

Digital Transformations in Automotive Dealer Chain – Chances and Challenges

Andrei A. Mirolyubov
*Graduate School of Management &
 Business, IIME&T
 Peter the Great Saint Petersburg
 Polytechnic University
 St. Petersburg, Russia*

Maria I. Turina
*Graduate School of Management &
 Business, IIME&T
 Peter the Great Saint Petersburg
 Polytechnic University
 St. Petersburg, Russia*

Andrei A. Tsekhanovich
*Graduate School of Management &
 Business, IIME&T
 Peter the Great Saint Petersburg
 Polytechnic University
 St. Petersburg, Russia*

Abstract—In this paper the question of the processes of improving communications in the internal and external environment of dealer enterprises of the automotive industry is raised. It is important for building the more accurate consumer demand prediction for the next period. The opportunities and risks associated with the introduction of digital technologies have been also discussed here. Today there is an acute problem of receiving and consideration of the customers feedback. The objects of the study are organizations that are linked in the supply chain from producer to consumer and the interaction between them in the construction of communication channels. The aim of the work is to identify ways to improve information flows between the manufacturer, importer and dealer and forecasting the development of sales in the automotive industry.

The study identified the main ways of technological changes based on the concept of "industry 4.0". These were the processing of big data using cloud storage, mobile technology and blockchain. Based on the analysis of automation of information flows between the plant, the importer and the dealer, the most important aspects of the successful construction of the supply chain were identified. Positive and negative sides in the organization of interaction with end users and suppliers were described.

The result of the work is a forecast of IT development in the field of distribution of the automotive industry. To substantiate the effectiveness of the proposed technological changes, the experience of large foreign companies was analyzed, the method of comparing the facts made a forecast for the near future in strategic development, provided the improvement of statistical data to build forecasts and automate the processing of information from the participants of the logistics chain, the methods of assessing the activities.

The developed recommendations for improving the work of the dealership are practical and can be applied by various companies in the automotive market.

Keywords—digitalization, supply chain, international market, automotive industry, cloud technologies, blockchain, mobile technologies, dealership, forecasting

I. INTRODUCTION

Modern companies operate in the dynamic market of information technologies which meet the needs of procurement, production, distribution and sales processes, as well as ensure effective communication between all these components [1]. Market participants offer new IT solutions

that take into account the specifics of business, industry and competition conditions in regional markets. Therefore, the use of a traditional toolset for the enterprise information architecture development seems insufficient. The companies' management no longer asks a question "Is it necessary to introduce innovative IT technologies?", but rather tends to determine the most effective forms and methods to implement them. The automotive industry, like other production economy areas, affects the development strategy for innovative IT technologies. Manufacturers of world's leading companies possess high-tech robotic assembling systems, which allows them to significantly reduce the costs of all types of resources for manufacturing products. However, the global automotive industry is faced nowadays with the challenge of better and more timely meeting customer needs by establishing flexible communications between all parties of the supply chain. An important stage in this activity is to improve the internal and external information flows coordination in the dealer centers, since they represent the companies' products in local markets and directly contact with clients. To attain this goal, employees and administration of car dealer centers shall correctly formulate and implement a customization strategy, and rationally allocate the available resources and technologies, ensuring the marketing programs implementation to best satisfy the customer needs.

The purpose of this work is to study the digital transformation technologies application in the dealer networks of the automotive industry, and to clarify challenges and opportunities of this process.

According to the results of the Global Automotive Executive Survey 2019 by KPMG [2], the advanced development trends in the current year are networking and digitalization. These trends in the automotive industry development outcompeted the development of battery-driven vehicles, fuel cell vehicles and hybrid electric vehicles. Besides that, according to the respondents' opinion, the digitalization trend would retain its leading position until 2030.

