PLATFORM SUPPORT FOR AN INTELLIGENT ENTERPRISE BUSINESS MANAGEMENT

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Abstract: The platform IDEA assists all the specific processes of an enterprise, from the meat processing industry, to help decision makers to manage performances by implementing the concepts Business Performance Management (BPM) and Business Intelligence (BI). The platform transforms data into information and then into knowledge being focused on business, technological and economical aspects specific to the meat processing enterprises helping them to realise an efficient use of their business policies, financial, human and material resources. The platform integrates the software developed components dedicated to decision processes management, customer relation management and enterprise resources planning components. The platform offers support for an intelligent management of the business processes, of the manufacture flows, and of the enterprise resources. Some tools considered in the development of the platform are business management systems, business workflow analysis, business performance management, OLAP (Online Analytical Processing), data modeling, data visualisation, report servers, AJAX (Asynchronous JavaScript and XML) technology.

Key-Words: Business Performance Management, dynamic interfaces, process modeling, data mining.

1 Introduction

The platform is developed by a multidisciplinary consortium under the coordination of ICI Bucharest.

The researches performed are addressed to the meat processing industry and aim at the specific processing and organizational aspects, the business relations in the market context.

The platform is oriented to modernization of processes and business models specific to meat processing industry and offers a multi-criteria assessment of the meat processing industry at national and international level, a set of prognoses regarding the area development and an information system that assists, by using technologies specific to Information and Communication Technologies (ITC), the complex processes specific to a meat processing enterprise that have been identified together with the decision persons of some enterprises.

The platform promotes innovative concepts and technologies oriented on business intelligence and performance management to realise a sustainable competitive manufacturing, which will contribute to the acceleration of the processes of transforming of the meat processing industry.

The platform realises an innovative and dynamic management of the processes specific to meat processing industry.

The platform assures in real time a visibility of processes, which become, using the provided facilities, more efficient minimizing the cost, simplifying the communication with providers and consumers, and supporting intelligent decision-making.

The platform will provide a real time searching and visualisation of desired information, of the opportunities of modification performing and solutions for the organisation of the processes and the monitoring of business relation with clients and providers.

2 Problem Formulation

The aspects considered in the platform creation have been the development of integrated solutions to an innovative and dynamic management of the processes specific to the meat processing industry by assuring in real time the visibility of processes that can become more efficient and the profitability from the business in order to improve the organization, to reduce the costs, to simplify the

interactions with all the clients and to support the intelligent decision making at a desired moment.

3 Problem Solution

3.1 Meat market structure
A global structure of the meat market considered by the platform is presented in the figure 1.
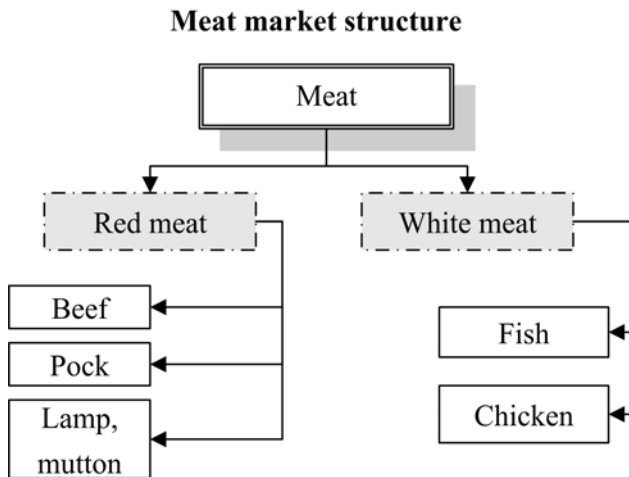
Meat market structure

Fig. 1 Meat market structure

3.2 Action area
Fundamental and applicative research activities performed in the research and development project dedicated to the processes specific for meat processing enterprises have been oriented on:

- Technological processes;
- Commercial processes;
- Economic processes;
- Interactions between processes.

