THE APPLICATION OF DYNAMIC SIMULATION IN THE DESIGN OF WAREHOUSES OF INDUSTRIAL ENTERPRISES

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Abstract

This paper deals with the knowledge of the author of the application of dynamic modeling in assessing proposal warehouses (input, output and assembly) of an industrial enterprise in terms of changing customer requirements. Usage of dynamic modeling can capture the complex binding process (material, financial and information) systems designed, comprehensively monitor their dynamic and stochastic factors (internal and external), including a set of quantitative indicators and parameters, and thus capture the effect of process parameters and evaluation indicators proposals. The proposed project is a modeling and optimization of project alternatives, risk analysis process and empirical analysis of the sensitivity of the project variables that allow to obtain an important information essentials (and often detailed) documentation for a serious assessment and verification of project proposals. The result of dynamic modeling is an overview of the project design options (transport, handling and storage) according to established criteria, indicators and quantitative risk analysis protocol.

Keywords: Dynamic simulation, project, warehouses (input, output and assembly), indicators, evaluation criteria

1. INTRODUCTION

The issue of storage is associated with the existence of input materials inventory, work in progress as well as finished products after manufacturing processes. Warehouse management in industrial enterprise has an important function between production and usage, contributes to the smooth transfer of material input into production, and protects places of work in progress and finished products in stores, thus the downstream part of the supply chain logistics industry business. The main task of the storage volume leveling and alignment of different sized material flows.

Usually are referred to the three basic functions of storage:
- transfer of products (receipt, transfer or storage of material, assembly of materials according to the order, reloading product, delivery of products),
- storage of incoming materials, semi-products and products delivered (temporary storage, temporary storage),
- transmission of information (as raw material, material condition in the motion, location inventory of inputs and outputs supply, customers, staff and the use of storage space, etc.).

In the production process in the production of industrial enterprises there are some stores:
- input (supply)-designed to maintain inventory of input materials,
- buffer stores manufacturing and assembly - for stockpiling between different stages of the production process (e. g, different capacity profiles),
- sales (output) stores - intended to cover timing differences between production and sales processes.

Warehouse logistics (warehousing) is integrated into all areas (processes) and logistics business and is closely focused on inventory planning activities (processes).
The project proposal envisages the company industrial warehouses and solve the following problems:

- evaluation of stored range and its characteristics (shape, size, weight, packing ...),
- evaluation of the stored amount of input materials, semi-products and products delivered - all kinds of inventory optimization,
- evaluation of alternatives ways of storage of all kinds of resources - selection of storage units, storage and handling equipment,
- capacity sizing of storage types,
- proposed method of receipt and distribution of materials,
- design system of registration and tracking inventory,
- organization and management of various types of industrial storage business.

First proposal process design warehouse industrial company mainly takes into account the links between material and information flows. Because warehousing is a part of the supplier-customer supply chain ensuring material flow in production and circulation processes using not only information, but also finance, it is important to take into account this dimension and in their design. The links between the three flows, material, information and cash flow account dynamic simulation model.

Further, in the present business environment is characterized by turbulences, so it is the unpredictability, frequency and speed of change that create threats and opportunities of industrial enterprises, which are automatically reflected in the operation of warehouse management. Also the growing demands and needs of customers on products supplied (higher added value, shorter delivery times, delivered wide portfolio of products, shorter product life cycles, demand variability, and others), again causing industrial business opportunities, but also threats to the enterprise must agility to respond to and must be prepared to design effective and efficient measures, preferably already in the project material management.

2. DYNAMIC SIMULATION OF WAREHOUSE MANAGEMENT COMPANY

Dynamic simulation afford to dynamic, stochastic, holistic, variant evaluation and optimization assessment of complex bonds (informational, financial, material) processes of the project, including the impact of process parameters on the evaluation results (indicators) of the project and thus improve the quality of the proposal, which is evaluated variants of processes, procedures and resources necessary to achieve the objectives and results of the project [own definition].

