Education is not only about the transfer and absorption of information but it also involves the active interaction among students and between student and teacher. There are many situations when it will be effective and efficient to use electronic tools to support and deliver education. In these circumstances it will be vital that the full education experience is delivered, including the opportunity to interact and collaborate.

11. Prospects for the Future. Mathematical visualization, like other areas in the rapidly developing field of visualization since, is still defining itself. Many of these techniques can be adapted to the emerging virtual reality medium as interactive performance continues to improve. There are clearly many areas of development that are appropriate for the participation of computer scientists with skills in interactive interface design, computer graphics, efficient algorithms, and perhaps data management. One can also conclude from looking at the images, graphic arts and design skills also have a unique role to play in improving the quality of graphical communication.[1]

12. Conclusion. Today, there is a live activity in the area of producing mathematically oriented computer graphics animations that are shown at computer graphics conferences and mathematics seminars. It is time to consider teaching a modern, reform calculus course that is a lean and lively group of topics from a dynamical systems perspective and uses technology to treat most topics graphically, numerically, and analytically.

Using animations add dimensions of motion and mobility to images in a presentation. Dynamic visual imagery greatly enhances a presentation's value and, as with the case of 3D animations, provides a simulation without sacrificing the speed of the presentation or disk space. Current state of bandwidth still limits the use of 3D animation in teaching mathematics to its fullest potential.[2]

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AN ARCHITECTURE FOR OLAP-BASED ENTERPRISE-LEVEL DECISION SUPPORT SYSTEMS

У статті пропонується розробляти стратегії розвитку підприємства на підставі поліпшення ринкової позиції підприємства та фінансового положення. Для розробки стратегії розвитку використовується система підтримки прийняття рішень. Пропонується використовувати OLAP- технології для інформаційної підтримки алгоритмічних модулів.

In this work it is considered that the strategic development of an enterprise is aimed at the improvement of the market position and financial status. Decision Support System for elaboration of development strategy of an enterprise is used. Suggested information support for algorithmic modules realization is based on OLAP technology.

1. Introduction. At present the strategic management of an enterprise becomes more and more topical. Market competition increases, the companies implement new innovation decision to expand their influence on the market of goods or services. This is leading to necessity of quick and due-time reaction to action of the competitor, as well as to necessary analysis of development strategy and its possible change. Experience shows that in modern environment it is impossible even to survive without reorganization of the management system of an enterprise on the principle strategic planning, not mentioning a successful operation. Including every component of the social reproduction system - production, distribution, exchange and consumption - the strategic planning turned out into the main moving force of a social reproduction. The monitoring system is widely used as well as the analysis of external and internal environmental factors; found as a result of analysis of possible threads to an enterprise, also its strong and weak sides serve as the information basis for setting and correction of strategic aims and ways to achieve them [1].

2. Strategic management of an enterprise. Strategic management is considered to be the dynamic aggregate of interdependent management processes (fig.1). There is a stable feedback. This is the main peculiarity of the strategic management structure.

In this work it is considered that that the strategic development of an enterprise is aimed at the improvement of the market position and financial status.

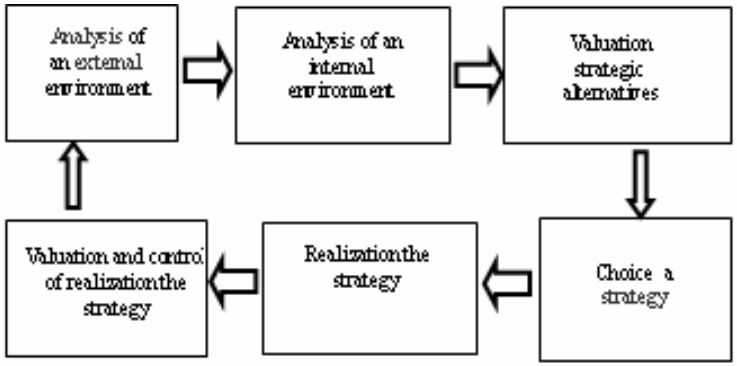

Fig. 1 Strategic management process

Similarly to Porter rhomb it is suggested to consider a rhomb of an enterprise competitiveness, consisting of four components: goods, finances, staff, and marketing (Fig.2). Let us review the process of forming a development strategy of an enterprise.

