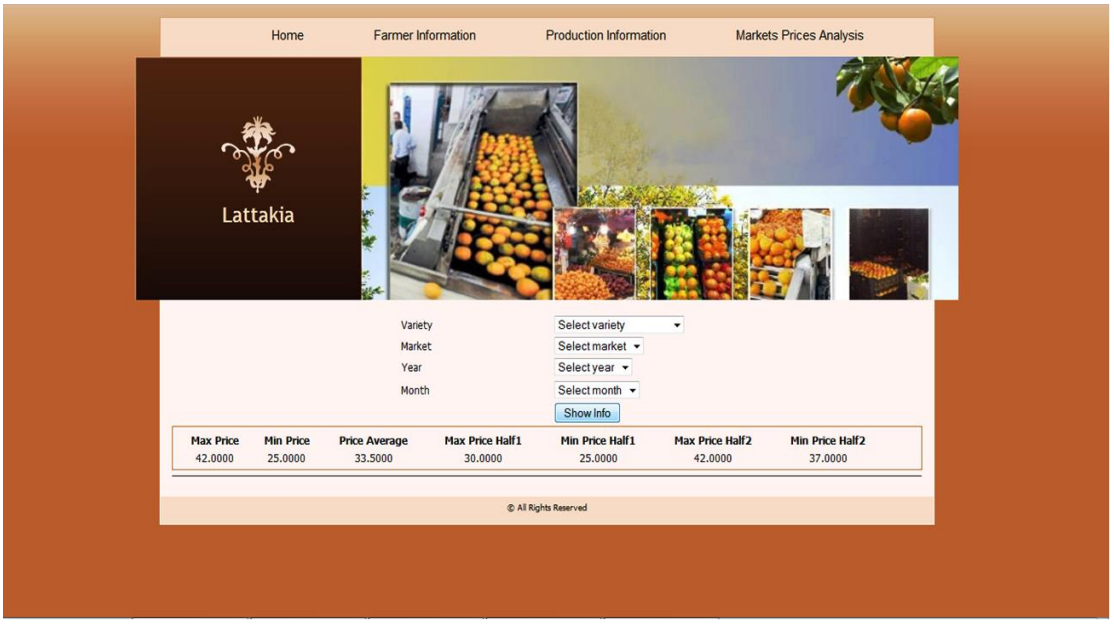


2- An example of farmers' information page



3- An example of a citrus quantity page

4- An example of citrus prices analysis page



5.3.3 Main AMIS Stakeholders

The main stakeholders in the Agricultural Marketing Information System are expected to be: farmers, traders, The Ministry of Agriculture, the Agricultural Directorate, extensions services, and agricultural pharmacies.

5.4 Future Agricultural Marketing Information System use in the Lattakia region

5.4.1 Administrator responsible for AMIS operation

The Marketing Department at the Lattakia Directorate of Agriculture is to be the administrator of the new AMIS; it would operate and update the systems and disseminate the information (supply, demand, and market research) by fax to its extension offices.

The group of farmers to be informed will receive, on a regular basis, information concerning citrus (actual and predicted prices, supply and demand, price trends, market conditions, production management, post-harvest management and weather conditions) by SMS from the extension offices.

5.4.2 The result of test AMIS functionality in the Lattakia region

AMIS functionality and hypothesis testing were achieved (following the methodology mentioned in (4.4.1) by the comparison of two groups (an informed and non-informed group) of homogenous citrus farmers (as possible) in the Lattakia region. However, due to space and time, only Valencia citrus will be discussed here, as an example of the citrus varieties in the Lattakia markets.

Based on the expected weekly Valencia fruit prices at each wholesale market, and at the farm gate in the Lattakia region since 1th week of February till the 4th week of July 2014 (the Valencia fruiting season), we recommended the members of the informed group to sell their Valencia fruit on the Lattakia wholesale markets at the end of marketing season (the last two weeks of July).

To measure the effect of the AMIS on spatial and temporal arbitrage in the market for Valencia citrus fruit market, we considered four marketing periods: a) before marketing season (by contract), b) at the beginning of the marketing season (during February and March; at the farm gate and on wholesale markets), c) in middle of the

marketing season (April, May and June; at the farm gate and on wholesale markets), and d) at the end of marketing season-late season- (during July; at the farm gate and on wholesale markets).

AMIS effects on transaction volumes

1- Spatial arbitrage (displacement) in transaction volumes

To be sure these differences between the two groups in spatial transaction volumes are related to other factors rather than total production or area of citrus orchard (table. 38)**.** The results showed on average Valencia citrus orchard ranged from 3.8 to 4.0 ha for the non-informed and informed group, respectively. However, the differences between the two groups weren't significant at $P_{5\%}$value (F= 0.334 and $P_{calculated}$= 0.564). Although, the informed group had an average total Valencia fruit production (15807.0 kg.) more than non-informed group (14350.0kg), no significant differences were shown to exist between the two groups at $P_{5\%}$value (F= 1.319 and $P_{calculated}$ = 0.252).

Table 38. Mean of total production and area for the two groups

Group	Non-informed	Informed	ANOVA Test	
	Mean	Mean	F	Sig.
Area	0.4	0.38	0.334	0.564
Total production	14350.0	15807.0	1.319	0.252

Sources: Own calculations based on questionnaire data

To determine the impact of the AMIS on farmers' marketing venues, the total transaction volumes for each group were summed and considered as 100%, and the rate of transaction volumes for each market (Lattakia, Al-Qurdaha, Jablih and Al-Haffi) were calculated and are graphically represented in Figure (23).

Figure (23) shows that: minimum and maximum percentages of total transaction volumes ranged from 16.48% at Al- Haffi to 46.36% at Lattakia, and from 20.49% at Al- Haffi to 26.77% at Lattakia, for informed and non-informed groups respectively.

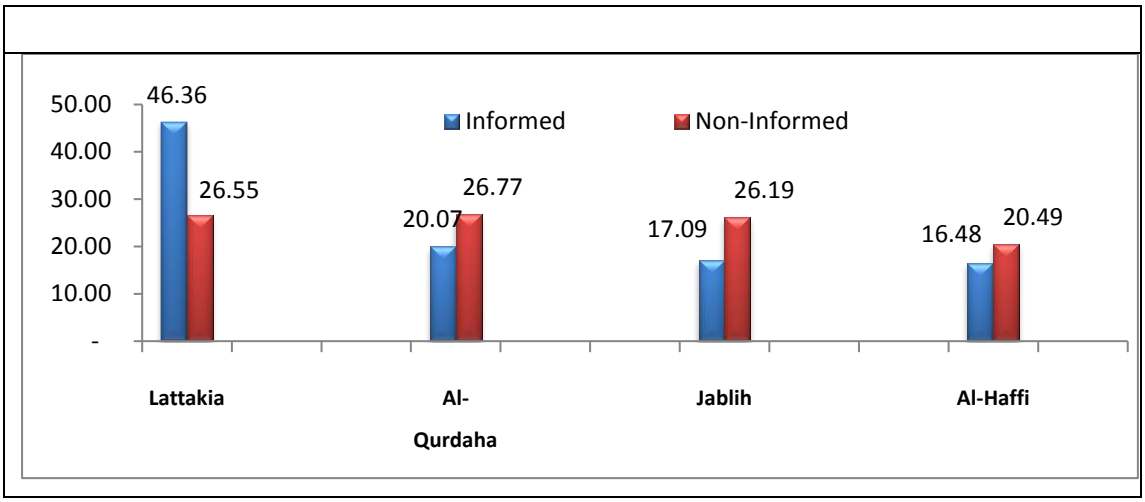


Figure 23. Spatial arbitrage in transaction volumes (percentage)

Sources: Own calculations based on questionnaire data

- At Latakia district, transaction volumes of Valencia fruits increased from 26.55% for the non-informed group to 46.36% for the informed group;
- At Al-Qurdaha district, the transaction volumes decreased from 26.77% for the non-informed group to 20.07% for the informed group;
- At Jablih district, the total transaction volumes decreased from 26.19% in the non-informed group to 17.09% for the informed group;
- In Al-Haffi district the transaction volumes decreased from 20.49% in the non-informed group to 16.48% for the informed group.

