MODELING THE PLANNING PROCESS OF THE UNIQUE PRODUCTS

Mihai-Victor ZERBES[1]

ABSTRACT: Still it can be said that the unique products occupy an important place in the industry even under the conditions imposed by globalization and mass production. Overall production of unique products is meant to make the link between research and industrial production. In this paper the author aims to present a way for conceptual modeling of the planning process of the unique products in order to optimize this process.
KEY WORDS: planning process, unique product, modeling, IDEF0

1 INTRODUCTION

In the production of unique product, the product is manufactured single or in few copies, according to specific needs. The achievements of such products require, general, labor intensive and involve a relatively long production cycle. This type of production is specific for example in shipbuilding and aviation.
Type of manufacturing unique products has a number of features (Badea & Bagu, 2014) such as:

- it runs a big variety of products;
- quantities produced are small, very small or unique;
- jobs are universal, served by a multi-skilled workforce in order to achieve a wide variety of technological operations;
- moving goods from one place to another is made in small batches of products;
- means of transport are used in discontinuous flow.

In this context the planning process is very important for optimization of production processes.
The challenge in the planning process is to make decisions that ensure the successful future of the organization.
Planning is a process that does not end with the creation of a plan, but continues with its implementation, taking into account that, in the implementation phase and control, the plan may require improvements or changes designed to make it more effective. Planning is an activity that is based on the decision-making and the management process that helps managers to organize, lead and control the organization providing a target and a direction for it.

[1]"Lucian Blaga" University of Sibiu, Department of Industrial Engineering and Management, Sibiu, Romania
E-mail: mihai.zerbes@ulbsibiu.ro

Therefore, the correct design of this process can be determined for industrial organizations and especially for those focused on manufacturing unique products.

To optimize the design process planning, specialists have turned to modeling and simulation.
This has greatly facilitated understanding of the planning process.
One of the methods used successfully in this regard is the IDEF0 method.
This is the method used by the author to modeling unique product planning process.

2 THE IDEF0 METHOD

This method (functional modeling method) was used because it allows a description of the features of the system by the decomposition of functions and classification of relations between functions (as inputs, outputs, and control mechanisms). In modeling using the IDEF0 method the author started from two methods of representing the process that is a representation table (matrix) and appealing to use graphical flow diagram.
This was used because the type of modeling structure allowed visualization of processes and information flows between them and understanding to the more detailed levels of modeling process.
It must be mention that this type of modeling does not allow predicting the final outcome of the process, for this is necessary to use the dynamic modeling for the investigated of processes.
IDEF methods are used to model activities and processes to support integration of information.
Instead of trying to analyze an organization with a single "super method", an attempt which generally leads to a complex and difficult to model, using IDEF methods serves as a useful tool effectively. IDEF methods are a set of independent methods prove useful when used in an integrated manner,

hence their name derives Integrated Definition (IDEF).
Original IDEF methods have been developed to improve communication between professionals to decide how their existing systems to be integrated.
IDEFØ (functional modeling The method) was designed to allow a description of the features of the system by the decomposition of functions and classification of relations between functions (as inputs, outputs, and control mechanisms).

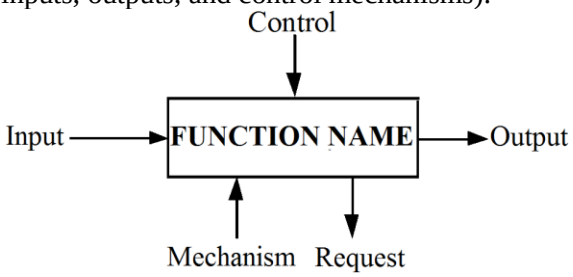

Figure 1. The IDEF Ø syntax (Lobonț, 2002)

IDEFØ can be used to model a wide variety of automatic and automatic systems: the new systems can be used IDEFØ beginning to define specific requirements and functions and then to design an implementation that meets these requirements, existing systems, IDEFØ can be used to analyze the functions they perform and record system mechanisms (means) by which these functions are performed.

