# REVIEW OF THE SOFTWARE SOLUTIONS OF LOGISTIC TASKS

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*Abstract: Description of software solutions for logistic tasks and their comparative analysis are considered in the article. The selection of the functionality of Logistics Information System, which is designed to automate the planning of the transport delivery of freights, is presented. The logistical tasks considering features of transportation of agricultural freights, which should solve the Logistics Information System, are analyzed.*

*Keywords: logistics information system, automation of delivery routes, temporary infrastructure, GIS – technology, ERP-systems.*

*ACM Classification Keywords: D.2.0 Genera - Software Engineering.*

## 1. Introduction

Formulation of the problem. Logistics is the science and practical methods of management of material, financial and information flows.

Based on the related work in the field [Гончаров, 2012], the conclusion can be made that the methods and tools for solving logistic tasks are becoming more demanded for such distributed system as agro-industrial complex.

The necessity of usage of logistics systems in the agricultural sector is associated with the fact that agricultural industries characterized by a lack of territorial localization of production processes. Enterprises processing agricultural products of industry, usually spatially removed from raw material sources, which necessitates the physical movement of the material flow in both time and space.

The main tasks of logistics are overcoming the distance during the movement of freights, time tracking and organization of effective service supply. At the same time, transportation, storage, maintenance of orders for products are the activities that have great importance for the effectiveness of any enterprise.

Analysis of recent research and publications. Investigations in the area of logistics are designed to solve economic problems and tasks related to the process of movement of goods, funds and information.

In case of the development of information technologies and the usage of logistic software solutions in agricultural firms, there is a problem of integration of logistics information systems because of the specific features of enterprises work, which is caused not only by the geographical distribution, but also by the strong impact of environmental factors on the transport system

Territorial distribution of transport systems makes them an ideal object for automation using the means of geographic information systems (GIS).

GIS is an optimal platform for complex solutions in the area of transport, since the spatial component is the natural basis for the integration of task of transport infrastructure management, solutions of computing tasks, tasks of operational management, navigation, etc [Разгуляев, 2010]. However, these solutions have specific nature because of ignoring the influence of external factors. Real complex solutions in this area have not offered in Ukraine yet.

Such situation is typical not only for Ukraine. Analysis of the works of domestic and foreign authors shows that there is no holistic logistics concept of the organization of transport operations in the agricultural enterprises by now [Костышева, 2013].

Naturally, current absence leads to a lack of tools for automation of logistics process management.

The purpose of current work is a comparative analysis of existing software products for the solution of logistical problems applied to agricultural enterprises.

## 2. The main tasks of Logistics Information System

The agricultural enterprise is complicated distributed object, which consists of many other different control objects [Бальченко, 2013]. Their functioning depends on impact of different factors (weather conditions, social environment, quality of resources used, quality of work performance, etc.) [Lytvynov, 2014].

The object of automation are the processes of planning optimal routes of delivery of commercial products to processing end-points, intermediate temporary storage points, warehouse managing, and controlling efficiency of these processes implementation, minimizing the products, financial and material losses during the implementation of logistics processes in agricultural enterprise, minimizing of possible risks.

At the stage of tasks setting it is necessary to consider the features of agricultural freights transportations: seasonality in the harvest that leads to fluctuations in freight turnover and traffic volume; short terms of harvesting, which require hard work of auto transport; unevenness of crops maturation in different climatic and soil regions of the country; fluctuation crop capacity during drought and other adverse weather conditions; heavy traffic work conditions of rolling stock, particularly in spring and autumn; low volume weight of agricultural goods, which does not allow full use of the load capacity of rolling stock.

Logistics Information System (LIS) is intended for complex informational, analytical, expert, predictive, optimizational ensuring of logistic processes of agricultural enterprise for the following tasks:

1. Planning and automation of route:

- planning of optimal delivery routes - automated control system (A&C) of the transport should automatically calculate routes and suggest the best option or typical delivery route that takes into account the type of vehicle, the degree of loading transport, time windows, randomness in time (time of day, weekend/weekday, season), and other criteria which can be adjusted according to the specific requirements of the company;
- development of operational planning schedules of traffic with a binding to work schedule of processing capacities of enterprise, state of transport units, meteorological forecasts;
- planning using different types of transport (tractor side vehicle, truck) - transportation planning, which takes into account the type of freight and its transportation features, will protect the company from force majeure and empty runs of vehicles - it will reduce transport costs;
- accounting of real road network (forbidden turns, one-way traffic, temporary roads), and paving roads that are not present on the map;
- accounting of different conditions during route planning: distances between points, cost of using cars, characteristics of freights and transport, time of loading/unloading and execution of documents, weather conditions and other;
- accounting of restrictions of delivery and features of freights: correcting of terms and conditions of delivery perishable freights, determination of losses during transport.