3.3 The platform as a business concept
The platform implements the business intelligence concept considering the process of gathering information in the field of business specific to meat industry.

The information is typically obtained from customer needs, enterprise specific processes, decision makers, competition aspects, manufacturing conditions, and economic, technological, and social trends.

The platform has specific short and long term goals derived from the organisational goals or from the development prognoses.

The platform transforms data into information and then into knowledge and is focused on business processes such as planning and forecasting.

The system helps businesses to discover efficient use of their business policies, financial, human and material resources.

The platform using BPM concept performs consolidation of data from various sources, enhances processes by creating better feedback loops using querying and analysis of the data and putting the results into practice.

The platform include a diverse number of processes of turning data into information and then into knowledge.

The industrial surveying is a type of business intelligence that uses covert techniques.

In order to gain sustainable competitive advantage the platform implements business intelligence concept.

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The platform includes a set of processes that help organizations from the meat industry to optimize business performance implementing the concept of Business Performance Management (BPM) that is the next generation of Business Intelligence (BI), BPM being focused on business processes such as planning and forecasting. It helps businesses discover efficient use of their business units, financial, human, and material resources.

Continuous and real-time reviews help to identify and eliminate problems before they grow.

Forecasting abilities help the organisation to take corrective action in time to meet earnings projections.

Forecasting is characterized by a high degree of predictability, which is put into good use to answer what-if scenarios.

BPM concept is used by the platform in risk analysis and predicting outcomes of merger and acquisition scenarios and coming up with a plan to overcome potential problems.

The platform provides several financial / non-financial metrics / key performance indicators that help organizations to monitor efficiency of projects and employees against operational targets, to assess the present state of business, and to prescribe course of action.

The platform integrates the BPM organisation's processes with its CRM components and ERP components.

The enterprises that use the platform will become able to estimate customer requirements, to control customer satisfaction trends and to influence shareholder actions.

3.4 The platform facilities

The platform contains a data warehouse for storing, retrieving and managing the large amounts of data types that are characteristics for describing and presenting the information flows specifics to the processes performed into an organisation from the meat industry.

Data mining, known as knowledge-discovery in databases (KDD), is the practice of automatically searching large stores of data for patterns. To do this, data mining uses computational techniques from statistics and pattern recognition.

Data mining concept defined also as "the nontrivial extraction of implicit, previously unknown, and potentially useful information from data" or as "the science of extracting useful information from large data sets or databases" is used in the platform development.

The platform:

- Provides data and reporting tools to support the decision-making process;
- Offers business roadmaps and business analysis which includes data models;
- Helps enterprises from meat industry to understand which processes control the enterprise and to predict the future impact of current decisions;
- Plays a key role in strategic planning process of the enterprise;
- Includes customer profiling, client order research, customer contact analysis, scoring, product profitability, and inventory movement;
- Contains applications and technologies for gathering, storing, analyzing, and providing

access to data to help users make better business decisions;
- Gives the possibility of usage of timely and accurate information to base decisions upon providing support for activities like decision support, query and reporting, online analytical processing, statistical analysis, forecasting.

3.5 Principal business relations

The principal relations between the specific elements of the business processes are the following:

- Relation between the clients and their product orders;
- Relation between the client orders and the required products;
- Relation between the products and the raw materials;
- Relation between the products and the auxiliary materials;
- Relation between the products and the intermediary products;
- Relation between the products and the technological operations;
- Relation between the technological operations and the equipments;
- Relation between the technological operations and the human resources;
- Relation between the technological operations and the time period;
- Relation between the client orders and the time periods;
- Relation between the raw materials and the batches;
- Relation between the auxiliary materials and the batches;
- Relation between raw materials and the provider orders;
- Relation between the auxiliary materials and the provider orders;
- Relations between the enterprise departments;
- Relation between the enterprise and transport operators.

3.6 Technological chain characteristics

Each product is manufactured on a technological chain that has well-defined specific characteristics illustrated in the figure 2.