These results may suggest that most "Informed farmers" group from Al-Qurdaha, Jablih and Al-Haffi marketed a part or total of their Valencia citrus fruit at the Lattakia markets to obtain better prices by using spatial arbitrage in transaction volumes.

So, it can be said that the AMIS proposed by the author is functional in spatial displacements of Valencia citrus fruit transaction volumes.

2- Temporal arbitrage in transactions volumes

In addition to some farmers who sell their production before marketing season (via contract), other farmers market their Valencia citrus fruit from the beginning of

February till the end of July, so these periods were divided into three periods (at the beginning, at mid and at end of the marketing season).

To get a better price, informed farmers were advised to sell their fruit either at the late period of the marketing season. This may suggest that, the displacement in marketing times is due to the information received from the AMIS, and form an indicator of its functionality. Therefore, we measured this difference in transaction volumes in each period for the informed group (trial group) and non-informed group (control group).

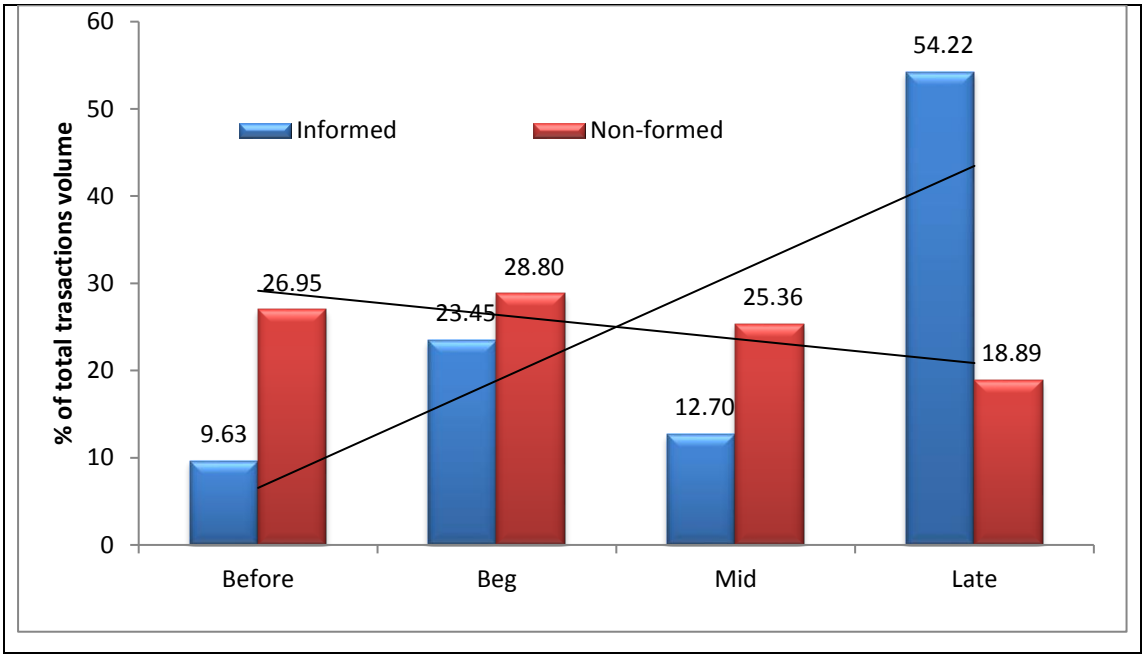


Figure 24. Transaction volumes as influenced by timing arbitrage

Sources: Own calculations based on questionnaire data

Figure (24) shows that: minimum and maximum percentages of total transaction volumes ranged from 9.36 to 54.22%, and from 18.89 to 28.80% for the informed and the non-informed groups, respectively.

- Before the marketing period, the transaction volumes of Valencia citrus fruits decreased from 26.95% in the non-informed group to 9.63% for the informed group;
- At the beginning of marketing period, the total transaction volumes of Valencia citrus fruit decreased from 28.8% in the non-informed group to 23.45% for the informed group;

- In the mid marketing period, the transaction volumes of Valencia citrus fruit decreased from 25.36% for the non-informed group to 12.7% for the informed group;
- At the end of the marketing period, transaction volumes of Valencia citrus fruit increased from 18.89% for the non-informed group to 54.22% for the informed group;

Transaction volume trends (the dashed line) for the informed group can be predicted by the formula: $y = 12.30x - 5.762$, which shows a clear linear increase in the marketing transaction volumes from the "before period" to the "late/end period", whereas, trends (the continued line) in transaction volume for the non-Informed group is represented by: $y = -2.763x + 31.90$**,** which shows a slight linear decrease in marketing transaction volumes from the before period to the late/end period.

These results may suggest that most of "Informed farmers" group had a clear tendency to market their Valencia citrus fruit in the late/end period of marketing, to obtain better prices by using temporal arbitrage in transaction volumes.

So, it can be said that the AMIS proposed by the author is functional as resulting from temporal displacements of Valencia citrus fruit transaction volumes.

3- Temporal and spatial arbitrage in transaction volumes

We encouraged farmers to sell their fruit directly to traders on the wholesale markets at the late/end period of marketing, to get better prices as a result of decreased fruit supply on one hand and the elimination of mediator traders on the other hand. The results of our questionnaires are represented graphically in fig (25).

Figure (25) shows that: minimum and maximum percentages of total transaction volumes of Valencia citrus fruit ranged from 5.54 (at the farm gate in mid marketing season) to 28.67% (on wholesale markets, in late marketing season), and from 8.27 (on wholesale market in late season) to 26.95% (at the farm gate by contract before the marketing season) for informed and non-informed groups respectively.