2. Planning and management of maintenance and repair of rolling stock.

3. Forecasting, distribution and planning of material resources:

- inventory management in storages of auto transport park and organization of storing materials at storages;
- accounting of deadlines storage of resources;
- planning of the usage of additional resources.

4. Planning in stationary conditions and in conditions of infrastructure changes. Infrastructure changes imply a dynamic change in the state of transport, fields, roads, and the use of temporary infrastructure (temporary storage).

- Developing of programs for economy of material resources, transport usage and control over their implementation: monitoring the usage of vehicles, fuel, kilometrage, transportation costs, travel time, number of involved vehicles, waiting time.

These tasks must be solved in real time and in a binding to current state of transport system.

These solutions require hardware-software tools for automatic collection of primary information and also software package.

### 3. Software solutions of logistic tasks

The analysis of the software products presented at IT-market has been conducted.

All logistics software can be separated into two categories:

- logistics software based on GIS – technology;
- logistics software based on accounting-optimization tasks.

GIS systems are more appropriate for solving transport logistic tasks. There is classification of their possibilities:

1. electronic map with the means of routing and road navigation, which also includes a universal reference system;
2. software products for monitoring the location and status of mobile objects ( transport, freights, sales representatives ), which are intended for solving such tasks as tracking the location and status of transport and freight; monitoring of implementation of schedule and route (deviation from plan);
3. software products for automatic planning of complex delivery with automatic controlling of parameters and the possibility of manual correction of calculated runs;
4. software products for complex automation of business processes of transport enterprise management.

Currently, the most demanded software products in IT-market are electronic maps with automatic making of routes. But companies that solve tasks of transport logistics, prefer software products of classes 2, 3 and 4 of the above classification [Бочкарев, 2013].

Usually, these modules are embedded into such products as MAPINFO, ARC/INFO, Optimum GIS, etc [Сергеев, 2008].


**OPTIMUM GIS**

Geoinformation system OPTIMUM GIS (developed by Group CDC, Russia) consists of several modules, which are designed for automation of  transport logistics (planning of delivery routes of freights), satellite GPS/GLONASS monitoring of transport, forming of routes and GPS/GLONASS monitoring  of field staff, all mobile workers (sales representatives, merchandisers, operational maintenance teams, service engineers, bank agents, etc.) [CDC official website, 2014].

OPTIMUM GIS modules for automation of transport logistics:

- Planning of routes of freights delivery (module «Delivery»).
- GPS/GLONASS monitoring of transport (module «Monitoring»).
- Automation of the forwarder (module «Forwarder»).

Related solutions:

- OPTOKEYS. Mobile solution for printing and storage of documents.
- GPS/GLONASS terminals and trackers.

Modules «Monitoring» and «Delivery», which are included in the system Optimum, are designed for automation of transport logistics processes and tracking of transport movement. Monitoring of implementation of current route is based on a predetermined move schedule on the key points of the route (control point, point of parking, refueling point, etc.). Current location and route are determined by coordinates of transport GPS-tracker, which should be transferred to server part of the system OPTIMUM by using GPRS/SMS through a network of mobile operators.

Optimum GIS module «Monitoring» allows reducing the costs from unjustified downtime of vehicles and route deviations, and provides the to-date information about the location and movement of vehicles on electronic map. The program allows controlling indexes of any sensors, which are installed in vehicle (fuel consumption, opening doors, glass broking, etc.).

Optimum GIS module «Delivery» automatically calculates the optimum loading of auto park, based on existing orders, the route duration, which accounts spent time for discharge and total kilometrage, and returning to storage to fill up. The program allows optimizing of route planning based on the density distribution of points, keeps accounting of «delivery windows», volume of the bulk body, type and class of transport, load capacity and prioritization of points. Module «Delivery» prints set of necessary documents: routing waybill, loading invoice, report forwarder, a paper copy of waybill, bill of lading, invoice, delivery note and other.

The license cost is $ 1,700.

Disadvantages: the program does not have its own protection.

