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Optimization of Data Management System Between Organizations

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Abstract: The research proves the necessity of introducing automated systems of data exchange and creating a clear structure of regulations regarding the interaction between all participants. The purpose of this research is the development of an optimum pattern of information interaction. The practical objective of the research is the description of a plan for the introduction of an information management system in business processes and optimization of the interaction pattern between the company department and with partners of the company. The result of the research and implementation of the developed solution to improve the efficiency of information interaction between all parties: the manufacturer, distributor and retailer, as well as to optimize business processes and information interaction into the company's departments. As the first stage of the transition to the work scheme that was described earlier, the PIM system was implemented in one retailer. According to the results of calculating the cost indicators: PP, NPV, IRR, it is possible to conclude that the efficiency of the organization has increased. The project payback period was less than 3 years.

Key words: business administration; e-commerce; information and communication technology; information systems; internal organization; IT management; optimization; retail

JEL codes: C61, L22, L81, M15

1. Introduction

In the research of the perfumery and cosmetics market, it was revealed there are almost no technological standards of data exchange in the industry that meets the necessary requirements. The lack of optimization is the cause for the lag in the priority area of e-commerce and the redundancy of overhead costs. This research substantiates the need for the introduction of automated systems of data exchange and the creation of a clear structure of the rules of interaction for all participants.

Target of the research is the development of optimal system of information interaction between manufacturers and retailers. Subject of the research is optimization of business processes in the management of information interaction. Object of the research: system of information management. Research hypothesis: the introduction and optimization of a product information management system will increase the effectiveness of organizations' interaction.

1.1 The Problem of Information Interaction

The problem of information interaction is currently a subsystem of authorization and delegation of access rights for the import and export of data.

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Contradictions arise between:

1) The need for common direct access to information by all stakeholders;
2) Generally accepted in the industry scheme of cooperation through distributors, when retailers do not have direct contacts with manufacturers;
3) Requirements for data protection from third-party access.

These contradictions lead to a practical lack of direct data transmission in the industry: manufacturers do not have sufficient resources to provide access to data to unknown retailers, retailers can't get this access, and distributors are not technically ready to pass these data flows through their systems, given the high intensity of flows, as well as the need for separate filtering and processing of data for each retailer separately.

As a result, even if the partners have systems similar to the one under consideration and are technically ready to perform these operations, it is usually not carried out due to the lack of coordination of the necessary access rights.

2. Methodology

2.1 Research Methods

Analysis of literature, electronic sources and business processes for develop an information management system; stakeholder interviews and surveys for compile a list of system requirements; development of regulations, schemes and instructions for developers, support services, clarification of details of interaction in the organization; statistical analysis; data extrapolation for identify common features in working with information on the cosmetics market, approbation of research — integration of the developed system of information interaction into business processes of a retailer.

2.2 Practical Value

The practical significance of the work lies in the development of an optimal system of information interaction and a description of its practical implementation in the business processes of retail. **Work approbation.** Information management system (PIM system) implemented in the company of trade of perfumes and cosmetics. The implemented data exchange system has increased the efficiency of information interaction. The project payback period was less than three years. The same practice can be used by any company in the market of perfumes and cosmetics.

2.3 Information Management Requirements

One of the objectives of this study is to develop information management requirements. To ensure successful business processes, information interaction must meet several basic requirements:

1) All necessary information should be available to all interested participants.
2) Information should be stored in a single storage. Duplication of data is allowed only in a limited number of cases, for technologically justified purposes and subject to its timely updating.
3) Information should be available automatically, directly on request, without manual operations.

2.4 Directions of Information Interaction

In the analysis of business processes, the following data streams and directions of information interaction can be distinguished:

1) Intra-corporate exchange — data exchange between departments of company, whether it is a manufacturer, distributor or retailer.

2) Direct streams b2b (business-to-business) — information about goods for the retailer: product descriptions, product specifications, promotional materials, etc.
3) Reverse streams b2b — feedback for the manufacturer from retailers and distributors: noticed errors in the description, sales statistics, etc.
4) Direct streams of b2c (business-to-consumer) — product information received directly by the buyer from the manufacturer or retailer (on websites, online applications, from consultants or customer support lines): product descriptions, usage recommendations and terms of use, etc.
5) Reverse streams of b2c — product reviews and evaluations sent by buyers to retailers or manufacturers. E-commerce and e-marketing involves to getting close to customers, understanding them better and maintaining a dialogue with them (Almar N., 2019).