Every product technological chain is based on a manufacture technology that is described through the raw and auxiliary materials and eventually intermediary products, operations, equipments and

human resources that are needed. Human resources are specified by person function.
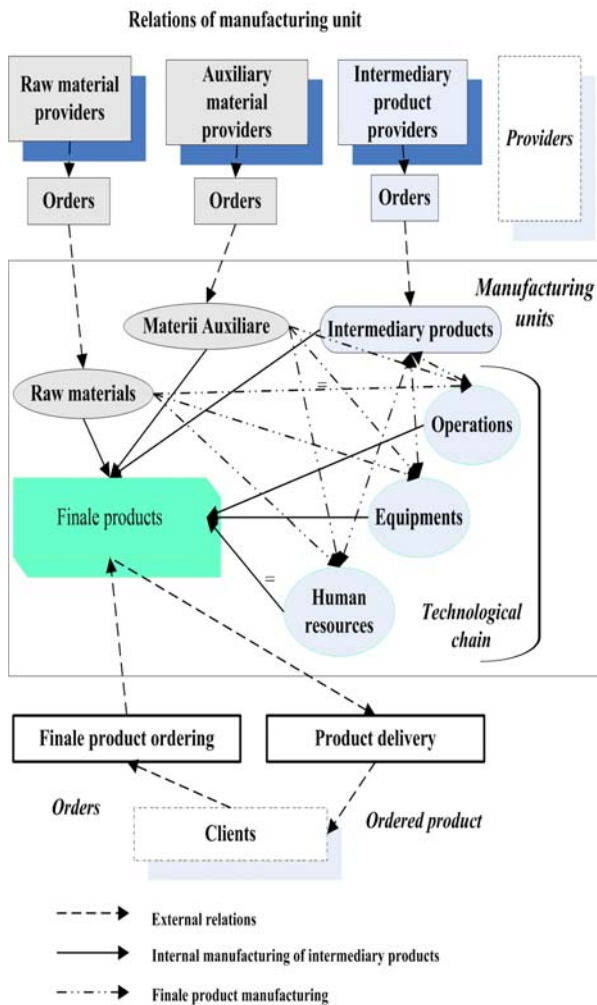

Fig. 2 Technological chain

An operation can be found in many technological chains; however there are specific characteristics that will allow the differentiation according to the technological context.

Some examples of the principal relations between the manufacture technology elements are presented in the below tables.

A meat enterprise produces a diversity of products $PR_1, \ldots, PR_j, \ldots, PR_n$.

For each product type there is a specific technological process characterised by the types and quantities of needed raw materials, intermediary products, auxiliary materials, performed operation and equipments and human resources used for each operation.

In order to produce for example a product PR_i have to be used the Raw Materials RM_i and, RM_m, the Intermediary Products IP_1, IP_i and IP_m, and the Auxiliary Materials AM_i and AM_p.

Table 1 Relation PRoducts – Raw Materials

	RM_1	…	RM_i	…	RM_m
PR_1	x				x
…					
PR_i			x		x
…					
PR_n			x		x

Table 2 Relation PRoducts – Intermediary Products

	IP_1	…	IP_i	…	IP_m
PR_1	x		x		
…					
PR_j	x		x		x
…					
PR_n	x				x

Table 3 Relation PRoducts – Auxiliary Materials

	AM_1	…	AM_i	…	AM_p
PR_1	x				x
…					
PRj			x		x
…					
PR_n	x				

Table 4 Relation PRoducts – Operations

	O_1	…	O_k	…	O_s
PR_1	x		x		x
…					
PR_j			x		x
…					
PR_n	x				x

The operation that will be executes are O_k and O_s.

The operation duration is a parameter of the system.

Table 5 Relation Operations - Equipments

	E_1	…	E_i	…	E_t
O_1	x				
…					
O_k			x		
…					
O_s					x

Table 6 Relation Operations – Human Resources

	HR_1	…	HR_j	…	HR_u
O_1	x				x
…					
O_k	x		x		
…					
O_s			x		x

The operation O_k will use the equipment E_i and the human resources HR_1 and HR_j. The operation O_s will use the equipment E_t and the human resources HR_j and HR_u.