Conclusion: the product is used in agroholdings to improve mobile commerce – it allows to create optimal routes of visiting the sale points, to define certain working scenarios, to monitor their implementation, to control location of mobile workers using gps-monitoring, to reduce the cost of fuel due to the notes of accurate kilometrage in itinerary list, optimizing the routes and control fuel consumption. It can solve only the part of assigned tasks.

**Chronomap**

Chronomap (developed by the company Mapping Information Systems Corporation, USA) - is a software module that is designed for simulation of transport networks, solution of various tasks of transport and geomarketing. It allows to perform calculations, simulate and visualize solutions, using the most complete and accurate database of digital road maps, increasing the efficiency of the company [MapInfo official website, 2014]. ChronoMap is used by trading networks, banks, service organizations,

government agencies, and consulting firms around the world, which need to solve logistical tasks. Modeling of transport network: the program works with any data of the road network in vector format MapInfo Professional. Feature of Chronomap is the ability to define rules for the construction of transport networks that allows bringing the mathematical model (graph) to the actual road conditions as close, as it is possible. The result will be more correct if the more rules will be defined for the transport network. They are including:

- Identify the characteristics of high-speed network segment – road class which has assigned speed characteristics.
- Setting different speed characteristics for the segment in different directions (for two-way streets).
- Setting areas with one-way traffic.
- Reducing the speed characteristics of the network at peak times or in bad weather.
- Prohibition of passage.
- Temporary closing of segment without rebuilding of network graph (for example, repair).
- Prohibition of turns.
- Prohibition on passage of certain kinds of transport (dimensions, tonnage, type, etc.).
- Library of different vehicles.

Also, there is a possibility of selection of the vehicle (car, bike, truck, tractor, etc.) to navigate the route, which is very important. The parameters of each vehicle may be modified: speed, reduction of speed in the rush hour, etc. It is also possible to change the physical characteristics of the vehicles (weight, dimensions, etc.). It allows creating and comparing of different scenarios of availability of certain point with estimating efficiency of each option.

ChronoMap has a function of finding the shortest way, calculation of routes from the starting point via intermediate points to a point of arrival. Optimizing functions allow to define the best route in terms of time, distance or transportation costs, and to optimize the sequence of «stops» (Traveling Salesman Problem).

The license cost is $ 9500.

Advantages: relative simplicity in mastering of the product; simple and clear licensing policy - buy one package and that is enough; the presence of all major functions; easy to learn and convenience of vector cartographic editor; the familiar MS Office-like interface; very high degree of stability in the work.

Disadvantages: weak mathematical support of processing spatial (vector, raster) and attribute data. However, problem is partially solved with help of various extensions, such as Vertical Mapper; interface of georeferencing raster maps is not very user friendly; typification of spatial data is not too strict; selection of built-in standard rules of validation topology is not too large.

Conclusion: it is particularly suitable for solving the problems of transport logistics for our LIS, but considering the drawbacks, it is better to choose another GIS system, for example, ArcGIS.

ArcGIS

ArcGIS (developed by Environmental Systems Research Institute (ESRI), California, USA) is a GIS-system that is the basis for the software products that are designed for complex vehicle fleet management of company or group of companies [ArcGIS official website, 2014]:

- receives data from A&C of enterprise;
- calculates optimal routes for transport via one of two main criteria: a minimum cost or a minimum of time;
- provides the results on any background map substrate (raster maps, vector maps, satellite images, aerial photos, WEB-services); in the form of itinerary sheets with a detailed description of route and stopping points, calculation of run and fuel consumption; in the form of tracks for use in mobile navigators;
- receives and processes data of GPS-sensors on vehicles in real-time;
- controls the route and traffic schedule, estimated time of arrival at destination, location in certain areas; to promptly notify the system operator and other interested persons about the situation using client application by email, SMS, etc.

Transport logistics: any complexity and detail of the road network model for calculations - from schematic to maximum details with according the type of road surface, traffic rules, restrictions on the dimensions of the vehicle, traffic intensity, etc. Monitoring in real-time mode: speed, idling/stop, territories, dangerous areas, arrival/departure, arrival time, observance of route. It is possible using additional modules Route Planner, ArcGIS Spatial Analyst, ArcGIS 3D Analyst, ArcGIS Geostatistical Analyst, ArcGIS Network Analyst and other.

The license cost is from $2100, but it is necessary to buy modules additionally.

Advantages: product has strict data topology; integrity control and data topology using geodatabase; developed apparatus of work with datums, coordinate systems and geographical projections; a well-developed mathematical apparatus of processing of spatial and attribute data.

