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## CONCEPTUAL MODEL OF FLORICULTURE SUPPLY CHAIN MANAGEMENT

**Olga Karpun.** *«Conceptual model of floriculture supply chain management».* The flower industry today is a fairly dynamic international industry. Proof of this is the significant growth rates achieved in recent years in this area. Thus transportation of perishable goods is one of the most difficult types of delivery, and transportation of flowers is even more difficult. Because it is necessary not only to strictly adhere to the temperature regime, but also to preserve the appearance of such a demanding cargo.

Conducted analysis of the flower industry has shown that market demand is stagnant, while supply is in surplus. In part, this is due to the fact that flowers are highly correlated with income, not being essential commodities. Although on the other hand, consumer demand is becoming more demanding and differentiated. The main factors influencing the market of floriculture products were identified and studied.

It was noted that the market of floriculture products in Ukraine is relatively small and young, but promising and growing rapidly. In addition, it is one of the most complex and time-consuming, due to its features. First of all, the floriculture market is represented by a significant number of participants that have different basic and current resources, goals for the market, needs, and so on.

Studies have shown that the floriculture industry can suffer huge losses, mainly due to the lack of proper infrastructure for storage and transportation, as well as due to the lack of control over the conditions of supply. Lack of visibility in supply chains leads to quality problems, which leads to product loss, product returns, rising costs, and time delays. In addition, changing consumer demands, an active lifestyle and an open economy are forcing manufacturers and suppliers to produce higher quality goods and constantly look for ways to optimize costs.

The proposed conceptual model of floriculture supply chain management will make it possible to form a new infrastructure that will unite all the subjects of the floriculture market into a single system. Thus, we can say that the priority areas of infrastructure development of the floriculture market should be determined in terms of a systematic approach and consist in the interaction of elements of production, intermediary, floristic, design, marketing, financial, information and agricultural components. Each part of the chain must perform its function effectively in order to maintain the optimal conditions of the environment in which the products of floriculture are located, during its supply from the manufacturers to the final consumers. To this end, a combination of innovative technologies that help to manage the supply of floriculture products in real time through the supply chain was proposed.

Therefore, in order to satisfy consumers, it is necessary to form an effective supply chain for floriculture products, all parts of which must work in a whole, so that end consumers can get high quality products.

**Keywords:** floriculture products, temperature regime, conceptual model, supply chain management, innovative technologies.

**Ольга Карпунь. "Концептуальна модель управління ланцюгами постачання продукції квітництва".** Квіткова індустрія сьогодні є досить динамічною міжнародною галуззю. Доказом цього є досягнуті за останні роки значні темпи зростання в даній сфері. При цьому транспортування швидкопсувних вантажів є одним з найскладніших видів доставки, а перевезення квітів ще складніше через те, що потрібно не тільки строго дотримуватися температурного режиму, а й зберігати зовнішній вигляд такого вибагливого вантажу.

Проведено аналіз квіткової галузі, який показав, що попит на ринку знаходиться в стані стагнації, в той час як пропозиція – в надлишку. Почасти це пов'язано з тим, що квіти мають високу кореляцію з отримуваним доходом, не будучи товаром першої необхідності. Хоча з іншого боку, споживчий попит стає все більш вимогливим і диференційованим. Були визначені та досліджені основні чинники, які здійснюють вплив на ринок продукції квітництва.

Було зазначено, що в Україні ринок продукції квітництва є відносно невеликим за обсягом і молодим, але при цьому перспективним і швидко зростаючим. Крім того він є одним із найскладніших та трудомістких, що зумовлено його особливостями. Насамперед, ринок квітництва представлений значною кількістю суб'єктів (учасників), що мають різні основні та оборотні ресурси, цілі щодо роботи на ринку, потреби тощо.

Проведено дослідження, які показали, що індустрія квітництва може зазнавати величезних втрат, головним чином, через відсутність належної інфраструктури для зберігання та транспортування, а також через відсутність контролю за умовами постачання. Відсутність видимості в ланцюгах постачання призводить до проблем із якістю, що призводить до втрати продукції, повернення продукції, зростання її вартості, а також затримок у часі. На додачу до цього мінливі запити споживачів, активний спосіб життя та відкрита економіка фактично змушують виробників і постачальників виробляти товари вищої якості та постійно шукати шляхи оптимізації витрат.

Запропонована концептуальна модель управління ланцюгами постачання продукції квітництва дасть можливість сформуванню нової інфраструктури, яка поєднає в єдину систему всіх суб'єктів ринку квітництва. Таким чином, можемо стверджувати, що пріоритетні напрями розвитку інфраструктури ринку квітництва мають визначатися з погляду системного підходу і полягати у взаємодії елементів виробничої, посередницької, флористичної, дизайнерської, маркетингової, фінансової, інформаційної та агросервісної складових. Кожна частина ланцюга повинна ефективно виконувати свою функцію задля підтримання оптимальних умов середовища, в якому знаходиться продукція квітництва, під час її постачання від виробників до кінцевих споживачів. Задля цього запропоновано поєднання інноваційних технологій, які допомагають реалізувати управління постачанням продукції квітництва в реальному часі через ланцюжок поставок.