2.4 Development of an Optimal Information Management System

As an optimal system, the following structure of information interaction between all stakeholders is proposed. For accumulation, storage and transfer of data in each company it is recommended to use specialized hardware and software systems that provide reliability of storage and convenience of data input, output and processing (Andersone I. & Gaile-Sarkane E., 2010).

As a basis for the construction of such a system, company can use both its own and ready-made technological solutions — PIM (product information management) systems. An important feature of PIM is the ability to use information obtained from a variety of sources, such as spreadsheets, web sites, catalogs, reports, etc. PIM implements not only the ability to store multi-format data created in diverse environments and used in various contexts, but also its systematization and reduction to a uniform standard. For example EDI (Electronic data interchange) means the electronic transfer from computer to computer of information using and agreed standard to structure of information. EDI is often used for business-to-business (Gaile-Sarkane E., 2008).

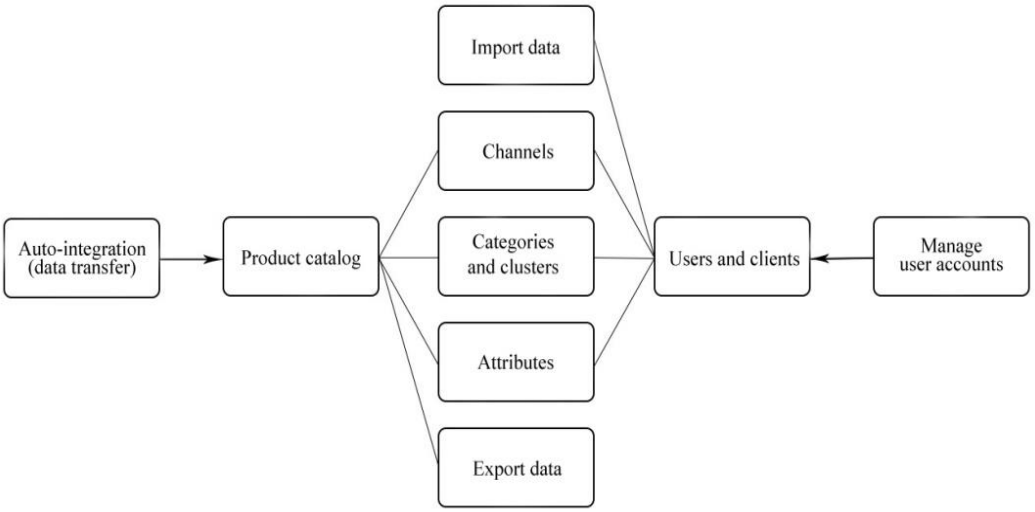

Figure 1 Structure of PIM System in the Present Research With Detailing and Creation of Links Between Modules

Modular structure of the system, combined with the principle of introducing larger modules while maintaining the quantity of inputs and outputs, allows to create complex systems (Армстронг М. & Бэрон А., 2014). In the practical part of research was introdused the system with the maximum detail modules, for example:

- Product catalog;

- Directory tree, to be able to edit a more important system without movement to the lower levels of product information;
- DAM, a separate storage of media files: product photos, logos and brand stories, videos, etc.;
- Import of large files containing data on hundreds of products.

Thus, all directory systems are independent of each other. The facilitates its use, fixing of errors, observing versions of changes and any mass operations on clusters of SKUs (SKU — Stock Keeping Unit).

The second concept is a hierarchical structure. Hierarchy is a structure with unequal relations between elements, when influences in one direction have a much greater impact on the element than in the other. In the PIM system, the hierarchical concept is applied for development of user access rights. Users are divided into three clusters: technical specialists (programmers, technical support specialists, testers); internal managers of the company; responsible managers of partner companies (manufacturers, distributors).

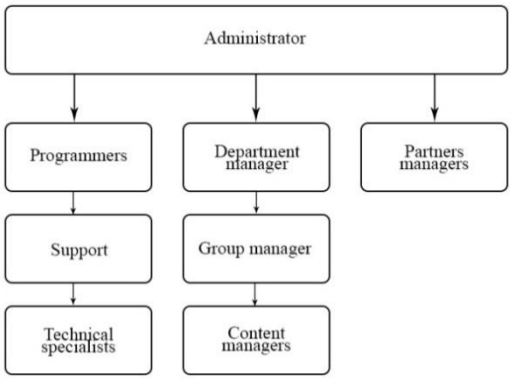

Figure 2 Hierarchical Structure (Interoperability) of the PIM System

2.5 Data Exchange System Requirements

In order to ensure the tasks of data exchange and optimization of internal business processes, such a system should include:

1) Directly data repositories (so-called Database — with Database Management System) — uniform for the company and containing complete information on all types of products.
2) Operator interfaces that provide input and output of information in the workplaces of employees of all department of the company.
3) Accounts management system. Authorization subsystem for these interfaces, which provides delegation of rights for reading and changing data for various sections of the database (depending on the role and status of the operator).
4) Import and export of data, ensuring the exchange in an automated mode with similar systems of other contractors.
5) Export access subsystem, providing delegation of authority to access certain data (depending on the type and status of the company requesting the export of data).
6) Feedback system that provides instant automated delivery of messages to administrators or system operators: both from other operators and external sources of other companies or from consumers.
7) System may include also various subsystems for automatic processing of input data, subsystems for checking integrity, quality and consistency of incoming data, etc.