The author has several years of experience and knowledge in simulation process interdependencies of processes proposals industrial enterprise. Currently is using the simulation means Project Management Forecast (neural networks), reflecting processes in simulation models proposal warehousing company:

- a complex assessment of the interrelations of all project processes,
- the impact of the immediate state of global and local factors (information, material and financial) to carry out the process and progress of each project,
- variability modeling processes (including transport, handling and storage),
- modeling cycle processes (including transport, handling and storage),
- modeling of branching processes (including transport, handling and storage),
- process optimization variants of the project (multi-criteria evaluation process),
- a complex risk analysis process of the project,
- the aggregate risk assessment process of the project (the probability of risk processes and levels of damage),
- quantitative and qualitative assessment of performance indicators and process efficiency of storage and storage management company,
- empirical modeling of sensitivity analysis process indicators project,
• independently repeated process simulation project,
• modular approach to modeling processes of the project material management,
• multiple projects simultaneously modeling business,
• simulation project material management during his implementation.

Using of dynamic simulation in the design of project management creates some certainty that the planned tasks, procedures and processes will be required in the term actually implemented, the animation process during the project can serve to explain and help predict behavior more thoroughly verify the achievements of the project given process variations (turbulence business environment, growing demands and needs of customers). At the same time this way reveal risks in the processes of the project prior to its implementation. Dynamic simulation models of proposals warehousing company are in fact "test company" on the computer, where are verified and numerous different variants of the proposed project alternatives process stockholding company.

Risk analysis is one of the functions of the simulation optimizer Project Management Forecast. The result of the analysis is a general protocol of the risk analysis process of the project, which contains comprehensive data on all study outcomes (indicators) of the project following a comprehensive evaluation of the performance and efficiency of the processes of the project. Which means that are available for all statistics tracking data, the minimum, maximum, average and current value. The various parameters of the project process are available charts and histograms that display the result set of values in the intervals studied. The simulation output is also monitored waveform window that is used to track the values of selected process parameters of the project over time. Simulation optimizer allows to view all the process parameters that were monitored. This complex risk analysis process allows the project often uncover hidden risks and whose removal is time consuming and is often associated high cost. Importantly, it is possible to take into account the dynamic simulation and operational and strategic changes in the procedures and objectives of the project and its impact on changing values of process parameters of the project, which substantially affect the value creation and risk damage risk processes of the project. The great advantage of dynamic simulation is that the aggregate value of the potential risks of the project processes that authoritative mapping "real potential" states a possible risk of the project value.

Holistic dynamic simulation model of the processes of project material management business (including the processes of transport, handling and storage), provides an assessment of its processes in terms of each of the three active flows also sources of project risk processes, that takes into account the combined effect of risk sources, which are characterized more precisely Step projects warehouse management processes. Such a comprehensive evaluation is carried out using a set of variables and indicators of strategic and operational level project management processes, warehouse management. It provides a holistic view of the possible states of the process for taking into account their interdependence and portability risks monitored indicators of project material management process (a structural framework, potential, productivity, efficiency and quality of delivery of services, costs, financial as well as others). Continuously during the risk analysis process of the project material management company are recorded data of selected indicators to show their waveforms. It is necessary to emphasize that this is a very long series of warehouse management processes and related monitoring indicators, which can be very difficult to holistically analyze and evaluate other available methods.

Through these options, the simulation means Project Management Forecast simulation outputs are achieved aggregate risk analysis processes, warehouse management company and notice very transparent way, providing information on numerous occasions, but also threats in summary form. E. g. achieve very bad condition (threat) some warehouse management processes is also reason to reiterate the necessary number of other independent simulation trials currently prevailing model, so you either confirm or correct example.
reached a state of emergency by simulating the processes of warehouse management. These are achievements that provides only a dynamic simulation model.

3. RESULTS FROM THE APPLICATION OF DYNAMIC SIMULATION WITH ANALYSIS AND EVALUATION OF PROPOSALS WAREHOUSE MANAGEMENT COMPANY

Application of dynamic simulation models for the analysis and evaluation of project proposals stock holding enterprise requires the use of the process approach and the hierarchical structure for the proposal stockholding company. Thus, it is planned to define the processes of the project (including variants), their logical design and the series, including material, financial and information flows, identify all the necessary resources, the criteria to optimize the efficiency and performance of storage management, but also a set of indicators intended results warehousing.