Отже, щоб задовольнити споживачів, необхідно сформуванню ефективного ланцюга постачання продукції квітництва, усі ланки якого повинні працювати як єдине ціле, щоб в результаті кінцеві клієнти отримали товар високої якості.

**Ключові слова:** продукція квітництва, температурний режим, концептуальна модель, управління ланцюгами постачання, інноваційні технології.

**Ольга Карпунь. «Концептуальная модель управления цепями поставок продукции цветоводства».** Цветочная индустрия сегодня является достаточно динамичной международной отраслью. Доказательством этого являются достигнутые за последние годы значительные темпы роста в данной сфере. При этом транспортировка скоропортящихся грузов является одним из самых сложных видов доставки, а перевозка цветов еще сложнее из-за того, что нужно не только строго соблюдать температурный режим, но и сохранять внешний вид такого привередливого груза.

Был проведен анализ цветочной отрасли, который показал, что спрос на рынке находится в состоянии стагнации, в то время как предложение - в избытке. Отчасти это связано с тем, что

цветы имеют высокую корреляцию с получаемым доходом, не будучи товаром первой необходимости. Хотя с другой стороны, потребительский спрос становится все более требовательным и дифференцированным. Были определены и исследованы основные факторы, которые оказывают влияние на рынок продукции цветоводства.

Было отмечено, что в Украине рынок продукции цветоводства является относительно небольшим по объему и молодым, но при этом перспективным и быстро растущим. Кроме того, он является одним из самых сложных и трудоемких, что обусловлено его особенностями. Прежде всего, рынок цветоводства представлен значительным количеством субъектов (участников), имеющих различные основные и оборотные ресурсы, цели по работе на рынке, потребности и тому подобное.

Проведены исследования, которые показали, что индустрия цветоводства может нести огромные потери, главным образом, из-за отсутствия надлежащей инфраструктуры для хранения и транспортировки, а также из-за отсутствия контроля за условиями поставки. Отсутствие видимости в цепях поставок приводит к проблемам с качеством, что приводит к потере продукции, возврату продукции, росту ее стоимости, а также задержка во времени. В дополнение к этому меняющиеся запросы потребителей, активный образ жизни и открытая экономика фактически заставляют производителей и поставщиков производить товары более высокого качества и постоянно искать пути оптимизации расходов.

Предложенная концептуальная модель управления цепями поставок продукции цветоводства даст возможность сформировать новую инфраструктуру, которая соединит в единую систему всех субъектов рынка цветоводства. Таким образом, можно утверждать, что приоритетные направления развития инфраструктуры рынка цветоводства должны определяться с точки зрения системного подхода и заключаться во взаимодействии элементов производственной, посреднической, флористической, дизайнерской, маркетинговой, финансовой, информационной и агросервисных составляющих. Каждая часть цепи должна эффективно выполнять свою функцию для поддержания оптимальных условий среды, в которой находится продукция цветоводства, во время ее поставки от производителей до конечных потребителей. Для этого предложено сочетание инновационных технологий, которые помогают реализовать управление поставками продукции цветоводства в реальном времени через цепочку поставок.

Итак, чтобы удовлетворить потребителей, необходимо сформировать эффективную цепь поставки продукции цветоводства, все звенья которой должны работать как единое целое, чтобы в результате конечные клиенты получили товар высокого качества.

**Ключевые слова:** продукция цветоводства, температурный режим, концептуальная модель, управление цепочками поставок, инновационные технологии.

**Introduction.** Transportation of perishable goods is one of the most difficult types of delivery, and transportation of flowers is even more difficult. Because it is necessary not only to strictly adhere to the temperature regime, but also to preserve the appearance of such a demanding cargo. Taking into account these reasons, carriers allocate them to a separate group of goods with special conditions of carriage and use special transport for their carriage. The main methods of delivery of fresh flowers are road and air transport. Logistics companies that organize international and domestic transportation of fresh flowers should do so using refrigerated flower semi-trailers that maintain the set temperature, humidity and ventilation throughout the journey.

The next important point to consider when transporting flowers is the speed of delivery. The main task when transporting freshly cut flowers is to deliver the goods to the customer in the shortest possible time. Based on this, flowers should be transported over long distances exclusively by air and only by direct flight.

It should also be remembered that the international transportation of plants requires a number of permits (phytosanitary documents and certificates). Without them, most countries do not allow plants and flowers into their territory. Therefore it is necessary to specify the legislation of the country where cargo is imported.