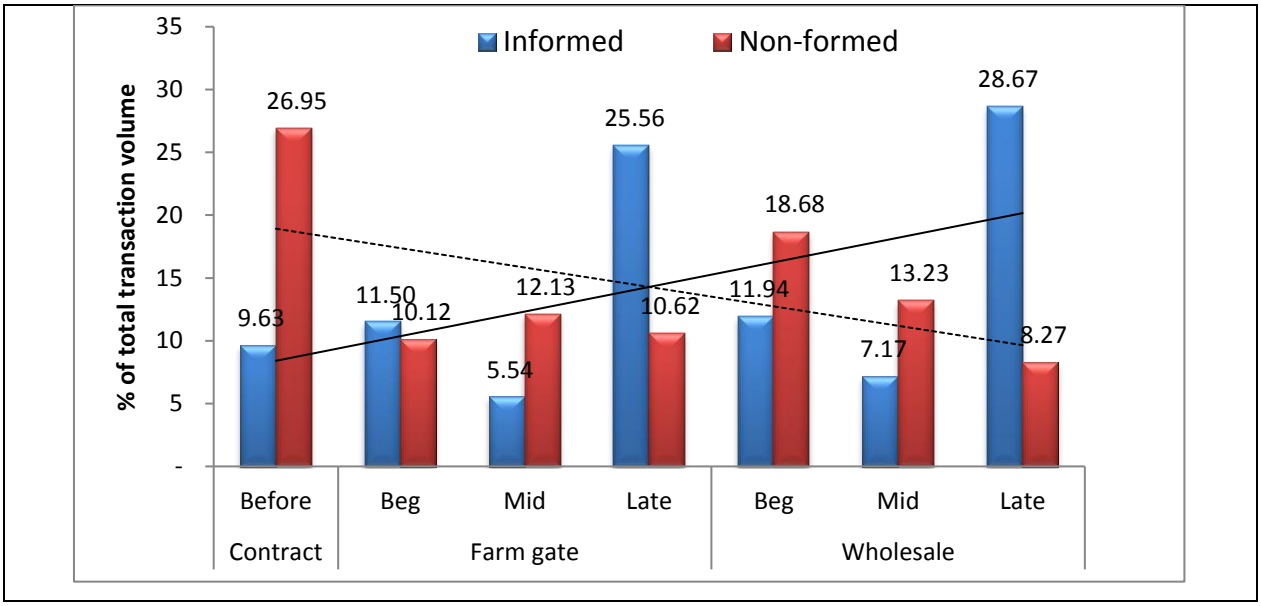


Figure 25. Temporal and spatial arbitrage in transaction volumes

Sources: Own calculations based on questionnaire data

- Before the marketing period, at the farm gate, transaction volumes of Valencia citrus fruit decreased from 26.95% in the non-informed group to 9.63% for the informed group. Which may suggest temporal arbitrage in fruit marketing, as some informed farmers decided to sell their fruit at other times rather than the period "before marketing", due to information received from AMIS.
- At the beginning of marketing period at the farm gate, the total transaction volumes of Valencia citrus fruit decreased from 11.50% for the informed group to 10.12% in the non-informed group;
- In the mid marketing period, at the farm gate, the transaction volumes of Valencia citrus fruit decreased from 12.13% for the non-informed group to 5.54% for the informed group;
- In the late of marketing period, at the farm gate, transaction volumes of Valencia citrus fruit increased from 10.62% for the non-informed group to 25.56% for the informed group;
- At the beginning of marketing period, on the wholesale market, the total transaction volumes of Valencia citrus fruit decreased from 18.68% for the non-informed group to 11.94% in the informed group;

- In the mid marketing period, on the wholesale market, the transaction volumes of Valencia citrus fruit decreased from 13.23% for the non-informed group to 7.17% for the informed group;
- In the end of marketing period, on the wholesale market, transaction volumes of Valencia citrus fruit increased from 8.27% for the non-informed group to 28.67% for the informed group.

Transaction volumes for the informed group can be predicted by the formula $y = 1.959x + 6.448$, which indicates a positive trend of citrus farmers selling their fruits on the wholesale market at the late/end period, whereas the trend formula for the non-informed group ($y = –1.545x + 20.46$**)** has a negative trend. These results may suggest that most of the "Informed farmers" group had a clear tendency to market their Valencia citrus fruit at the late/end period of marketing, on the wholesale market, as they were encouraged by the information received from the AMIS in order to obtain better prices by using temporal and spatial arbitrage in transaction volumes. Therefore, it can be said that the AMIS proposed by the author is functional as resulting from temporal and spatial displacements of Valencia citrus fruits transaction volumes towards the wholesale markets at the late/end period of the marketing season.

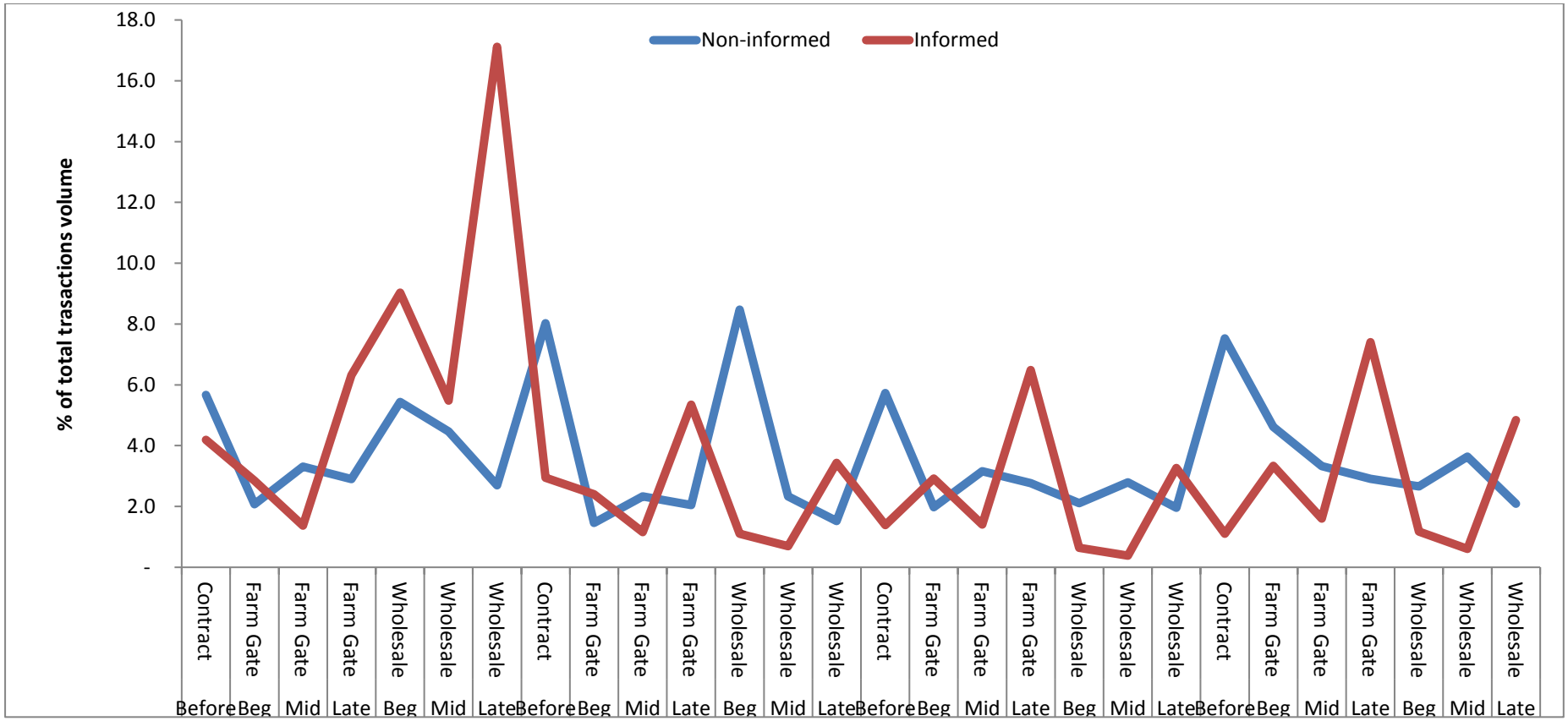


Figure 26. Transactions volumes as influenced by spatial and temporal arbitrage

Sources: Own calculation based on questionnaire data

Figure (26) shows that: minimum and maximum share of total transaction volumes of Valencia citrus fruit ranged from 0.38 (on the wholesale market, in the late/end marketing season in Al-Haffi) to 17.12% (on the wholesale markets, in the late/end marketing season, in Lattakia), and from 1.46% (at the farm gate, in mid-season in Jablih) to 8.47% (on wholesale, at the beginning of the marketing season, in Jablih) for the informed and the non-informed groups respectively. So, the range between minimum and maximum is more extended for the informed group as compared with the non-informed group, suggesting temporal and spatial arbitrage in transactions in the Lattakia wholesale market at the late/end period of the marketing season.