2.6 Proposed Solution

To solve this problem, it is proposed to use inherited scheme of delegation of access rights. The distributor, starting to cooperation with the manufacturer, is registered in its system, automatically receiving authorization data, encryption keys and other information necessary for the import and export of data. At the conclusion of a contract between them for the supply, all SKUs supplied under this contract are registered by the manufacturer in the distributor's account, and he is able to import all information on these SKUs by direct access to the manufacturer's database. It is important that only those products that are registered in the distributor's account are included in the selection of information. That is, the distributor gets access only to those SKUs that are directly purchased from this manufacturer. At the conclusion of subsequent or additional contracts, new SKUs are also added to the same distributor's account. Updating of SKUs available to the distributor should be automatic.

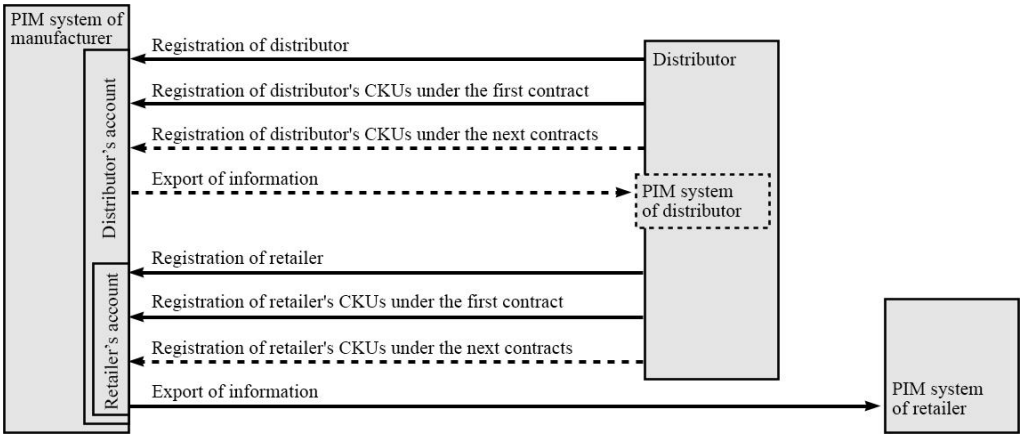

Figure 3 Development of the System of Interaction With the Inherited Access Rights to the Database of the Manufacturer

This solves the problem of information leakage, when information on new products that appeared in the system of the manufacturer before the actual sales, becomes available to all and can be transferred to a competing company. This problem really exists in the market of cosmetics and perfumery, as a huge amount of resources invested in innovation, formulation development, consumer research and construction of "gold standards" for product lines and promotion to launch new products.

Starting to cooperation with the retailer, the distributor independently and on its own behalf registers it in the manufacturer's system and makes a list of goods supplied in its account, within its own available set. After authorization in the manufacturer's system and receipt of keys and other technical data from it, the retailer also gets the opportunity to directly import information from the manufacturer's database on all SKUs officially purchased from the distributor. At the conclusion of subsequent or additional contracts, new goods are also added by the distributor to the retailer's account.

Thus, the retailer gets direct access to the manufacturer's database, within the framework of the contracts officially concluded with the distributor, under the responsibility of distributor without the need for direct contact with the manufacturer. This decision eliminates the need for the manufacturer to clarify information about the retailer, for example, whether it is an official seller, from whom it buys products, etc.

If the supply contract is concluded between the retailer and the distributor, the manufacturer delegates communication to the distributor as its representative.

In addition to the issuance of the requested information about SKUs, the manufacturer also gets the

opportunity to automatically generate and send packages of promotional information on new expected products, based on a set of SKUs already purchased by a distributor or retailer, as well as the volume and dynamics of their sales. If necessary, the scheme may include arbitrarily long chain of distributors.