There are many nuances when transporting flowers. For example, when

transporting cut or planted in pots of flowers and bulbs should take into account the peculiarities of transportation of a particular species of plant. There are also subtleties during customs clearance.

As we can see, transporting plants is a much more difficult task than it may seem at first glance. Its trouble-free solution requires the experience of professional logisticians in the field of such transportation and the availability of special equipment for transportation. For today, there are some scientific developments in the formation of Fresh Supply Chain [4] and in particular Floral Supply Chain [2, 3, 11, 12, 14]. However, they lack an integrated approach to building a model of effective floriculture supply chain management.

**The purpose and objectives of the research.** It consists in substantiating the theoretical and practical foundations and developing of scientific and methodological recommendations for the formation of a conceptual model of floriculture supply chain management which will help to increase its efficiency.

**The main material and results of the research.** The flower industry today is a fairly dynamic international industry. Proof of this is the significant growth rates achieved in recent years in this area. Europe and North America dominate the flower trade, while producer countries are closer to the equator. For the past ten years, the list of leading exporters of flowers includes the Netherlands, Colombia, Kenya, Ecuador and Israel [1, 8]. Relatively recently, a country like Ethiopia has joined the list, while Israel's position has weakened. Thus, one of the major structural changes currently taking place in the world of the flower industry is the intensification of international competition. Due to a combination of local production and imported flowers, the Netherlands is the leading central market in this sector (Fig. 1).

In addition, there is a general opinion that today the industry is facing drastic changes, reacting sharply to the problems associated with modern economic conditions. Market

demand is stagnant, while supply is in surplus. In part, this is due to the fact that flowers are highly correlated with income, not being essential commodities. Although on the other hand, consumer demand is becoming more demanding and differentiated. Interestingly, even factors such as religious and cultural characteristics of people also play an important role in the flower trade.

Over the past few years, the Ukrainian flower market has experienced a downturn as a result of the economic crisis in Ukraine. Thus, after falling by more than 58% in the period 2013-2015, the market began to recover, and over the next 2 years grew by 40%. In 2018 and 2019, there was also a trend towards recovery [8].

The analysis showed that this was facilitated by the following factors [1, 8]:

1. Macroeconomic indicators. At the time of the crisis, imported flowers accounted for the vast majority of the market, so the sharp fall in the hryvnia collapsed it. In recent years, the exchange rate has stabilized, and local producers have increased their market position. This and the improvement of the economy in general contributed to the recovery of the flower market in Ukraine.

2. High share of imported products in the market. Analysis of the flower market showed that most flowers are of imported origin. With the onset of the crisis, of course, Ukrainian producers were forced to raise prices due to rising costs of consumables (seeds, fertilizers, greenhouses and logistics). However, thanks to a more affordable, compared to foreign partners, pricing policy and flexibility in cooperation, network retail and large sellers are refocusing on cooperation with Ukrainian producers of flowers and seeds.

3. The market is characterized by seasonality. The number of imported flowers increases in the winter-spring period, and in the summer-autumn period the number of domestic flowers increases. Although growing flowers in greenhouses is possible, in winter the cost increases significantly. Therefore, imported plants have growing



potential for competition, and their share is increasing.