- **Lattakia district**

- Before the marketing period, at the farm gate, the transaction volumes of Valencia citrus fruit decreased from 5.67% in the non-informed group to 4.19% for the informed group.
- At the beginning of marketing period at the farm gate, the total transaction volumes of Valencia citrus fruit decreased from 2.84% for the informed group to 2.07% in the non-informed group;
- In the mid marketing period, at the farm gate, the transaction volumes of Valencia citrus fruit decreased from 3.31% for non-informed group to 1.37% for informed group;
- In the late/end of the marketing period, at the farm gate, transaction volumes of Valencia citrus fruit increased from 2.90% for the non-informed group to 6.32% for the informed group;
- At the beginning of the marketing period, on the wholesale market, the total transaction volumes of Valencia citrus fruit increased from 5.44% for the non-informed group to 9.03% in the informed group;
- In the mid marketing period, on the wholesale market, the transaction volumes of Valencia citrus fruit increased from 4.47% for the non-informed group to 5.48% for the informed group;
- In the late of marketing period, on the wholesale market, transaction volumes of Valencia citrus fruit increased from 2.7% for the non-informed group to 17.2% for the informed group;

- **Jablih district**

- Before the marketing period, at the farm gate, transaction volumes of Valencia citrus fruit decreased from 8.03% in the non-informed group to 2.94% for the informed group.
- At the beginning of the marketing period at the farm gate, the total transaction volumes of Valencia citrus fruit increased from 1.4% for the informed group to 2.4% in the non-informed group;
- In the mid marketing period, at the farm gate, the transaction volumes of Valencia citrus fruit decreased from 2.3% for the non-informed group to 1.16% for the informed group;
- In the late/end marketing period, at the farm gate, transaction volumes of Valencia citrus fruit increased from 2.04% for the non-informed group to 5.34% for the informed group;
- At the beginning of the marketing period, on the wholesale market, the total transaction volumes of Valencia citrus fruit decreased from 8.47% for the non-informed group to 1.1% in the informed group;
- In the mid marketing period, on the wholesale market, the transaction volumes of Valencia citrus fruit decreased from 2.32% for the non-informed group to 0.70% for the informed group;
- In the late/end marketing period, on the wholesale market, transaction volumes of Valencia citrus fruit increased from 1.52% for the non-informed group to 3.44% for the informed group;

- **Al-Haffi district**

- Before the marketing period, at the farm gate, transaction volumes of citrus Valencia fruit decreased from 5.79% in the non-informed group to 1.39% for the informed group.
- At the beginning of the marketing period at the farm gate, the total transaction volumes of Valencia citrus fruit increased from 1.97% for the informed group to 2.92% in the non-informed group;

- In the mid marketing period, at the farm gate, the transaction volumes of Valencia citrus fruit decreased from 3.13% for the non-informed group to 1.40% for the informed group;
- In the late/end marketing period, at the farm gate, transaction volumes of Valencia citrus fruit increased from 2.76% for the non-informed group to 6.48% for the informed group;
- At the beginning of the marketing period, on the wholesale market, the total transaction volumes of Valencia citrus fruit decreased from 2.11% for the non-informed group to 0.64% in the informed group;
- In the mid marketing period, on the wholesale market, the transaction volumes of Valencia citrus fruit decreased from 2.79% for the non-informed group to 0.38% for the informed group;
- In the late/end marketing period, on the wholesale market, transaction volumes of Valencia citrus fruit increased from 1.96% for the non-informed group to 3.27% for the informed group;

➢ **Al-Qurdaha district**

- Before the marketing period, at the farm gate, transaction volumes of Valencia citrus fruit decreased from 7.52% in the non-informed group to 1.1% for the informed group.
- At the beginning of the marketing period at the farm gate, the total transaction volumes of Valencia citrus fruit decreased from 4.61% for the informed group to 3.3% in the non-informed group;
- In the mid marketing period, at the farm gate, the transaction volumes of Valencia citrus fruit decreased from 3.3% for the non-informed group to 1.6% for the informed group;
- In the late/end marketing period, at the farm gate, transaction volumes of Valencia citrus fruit increased from 2.97% for the non-informed group to 7.41% for the informed group;
- At the beginning of the marketing period, on the wholesale market, the total transaction volumes of Valencia citrus fruit decreased from 2.66% for the non-informed group to 1.17% in the informed group;

- In the mid marketing period, on the wholesale market, the transaction volumes of Valencia citrus fruit decreased from 3.64% for the non-informed group to 0.6% for the informed group;
- In the late/end marketing period, on the wholesale market, transaction volumes of Valencia citrus fruit increased from 2.09% for the non-informed group to 4.84% for the informed group;

These results suggest that most of the "Informed farmers" group had a clear tendency to market their Valencia fruits on the wholesale markets, in the late marketing season, in the Lattakia district, in order to obtain better prices by using temporal and spatial arbitrage in transaction volume.

AMIS effects on average prices obtained per 1kg of Valencia citrus fruit

Farmers sold their fruit in 1-6 transactions, with different volume and prices, so we calculated the average price obtained by farmers per 1 kg of Valencia citrus fruit, by:

$$\text{Avg\_ price\_ per\_ kg} = \frac{Total\_gross\_income}{Total\_transaction\_svolume} \quad (1)$$

$$\text{Total gross income} = T_1*P_1+T_2*P_1+\ldots\ldots T_n*P_n \quad (2)$$

Where:

T=transaction;

P=price

Average price per 1 kg of Valencia citrus fruit obtained by informed and non-informed farmer groups.

Figures (27) show that: farmers from the informed group obtained better prices than their peers in the non-informed group, this due to their better decisions in selecting the right market at the right time.