3.7 Manufacture planning

The manufacture planning is carried out accordingly with the firm orders, the predictable orders with high probability and the statistic evolution of the orders from previous years regarding a certain time period.

There are used the stocks of raw materials, auxiliary materials and intermediary products existing in the enterprise warehouses and there are proposed the acquisition orders that must be launched.

The manufactured products are structured in three categories:

- Finale product;
- Level 1 intermediary product which enter in the composition of finale product;
- Level 2 intermediary product which enter in the composition of level 1 intermediary product.

The relation between the product orders (OR) received from the clients considered in the manufacture process and the required time periods (T) is highlighted in the below matrix.

Table 7 Relation ORders – Time periods

	OR_1	…	OR_l	…	OR_q
T_1	x				
…					
T_k					x
…					
T_w			x		

The total quantity for each product which must be manufactured is indicated by the "Total T_w" vector. This total quantity is obtained by adding the product quantity included in the client orders. It is considered a time period for the planning of the product manufactory.

Table 8 Relation PRoducts on ORders to Time period T_w

	PR_1	…	PR_j	…	PR_n
OR_1	x		x		x
…					
OR_l	x				x
…					
OR_q			x		x
Total T_w	Σ		Σ		Σ

Knowing each product quantity that must be manufactured there is needed to determine the quantity of the raw materials (RM) and respectively of the auxiliary materials (AM) that must be acquired. In the below table is presented the quantity from each raw material that is needed to the manufacturing of the product specified in each row.

Table 9 Need of Raw Materials for PRoducts to be manufactured in the Period T_w

		RM_1	RM_2	RM_i	RM_{m-1}	RM_m
TOTAL	PR_1	x	x			x
	…					
	PR_j		x	x	x	
	…					
	PR_n			x	x	x
	Total	Σ	Σ	Σ	Σ	Σ

The relation between raw materials (RM) that exist in each acquisition batch (B) and the departments that perform their administration (A) is presented in the following tri-dimensional matrix.

Table 10 Raw Materials existing in Administration at Batch level

	A_1			…	A_{r-1}			A_r			Total Raw Materials on Batch		
	B_1	B_k	B_l	…	B_1	B_k	B_l	B_1	B_k	B_l	B_1	B_k	B_l
RM_1	x		x								x		x
…													
RM_i					x	x					x	x	
…													
RM_m		x							x				x

In order to launch the manufacture of selected products it is needed to know the raw materials and the auxiliary materials that will be acquired based on the existing firm orders.

Table 11 Raw Materials in acquisition ORders in period T_w at ProviDer level and Batch level

	PD_1			...	PD_f			Total Raw Materials on Batch		
	B_{l+1}	...	B_{l+k}	...	B_{f+1}	...	B_{f+k}	B_{l+1}	...	B_{f+k}
RM_1	x				x		x	x		x
...										
RM_i			x							
...										
RM_m	x				x		x	x		x

If the existing quantity plus the quantity that is going to be acquired based on some existing firm acquisition orders is smaller than the needed one, new acquisition orders must be drawn.

3.8 The platform system structure

The platform contains from conceptual point of view many subsystems. A subsystem includes an integrated set of activities relatively homogenous with a specific finality, well-defined actors and a clear mission within the information system of the meat processing enterprise, namely:

- „Marketing" subsystem that carries out a market assessment at the level of meat products commercialized on the internal and external market;
- „Product order administration" subsystem that includes the chain: product ordering, order centralization, product need determination;
- „Manufacture" subsystem that includes the technologies specific to each product type, manufacture planning and monitoring, and verification with the appropriate notices of the real manufacture parameters in relation with the planned parameters;
- „Stock administration" subsystem for raw materials, auxiliary materials, intermediary products, finale products;
- „Raw materials and auxiliary materials acquisition" subsystem that includes the chain: launching of acquisition and good reception orders;
- „Product delivery" subsystem that assures the dispatch to clients of manufactured products accordingly with the product orders received

from them and with the enterprise's promotion policy;
- „Economic administration" subsystem that offers a mirror, in terms of costs (incomes, expenses and profit), of all the actions deployed through the previous subsystems;
- „Support for decision making" subsystem that supports the decision making regarding the manufacture process based on a well-substantiated product order portfolio. There are provided sets of information relative to relations with business partners, product offer, status of stocks and movements of raw materials, intermediary materials, auxiliary materials, finale products, manufacture cycle deployment way.

A more global image of the platform is given through its components structuring on the following four categories: components support for business and relations with business partners, components support for manufacture management, components support for human resource management and components support for economic administration.

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The architecture of IDEA system is presented in the figure 3 underlying the components and the interactions between them.
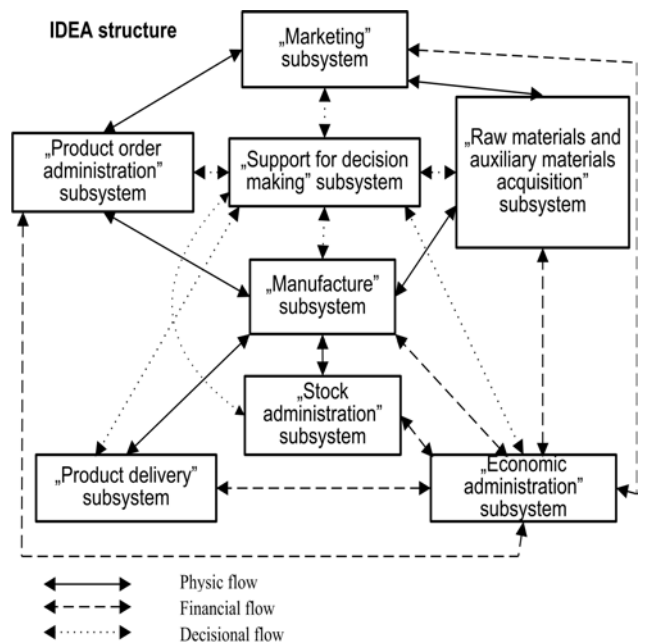

Fig. 3 The principal components

3.9 Considered tools

Some tools considered in the development of the platform are the following:

- Business management systems of p2p (process to process) type;
- Business workflow analysis, business performance management;
- OLAP (Online Analytical Processing) based on dimensional analysis and hypercube;
- Data modelling and tools for defining Business Logic Layers and Business Rules;
- Data visualisation, report servers.

3.10 The platform interfaces examples

Some of the platform user interfaces examples created as dynamic interfaces contextually chained based on AJAX (Asynchronous JavaScript and XML) technology that allows the asynchronous updating of areas from an active server page are presented below in the figures 4 - 9.

The system addresses to the users that are not specialized in computers.

In the design of interfaces have been considered the services offered to the users, the functionalities based on which the respective services are carried out, the processes support for the respective functionalities carrying out.