2.7 Auxiliary Subsystems

Feedback subsystem is required to promptly correct any errors and failures in the system, and for quick communication in case of any emergency situations. It should include:

- Receiving module — a software unit accessible from the Internet that receives messages in the prescribed format;
- Addressing module that redirects the message to the responsible operator depending on the source and type of message;
- Delivery module that is integrated into the operator interface and informs him about a new message.

Also the module of creation of messages that is integrated with the interface of viewing of information for the automated generation of messages with reference to object of correspondence — to goods or other object of a database is required. The message delivery system can be created on the basis of both its own solutions and on the basis of standard protocols for sending emails. In the latter case, all modules of the subsystem are created on the basis of standard mail servers and clients with connection of corporate e-mail accounts and automatic fixation of sent and received messages with reference to the object of correspondence.

Auxiliary subsystems of data input and verification and operator interfaces, can also vary depending on the volume, type and kind of activity of the company-owner of the system, as well as the range of tasks it solves, without a noticeable impact on the system operation and interaction with similar systems of other companies-contractors.

The system created according to this scheme, if necessary, can be easily integrated with other automated systems of management (Business Process Management, Enterprise Resource Planning, Customer Relationship Management, Product Data Management, various warehouse and logistics systems, etc.) and is included in the common system of electronic document management.

The degree of decentralization of the information system is usually chosen by analogy with the degree of decentralization of other functions in company. The choice of means for the development of information systems is carried out according to the strategic criterion, which most fully reflects the role of the information system for the organization (Громов Ю. Ю., Земской Н. А., Лагутин А. В., Иванова О. Г., Тютюнник В. М., 2007).

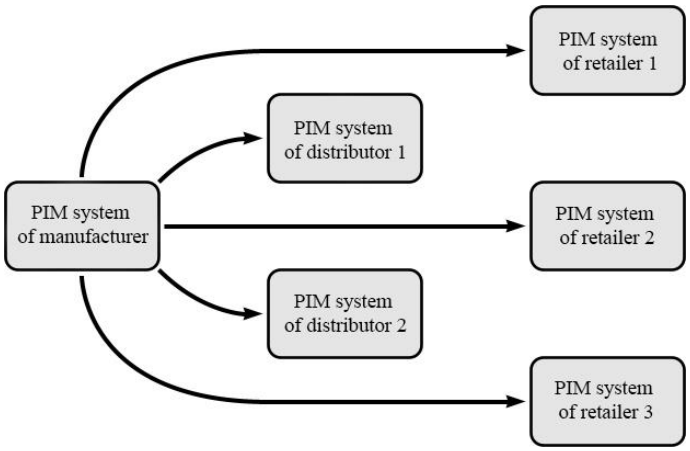

Figure 4 Data Exchange Between All Participants, Ensuring the Uniformity and Relevance of Information

2.8 Integrating PIM Into Retailer's Business Processes

As the first stage of the transition to the work scheme that was described earlier, the PIM system was implemented in one retailer. According to the results of calculating the cost indicators: PP, NPV, IRR, it is possible to conclude that the efficiency of the organization has increased. The project payback period was less than 3 years.

To calculate the effectiveness of the implementation of the product information management system, average values taken from open sources will be used. Below we will consider improving the efficiency of the organization of information exchange by comparative cost analysis in a medium-sized company (approximately 2,000 employees).

Since one of the main functions of the PIM system is to fill the storefront of an online store, the data in question are more relevant to online stores. Number of employees engaged in entering information (Костров А. В., 2009): photographer; retoucher; copywriter; content manager; account executive; purchasing manager.

Table 1 shows the average salary of employees working in the online store in Moscow. Data taken from the largest Internet recruitment company in Russia — HeadHunter.ru. Prices are in euros at the rate of September 2019.

Table 1 Average Salaries of Specialists in Moscow, Russia

Specialist	Average salaries
photographer	EUR 938
retoucher	EUR 727
copywriter	EUR 621
content manager	EUR 677
account executive	EUR 1370
purchasing manager	EUR 1277

If we summarize the calculations, the amount of salaries of employees involved in entering information is EUR 5610. Each month, the company spends this amount to fill out product cards.

Unfortunately, the cost of ready-made technical solutions presented on the IT market in the public domain is not available. Companies providing PIM systems prefer not to give any numbers, always considering cooperation on individual terms. BrandQuad service works by subscription, tariffs start from EUR 2112 per month (Топливо для ИТ, 2019). We will operate with this value in the further analysis.

Provided that all descriptions are entered directly from the manufacturers system, as in the optimal scheme, or the data is entered by partners and suppliers, as in a practical example, company-retailer can refuse the services of all employees hired to fill out the database. Instead, a company can hire one project administrator, whose duties will include:

- Monitoring compliance with regulations and deadlines for entering data;
- Support Interaction;
- Check spelling and punctuation in texts;
- Verification of compliance of photographic materials with technical requirements and an agreed order of angles;
- Updating instructions;
- Advising of users;
- Provide training for users;

- Coordination of system updates, development of additional functions.