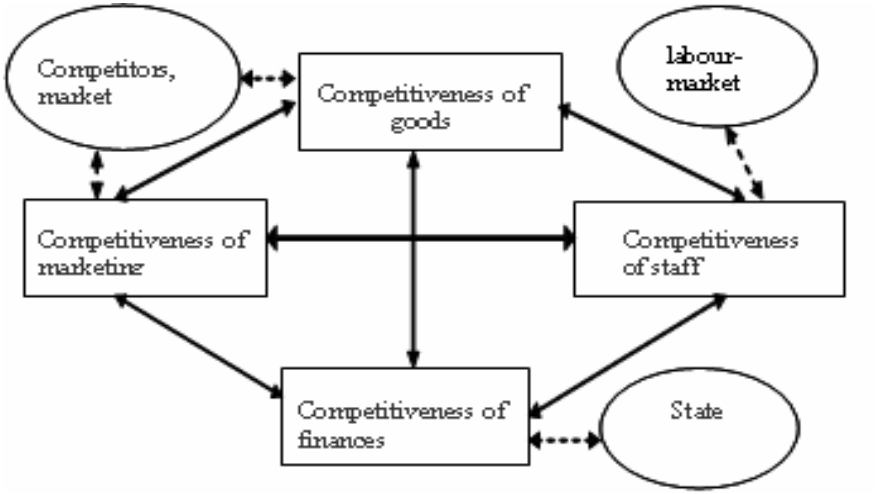

Fig. 2 Enterprise competitiveness rhomb

Stage 1. Identifying aims of the research.

Stage 2. Data collection.

Stage 3. Evaluation of enterprise competitiveness in respect of four components: goods, finances, staff, marketing.

3.1 Competitiveness of goods. An integrated method evaluation of competitiveness of goods, is used, based on application of integrated indexes or on the comparison of the specific useful effects of the analyzed production and a standard [2]. We choose as a standard an ideal product or a competitor's product. For an enterprise with the product mix an integral indicator of competitiveness of goods should be used, that takes into account share of each product in the product mix.

3.2 Competitiveness of finances. It is possible to use different models, for example, Altman's model based on usage of financial coefficients.

3.3 Competitiveness of marketing. Methodology of accounting of marketing potential characteristics is used. It takes into accounts commercial activity characteristics (gross revenue, marketing costs, gross expenditures) [3]. Marketing potential includes estimations of: marketing researches; marketing information system; segmentation of target market; an enterprise production policy; pricing; merchandising; personal sales; advertising; sale stimulation; formation of public opinion.

3.4 Competitiveness of staff. A methodology taking into account the expert estimation of a competitive advantage of staff is used [2].

Stage 4. Calculation of the integral index of competitiveness. The integral competitiveness index is often determined as[4]:

$$K = \sum_{i=1}^{N} W_i K_i,$$

Ki — particular competitiveness indexes of individual enterprise activities, *i=1..N,*

Wi — weight of individual indexes in general sum.

One variant of using the method [5]:

$K = 0{,}15K_n + 0{,}29K_f + 0{,}23K_м + 0{,}33K_m$,

K_n —a coefficient of competitiveness of personnel; K_f — a coefficient of competitiveness of finances; $K_м$ — a coefficient of competitiveness of marketing; K_m — a coefficient of competitiveness of goods.