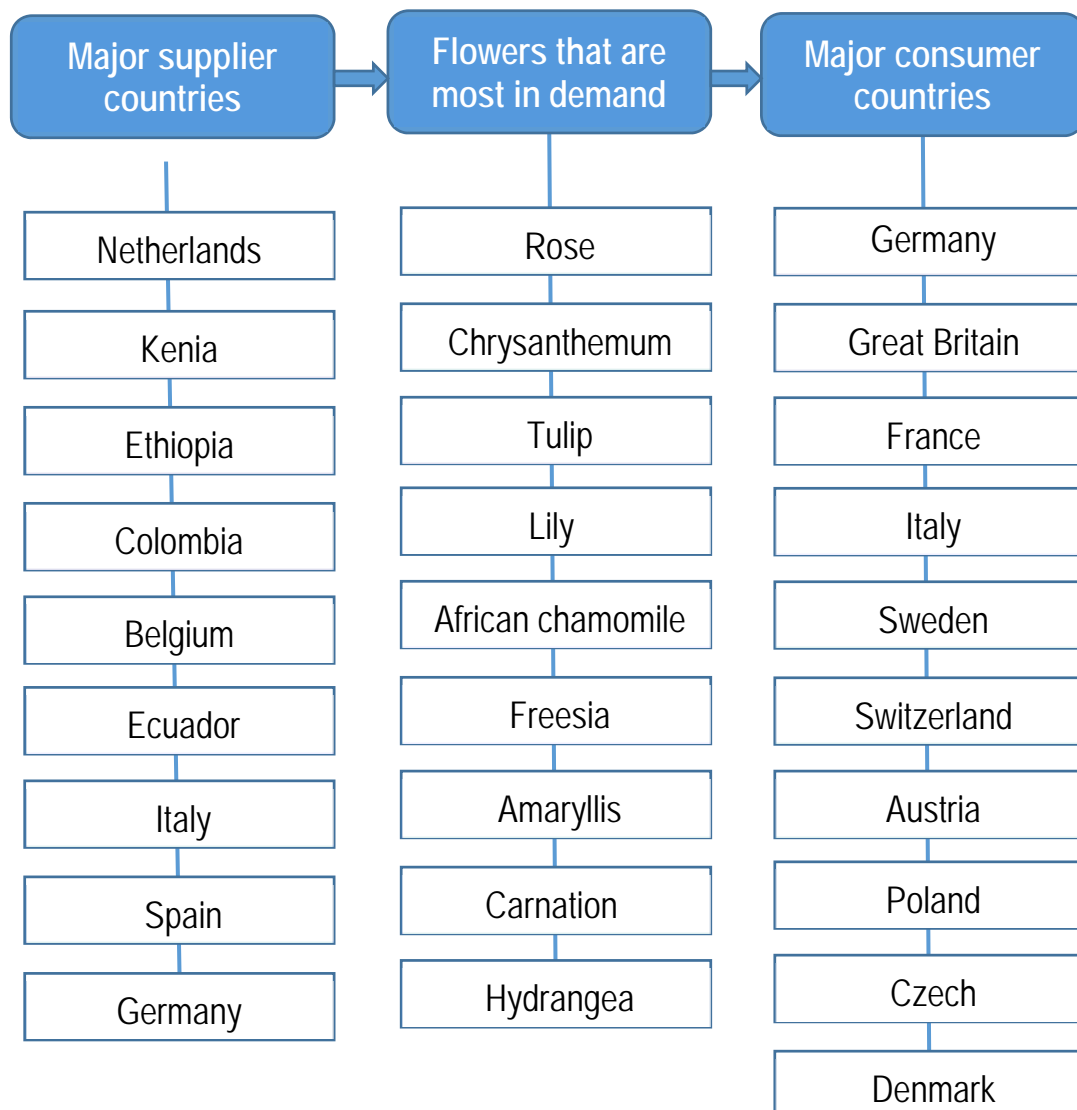


Figure 1 – The main suppliers, buyers and the most popular flowers of the "flower market"  
 [based on 5, 9]

Analysis of the flower market in Ukraine has shown that it is most diverse in the capital. Regional wholesale bases are replenished with flowers about once a week, and the smaller the settlement, the fewer outlets and a narrower range of flowers. For today, there is a redistribution of demand, but the market structure by price segment remains. The lowest price segment is currently the most popular.

In Ukraine, the market for floricultural products is relatively small and young, but

growing rapidly. In addition, it is one of the most complex and time-consuming, due to its features. First of all, the floriculture market is represented by a significant number of participants that have different basic and current resources, goals for the market, needs, and so on. Today, there are two main groups of participants in the market: sellers, which include manufacturers, processing companies and intermediaries, and buyers (Fig. 2).

The subjects of the market are enterprises of various forms of ownership and management, which usually offer a very wide range of products. The offer of the floriculture market is formed by domestic and imported products (live cut flowers, potted plants, planting material, ornamental plants of open and closed soils, etc.) and processed products (flower arrangements, bouquets, floral wreaths, collages, etc.).

Consider the goals and requests of each subject of the flower market.

The main goals of customers.

Because cut flowers are a luxury product, consumers demand a certain level of quality, as well as value for money. The main aspects of quality are color, freshness, stem length, absence of pests, aroma and life expectancy in

the vase. The analysis shows that color, freshness, disease-free status and good appearance are the main factors when making a purchase decision. And this can be achieved only by floriculture supply chain management.

The main goals of flower shops.

Today, flowers are sold in a wide range of outlets. Many retailers now sell a wide range of goods, tending to become a department store and occupy a larger share of the retail market. This means that flowers have appeared in supermarkets, gas stations, corner shops and wine shops. An increasing number of floriculture products are sold by phone and online. Everyone usually has a specific target market.