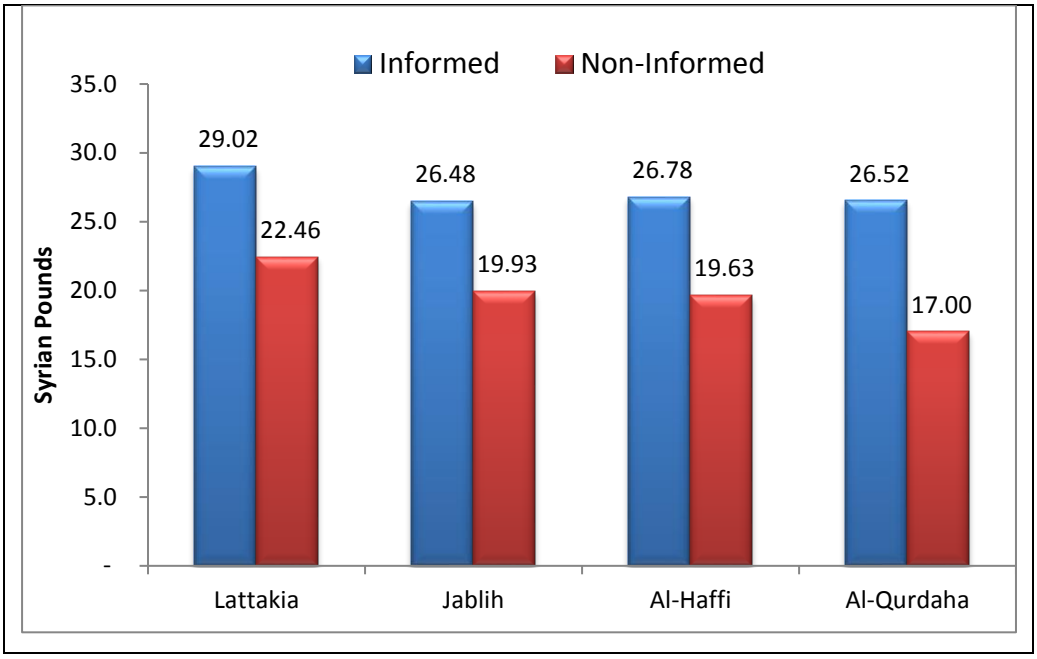


Figure 27. Average prices per 1 Kg obtained by farmers in each market

Sources: Own calculations based on questionnaire data

- Minimum and maximum prices obtained per 1 kg. of Valencia, citrus fruit ranged from 26.48 Syrian Pounds (in Jablih market) to 29.02 SP (at Lattakia market), and from 17.0 SP (at Al-Qurdaha) to 22.46 SP (at Lattakia market) for informed and non-informed groups.
- At Lattakia market, the average prices per 1 kg. Valencia citrus fruit obtained increased from 22.46 SP for the non-informed group to 29.02 SP for the informed group;
- At Jablih market, the average prices per 1 kg. Valencia citrus fruit obtained increased from 19.93 SP, for the non-informed group to 26.48 SP, for the informed group;
- At Al-Haffi market, the average prices per 1 kg. Valencia citrus fruit obtained increased from 19.63 SP in the non-informed group to 26.78 SP, for the informed group;
- At Al-Qurdaha market, the average prices per 1 kg. Valencia citrus fruit obtained increased from 17.0 SP, in the non-informed group to 26.52 SP, for the informed group.

From this point, we can note that most of the "Informed farmers" obtained better or higher prices by using spatial and temporal arbitrage when they sold their Valencia

citrus fruits in the Lattakia market at the end of the season, with the advantage of spatial arbitrage being that all the markets are not so far from each other and the furthest area would be about 30-35 km from Lattakia market, so there was no negative impact on transport cost.

Referring to the methodology 4.4.1 with the formula:

$$Y_{\iota J\kappa} = \mu + \beta_J + \gamma_\iota + \delta_\kappa$$

Table 39 shows that the informed group obtained significantly higher prices (8.7 Syrian Pound) per 1 kg of Valencia citrus fruit obtained at each place and time.
Where the higher price in the Lattakia market was (2.5 Syrian Pound) more than the price in Jablih and Al-Haffi market, also the price was higher at the end of the season. This confirms the benefit of the marketing information in both terms: choosing the right time and going to the right place for selling citrus fruit produce for the informed group (Sulaiman et al., 2016) Article in Engineering for Rural Development.

Table 39. An ANOVA test for marketed quantities and prices obtained by farmers from the two groups, in different marketing periods (SP)

	Df(price)	**F(price)**	**P>F(price)**	**Df(quant)**	**F(quant)**	**P>F(quant)**
Model	6	207.911	0.000	6	5.515	0.000
Market	3	12.779	0.000	3	3.326	0.019
Inf	1	669.738	0.000	1	20.977	0.000
Season	2	269.694	0.000	2	4.841	0.008

Note; Residual degree of freedom: for price 2399, for sales (quant) 587

Estimated parameters

	Markets				**Treatment group**		**Season**			
	Lattakia	**Jablih**	**Al-Haffi**	**Al-Qurdaha**	**Non-info**	**Info**	**Beg**	**Mid**	**Late**	**Cons**
Price	0.0	-2.5	-2.5	-1.4	0.0	8.7	0.0	-5.6	3.9	21.9
Quantity sold	0.0	566.9	411	525.6	0.0	743.6	0.0	-82.6	461.7	2,726.9

Sources: Own calculations based on questionnaire data

5.5 Research summary

Citrus prices in Lattakia have seasonal characteristics and further fluctuation between the months and markets, these findings may suggest that farmers in the region cannot choose the right market at the right time to sell their citrus fruit, and it is clear that the risk of price fluctuation among agricultural products has become one of the main risks faced by agricultural producers in the developing countries (Chuan, 2010), thus market information can be expected to mitigate these fluctuations, shifting the products from surplus to deficit markets either by farmers or traders depending on this information in addition to changing the harvest time and storage requirements for the produce.

Our finding concerning the citrus fruit marketing processes in the Lattakia region showed that "pre-harvest" contracts ranked first among the different ways of selling citrus fruit and accounted for more than 40% of cases. Middlemen usually visit farmers in October/November and negotiate the total sales of their whole production.

Similarly, to Lakshmi (2012), in India, where the Tiruchirapalli market is dominated by the pre-harvest middleman pre-buying produce half way to maturity of the crop and where this practice is adopted by 88% of the growers. The reason attributed by the grower is that the middleman gives them around 50% of the payment to meet the immediate needs of production, consumption and for the social activities of the growers (Lakshmi, 2012). The same result was obtained by Bhole (2015) that the middleman was the main agent to whom the orange fruit produce is sold by the farmers.

The majority of the citrus farmers in the Lattakia region depend on their neighbours to receive market information, this result supports that found by Orbunde, (2010) that in the Middle Belt region of Nigeria the popular sources of agricultural marketing information especially for farmers from the local government areas were friends, family and neighbours. Similarly, the major source of market information for the farmers in Ethiopia about prices, demand and supply was from traders, neighbours, friends, and relatives (Alemu et al., 2006). From this point we have to think how to

create reliable sources of information and the means to disseminate this information to farmers.

Almost 90% of the farmers in Lattakia region had an insufficient degree of access to market information, which means that they did not have the ability to negotiate with the trader and had disadvantages in their bargaining power; on the other hand just 3% of the farmers in the Lattakia region had sufficient access to market information, so that, for these reasons, in addition to poor access to market information and information asymmetry, all of the farmers depended on the middleman to market their production and did not assume the risk of going to the market.

This finding was compatible with that a majority of farmers in Malawi did not travel to distant markets rather than selling their produce in the local markets or at the farm-gate (Katengeza et al., 2012), and this result is in accordance with Shiferaw and Teklewold (2007) who found that farmers, especially those in remote areas, suffer from poor links to the market so they are often obliged to accept low prices for their produce without the ability to object or negotiate. The provision of market information services to the farmers should lead to increased awareness by farmers of information about prices and market conditions which would help the farmer's make their decisions about when and where they sell.

We can note that, we should seek the implementation of an AMIS, which should include prices, quantity and other important information in addition to doing market analysis (supply, demand, higher and lower price, market prospect, and market trend) and after that disseminate the important information to the farmers, so that, from a theoretical perspective at least, farmers would have the ability to sell at least half of their products directly in the markets and take the marketing risk, even though doing contracts for the second half but with better positions in negotiation with middlemen which should be reflected in prices received and farmer incomes. A further important role could be the AMIS providing important information to the government which will help the government organizations to make better interventions in citrus marketing based on real data and organized management of the market.

Taking into account that most of the citrus farmers in Lattakia have a mobile phone, it is rational to use them in delivering the needed marketing information via SMS. Mobile phone services offer greater flexibility with two-way direct communication by SMS and voice, which TV and radio for example cannot do, in addition to giving the farmer the advantage of receiving the necessary information by SMS, it allows them chose the information for specific cultivated varieties while it is no possible to do that with TV, radio and magazines, and as seen in many developing countries the mobile phone has become one of the most important means of information and communication technology which supports farmers having better access to market information (Furuholt, 2011).