Fig. 4 Production planning
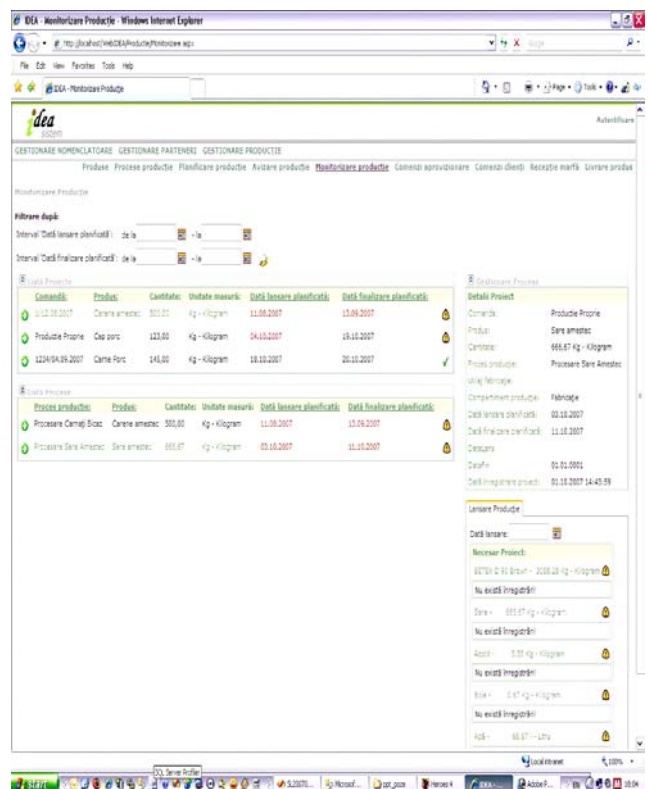

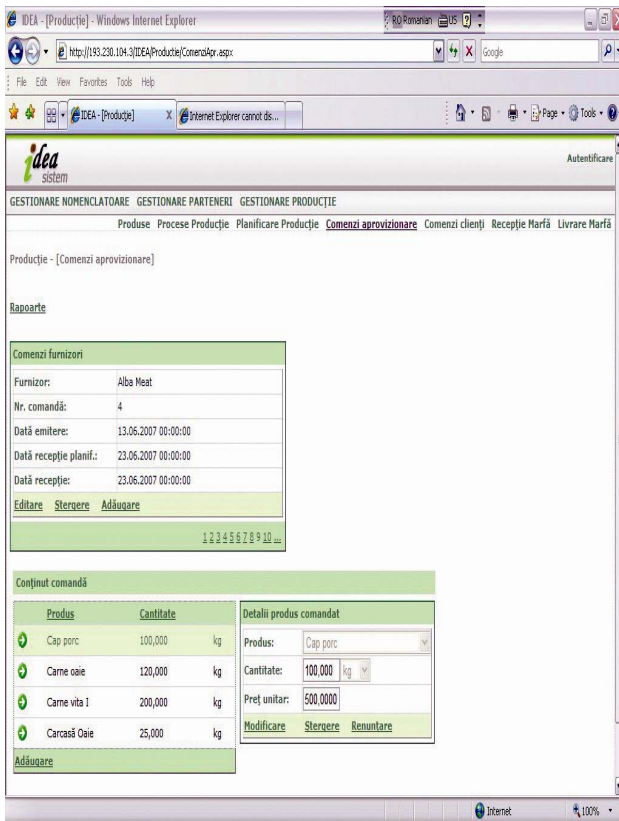Fig. 5 Production management

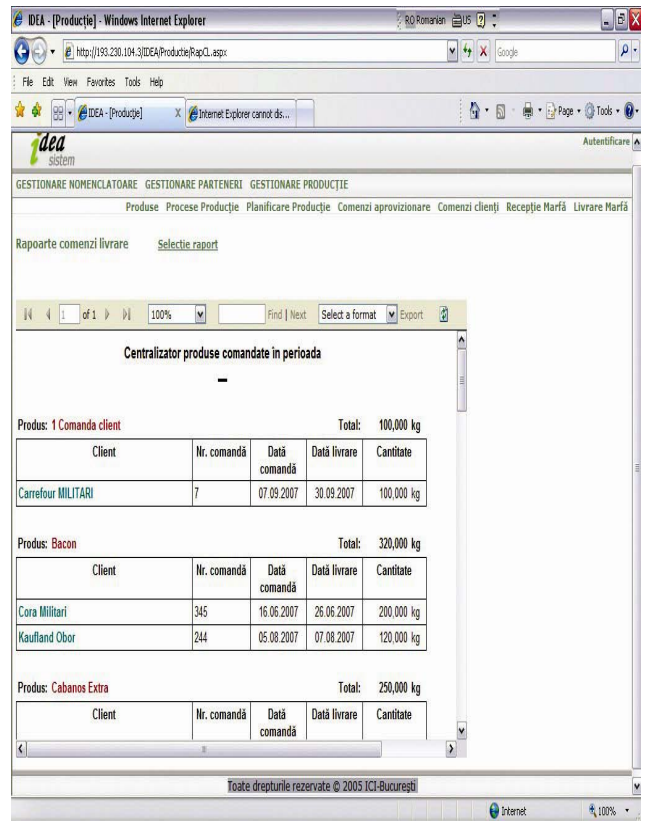Fig. 6 Production monitoring

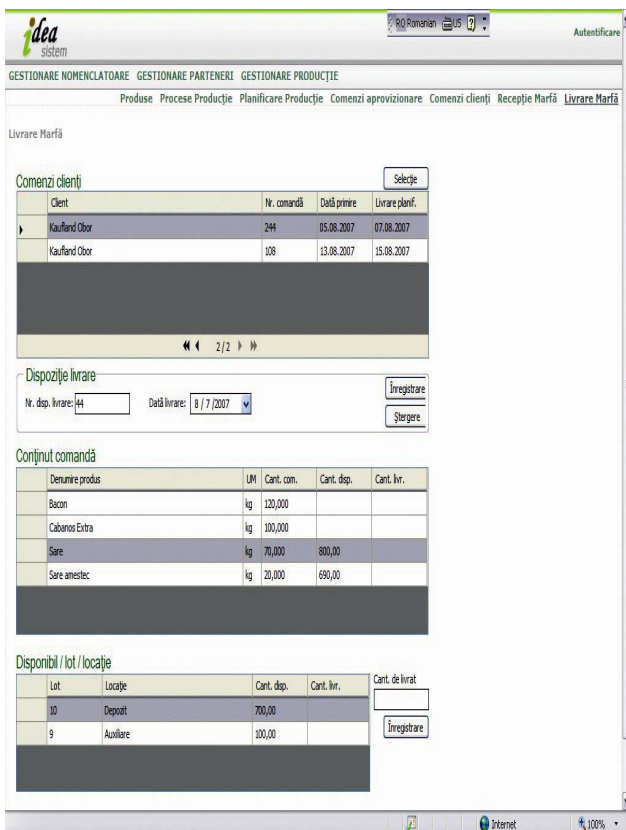Fig. 7 Client order management

Fig. 9 Client order report

Fig. 8 Product delivery

3.11 Provided facilities

IDEA:

- Provides data and reporting tools support for decision makers;
- Offers action plans and analyses of the processes based on data modeling;
- Gives the possibility to the actors from meet processing industry to examine the impact of made decision;
- Plays a key role in strategic manufacturing planning process at enterprise level;
- Gives the possibility to create profiles for the different types of actors involved in the enterprise processes;
- Manages the client orders and provider offers.
- Assists financial management of the meat processing enterprise;
- Provide solutions for data acquisition, storage and analyses and also for data access, given to the manager real time alternatives to take better decisions;
- Provides analytical and statistical analyses and prognoses.

3.12 Platform environment

IDEA platform environment is illustrated in the figure 10 being structured in two levels:

- Enterprise external environment that reflects the business partners of the enterprise and the relations with them;
- Enterprise internal environment that reflects the principal processes that are operational inside the environment.