Model diagram shown in Figure 1 is based on a simple syntax. Inputs are transformed or consumed to produce output function (Lobonț, 2002).

3 THE CONCEPTUAL MODEL

Models, which are presented below, have been developed based on the author's experience in industrial organizations.
The conceptual model developed (A0) presented in Figure 2 is split into two levels of detail.
This model, has also defined the following goal, objective and overall performance indicator, as follows:

- **Purpose**: Advanced planning optimization products in preparation for launching the ZERO series.
- **Objective**: ZERO nonconformances due to poor planning.
- **Performance Indicator:** number of non-compliant activities / number of planned activities.

Representation of each stage (A1 to A4) of this process was modeled such as shown in Figure 3.
Each of these steps, addressing the processes were decomposed into subprocesses and then modeled as follows (Figures 4 - 7).

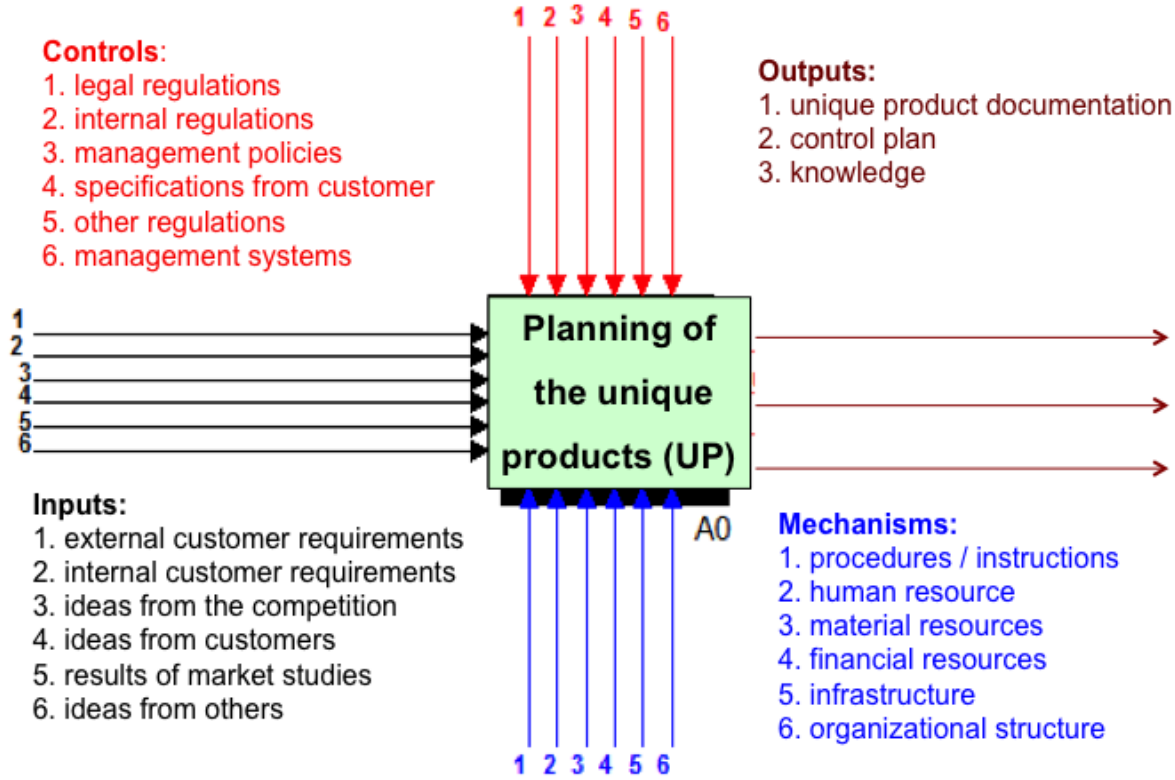

Figure 2. The conceptual model of the planning process of the unique products

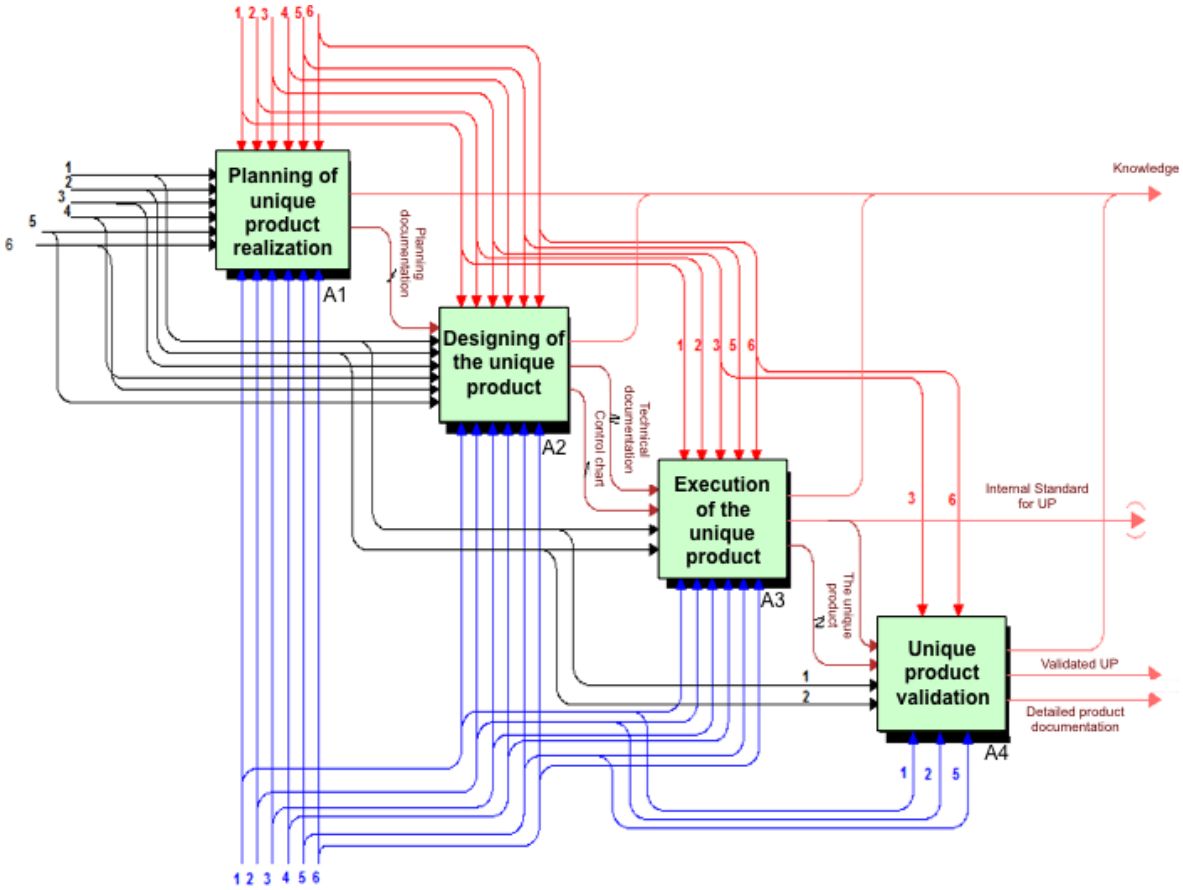

Figure 3. Stages of the conceptual model of the planning process of the unique products.