Disadvantages appear with the introduction of monitoring projects, where update speed is critical:

- licensing policy is confusing and not always clear from the first time. At first, it is unknown what right tool is absent in the purchased license to solve task. Only trained specialist will be able to understand the types of licenses and functionality. The product is not very democratic;
- editor is a little overloaded for mastering – it is not necessary to operator to have a university education;

- bad testing of first assemblies versions (unfortunately, error of program happens in the first releases);

- technical support: there is a huge amount of documentation, a lot of articles. But almost all documentation in English, which is critical for the local user.

Conclusion: product partially covers the tasks of transport logistics in agriculture. But the rest of the field was not affected - the warehouse and distribution logistics, inventory, procurement. But it doesn't work with storage and distribution logistics, inventory, procurement. The modifying and integrating with other systems must be performed.

Also there are independent software products that implement separate logistic functions - **modules of large ERP-systems.**

Minus: they require the acquisition and implementation of expensive «basic» system (often - primitive logic, using a few simple methods).

Plus: working in one information field - problems of compatibility of data are minimized.


**Microsoft Dynamics AX (Axapta)**

Axapta is one of the solutions for enterprise management, which delivers Microsoft Dynamics Division of Microsoft Corporation. Multi-functional ERP is a system of enterprise resource management for medium and large companies. It covers all areas of management: production and distribution, chains of supply and projects, finance and tools of business analysis, relationships with customer and staff [Microsoft Dynamics official website, 2014]. It includes the module «Trade and Logistics» Microsoft Dynamics AX 4.0, which supports the following areas of work departments:

- everyday monitoring: operations for the purchase, sale, other storage operations, work with the specifications;

- setting of storage and nomenclature units;

- organization of the storage infrastructure: managing the placement and packaging of freights for individual storage cells, monitoring of material handling equipment, accounting of tare;

- analysis of inventory flows: obtaining of information about storage movements and stock levels, the use of special reports on logistics, such as ABC-classification, etc .;

- planning of inventory movement: making plans and working with them, calculation of needs the product and using of its results, and forecasting of inventory levels.

Cost of the license of a single workplace is $2200 – 3500.

Advantages:

- the number of concurrent users is from 20 to 5000;

- support of more than 40 languages;

- automates specific and complex business processes (distributed enterprise, holdings, distribution and manufacturing companies, service providers, and so on).

Disadvantages: lack of the transport logistics and cartography; require training to work with the system.

Conclusion: Axapta is actively used in agrobusiness as a software package, which includes a logistics module. However, as regards our LIS, it only partially solves the problem of storage accounting tasks. Due to interfaces it is suitable for management and accounting of the cost of storage of agricultural products, the planning processes of distribution and sales by region.


**Oracle Transportation Management**

Oracle Transportation Management (developed by the Oracle Corporation, USA) provides a full-featured tool for planning and execution of transportation considering the production capabilities of shippers and third transport companies. This integrated solution allows to combine and to simplify the process of transportation planning, execution, payments to suppliers and customers and to automate business processes within a single application, considering all types of transportation [Oracle official website, 2014].

Oracle Transportation Management (TMS) can be used together with ERP or legacy system Order Management, and any best in its class solution or legacy system Warehouse Management System (WMS). Oracle Transportation Management system is not actually part of the Oracle E-Business Suite, although for some time Oracle has positioned it in such way due to replacing old logistics module by it in OeBS. TMS is also integrated with Oracle Order Management and Oracle Warehouse Management.

It allows solving the following management traffic tasks:

- management of orders for transportation;
- fleet management;
- transportation planning;
- reservation of transportation in carriers, tenders;
- tracking of delivery events;
- automation of solutions about exceptions;
- container optimization;
- minimize the transportation cost.

New versions, starting from Oracle Transportation Management 6.3, include advanced capabilities of fleet management, procurement of transportation services; business analysis in the area of freight transportation; transport planning; management of rail transportation; automation of processes and event management; management and control of freight payment, billing for services and resolution of claims; management of transport and customs documents.

Using two specialized mobile applications TMS also supports key business processes, such as interaction with service providers of organization of transportations, tracking execution of orders/transportations, event management, data access, business analysis of freight transportations on mobile devices.

Cost of the license is $80,000.

Cost of the software is $16,000.

Advantages: improving the quality of transportations: the transparency of terms, reducing the risk of loss of the freight; system transparency for top-management.