II. MATERIALS AND METHODS

Digitization is gradually becoming an integral part of the modern human life, but still there are many prospective areas for the deployment of new technologies. When studying the state of automation and digitalization of the automotive industry in Russia and abroad, it was revealed that investments

in modernization of the car production process in recent years were quite significant, which resulted in an increase in both the speed of the production process and the quality of final products. On the other hand, according to the survey of managers of official dealer centers in Russia, there are significant problems with the sale of cars related to the organization of distribution, imperfect logistics and customer dissatisfaction. Therefore, the problem of functioning of the automotive industry supply chain is clarified, requiring the application of innovative technologies.

To determine the ways to tackle the problem, first of all it seems necessary to draw up the complete picture of the current state of digitalization in the car dealer market. From the analysis of statistical data, research results from analytical agencies and ABC analysis charts, it was necessary to establish for which region the changes would be most relevant. In parallel with this, the place of the dealership is determined as a link of the automotive industry value chain.

To assess the digital potential of dealer centers, the following problems were set:

- Research of innovative IT technologies according to the Industry 4.0 concept;
- Study of the experience of the technology application in the dealer networks of foreign countries;
- Study of the experience of the technology application in Russian dealer networks
- Identifying the potential for innovative IT technologies to improve the efficiency of car sales;
- Assessment of prospects for the automotive dealer supply chain to be expected from the introduction of innovative IT technologies.

III. RESULTS

A. Analysis of the Current State of Global Automotive Industry

The automotive industry is a mechanical engineering industry engaged in the production of passenger cars and trucks (including special purpose vehicles), buses, trailers, as well as their parts, components and assemblies, and arranges their marketing [3].

According to Cardigram [4], the modern sales structure of the leaders of global automotive industry is as follows. Despite the fact that VW Group ranks first in the rating, the rest of European car concerns tends to decrease their sales volumes. The majority of TOP-10 entities are represented by car manufacturers from Asia with a positive dynamics in sales volume for 2018. American companies are also in the top ten positions but their sales have a negative growth rate. Therefore, it may be reasonably assumed that in the nearest future the car manufacturers from Asian countries would outskirt the European and American companies providing lower product and service prices. This means that in order to maintain and improve their market positions, car manufacturers from Europe and America would need to find their own tools to stimulate demand. One of solutions of this problem may be to improve the quality of interaction between members of the supply chain to ensure the prompt execution of customer orders (fig. 1).



Fig.1. Sales chart of world car market for 2018.

Automotive industry is an oligopoly, traditionally presupposing low price competition. However, recently this situation has changed: discounts, prime financing policies and long-term guarantees help to attract new customers; at the same time these factors produce a negative impact on the long-term sales profits. In addition, the competition is increasing due to the wide spread of car sharing services. When choosing the latter option, operating costs are transferred to the leaseholder company, which is incredibly advantageous for the client.

The automotive industry in the XXI century requires a sustainable innovation development to increase its stability towards economic recessions. The digital revolution has a significant impact on the supply chain actors. Due to Internet technologies, a potential client has a customized access to the product information without the need for the personal visit to a car dealer center.

According to P&G, there are three stages in creating and meeting customer demand in the market. First of all you need to identify the unsatisfied needs of a customer and elaborate the concept to meet them in the best way possible. At the second stage, it is necessary to inform the customer of the availability of your market solution, to convey information about your product or service to a potential client. And finally, the direct demand response in the right place and time. At the same time, for a successful sale it is necessary to provide a product range, able to meet the consumer demand ASAP.

Cars are sold to end users either directly through the car producer subsidiaries, or through the partner retail networks. The car body is a unified design structure unit, and the main task of production is the modification of the assembly process, since there is a limited number of units or systems to be used for the model range without significant alterations. To retain the competitive position, car companies need to run a highly customized production. This means that the company is faced with the challenge of best satisfying the client's needs (as precisely and as quickly as possible). When visiting a car dealer, the client can specify the required options of the desired vehicle, such as the car color, the type of upholstery, and additional features, such as air conditioning or the navigation system. When the request from the customer is received, the seller company can immediately offer a choice of several suitable vehicles from those that are available. However, often the sales manager has to order a car that does not meet all parameters of the order. According to statistics, a time interval from 6 to 8 weeks seems optimal for the execution of the order in accordance with the wishes of the end user. However, as the price of a product rises, so does the

customer demand. Moreover, the emergence of such options for potential customers as car sharing and affordable taxi complicate the process of selling a new car. That is why the dealer centers are forced to optimize the storehouse management, demand forecasting and order management to attract the buyers by meeting their requests as soon as possible.