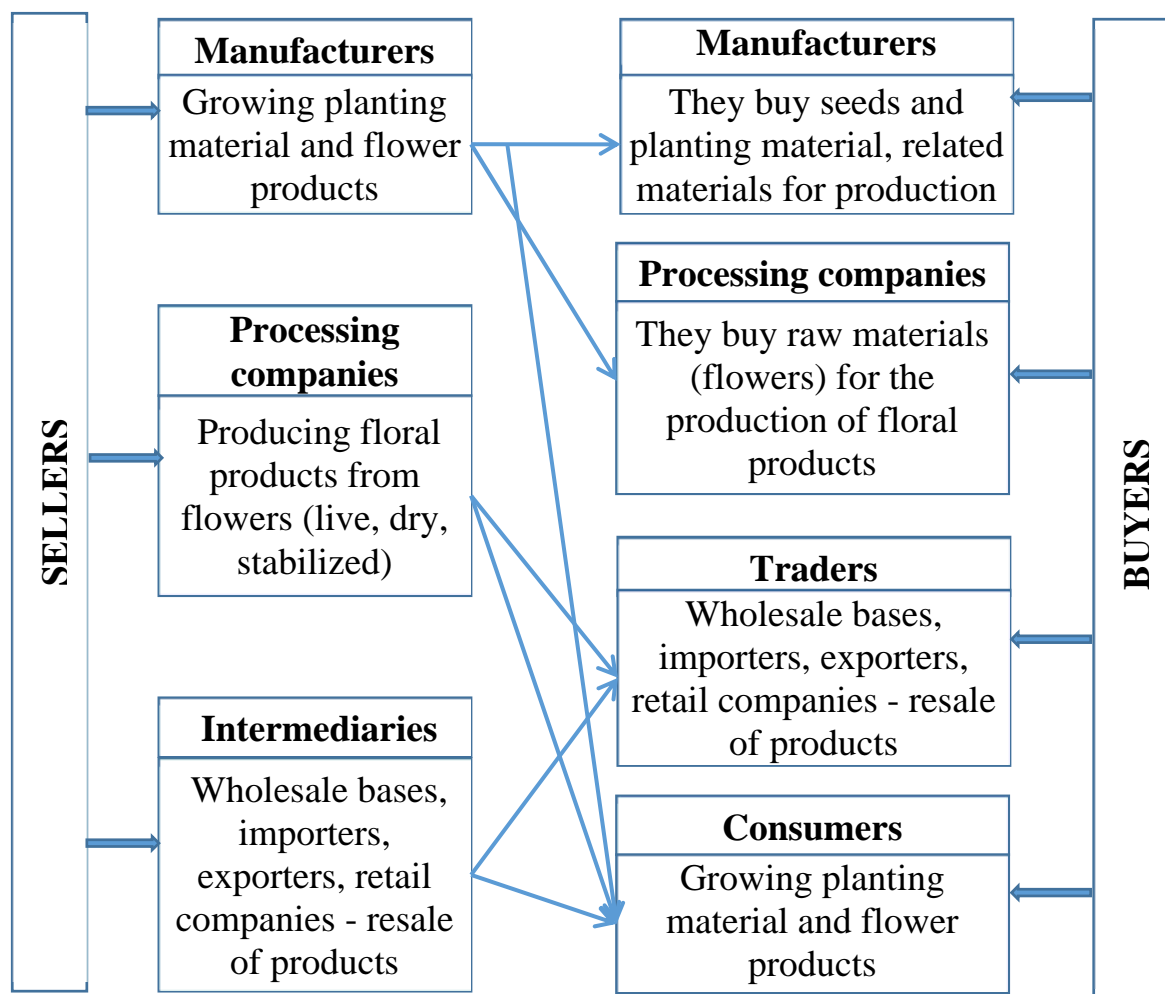


Figure 2 – Relationships of the main participants in the market of floricultural products [based on 2]

Supermarkets usually want large single line deliveries at constant prices and delivery dates. This puts pressure on manufacturers to meet these requirements.

Flower shops work directly with the consumer and receive direct feedback. They are also more responsible for quality than wholesale retailers and supermarkets. Flower shops need a wider range of goods to decorate bouquets. They want to differentiate their products from other retailers, such as supermarkets. This may mean that manufacturers or wholesalers may offer different packaging and labeling. Otherwise, they have to repack the flowers in a new package.

The main goals of wholesalers. The wholesaler reflects the needs and requests of consumers:

- value for money;
- stable product;
- availability over a long period;
- variety of products and colors;
- life expectancy in a vase;
- quality;
- cool chain that is maintained from the manufacturer to the shelf.

Although wholesalers can get some types of flowers all year round, in some seasons the life of vases is bad. Tulips in summer have a bad life in a vase and are not worth the stock. Wholesalers would like to better show the life of vases in different seasons.

The main goals of exporters.

Exporters range from people who only sell their own products to others who deal with many manufacturers and a large number of buyers in many countries. They are in constant contact with buyers in major markets and must respond to market signals. Importers want:

- what was ordered;
- timely delivery;
- commodity in a good condition;
- a product with the correct documentation.