All the flustered processes are assisted by the software components of the IDEA platform providing optimization solutions and scenarios for decision maker in order to increase the performance of enterprise management.
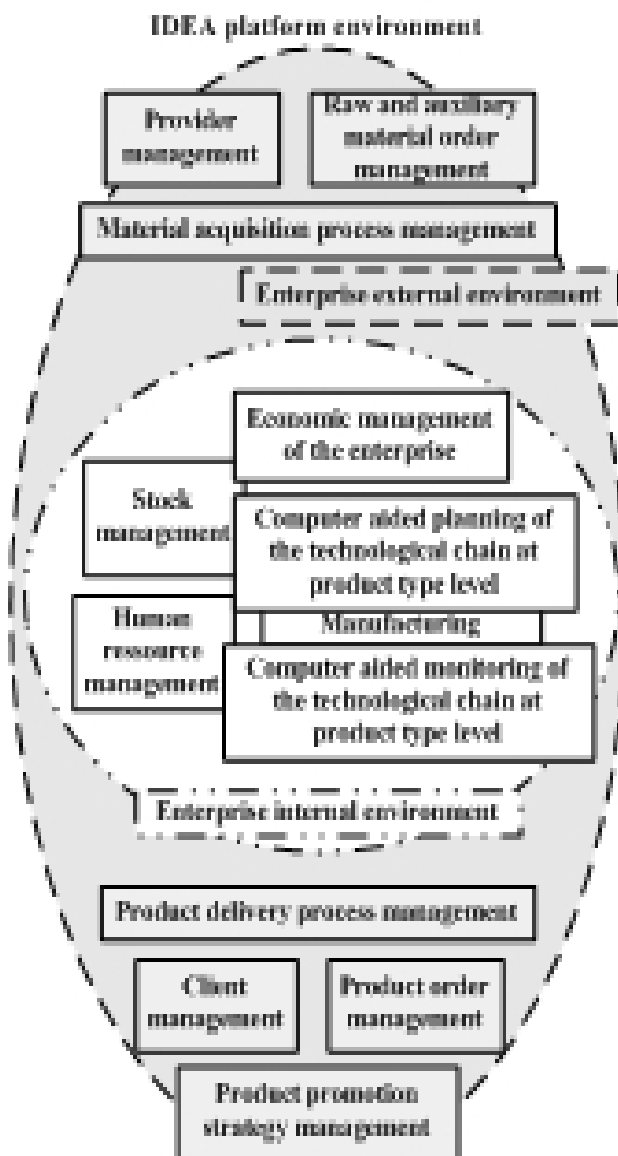

Fig. 10 IDEA platform environment

The relations with the partners are considered taken into account the dynamic modification of the business processes.

The principal processes of the enterprise external environment managed by the IDEA platforms are the following:

- Product promotion strategy management;
- Client management;
- Product order management;
- Product delivery process management;
- Material acquisition process management;
- Provider management;
- Raw and auxiliary material order management.

The principal processes of the enterprise internal environment managed by the IDEA platforms are the following:

- Computer aided planning of the technological chain at product type level;
- Manufacturing;
- Computer aided monitoring of the technological chain at product type level;
- Stock management;
- Human resource management;
- Economic management of the enterprise.

3.12 Technical requirements

Technical requirements to implement IDEA platform into a meat processing enterprise for the server level and workstation level are the following:

- Server:
  - Windows 2003 Server;
  - SQL 2005 Server;
  - IIS 5.1 or next versions;
  - Net Framework 2.0.
- Workstation:
  - Any operating system;
  - Web Browser: IE 6 or a next version or Modzilla FireFox.

4 Conclusion

The innovation elements created in the project and implemented in the platform are of two types, namely: *functional innovation* and *technical innovation.*

The *functional innovation* consists of the dynamic modelling of technological process accordingly with the continue modification of the product demand.

The technological flow is automatically built based on the situation of the raw, auxiliary and intermediary materials existing at the planning moment through the creation of a chain of

operations (characterised by inputs/outputs), so the inputs needed by an operation correspond with the outputs of its previous operation in the flow.

Accordingly with the available stocks, the technological flow for a certain product may vary from one planning to another. In the process of modelling and definition of manufacture technology planning scenarios, there are considered the quality parameters of raw materials, intermediary products and auxiliary materials in order to increase the finale product quality.

The *technical innovation* consists of the creation of dynamic interfaces contextually chained based on AJAX (Asynchronous JavaScript and XML) technology that allows the asynchronous updating of areas from an active server page.

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