The production system for car assembling usually consists of four stages: pressing metal or aluminum sheets, welding a body from molded sheets in a body shop, painting and final assembly, where the painted body, engine, transmission and other components are combined. At the last stage, one or several production lines are used, consisting of a fairly large number of sequential assembly stations, between which cars are transported with a fixed belt speed. The processing time at the assembly station depends on the assembly option of the chosen car. Therefore, the overall use of the station is determined by the sequence in which cars / orders are collected on the line (the so-called “model mix”). The more accurate the incoming orders are, the easier it would be to arrange a system for the “just-in-time” components delivery, so as to get rid of the excess stock and quickly deliver the order to the final consumer.

The supply chain management in the automotive industry solves the problem of increasing the share of personal orders of the final consumer and reducing the number of retailers' orders based on the forecast. Nevertheless, the number of cars made to order is varying from month to month, while remaining generally low. Accordingly, the bulk of orders comes from the disposition departments of dealerships, formed on the basis of forecasting. Therefore, the most important task for improving the global supply chain in the automotive industry is to improve the accuracy of forecasting the number of orders and modifications of cars when placing orders by the dealerships.

A dealer center in the automotive industry is an intermediary between a car manufacturer and end customers (either legal entities or private customers). Its main functions are the purchase of new cars for resale to end users and providing service maintenance. When running logistics operations, an auto dealer interacts with the following counterparties:

- car manufacturers;
- importers;
- spare parts suppliers;
- transport companies for the delivery and transportation of vehicles;
- individuals and legal entities acting as consumers.

The communication with the car manufacturers is carried out through the brand representatives in the national market. Importing companies transfer the placed orders to production facilities, control their execution and delivery to the territory of their countries, ensure customs clearance. As follows from Fig. 2, the “distribution and sales” link directly interacts with the initial stage of the supply chain associated with the design of car, affecting production, and with the quality of after-sales service, impacting the client loyalty. Thus, it is possible to outline another important function of the auto dealer: the

transfer of feedback from a particular buyer to manufacturer in form of self-generated orders based on consumer desires. The accuracy of forecasting is directly proportional to the amount of data included in the analysis and the quality thereof.

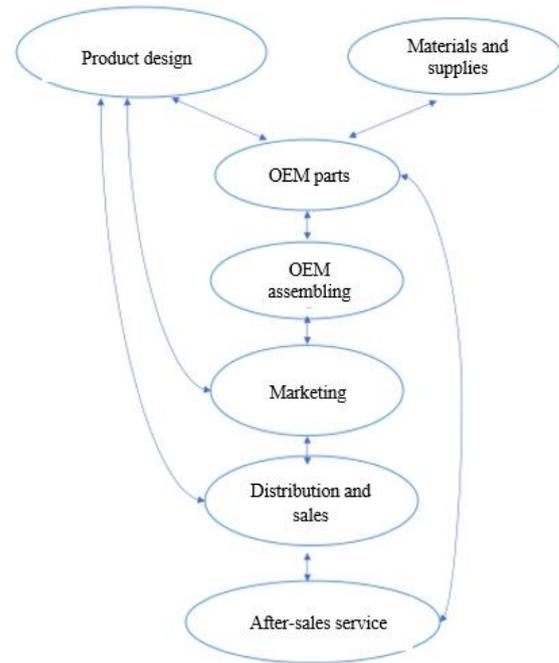


Fig. 2 Model of the supply chain in the automotive industry

To improve the efficiency of the global supply chain, the dealer center managers face the following tasks:

- Building a close cooperation between the disposition department and other departments of the company to increase the efficiency of decision-making on the basis of the comprehensive information;
- Omni-channel interaction with customers, that involves tracking the status of cars sold and maintaining contact with the established customers to obtain multidimensional and complete information as feedback for warranty, post-warranty service and forecasting the expected demand. It is necessary to use the historical and demographic data regarding the preferences in order to optimize the process of customization;
- Security and confidentiality of the customer information to increase the overall brand confidence.