Today, the flower business needs a new infrastructure that would unite all the subjects

of the floriculture market into a single system. One of the most important components of such infrastructure should be a network of wholesale and retail enterprises of floriculture products. In addition, the infrastructure system of the floriculture market should include enterprises and institutions whose activities support economic relationships in the flower business, ensure the process of growing flower and decorative products and continuous trade. Studies have shown that, in addition to marketing, financial and information components, the infrastructure of the floristic market should include agricultural enterprises that provide logistics (seeds and planting material, mechanization and chemicalization, construction materials, fuels and lubricants, etc.) and those enterprises that offer a wide range of additional services (equipment repair and maintenance, agrochemical maintenance, transport maintenance, etc.) on the market.

The current state of the floriculture products market is characterized by the slow formation of market infrastructure, which should ensure effective promotion of products from producer to consumer, reduce losses of floricultural products, improve its quality and flowering time, promote optimal market prices. The following factors must be taken into account when making decisions about the location and development of the subjects of this market:

- location and concentration of producers;
- location and concentration of potential consumers;
- location and concentration of large importers;
- export prospects;
- available and possible transport communications.

The most important problems that need to be addressed in the process of forming a market for floriculture products are:

- commercialization of sales;
- slow filling of goods flows;

- consumer orientation on imported products;
- insufficient use of regulation and monitoring of supply and demand;
- restraint of the export potential of floriculture and ornamental horticulture (due to underdeveloped market infrastructure and state protectionism, non-adaptation of the market to the norms of international systems and the requirements of the World Trade Organization).

Studies have shown that the floriculture industry can suffer huge losses, mainly due to the lack of proper infrastructure for storage and transportation, as well as due to lack of control over supply conditions. Lack of visibility in supply chains leads to quality problems, which leads to product loss, product returns, rising costs, and time delays. In addition, changing consumer demands, an active lifestyle and an open economy are forcing manufacturers and suppliers to produce higher quality goods and constantly look for ways to optimize costs.

To form an effective model of supply chain management for floriculture products, the following steps must be performed [based on 10]:

- explore and plan the range of varieties of flowers that will result in the best profit;
- to ensure their cultivation in accordance with the requirements of consumers or to choose a flower supplier who will be able to provide this;
- plan flowering or purchase at the right time;
- collect at the right stage, avoiding old flowers, as this will only worsen the condition of fresh flowers;
- collect early in the morning, especially in summer, immediately put them in water to keep their temperature and humidity;
- keep them in the shade or in an isolated vehicle;
- quickly deliver them to storage;
- carefully treat / disinfect flowers to ensure insect-free condition;

- cut to uniform length, sort to uniform lines by color, size and shape;
- place flowers in a sleeve / box of the required size; cool quickly to +2 ° C and move to the market in insulated or refrigerated trucks - maintaining a temperature of about +2 ° C;
- immediately move the flowers to the cool room of the wholesaler / exporter / florist;
- deliver flowers to florists / outlets / consumers in isolated or refrigerated trucks or vans;
- ensure that the exporter quickly and directly transfers flowers from its warehouse to the foreign consumer, maintaining a cool temperature.

At each stage we need to make sure that the product is homogeneous. Because, one bad flower can destroy an entire party.

Here are some factors that determine the emphasis on such floriculture supply chain management (SCM):

- the access and availability of information between different actors in the supply chain make it easy to establish connections that allow the use of network delays;
- the level of competition in both domestic and international markets requires organizations to be fast, agile and flexible;
- consumer expectations and requirements become much more stringent.

Thus, we can say that the priority areas of infrastructure development of the floriculture market should be determined in terms of a systematic approach and consist in the interaction of elements of production, intermediary, floristic, design, marketing, financial, information and agricultural components. Therefore, in order to satisfy consumers, SCM must work with two main goals – timeliness and quality.

Quality factors are important for optimizing of floriculture supply chain management. This requires a combination of innovative technologies to implement real-time supply management of floriculture products through the supply chain. They

combine technologies in tracking and tracing, such as RFID, quality monitoring, wireless sensor networks, and the Internet, such as cloud computing and web services.

Virtual objects play a central role in the management of supply chains for floriculture products. Virtual objects are digital images of objects that are stored, processed, and transmitted over the Internet. Thus, virtual objects serve as central hubs of information about objects on the Internet, which integrate data about objects from different sources. In virtual supply chains, objects are transferred between many different partners from the main production to the market.

There are three groups of technologies that provide this approach to managing virtual objects [based on 14]:

1. Identification, reading and communication technologies, which include technologies for automatic identification and data collection.

2. Intermediate software technologies that allow the unimpeded exchange of

information about objects between different participants in the supply chain.

3. Programs that provide specific functionality for different users of the supply chain based on information about the virtual object, available through the intermediate level.

Thus, we can offer the basic information systems architecture needed to provide virtual floriculture supply chain management (Fig. 3).