Disadvantages: cost – it is impossible to purchase module separately, but only with the package OeBS; insufficient protection: vulnerability of the system allows a remote user to manipulate certain information, to reveal confidential data and to cause denial of service.

Conclusion: product allows managing of transport and transportation planning in agricultural enterprises, in addition to other modules OeBS connects management of storage operations. But it does not take into account the peculiarities of the transport of agricultural freights (harvest season, short harvesting terms and others, which are specified in the previous section).


«1C – Rarus», «Transport logistics and forwarding»

«1C – Rarus», «Transport logistics and forwarding» is a solution for automation of the process of transportation for companies that provide services for the delivery and freight forwarding by various modes of transport: road, rail, air, sea [1C-Rarus official website, 2014]. Works on a platform of «1C – Enterprise». Services are provided for companies with their own transport and for companies that do not have their own vehicles.

Main functional features:

1. Order Management of clients:

- accounting of clients;
- selection of the necessary vehicles and carriers;
- creating the orders for carriers;
- the ability to create templates of standard operations and automatic calculation of the cost of services tariff;
- registration of orders for freight transportation, tracking of future status of freight and its history of changes;
- distribution of freights in containers and container traffic accounting;
- accounting of nomenclature of transported freights;
- accounting of additional characteristics of freights;

- accounting of transactions for freights and orders to the carrier;
- registration of runs of carriers, distribution of freights and containers at runs;
- planning of moving of freights along the route and operational data input about the location of the freights;
- location and shipment of freights from the storages;
- registration of the transfer of freights to the consignee.

2. Fleet management:

- accounting of own and attracted vehicles;
- direction of vehicles in runs;
- control of disposition.

3. Management of mutual settlements:

- accounting of price-lists and tariffs;
- calculation of the cost of transportation;
- creating bills and acts for transport service.

Technical support is carried out in Ukraine.

Cost of the license is $500.

Disadvantages: product does not include a license for the platform «1C: Enterprise 8» - it must be purchased separately; also there is no mapping module, which makes impossible to automate routes.

Conclusion: it covers such areas of logistics, as storage, partly transport and distribution, taking into account the platform «1C: Enterprise 8». It is applied in agribusiness. However, the system does not allow the features of transportation of agricultural freights for solving our tasks.


### «Top Logistic»

«Top logistic» is a product of the «TopPlan», developed in Russia.  System is designed for automation of planning process of freights delivery by autotransport. The company specializes in the development of electronic maps, databases, and solution of transport tasks [TopPlan official website, 2014].

The main purpose of this product is creation of the most efficient delivery route, considering parameters such as: time interval of delivery, points of delivery address, etc. The program is designed for small, medium and large enterprises. An important advantage of the program is GPS/GLONASS module, which allows controlling traffic in real time and movement the recording of way to archive. This system allows to perform one of the most important task of organization: a comparison of actually performed works with the plan works. The software also has a mapping module and detailed maps of regions and cities (Ukraine, Russia and CIS countries).

The system provides:

- simple and fast integration with the accounting system of the enterprise;
- automation of works connected with distribution of orders between vehicles;
- automatic calculation of routes of orders delivery;
- visualization of addresses and delivery routes on the electronic map;
- creation of optimal order of detour delivery points with the ability to change it.

The system generates:

- database of warehouses for orders shipment;
- database of vehicles with the characteristics of each vehicle;
- database of consignees with addresses that attached to the map;
- database of customer orders with the characteristics of the orders.

The system calculates:

- planned gasoline consumption, kilometrage and working time of each vehicle;
- fuel costs for each run;
- the fuel component of the unit costs of delivery of freight;
- loading factors of vehicles and runs;
- needs for vehicles for delivery of freight.

Cost of license: negotiated price is from $ 1,000 for basic set of functions.

Disadvantages: absence of the module of storage logistics.

Conclusion: It only partially solves the tasks of transport logistics. Logistics industry requires the integration with other software packages.


**«INGIT. Business Map»**

«INGIT. Business Map», is a product of «INGIT», Russia, which is designed for optimization of freight transport flows, adding the clients on the map and data processing, for solution of analytical and commercial tasks [INGIT official website, 2014].

Business Map can be integrated with any databases (including «1C - Enterprise» for storage operations).

Functional capabilities:

- Creation and supply of client database that is automatically applied to map by the addresses, automatically sorted by the administrative-territorial division and service areas. Databases ACCESS, EXCEL, FOXPRO, PARADOX, LOTUS, DBASE can be used as data sources, which processes Business Map.