Joining efforts and integration of all departments within the enterprise, as well as all members of the chain, becomes a vital condition for the existence of modern car manufacturing groups. It is difficult to tackle this challenge just using the classical methods of information processing, storage and transfer. So innovative solutions in the field of IT technologies are to help car dealers.

B. Characteristics of IT Solutions for Improving the Supply Chain in the Automotive Industry

The fourth industrial revolution or Industry 4.0 concept is reflected in all areas of social development and, of course, in the methods of the modern business. IDC analytical agency

has identified four main directions of the market of IT innovations: cloud technologies, social networks, mobile technologies and big data. As for the logistics, IT innovations are designed to provide the following competitive advantages:

- Transparency of all operations, product tracking;
- Timeliness of execution;
- Elimination of human error;
- Exclusion of different options for execution of a single operation;
- Information reliability;
- Availability of control points responsible for the correct execution of all operations at all stages.

The main trend in the development of internal and external communication of the dealer centers is cloud computing, which is the basis for digital business models and processes already playing a key role in doing business. The Internet of Things, Industry 4.0 etc, virtually all latest IT sector innovations rely on the facilities for the companies, ensured by the speed and the scalability of the cloud technology. This technology offers massively increased storage capacity and extensive data analysis. This allows the virtually unlimited number of users to get a centralized access and the ability to analyze huge amount of data. In addition, the cloud technologies provide flexibility and scalability, as well as standardized and harmonized processes throughout the entire organization. The main characteristics of the technology include the following components:

- Rapid adaptation is an important element of economic value creation, allowing organizations to avoid the inadequate and excessive allocation of capital-intensive and unnecessary IT resources. An organization can achieve significant savings by using the variable transactional needs of the most applications and reallocating the unused computing cycles during slower periods of a single application to more demanding simultaneously running applications. Although the costs associated with introduction of cloud technologies can be significant compared with the purchase of a comparable server for the same period, the advantage of the elasticity of cloud computing will overcompensate for the additional costs incurred;
- Pay-Per-Use model is the provision by cloud computing providers of custom metering of resource consumption, where consumers are only billed for the actual use of resources;
- The broad network access covers end users and devices accessing remote servers located in cloud services or applications using laptops, tablets, smartphones, etc.;
- Permanent ubiquitous end-user access to computing capabilities (storage or computing power) without requiring human interaction with the service provider;
- Resource pooling is the basis of scalability in the cloud computing paradigm, which makes it possible to control access to services and information assets

from any location without the need to know, where the asset is located.

Cloud computing not only allows organizations to remain flexible, but also helps them dynamically respond to changes in business forecasts. Cloud computing allows small companies to provide services that until now were only available to large organizations. Computing resources (infrastructure and software) can be transferred to outsourcing companies (which assume the capital risk of infrastructure management). Cloud computing capabilities enable organizations to reduce costs, eliminate points of friction in business, and increase the business flexibility.

However, not all companies decide to introduce a new technology because of its novelty and insufficient knowledge. Many organizations still fear for the security of their data in the cloud. In addition, it is still quite difficult to calculate the necessary costs in the implementation and operation of cloud technologies. The study of the successful experience of foreign companies elucidates the potential for the development of cloud technologies in Russia. The impetus for considering the introduction of this technology to the enterprise is the emergence and development of the provider market, offering various solutions for optimizing storage and access to big data.