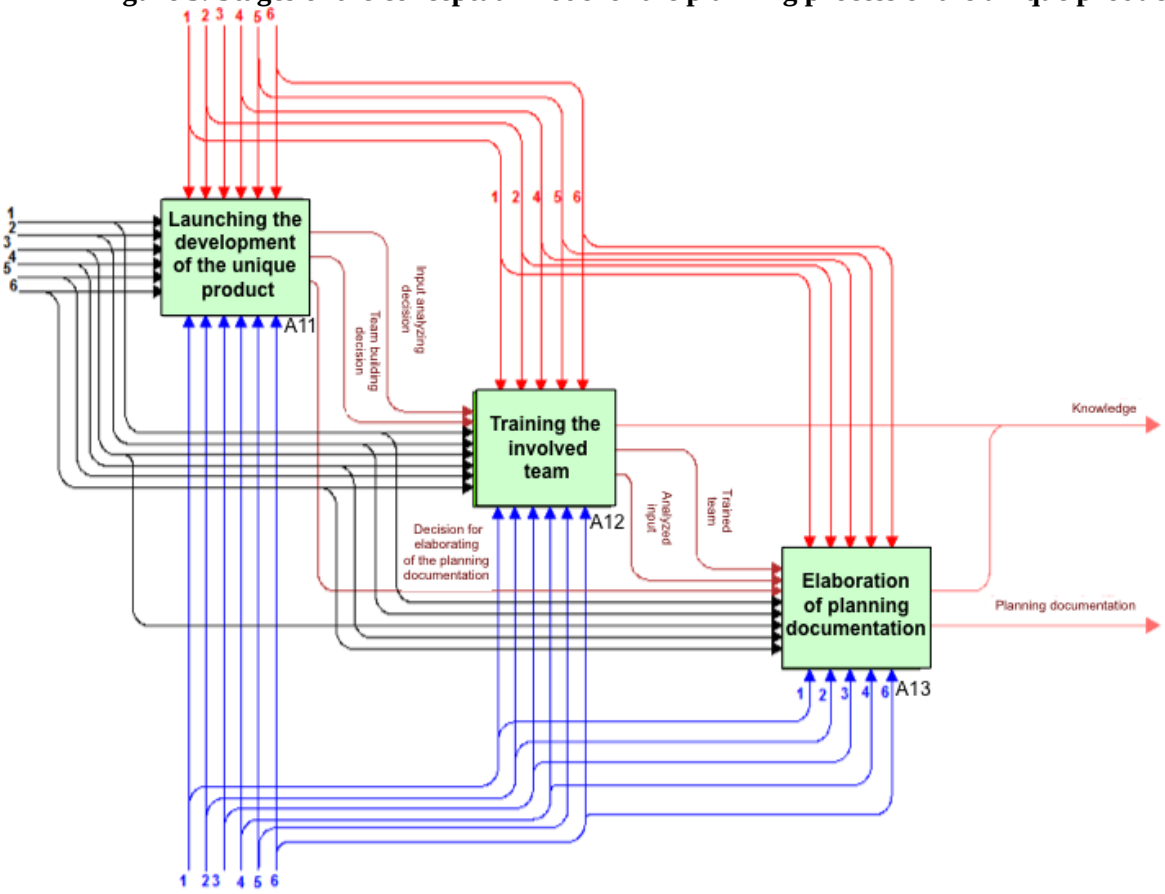

Figure 4. Planning of unique product realization

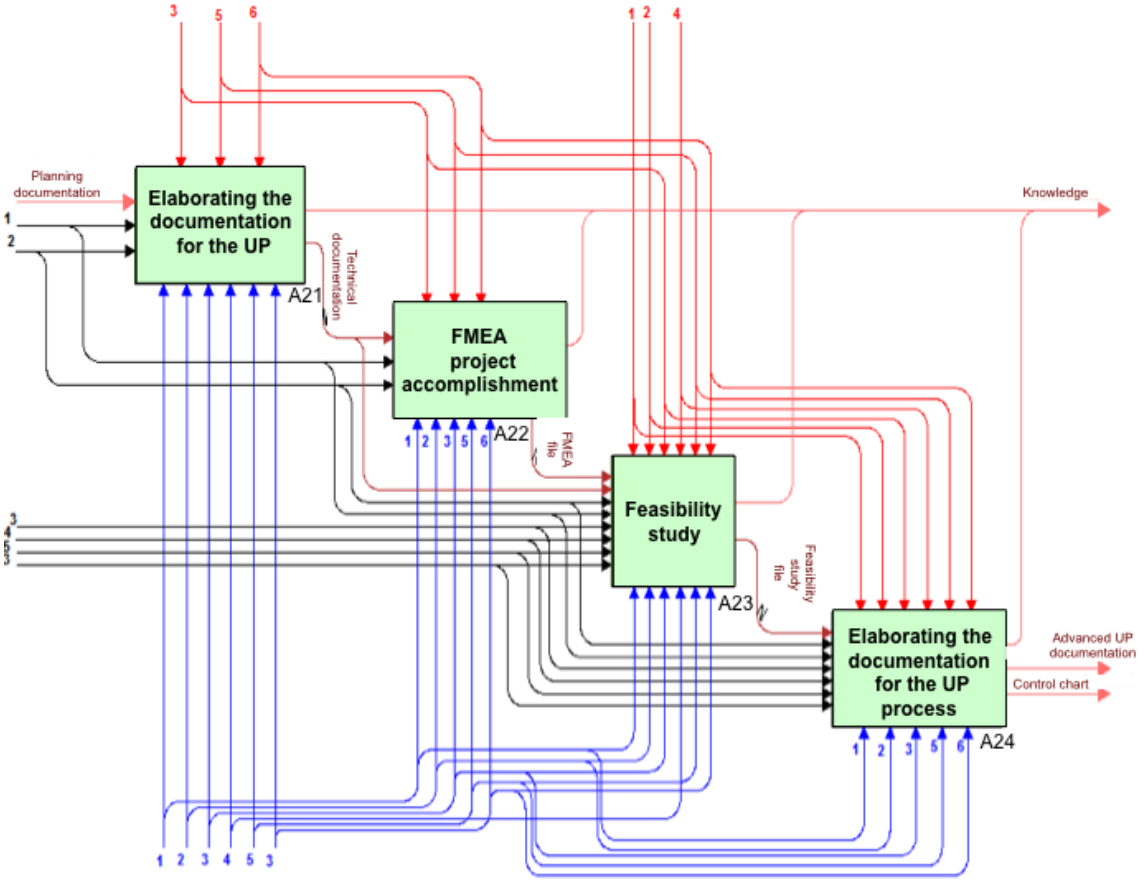

Figure 5. Designing of the unique product

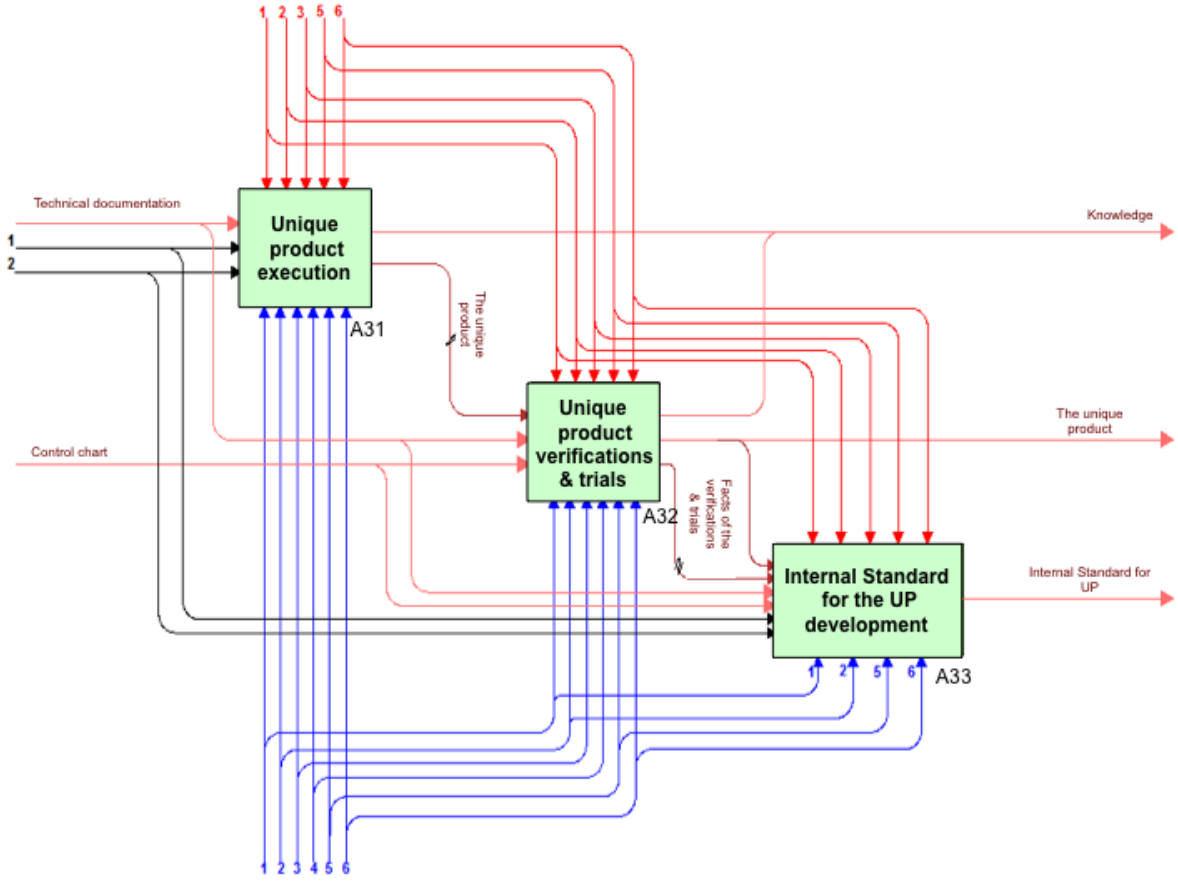

Figure 6. Execution of the unique product

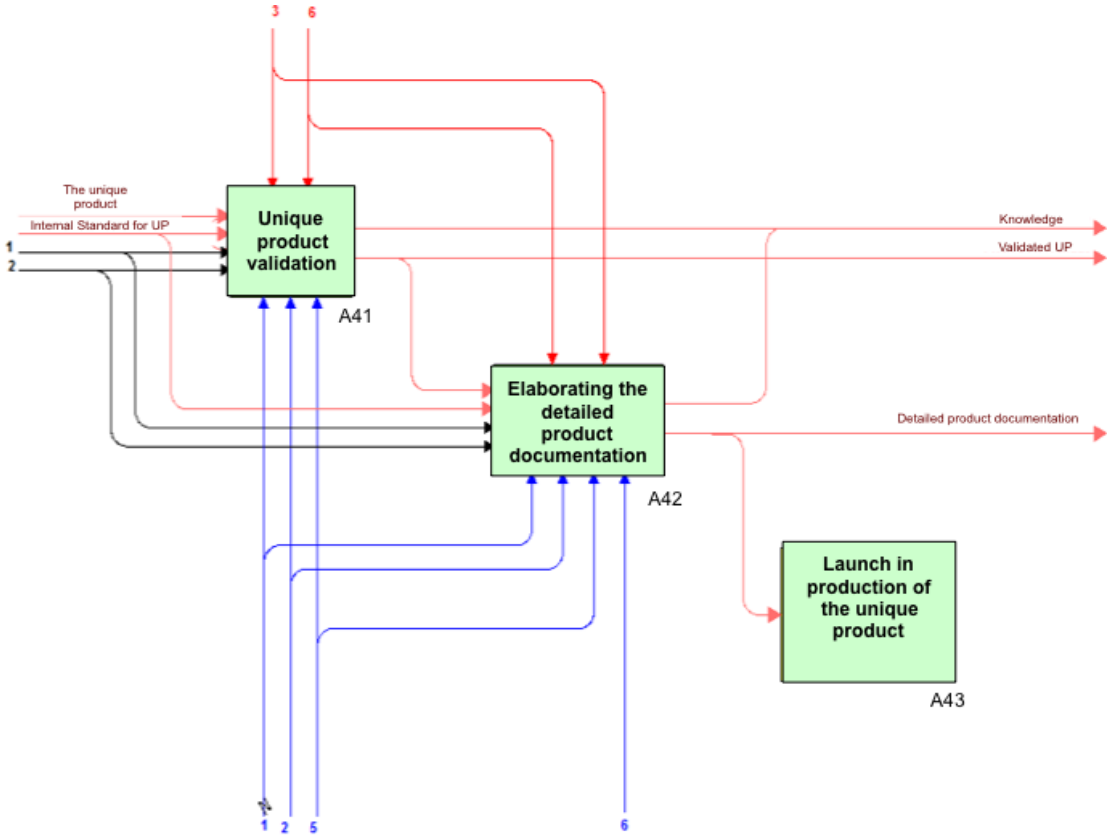

Figure 7. Validation of the unique product

Overview of the conceptual model is given by the detailed description of the steps presented in the matrix model of research, development of the unique products and related processes presented in table 1.

Expressed mathematically this matrix is presented as the following model:

$$M_{UP} = \sum_{i=1}^{4} S_i r_i \quad (1)$$

were:

$$\sum_{i=1}^{4} S_i = \sum_{j=1}^{7} I_j p_j + \sum_{k=1}^{7} I_{jk} p_k + \\ + \sum_{l=1}^{4} I_l p_l - \sum_{m=1}^{2} I_m p_m \quad (2)$$

accordingly, in this case:

$$M_{UP} = \left(\sum_{j=1}^{7} I_j p_j\right) r_1 + \left(\sum_{k=1}^{7} I_k p_k\right) r_2 + \\ + \left(\sum_{l=1}^{4} I_l p_l\right) r_3 + \left(\sum_{m=1}^{2} I_m p_m\right) r_4 \quad (3)$$