Our results showed that the farmers were members of farmers' organizations and agricultural cooperatives, but farmers did not take advantage of these organizations to access market information or to take collective action which might benefit them in reducing transport costs and encouraging their bargaining power, so that in general, an AMIS cannot wait to build on the ability of farmers to take collective action; instead the system has to be built as a service (most likely publicly-financed and organized) to first gain the confidence of farmers and gradually involve them in its organization and funding. What is important for the farmer is how to improve their income by promoting their access to the market while reducing the risks of participating in the market via collective action, which would help them by integrating them with market information systems, providing all the needed information about the markets and prices (Gyau et al., 2013). Thus farmers' organizations should, over time, be able to prepare the environment for their members to involve themselves in collective action and receive from the start all the necessary support from the market information system.

The more informed the farmers become, the less middlemen will operate in the marketing chain. In this context Chircu and Kauffman (1999) said that disintermediation may decrease the cost of servicing which would lead to decreasing total costs by eliminating some actors in the value chain to increase profit margins for the manufacturer. We can also apply this strategy with citrus marketing to increase the profit margin for the farmer; further, an AMIS would serve to eliminate the information asymmetry over the market chain actors.

Application of a trial AMIS on an experimental group (the informed group) helped farmers in purchasing their production logistics with cheaper prices as compared with their peers from a non-informed group. In addition, the trial AMIS caused spatial displacements in citrus fruit sales venues and improved substantially farmers gross income from citrus fruit. Information received was shown to be helpful in obtaining better prices per 1 kg of Valencia citrus fruit.

These results are in line with Binayee (2005), who reported that, when farmers got market information before selling their products they had a chance to choose the right place and time to sell them and got higher prices, which also saved on the cost of multiple transportation and handling.

Svensson and Yanagizawa (2009) studied the effect of disseminating information through local FM radio stations in Uganda on two groups of farmers, and they found that households with access to a radio did deals for higher farm-gate prices than households without access to a radio. An initiative to link farmers and buyers In Kenya, the Agricultural Commodity Exchange, created a system for disseminating market information (Karugu, 2010). This system enabled farmers get better prices for their products. When comparing the obtained price with that sold through middlemen, they were significantly higher.

Evidence in Peru about the role of telecommunications, Chong et al. (2005) studied the effect of using public telephones on two groups of farmers with and without public telephones and they found positive links between using public telephones and the amount of income received. Telephone use resulted in a 13% increase in farm income in comparison with the second group whose did not use public telephones.

Our finding may suggest that most of the "Informed farmers" had a clear tendency to market their citrus fruits at a later period of marketing, obtaining better prices by using temporal arbitrage in transaction volumes.

Therefore, market information can play a crucial role in the short term because farmers can benefit from this information to create better spatial and temporal

arbitrage in addition to discovering new markets, which in turn leads to reductions in price instability and provides more profit for farmers (Staatz et al., 2011); but we should take in account that the lack of competition in the markets and high transport costs on the national level have negative effects in making spatial and temporal arbitrage effective (Moser, 2005).

The proposed AMIS caused spatial and temporal arbitrage in citrus fruit sales and allowed farmers improve their gross income. We should therefore find the best ways and tools to disseminate timely, real and accurate information to the farmers which in turn can help them in the negotiation process and in making their decisions. For example, in our research we depended on mobile phones to send information, and 93% of Lattakia farmers have mobile phones.

So, it can be said that the AMIS proposed is functional as the information received were helpful in obtaining better prices per 1 kg of citrus fruit.

In this study we provide important and unique information about citrus marketing and the current situation regarding the distribution of information on prices and demand respective to citrus varieties. We believe our findings justify the need for the creation of an AMIS, on the one hand, and suggest the technical and organizational options for a better way to disseminate information among the farmers, on the other. Furthermore, our study concludes that general constraints for effective information dissemination, such as the high cost and/or low availability of technical facilities are not the main challenge as Lattakian farmers are sufficiently equipped with mobile phones and these offer a sufficient technical basis for an effective AMIS. Farmers possess ICT media at present, but their potential remain as yet not fully recognized nor used to acquire market information. We can observe that the use of ICT, particularly mobile phones for getting information on the most recent market developments, is common among middlemen and traders. However it is not only the ICT that makes the difference. The middlemen get information from their trading partners, but there is no information channel for farmers except of the middleman. As a result, it is the middleman involved in contract negotiations who himself creates the clear asymmetries in the traditional bargaining process.

Based on our pioneering survey regarding on the need for an AMIS in the coastal areas of Syria, we would specifically focus on advisory services using mobile phones. We propose that the costs should be covered or co-shared by the government and/or some development programme at least at an initial stage to improve the adoption and efficiency of the AMIS for the farmers. For that purpose, the government or any development initiative should use the already existing network of advisory service centres as contact points for the farmers.

The bonus of tools such as AMISs lies also in the building up of a system and the development of infrastructure that can be used later on for other sectors, as well as for e-government, which could be one of the most interesting economic post-war-reconstruction-led reforms, completely impartial and easily communicable as well as leading to higher efficiency in administration, taking a large leap ahead due to the inherent motivation of its users: heads of families of producing farmers interested in better market prices, the removal of the omnipresent middlemen from the commercialization chain and having as an impact on creating a better distribution of wealth in the local population.

According to the theory of public goods, such goods often face problems related to under-provision by the private sector (Samuelson, 1954) and if they are to reach larger strata of the population, they have to be "non-excludable" as well as "non-rival"-based. The post-war reconstruction effort should therefore be directed in this field through public policies, although focusing on private farmers, as this has many advantages over other strong structural policy applications, among others, the support for active local producers, the absence of local political involvement, as well as the lower cost, though it should still be regarded a tool which is not to be implemented without other types of support.

6. Conclusions and recommendations

6.1 General conclusion

Citrus prices differed significantly between markets in the Lattakia region, where the Lattakia wholesale market showed the highest prices and the Al-Qurdaha market the lowest ones. These differences in citrus fruit price averages between different markets increased during the period 2010 -2013, due to factors such as the lack of market information and the on-going information asymmetry, the presence of large retail chains in Lattakia city, the decrease in the purchasing power of consumers, the seasonal nature and differences in the harvesting periods of citrus fruit varieties affecting prices, as a result of surpluses in supply in January – April, and a shortage of supply in the summer periods, and lastly the lack of citrus exports, caused mainly by the politico-economic embargo imposed on Syria.

In fact, during our study in 2012-2013 every actor in the citrus chain continued about their normal business without any effects from the crisis, because this was just at the beginning of the civil war and the export sector was still working at that time. Of course, four years later, the situation could be different as all trading partner countries have ended economic relations with the country. This unfortunate situation, however, does not undermine the value of our results. Once things improve, the recovery of the citrus business might benefit from our findings and an AMIS will definitely serve as an important element in development of the agricultural sector in Syria with the implementation of post-war reconstruction plans.

6.2 Conclusions on hypotheses

The questionnaire analysis and analytical work leads to conclusions for the whole of the work dependent on the hypotheses and the results.

Conclusion on Hypothesis 1

The hypothesis "There is a fluctuation of citrus prices in the Lattakia region markets" has been confirmed as true. For example, for a variety such as Lemon Autochthon, the prices in the summer are two to three times higher than in the winter months. The Lattakia wholesale market also showed the highest prices and the Al-Qurdaha wholesale market the lowest ones.