Dealer centers of car manufacturers in the foreign countries are already actively using innovative technologies, often organizing both the external and internal information flows within CC. There are already many software offerings on the market that connect communication directions within an enterprise. These solutions are mostly based on the cloud technologies.

This is evidenced by the experience of twenty BMW dealers in Belgium who installed TimeXtender cloud software. One holding sells about 6,000 cars a year. With such a business scale, it becomes a serious problem to update information in real time to control the performance of all departments. Dealer Management System (DMS stands for "Dealer Management System", not to be confused with Data management System) is an indispensable tool to support the dealer's daily operating processes [5].

Although DMS has allowed BMW to manage administrative, commercial and service activities, it did not provide sufficient management reporting and analysis facilities. Employees claim that they had to spend hours performing reports in Excel, struggling with the interpretation of complex summary tables. Besides the fact that it takes a lot of time, it also introduces a potential risk of human error. That is why the large BMW dealers have decided to invest in the management information systems for their companies. The solution has to be an adequate, well adapted to the BMW administrative business and easy to integrate with the DMS, as well as for the other automotive business within the holding. A complicated process of implementing a typical business analytic solution, often taking from 6 to 12 months, would be beyond the capabilities of BMW dealers. The new solution had to be introduced quickly and with minimal effort of dealers.

After evaluating the classic Microsoft-based development tools, it soon became clear that creating a data storage would

be difficult and maintaining it on the long-term basis would be even more costly, so it would not be available to the dealer.

Scanning the market has led us to CALM-Co & TimeXtender, an expert in the automotive business intelligence, as a viable alternative.

Every night the data from DMS holding is sent to the centralized server. Then TimeXtender automatically generates the entire ETL (Extract, Transform, Load) procedure for retrieving the useful information. The end result is the centralized and fully automated data depository containing all the necessary facts, figures and calculations required for submitting reports.

In every dealer center the project was implemented over a period of less than a month.

Now the company manages to visualize all the necessary information almost on the real time basis on the displays of manager staff, allowing them to investigate potential problems with just a few mouse clicks.

The largest dealer centers in Russia are also beginning to adhere to the trend of cloud storage organizations. Rolf Group has transferred its data to the hybrid cloud of an external provider, providing more freedom in customizing systems and optimizing the cost of services by transferring a part of the infrastructure to a public cloud.

The digital transformation is already taking place at KAMAZ enterprise, where "SAP Hybris Cloud for Customer" is implemented to simplify the interaction of all links of the supply chain, from the manufacturer to the final consumer. However, for the effective operation of the chain, it is necessary to introduce new generation technologies at each dealer enterprise. Information on each transaction should be collected and processed in a single database. Then the identification of customer needs can become more accurate and efficient, leading to the improved forecasting.

C. The Use of Blockchain to Improve the Accuracy of Demand Forecasting and the Quality of Meeting Requests

Transparency and data tracking in dealerships can be provided by the Blockchain technology. This is an emerging very promising technology that underpins the growth of Bitcoin and the other cryptocurrencies. Blockchain can solve such logistics and marketing challenges as reducing the transportation costs, improving planning and strengthening the company's reputation. However, some experts adhere to more conservative methods.

The standard properties of a modern database include

- 1) open access, which may be restricted if necessary;
- 2) digital information using high-strength encryption and highly secure technology;
- 3) mutually guaranteed trust and verification to ensure data security and accuracy.

Blockchain will enhance these properties by adding the following features:

- 1) decentralization: so, the single point of ownership disappears (distributed ownership);

- 2) cybersecurity: error protection is the ability to code "smart contracts", preventing the accidental and / or the intentional entry of transactions that violate the contract terms;

- 3) historical record of every transaction that ever occurred, which makes it easier to track changes.

After transformations you get a digitized record-keeping platform that is verifiable, decentralized, unalterable and secure.

Blockchain technology can transform the current supply chain models while reducing costs. The capabilities of this technology are presented in Table 1.