were:

- M_{UP} – the conceptual model of the planning process of the unique products
- S_i –model stages
- r_i – risk factor
- $I_{j,k,l,m}$ – performance index
- $p_{j,k,l,m}$ – weighting coefficient

It should be noted that ri - risk factors may vary from one organization to another depending on several factors such as experience, time priorities, organizational politics, etc.

4 CONCLUDING REMARKS

The dynamics of economic life, fierce competition and contemporary information explosion makes use of the concept of integration a necessary principle to be followed in order to be proficient in this environment.

Despite the limitations of impossibility perfect reproduction of reality with the tools, techniques and methods that have established, they have now become indispensable to modern top manager, the vast majority of routine decision-making activities, the total amount of information necessary decision-making process together with techniques search and retrieval of information and forecasting is greatly simplified by these models.

In addition, their continuous improvement, coupled with improved performance computers and specialized software, it provides increased take-up of segments of increasingly comprehensive forecasting and simulation activity designed to reduce time and costs of implementing the decision.

Therefore after implementing an planning model for the unique products can predict the appearance of two large groups of effects: direct effects and indirect effects of planning in general.

Some of the direct effects include: reduction of activities involved in the planning process advanced

in comparison to the number of independent models for planning activities related to advanced products and processes that, reducing labor costs resulting from the reduction of activities, reducing dependence makers expert services because this model results directly and creating a knowledge base that can call if necessary, active and direct involvement of stakeholders in evaluation and validation stages of products; big picture the forward planning process, increasing the efficiency of resources etc.

Of the main indirect effects we can remember: increasing quality processes, improving relationships with customers and other interest holders, increasing the number of knowledge workers.

Mention that the conceptual model will have limited ability to adapt to the speed of technological and human techniques and fear of change that can lead to human cases of resistance. Various categories of staff: managers, personnel planning and design experts, etc. can oppose the introduction of the model for various reasons: they feel that they are less important (status) and / or take a new responsibility (management) etc..