The average salary for project administrator according to HeadHunter.ru is EUR 1126.

Thus, it can be argued that the company's savings after the implementation of the information management system will be 5610 - (2112 + 1126) = EUR 2372 per month or 28464 EUR per year.

2.9 Evaluation of the Effectiveness of the Implementation of PIM

The method of discounting cash flows is used as a mechanism for assessing the efficiency of the company. In this case, the model of the investment project is used, which is superimposed on the model of the existing company. The peculiarity of this scheme is that all funds invested in the system are evaluated as one-time costs. The value of cash flows is tied to the activity and its size is affected by the value of savings.

Three values were determined: PP, NPV, IRR. The discount rate was calculated in accordance with the weighted average cost of capital (WACC) model. In the framework of this reseach, intermediate calculations are not presented, only results are given. Table 2 presents the results of calculating the effectiveness of the implementation of PIM system in the retailer.

Table 2 Evaluation of the Effectiveness of the Implementation of the PIM System Over a Three-Year Period

Index	Designation	Value	Criterion
Payback period, year	PP	2.74	Less than 3 years
Net present value, EUR	NPV	5230	Above zero
Internal Rate of Return	IRR	16.8%	More than 15%
Internal Rate of Return with the weighted average cost of capital	IRR-WACC	4.73%	More than 4%

Thus, all the calculated cost indicators meet the specified criteria, which allows us to conclude that the introduction of the PIM system in the retail has increased the efficiency of the organization.

3. Results

3.1 Development of an Optimal Data Exchange System

As an optimal solution, a system of data exchange between manufacturers and retailers was proposed.

This system provides for all contradictions arising in the process of interaction:

1) Need for direct access to information by all stakeholders;
2) Generally accepted in the industry scheme of cooperation through distributors;
3) Data protection requirements.

To solve this problem, it is proposed to use the scheme of inherited delegation of access rights. This solves the problem of information leakage, when information on new products that appeared in the system of the manufacturer before the actual sales, becomes available to all and can be transferred to a competing company.

The implementation of the proposed scheme will be beneficial for all participants: manufacturers get a uniform representation of their products in the entire market; distributors get rid of the need to spend resources on processing and transmitting information from manufacturers to retailers; retailers get direct access to actual information.

This is achievable without a major transformation of the existing scheme of cooperation, but also with a reduction in overhead costs and saving resources, which previously spent on the collection, processing and transmission of information.

3.2 Integration of Information Management System

The introduction of information management system in the retail chain should show how the previously described scheme of optimal interaction has affected the overall efficiency. Performance management is a continuous and flexible approach to the management of the organization, which involving the most intensive dialogue between the participants (Костров А. В., 2009).

Implemented PIM system is certainly primarily a database (repository, storage). All employees who need to have any information have access to the system.

The PIM system has created an account system that provides different user roles. There are two large clusters that combine accounts into those that can make changes to the system and those that can only view and download information from the system. Accounts of partners and suppliers are created only for its goods for which they are responsible under the contract. For each partner can be opened several representative accounts.

The possibility of automatic import and export of data has been tested. The PIM system itself is updated daily, PIM is integrated with internal systems and with the company's website. Any error correction and change of the information imported from the PIM in Internet store no later than the day.

Thus, it can be concluded that most of the requirements of the developed optimal system of information interaction are implemented in practice, which increased the efficiency.

An analysis was conducted of the effectiveness of the introduction of the PIM system using the cash flow discounting method, which showed the results:

- The payback period of the project is 2.74 years
- The net present value of the project is EUR 5230
- Internal Rate of Return — 16.8%
- IRR with the weighted average cost of capital — 4.73%

The calculations allow us to conclude that the introduction of the PIM system in the retail has increased the efficiency of the organization.

4. Conclusions

The result of the research and implementation of the developed solution to improve the efficiency of information interaction between all parties: the manufacturer, distributor and retailer, as well as to optimize business processes and information interaction into the company's departments. And also:

- Developed requirements for information interaction both within the company and in the data exchange with partners.
- Created the project of optimal system of data and information exchange.
- Developed a plan for the implementation of information management system in the business processes of the retailer, the optimization of the scheme of interaction between the company's departments and with partners.

Optimization of information interaction mechanisms and introduction of product information management system affects the efficiency of interaction both in the internal business processes of the company and in cooperation with contractors and partners.

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