TABLE I. BENEFITS OF BLOCKCHAIN TECHNOLOGY

Advantages	Description
1. Availability Confirmation	Evidence of the product availability at some time point
2. Ownership Verification	Evidence of transfer of ownership to another party (copyright, certificates, deposit accounts)
3. Tracking	Traceability of product movement over time (quality/safety feedback management, inventory visibility, tracking and origin)
4. Storage	The ability to store encrypted data that can be retrieved but neither modified nor deleted

In terms of improving network supply chain management processes, Blockchain facilitates the process of collecting specific information from the VIN of a vehicle. Data on service history, driving behavior, GPS locations, etc. are stored in one place. This makes it easier for car dealers to connect with their customers, as cars become more connected than ever before. This connection is provided by digitizing the goods using RFID tags, QR or bar-coding, which allows you to track the life cycle of the goods before and after meeting with the end user. Representatives of the company have the opportunity to retrieve information online about the condition of the car, its owner and his product handling. This allows to establish a direct communication between the manufacturer and the consumer. Since each dealer center does not only sell goods, but also deals with after-sales services, its representatives are interested in receiving timely and accurate information about the condition of the sold car in order to duly warn the client about the need to visit the car dealership.

Since Blockchain technology can be used to keep track of the origin of each component of a car, your customers can be assured of the guaranteed quality when ordering spare parts and very accurate notifications in case their car becomes a part of the manufacturer's recall group.

However, there are some problems that complicate the implementation of this technology for many companies. The level of decision making is not clearly defined. One, two or even several competing solutions exist, and it is necessary to make a choice for a principal one. In addition, the rate of adaptation of the company to a new technology is not known in advance and may be long.

The sales process can be simplified by introducing personal mobile devices for each manager with a mobile access to the full database of the dealer Company.

IV. DISCUSSION

A. Recommendations for Car Dealer communication improvement

At the moment, the information flows linking operational management layer of a company with external counterparties are as follows (see. Fig. 3)

The communication between the manufacturer and the dealer is carried out through the importer. There are 3 types of software applications related to forecasting and ordering cars, not related to each other.

The disposition department receives from the importer data on quotas, delays, model mix and prices as Excel spreadsheets by e-mail, after which it independently processes and analyzes the information. In response the dealer generates orders for cars in Nadin software on the basis of the dealer's independent forecasting on the basis of the company's internal information flows, and sends the reporting documents in form of tables by mail.

The disposition department of the dealer center receives the market information from the marketing department and the sales reports in the form of sales statistics in Aurora software. However, the statistics of the sold cars is not enough to form an accurate forecast; it also needs the up-to-date information about the requirements of consumers with are contacted directly by sales managers. At the moment, the information recorded by managers in a separate program for accounting for customer traffic is not transmitted to the disposition department for forecasting.

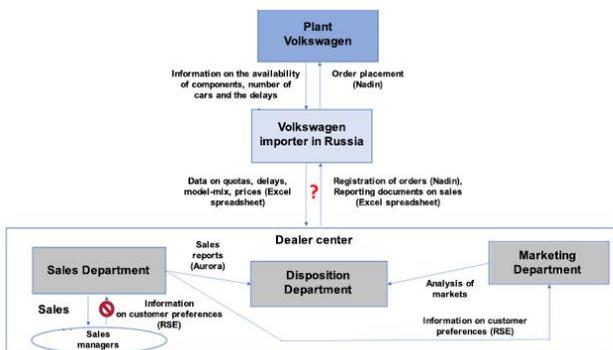


Fig.3. Information flows in the supply chain from the manufacturer and up to the VW dealer center

The first problem the company faces is associated with errors and delays in entering and independently processing information on quotas and the availability of accessories.

The second identified problem is the lack of consideration of consumer requests when placing an order for the next period, so that logistics managers can take into account not only the statistics of cars sold, but also the actual customer needs.