Conclusion on Hypothesis2

The hypothesis "Citrus Farmers in the Lattakia region receive a lower value share compared Market agents" has been confirmed as true. Because the results show that farmers are receiving only 44.8% of the final price, while the rest of the 55.2% price is grasped by other market agents, middlemen getting 26.7%, and the wholesalers 10.5%, while the remaining 18% profit margin goes to the retailers. So the most important role of an AMIS is to exclude the middlemen from the citrus market chain and improve the producers share by marketing their products directly to the traders at higher prices.

Conclusion on Hypothesis 3

The hypothesis "Small producers (households) who receive improved market information from an AMIS are more likely to sell their citrus products in competitive crop markets " has confirmed as true, by comparing a group of informed farmers, who received market information with another, non-informed one, who did not receive market information. We found transaction volumes by contract before harvesting decreased from 26.95% in the non-informed group who marketed their products via these “disadvantageous” contracts, to 9.63% for the informed group. As opposed to this, the informed group showed a clear tendency towards selling their fruit on the Lattakia wholesale markets.

Conclusion on Hypothesis 4

The hypothesis "The provision of market information shifts the sales to the later season" has been confirmed as true. Because most of small producers (households), who receive improved, market information, have displayed a clear tendency to sell their citrus products in the later sales period to obtain better prices by using temporal arbitrage in the transaction volumes.

6.3 Recommendations

Based on the above conclusions the following recommendations have been formulated:

(i) The government should implement an AMIS by means of agricultural extension services, and enhance the role of cooperatives/associations in helping poor and illiterate farmers receive information on a regular basis, such as via meetings and seminars;

(ii) In order for the AMIS to be considered a robust reconstruction tool, the AMIS has to be in conformity with the definition of a public good in the ownership of government; with its extensive agricultural background, the Lattakia region exports, among others, cotton, cereals, fruits, eggs, vegetable oil, pottery, tobacco, while citrus production remains among the most important sectors. The idea of an AMIS could if, successful, therefore be applied to other sectors as well and justifies the importance of the AMIS.

(iii) The implementation of the AMIS in post-war Syria might therefore be gradual, with the focus on the more educated producers in order to launch the system and acquire credibility with the population.

(iv) In order to improve the situation in the Lattakia citrus sector, we suggest the following recommendations:

- Construction of citrus juice factories capable of absorbing production surpluses in the peak season.
- Construction of storage facilities for citrus fruit.
- Improvement of access to transport and credit facilities.
- Citrus crops to be considered as a semi strategic crop, so that, they will receive more governmental support during the production and marketing process.

(v) The small size of citrus orchards is a real problem in citrus fruit marketing; in addition, citrus producers grow more than three citrus varieties in the same area. For these reasons, individual production is too low and cannot compete in the larger markets; therefore, it is important to think about collective marketing or to establish special facilities for every 5-10 villages to assemble their production.

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Annex

Annexes 1, 2, 3

Annex 1Normal distribution and equal variance tests

Based on the questionnaire, we have four groups. We study the normality of these four groups. We took the mean for each group and finally the normality test is performed by taking into account the district as a factor.

Tests of Normality

	district	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	Df	Sig.
Group1	Lattakia	.162	100	.000	.869	100	.000
	Jablih	.125	100	.001	.967	100	.014
	Qurdaha	.126	100	.000	.963	100	.007
	Haffi	.153	100	.000	.960	100	.004
Group2	Lattakia	.183	100	.000	.921	100	.000
	Jablih	.218	100	.000	.877	100	.000
	Qurdaha	.270	100	.000	.835	100	.000
	Haffi	.185	100	.000	.911	100	.000
Group3	Lattakia	.367	100	.000	.755	100	.000
	Jablih	.414	100	.000	.606	100	.000
	Qurdaha	.430	100	.000	.580	100	.000
	Haffi	.409	100	.000	.566	100	.000
Group4	Lattakia	.523	100	.000	.379	100	.000
	Jablih	.523	100	.000	.379	100	.000
	Qurdaha	.473	100	.000	.524	100	.000
	Haffi	.473	100	.000	.522	100	.000

a. Lilliefors Significance Correction

As it is known, the null hypothesis for normality test is that the data is normally distributed. This table shows that (p-value < 0.05), so we have to reject the null hypothesis and accept the alternate hypothesis. That means we reject the normality distribution of the four groups regarding to the district factor. As a result, the groups are not normally distributed.

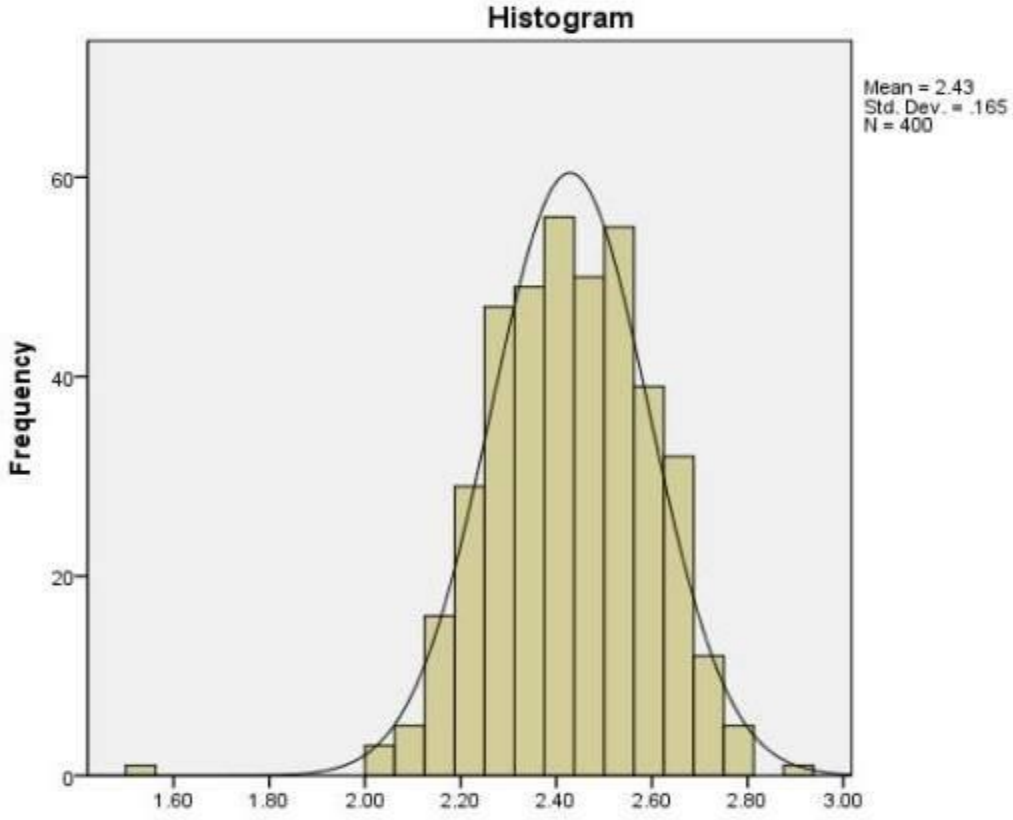
To test the equality of variances for the selected groups, nonparametric Levene's test has been performed. To accomplish that, first we prepare the data by taking some initial steps to create three new variables with; ranked data, group mean ranks, and deviations from mean ranks. After that, we perform ANOVA analysis and the result is listed in the following table.