According to this architecture, the level of reading objects is engaged in collecting information from physical objects. The level of data exchange ensures efficient and secure data transmission of the object. The information layer processes the information received from networks and turns it into useful information. The application service layer provides specific content services based on processed information for different users.

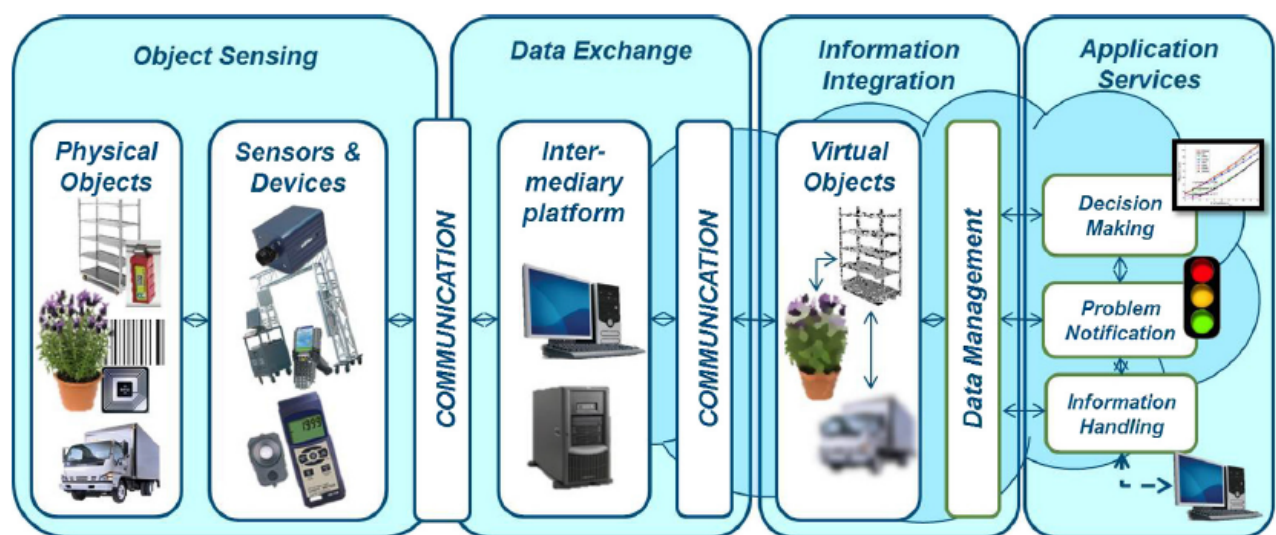


Figure 3 – Architecture of information systems for providing virtual floriculture supply chain management [14]

This is very important because different flowers require different conditions of storage and transportation. It should be noted that in this category of goods there are three subcategories, each of which has its own requirements for temperature [6]:

- bulbs and seeds of plants (temperature of transportation from +4 to +10 °C);
- cut flowers (temperature from +1 to +8 °C);

– planted plants, which include plants in the soil and garden plants (transport temperature from 0 to +2 ° C).

Thus, we can see that plants in the process of transportation require the creation of a special, natural environment for their

existence. Often different subcategories need to be transported separately from each other. It is extremely important that other loads are not transported in the body with flowers to avoid mixing odors.