Both problems are associated with lack of automation of storage and processing of big data, and can be solved by introducing cloud technologies to the enterprise, due to which the number of orders with delays will be reduced, and as a

result – the higher customer loyalty can be achieved. From the data provided by the Avtostat analytical agency, the average Net Promoter Score (NPS) of VW is 56%, while it was found that the share of orders with delays was equal to 15%. Due to the proposed automation option, it is presumed to reduce the delays by 10%, which will increase the NPS to at least 65% (Table 2).

TABLE II. FORECAST OF SALES INDICATORS FOR VW GROUP DEALER NETWORK

Indicators	2018	2020
Share of orders with delays	15%	5%
NPS (VW)	56%	65%

The prospective of the company's financial indicators as a result of these innovations is presented in Table 3.

TABLE III. FORECAST OF FINANCIAL PERFORMANCE INDICATORS OF THE DEALER NETWORK

Indicator	2018	2020
Sales revenue (in thousand Rbs)	2,936,316	4,110,842.4
Bank payments (in thousand Rbs)	2,942,478.5	4,113,647.6
Indemnity from importer (in thousand Rbs)	78,253.1	90,284
Income for 12 months (in thousand Rbs)	72,090.7	87,478.8

V. CONCLUSIONS

A. Prospects for Development of Innovative IT Technologies in the Supply Chain of Car Dealers

1. The concept of building information and logistics system implies a departure from the traditional attitude to information systems in logistics, intended solely to automate the solution of individual logistic tasks and perform separate logistic functions; as a rule, they are not connected to a unified system within the Company and are not correlated with information systems of external contractors. Today there is a need to implement the integration of all levels of control rather than a single deliberately chosen control level. In addition, the information and logistics system should operate in the real

time, since only in this case the maximization of the efficiency of the management process is ensured.

2. The cloud technologies will get widespread use at car dealer centers. Meanwhile, to ensure the effective functioning of car manufacturers, it is necessary to build an integrated transparent unified system for all participants in the value chain. Thus, the information from the client would come directly to a manufacturer, providing a more accurate demand forecasting. Mobile IT applications are able to replace the procurement service, analytics and security departments, reducing the impact of human factor. The trends of the global integration of automakers supply chain participants can be implemented by Blockchain technology.

3. The need to introduce innovative technologies exists not only for the dealer centers; the integration with the importer and car manufacturer is enhanced by the highly competitive environment. To increase the customer loyalty, it is necessary to carry out the accepted orders just in time, which directly depends on the accuracy of configuration prediction and the number of cars ordered for the subsequent period (this information is to be retrieved by an extensive analysis of big data). Strengthening the processes of trans-nationalization in the car manufacturing the goal of exercising control over the multitude sales representatives around the world and forecasting sales at the regional level. Accordingly, the concern's leadership needs to get the reliable information in form of reports from all links in the value chain (fig.4).

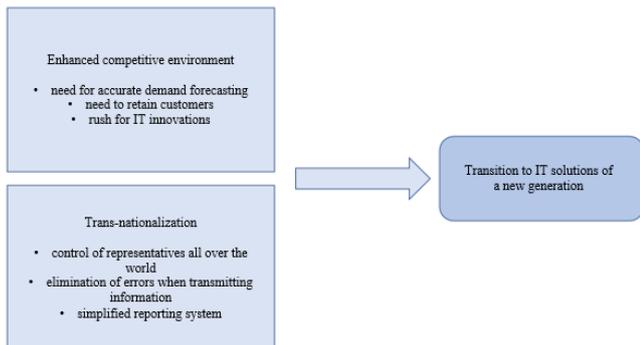


Fig.4. Driving factors of auto dealer supply chain network transformation

Therefore, it is necessary to further reduce the role of human factor in ensuring the reliability of information and the transparency of operations performance. The final sales stage, requiring the presence of the personnel, is the communication of sales managers with the customers; meanwhile, it can be anticipated that this stage will be replaced in the nearest future by e-commerce workflows.

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