ANOVA

		Sum of Squares	Df	Mean Square	F	Sig.
ind_diff_1	Between Groups	11833.547	3	3944.516	1.333	.263
	Within Groups	1171691.148	396	2958.816		
	Total	1183524.695	399			
ind_diff_2	Between Groups	75314.431	3	25104.810	7.519	.000
	Within Groups	1322138.691	396	3338.734		
	Total	1397453.122	399			
ind_diff_3	Between Groups	3805.928	3	1268.643	.493	.688
	Within Groups	1019876.189	396	2575.445		
	Total	1023682.117	399			
ind_diff_4	Between Groups	12553.165	3	24184.388	1.409	.189
	Within Groups	928992.593	396	2345.941		
	Total	941545.758	399			

As it is known, the null hypothesis is that there is an equality of variance. If the p-value is above 0.05, we keep the null hypothesis and assume equality of variance. If the p-value is below 0.05, we reject the null hypothesis and assume that the differences in variances or speed between the groups are statistically significant.Based on the last table, the Levene's test verified the equality of variances of groups 1, 3 and 4 while assumed that the differences in variances of the groups 2 are statistically significant. In other words, the district factor has no effect on the variables of the groups 1, 3 and 4, while it is significantly effects on the variables of the groups 2.

According to several studies ANOVA test is robust with non-normal distribution by using a variety of non-normal distributions, have shown that the false positive rate is not affected very much by this violation of the assumption if the sample sizes are larger than 50 and are not unbalanced (Glass et al. 1972, Harwell et al. 1992, Lix et al. 1996), also Vittinghoff et al. 2012 say with large samples even if the normality assumption is violated we can use one-way analysis of variance F test.


Histogram
Mean = 2.43
Std. Dev. = .165
N = 400
Frequency
60
40
20
0
1.60
1.80
2.00
2.20
2.40
2.60
2.80
3.00

Annex 2

A Chi-Square Test calculator for a contingency table

Results

	Lattakia	Al-Haffi	Al-Qurdaha	Jablih	Row Totals
Car	23 (22.31) [0.02]	22 (22.66) [0.02]	23 (22.31) [0.02]	23 (23.71) [0.02]	91
Motorbike	21 (20.84) [0.00]	21 (21.17) [0.00]	21 (20.84) [0.00]	22 (22.15) [0.00]	85
Bicycle	20 (20.84) [0.03]	22 (21.17) [0.03]	20 (20.84) [0.03]	23 (22.15) [0.03]	85
Column Totals	64	65	64	68	261 (Grand Total)

The chi-square statistic is 0.2212. The *p*-value is .999792. The result is *not* significant at $p < .05$.

Results

	Lattakia	Al-Haffi	Al-Qurdaha	Jablih	***Row Totals***
Radio	24 (23.50) [0.01]	23 (23.24) [0.00]	24 (23.76) [0.00]	23 (23.50) [0.01]	94
TV	23 (23.75) [0.02]	25 (23.49) [0.10]	23 (24.01) [0.04]	24 (23.75) [0.00]	95
Mobile phone	24 (23.75) [0.00]	23 (23.49) [0.01]	24 (24.01) [0.00]	24 (23.75) [0.00]	95
Internet	21 (21.00) [0.00]	20 (20.77) [0.03]	22 (21.23) [0.03]	21 (21.00) [0.00]	84
Column Totals	92	91	93	92	**368 (Grand Total)**

The chi-square statistic is 0.2641. The *p*-value is .999998. The result is *not* significant at $p < .05$.

Results

	Lattakia	Al-Haffi	Al-Qurdaha	Jablih	***Row Totals***
Agricultural trade	19 (19.00) [0.00]	18 (19.00) [0.05]	20 (19.00) [0.05]	19 (19.00) [0.00]	76
Job	6 (6.00) [0.00]	7 (6.00) [0.17]	5 (6.00) [0.17]	6 (6.00) [0.00]	24
Column Totals	25	25	25	25	**100 (Grand Total)**

The chi-square statistic is 0.4386. The *p*-value is .932159. The result is *not* significant at $p < .05$.

Annex 3 Questionnaires

Farmer questionnaire

A- Status of respondents:

Name of the farmer ……

1) Age: ( ) up to25; **( )** 31-35; **( )** 36-40; **( )** 41-45; **( )** 46-50; **( )**50 <

2) Gender: **( )** Male/ **( )** Female

3) District: **( )** Lattakia, **( )**Jablih, **( ) Al-**Qurdaha, **( ) Al-**Haffi

4) What is your level of education?

( ) Illiterate ( ) Primary ( ) Secondary ( ) Higher education ( ) University

5) Communication and mobility

Radio	**TV**	**Personal computer**	**No. of Cell Phone per family**	**Internet**	**Car**	**Motorbike**	**Bicycle**
( )	**( )**	**( )**	**( )**	**( )**	**( )**	**( )**	**( )**

B- **Characteristics in business:**

6) Family income per year (S.P)

<200.000	**200.000-300.000**	**350.000-400.000**	**>400.000**
( )	**( )**	**( )**	**( )**

7) What is the cost of production per year?

Particular	Amount	Unit cost	Total cost
Sapling			
Manure			
Labour			
Fertilizer			
Pesticide/chemical			
irrigation			

8) Production and marketing of citrus types

Citrus types	**Total production (kg)**	**Amount sold annually to traders collecting from farm gate/village (kg)**	**Prices average**
Lemon Autochthon			
Jaffa			
Clementine			
Valencia			
Grapefruit			

C- Behaviour on market:

9) Did you make the grading and packaging for your product? ( ) Yes ( ) No

10) Who is your main buyer of citrus types among the following?
() Farmer collector () Road head collector () Wholesaler () Retailer

11) Did you make a contractual agreement? ( ) Yes ( ) No

12) If yes, when do you get the contract?
( ) Beginning of the season ( ) Just before harvesting/pre-harvest

13) Who decides on the price of citrus?
( ) Bargaining process between myself and buyer ( ) Buyer

D- **The necessary, and access to, market information**

14) What kind of market information do you need?
() Citrus prices, () Supply demand, () Input prices, () Weather and agricultural technology.

15) From which sources do you get market information and citrus prices?
( ) Agricultural extension, ( ) NGO, ( ) Neighbours, ( ) Mobile Phone

16) Do you have access to the market information?
( ) Insufficient, ( ) Completely unknown, ( ) Sufficient

17) Are you a member of : ( ) Agricultural cooperatives; ( ) Peasant union; ( ) Agricultural chamber, ( ) None of the above;

Trader questionnaire

A- Status of respondents:

Name of the trader: ……

1) Age: ( ) Up to 25, ( ) 25-40, ( ) 41-55, ( )55<

2) Gender: ( ) Male / ( ) female

3) District: …… ( ) Lattakia, ( ) Al-Haffi, ( ) Al-Qurdaha, ( ) Jablih

4) What is your level of education?

( ) Illiterate, ( ) Primary ( ) Secondary ( ) Higher secondary ( ) University

5) How long have you been in the business of citrustrading?

( ) 15<
( ) 10-15
( ) 5-10
( ) 5 >

6) Communication and mobility

Radio	**TV**	**Mobile phone**	**Internet**	**Car**	**Motorbike**	**Bicycle**
( )	**( )**	**( )**	**( )**	**( )**	**( )**	**( )**

B- Characteristics in business:

7) What are the sources of income?

() Agriculture trade; () Job

8) Trader income per year (S.P)

<2.000000	**2.000000-3.000000**	**3500.000-4.000000**	**>4.000000**
( )	**( )**	**( )**	**( )**

C- Behaviour in the market

9) From where do you buy citrus?

( ) Farm gate; ( ) Contractor; ( ) Wholesaler, ( ) All of the above

10) When you buy from the farmers how can contact them to buy their production?

( ) Fixed telephone; ( ) Mobile phone; ( ) Direct visit; ( ) All of the above