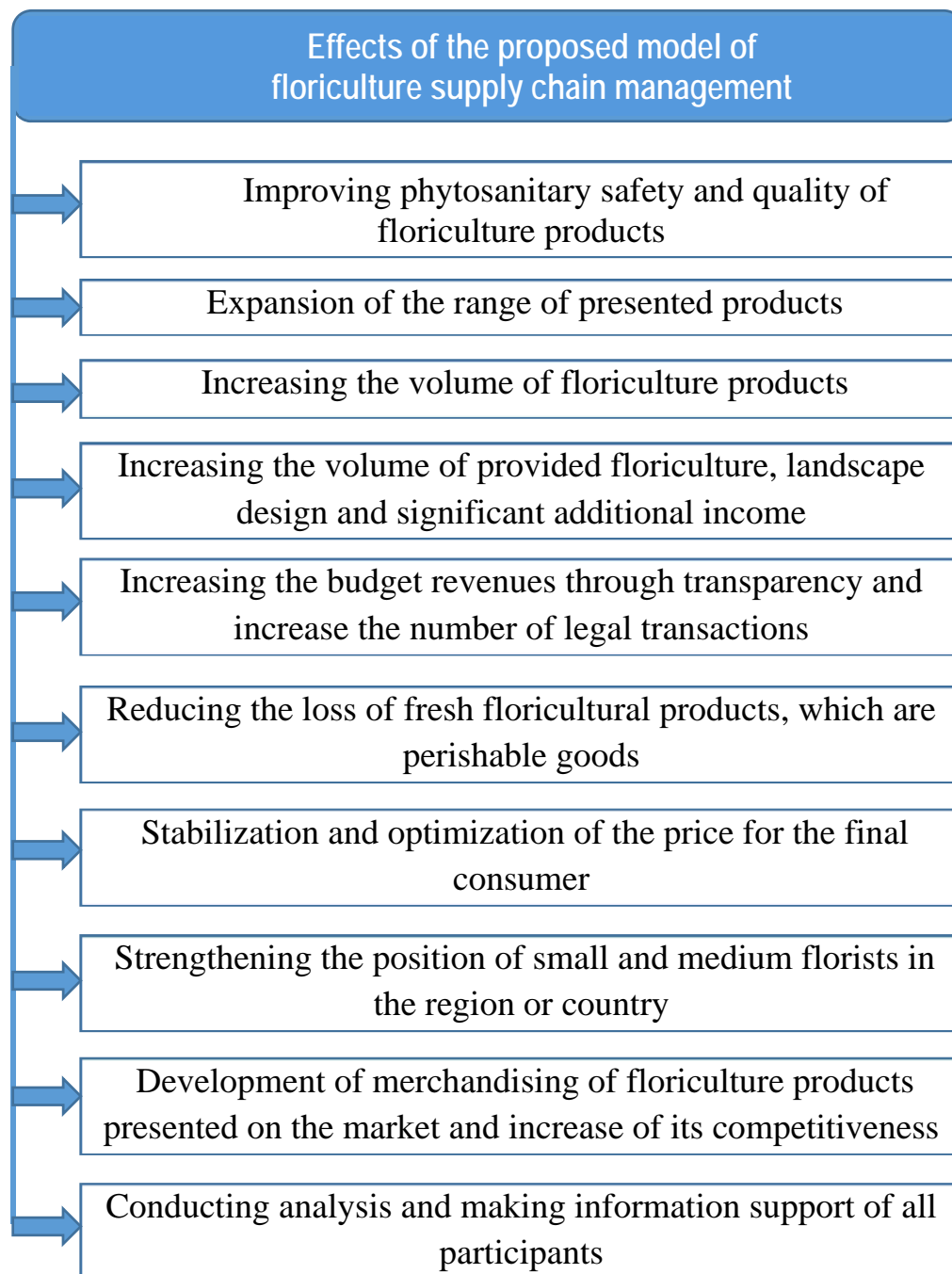


Figure 4 – Effects of the proposed model of floriculture supply chain management

For these purposes, specially equipped compartments with built-in climate

controllers and temperature recorders (a device that records temperature fluctuations throughout the movement) are used [6, 7].

In addition to controlling climatic conditions during transportation, it is necessary to approach responsibly to packing and fastening of plants in a body of motor transport or in the container. If there are no special packaging rules for seeds, the plants must be carefully packaged. Flowers should be packed in special boxes, cases or carts, and a protective film should be used. Boxes or cases must be marked with appropriate signs. It is important to achieve tightness and give each plant enough free space.

Flower pots must be transported in special containers. Planted plants in pots should be tightly installed in specially equipped trays with recesses. Spread plants should be wrapped in paper and fastened with wire. Flower buds, to avoid breakage, should be easily wrapped with thread or fixed with an elastic band.

Flowers should be carefully watered before sending, cut plants should be packed together with sponges soaked in water. Houseplants or plants in the soil are very easily damaged during transportation due to improper mounting or careless delivery. Therefore, the above measures can protect the fragile load from kinks, crumpled leaves, damage or death of the plant [7].

Thus, the availability of a rationally developed infrastructure of flower markets and effective floriculture supply chain management will provide the following opportunities (Fig. 4).

At all stages of flower delivery, quality and freshness are expected, which can only

be obtained by maintaining cool temperatures throughout the supply chain. Each part of the chain must do its job. Emphasis should be placed on the constant content of flowers at a temperature of +2 °C. All links in the supply chain must take responsibility for their product, so that the end customer receives a high quality product.

**Conclusions.** Thus, research has shown that flower market participants continue to search for innovative solutions in supply chain management. As the industry becomes more global and competitive, dedicated supply chains will become more important in controlling the risks associated with affordability, quality, ethical issues and price. In order for such a supply chain to function smoothly, a single strong "facilitator" is needed; because chains with many intermediaries are becoming "obsolete." Such facilitators are already appearing. For example, in 2014, Bouqs introduced its new supply chain model [13]. By applying a direct supply chain to the customer, they can reduce costs and delivery time. This model allows suppliers to cut only the flowers they use and place them in place, saving time and disposing of waste.

Of course, at each stage of the supply chain there is a risk that the flowers will be exposed to higher temperatures, which will lead to their deterioration ahead of time. The right logistics company helps keep both cost and temperature under control, so the flowers will arrive fresh and stay that way for much longer.

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