5 ACKNOWLEDGEMENTS

This work was supported by the strategic grant POSDRU/159/1.5/S/133255, Project ID 133255 (2014), co-financed by the European Social Fund within the Sectorial Operational Program Human Resources Development 2007 – 2013

6 REFERENCES

►http://www.biblioteca-digitala.ase.ro/ biblioteca/ carte2.asp?id=68&idb= *Sisteme de organizare a productiei*, Prof. univ. dr. Florica BADEA, Prof. univ. dr. Constantin BAGU

►Lobonț, L., (2002) Paper 1: Modeling and Process Management, Faculty of Engineering of the University "Lucian Blaga" of Sibiu, scientific coordinator Prof. univ. dr. ing. Oprean Constantin.

►***, (2012) Documentation Integrated Quality Management System-Environment Organization SC Continental Sibiu.

►***, (2008) Documentation Integrated Quality Management System-Environment Organization SC COMPA SA Sibiu, Revision 3.

►***, (2006) Documentation Integrated Quality Management System-Environment-Health and Safety organization of SC Deko-Rame SRL Sibiu, certified November 15, 2005, Revision 5.

Table 1. The matrix of the process of the products and related processes for conceptual model proposed

STAGE	ACTIVITY	OBJECTIVE	PERFORMANCE INDICATOR
Planning of the unique product realization	Launching the development of the new product	1.Increasing the product portfolio 2.Addapting product portofolio to the market requirements	1. (Existent product number + new products)/ Existent product number 2. Clients satisfaction leve
	Team building	1.100% covering project required specializations 2. covering the necesarry personeel	1. Involved specialists/ Necesarry specialist 2. Involved specialists / Provided personeel
	Training the involved team	100% instructed team members	Team members to be trained / Team members involved
	Inputs analysis, client specific requirements	Establishing all the product development	Established stages / Necesarry stages
	Plans elaboration emmergency preventive plans if applicable (if it is a case)	Zero non-conformities related emergency prevention	Number of non-compliance due to inadequate emergency prevention
	Elaborating the product planning quality graphic	All activites planning	Planned activities / Necesary activities
	Elaborating quality plan	Zero nonconformance establish resource needs and responsibilities	Number of non-compliance due to improper setting of resource needs and responsibilities
Designing of the unique product	Elaborating the documentation for the UP	100% implementation in the technical documentation of input data	Transposed input / necessary data
	FMEA project accomplishment	Estimation of project risk (criticality index C)	Real risk / risk estimates (Cr/Ce)
	Elaborating informations for purchasing the supplies	1.100% of requirements for compliance. materials supplied 2. Zero uninformed suppliers	1. Compliance requirements for incoming material 2. Number of suppliers uninformed
	Elaborating the documentation for UP trials	Development documentation for tests UP	Preparation of all necessary testing equipment
	Background note Development / Feasibility Study	Product feasibility analysis	Confirmation or rejection of product fesability
	Elaborating the documentation for the UP process	Preparation of all necessary equipment for the prototype manufacturing process	Equipment ready for manufacturing of UP / Equipment required for manufacturing of the UP
	UP Control Plan Development	Identification of all elements necessary for compliance monitoring and control planning	Monitoring and control elements developed / Monitoring and control elements necessary
Execution of the unique product	Checking supplied products	100% of requirements for compliance. materials supplied	Purchased product / product request
	UP execution	100% framing in the scheduled consumption	Achieved consumption / planned consumption
	UP verification	100% framing into the quality parameters	Qualitative parameters achieved / qualitative parameters plan
	UP trials	100% framing into the technological parameters	Achieved technical parameters / technical parameters plan
	Internal Standard-Product Development	Zero non-conformities due to manufacturing process of the new product	Number of non-compliance due to failure of new product manufacturing process
UP Validation	UP	100% fulfill requirements of product documentation	Requirements fulfilled / planned requirements
	Elaborating the documentation for launching in production of the UP	Prepare all necessary equipment to manufacture the UP	Equipment ready for manufacturing of the UP / equipment required for manufacturing of the UP