The result of the application of dynamic simulation of the review process of project alternatives in terms of defined criteria, a documented numerous charts, bar charts, tables, protocols, risk analysis and follow-up data that are needed for serious decision making, and quality project management.

I would like to focus the attention to the third dimension of dynamic simulation and financial flows. This flow in relation to the other two material flows and information modeling provides holistic business continuity management processes, warehouse management business. It is actually a process that identifies potential impacts of events (uncertainties), threatening warehouse management business processes, which allow also to define the basic framework of deepening skills on such events (uncertainty) efficiently and effectively.

Analysis of the impact of events (uncertainties) warehouse management processes to:
- identify of critical processes in project design,
- identify of potential impacts of critical processes (histograms, charts, graphs, reports),
- identify and evaluate potential risks, warehouse management processes (histogram, charts, graphs, reports).

Holistic business continuity management processes, warehouse management company could be due to the fact that the simulation facility Forecast Project Management enables the “real” time to implement financial income and expenses and immediately reflected in the observed values of indicators (outcomes) of the project, for example, value of cumulative costs, values of cumulative cash - flow, cumulative sales value, discounted value of cumulative costs, values of cumulative discounted cash - flow, or in any other financial indicators of the project.

The application of this method can be a relatively simple way to determine which events affect most processes, project analysis results and thus which should be paid attention to in order to achieve the desired results (indicator values) project. If we analyze the financial risk of the project design is suitable to monitor fluctuations in the values obtained cash - flow with variation / change any of the events, processes the project. These events processes that most affect their tolerance of the resulting cash - flow, are the most dangerous event of the project. Knowledge of risk events in the design phase of the project allows the company to design effective measures that lead to the minimization of possible deviations of adverse events to project and create the conditions to achieve stable values projected results (indicators) project.

Control of continuity management represents a new holistic process of identification the potential risk impacts for process of projects for the company which provides space for effective response and recovery by taking into account the interests of stakeholders of the project company. These draft measures make up an integral part of Administration and Management company by legal and operational standards and regulations.
Stakeholders and project management are especially interested in how the implementation of the project in the future will ensure achieving the objectives and results of the project, it means fulfillment the planned output, financial indicators (intended results), including return, what will be cash - flow, net present value of the project, what risks there may be processes of the project with a time horizon, for example more years after the completion of the project. What does it mean to verify the achievement of the expected results of the project in the future taking into account the operating conditions for cash - flow of the project, which is important in terms of its operability. Because the implementation of the project if they are unable to generate sufficient funds to meet commitments, the project investor enters into liquidity risk. It's a risk when you can not meet the payments due. This may ultimately lead to new loans, for example in the rate of interest. Liquidity risk is very important because most loans and credits degrade position of the company.

![Empirical analysis dependence of selected indicators based on proposal](image)

**Source:** own

Successful management of liquidity risk depends on the successful cash management project. Delay in completion of the project and problems with introduction into operation and problems of input supply and receipt of production can lead to unmet cash inflows and outflows and the liquidity risk. Therefore, it is necessary to model the cash - flow for discounted and undiscounted inflows and outflows of funds.

The application of dynamic simulation to analyze and evaluate proposals for warehouse management company provides a full range of holistic business continuity management, including liquidity risk of the project. Simulation means extra Forecast Project Management enables you to perform empirical analysis of selected indicators based on project design (Fig. 1). It means that for one main indicator can display graphics and six dependent variables. Six variants of these permutations provide a quite good overview about plastics, everything what could happen. Using these variants is possible to compare the magnitude of the change as the results of the evaluation indicators, for example risk factor and also so-called check. Disruptive value, respectively resistance to the associated risk. This value represents maximum possible change of risk factor for maintaining the effectiveness of the project design process.

### 4. CONCLUSIONS

Applications of dynamic simulation to analyze and evaluate proposals for warehouse management company confirmed its validity and benefits resulting from the subsequent successful application for new projects in practice.
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LITERATURE