- Usage of detailed map allows performing not only logical selections of the client database, but also any space selection (in service areas, near points, etc).

- By client location at the map it is possible to do selection for detour routes for controlling the length, number of clients, and the total load.

- The system of automatic routing of vehicles provides real-route for vehicle for customer service, considering traffic organization, which are selected from the database using any queries or selected on the map, considering the weight and quantitative restrictions.

- Automation of calculations for the freights delivery provides instant calculation of routes for whole vehicle fleet to perform the whole volume of daily orders. Load capacity and transport capacity, requirements of urgency of orders and execution time, optimization of movement including road signs, restrictions on time or length of the routes, for example, to deliver hot bread in points of sale etc. are accounted in the calculations. The system of the results presentation allows to give each driver a printout of his day job, i.e. when, where and what to load, sequence of deliver, and so on. It provides a dynamic view of transport operations for delivery of orders, i.e. at any time it can be seen on the map where the vehicles are located and what they do, it means unloaded, loaded, or follow into the next point.

- Documentation system provides a printout of all forms of documents (lists, bills of lading, waybills, etc.) for customers, selected from the database for any queries or detour routes.

- Multifunctional Information center: it performs quick search of streets, homes, companies, organizations and firms with map display. The open database allows inserting and updating of information by types of activities with simultaneous reference to the map. Information can be supplemented with references to any files (documents, images, etc.), which will be used by appropriate programs.

Cost of license: $600 per a basic set including a server part and a permanent client access license. Additionally it is necessary to buy access key to the cloud GIS server each month.

Disadvantages: inconvenient interface; problems with self-installing of the program and with the transfer to another computer; nonoptimal work of the map.

Conclusion: although it is used in agriculture, it is inappropriate to use this system for solving of the required tasks.  It covers them partly – only in the part of the transport and distribution logistics.

## 4. Comparative characteristic of software products, depending on the tasks that must be solved by LIS

After more detailed description of software for logistics was performed, it is necessary to know the functional suitability of each program and to do comparative analysis (Table 1).

Table 1. Summary table of comparative analysis of functional suitability of software packages

| Program product<br><br>Tasks | Optimum GIS | Chronoma p | ArcGIS | Axapta | OTM | 1C – Rarus | Top Logistic | INGIT. Business |
|---|---|---|---|---|---|---|---|---|
| planning of optimal delivery routes | yes | partly | yes | no | yes | no | yes | yes |
| creating of operational planning schedules of transport movement | partly | partly | partly | no | partly | no | partly | partly |
| dynamic of planning of transport usage | partly | partly | partly | no | partly | no | partly | partly |
| accounting of set of conditions in planning of routes | partly | partly | partly | no | partly | no | partly | partly |
| forecasting, distribution and planning of material resources | no | no | no | yes | yes | partly | no | partly |
| accounting of restrictions of delivery and features of freights | partly | no | partly | no | partly | no | no | partly |
| planning and management of maintenance and repair of rolling stock | no | no | no | yes | yes | no | yes | no |
| planning in stationary conditions and in conditions with infrastructure changes | partly | partly | partly | partly | partly | no | partly | partly |
| inventory management in storages of vehicles and organization of storing materials at storages | no | no | no | yes | yes | yes | partly | partly |
| accounting of deadlines storage of resources | no | no | no | partly | partly | no | no | no |
| planning the usage of additional resources | partly | no | no | no | yes | yes | partly | partly |
| developing of programs for economy of material resources, usage of transport and control over their implementation | partly | partly | no | partly | yes | yes | partly | partly |

## 5. Conclusions

All software solutions provide wide coverage of management functions, including logistics and inventory management. But neither product provides complex solution of our tasks for agricultural. This is associated with the fact that these software systems are more oriented to large corporate structure, and not every medium-sized company can afford to purchase them. The other reason is the situation with the intricacies of their introduction, the payback period, the availability of experts for teaching about system usage features, features of the enterprise. Domain is not completely investigated and requires new algorithms for solving such tasks as:

- route planning considering randomness in time, the type of vehicle;
- route planning considering real road network, weather conditions, etc., and pave roads that are not present on the map;
- route planning considering delivery restrictions and features of agricultural freights;
- planning in stationary conditions and in the conditions of dynamically changing states of transport fields, roads, etc.;
- cost reduction by decreasing fuel consumption, kilometrage, transportation costs, travel time, the number of involved vehicles, the waiting time.

For solving such types of tasks it is necessary to develop new information technologies and program solutions.

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