Coefficients 0,15; 0,29; 0,23; 0,33 were defined by expert method by the way of logical comparison [5]. In work [4] the modified calculation of an integral competitiveness index is presented as:

$$K = K_m^{W_1} \times K_f^{W_2} \times K_n^{W_3}$$

In this stage it is necessary to determine the interdependency of the competitiveness indices. For this it is necessary to accomplish the integral analysis of the integral competitiveness index of an enterprise. For a small enterprises it

is possible to limit oneself with the simple factor analysis but for bigger enterprises a multiple-factor analysis is necessary. It is also recommended to make flexibility analysis of competitiveness indices. Similarly to a cross flexibility of demand it is suggested to calculate the rate of competitiveness flexibility of goods, finances, staff, marketing. The cross flexibility of competitiveness of goods and finances can be calculated in the following way:

$$E_{m/f} = \frac{K_m}{K_f} \cdot$$

Indices of a cross flexibility of competitiveness of finances and goods, staff are calculated similarly. The analysis shows how components of competitiveness of an enterprise can change the integral competitiveness index. Showing components interdependence it is possible to develop a plan on improvement competitiveness components of an enterprise.

Stage 5. SWOT- analysis. At this stage the report (SWOT matrix) resulting from stages 1-4. Then the comparison with competitor (standard) data is held and directions of raising competitiveness of an enterprise in whole and on individual components of competitiveness of an enterprise are developed

Stage 6. Designing a development strategy of an enterprise. On basis of the SWOT- analysis on competitiveness components strategies of individual directions are developed.

6.1 Development a strategy on product improvement. The model «attractiveness – competitiveness» (Mac Kinsy matrix) is used. It allows to define market attractiveness, competitiveness of an enterprise, priority at resources distribution etc.

6.2 Development of a strategy on finances improvement. At this stage recommendations on improvement of individual financial indices indexes and financial coefficients are used. It is recommended to carry out a preliminary factor analysis of the enterprise profit. It is allows defining more «influential» costs and interdependency of the most important financial coefficients.

6.4 Development a strategy on marketing improvement. Recommendations on introduction of marketing strategy are used.

Stage 7. Elaboration of development scenarios of an enterprise. Prediction of external environment of an enterprise (pessimistic, optimistic and realistic) is carried out. For different variants of prediction they develop possible scenarios provided that the status of the enterprise does not change. Than probable development scenarios and desired scenarios are compared. It possible to use the method of hierarchy analysis (Saaty method) and other approach are used.

In paper [5] the system optimization approach for construction of development trajectory is used. The market research will allows to construct the directive area that we will review from the point of view of competitors and

consumers. The results of analysis of the enterprise production activity will allow to construct the enterprise area defined by constraints of existing enterprise resources. To solve the stated problem, the enterprise management should consider two development strategies:

-a strategy of entering the market (i.e. presence in the market);

-a strategy of the market expansion segment (the greatest possible capture of the market).

Two development trajectories correspond to these two strategies. The first trajectory is characterised by minimum expenses related to the minimal increase of production potentiality that will enable production. The second trajectory assumes the maximum increase of the production potentiality that will allow maximum production for the maximal capture of the market.

Stage 8. Elaboration, estimation and choice of investment projects that realize the development trajectory (a development scenario).

Stage 9. Determination of the financing scheme of the investment projects of an enterprise development. [6]

Stage 10. Realization, evaluation, control of the strategy implementation.

3. Strategic decision support system. Decision Support System (DSS) for elaboration of development strategy of an enterprise is used. DSS is the aggregate procedures on data processing and opinions that help manager in a decision making process. It is generated using mathematical models and algorithms.

Figure 3 shows DSS as the “Complex Strategy" program. model in UML notation was implemented.

The algorithmic module consists of the following blocks.

1. Block «Competitiveness»: calculation of an integral index of competitiveness on basis of four components: products, finances, staff, marketing.

2. Block «Prediction»: determination of predictable values of sales for a strategic period. Expert methods, statistic and of neural network technologies are realized.

3. Block «Expenditures»: Determination of cost function using regression analysis and a prediction of cost behavior in the future.

4. Block «Profit factor analysis»: determination of the type of the most influencing costs and coordination of these costs with the enterprise strategic plans.

5. Block «Development trajectory»: the development trajectory represents the quantity of monetary resources allocated on each interval of the time, providing necessary capacities for the planned throughputs. Having generated a strategy of the enterprise, the administration can choose one of the development trajectory variants.

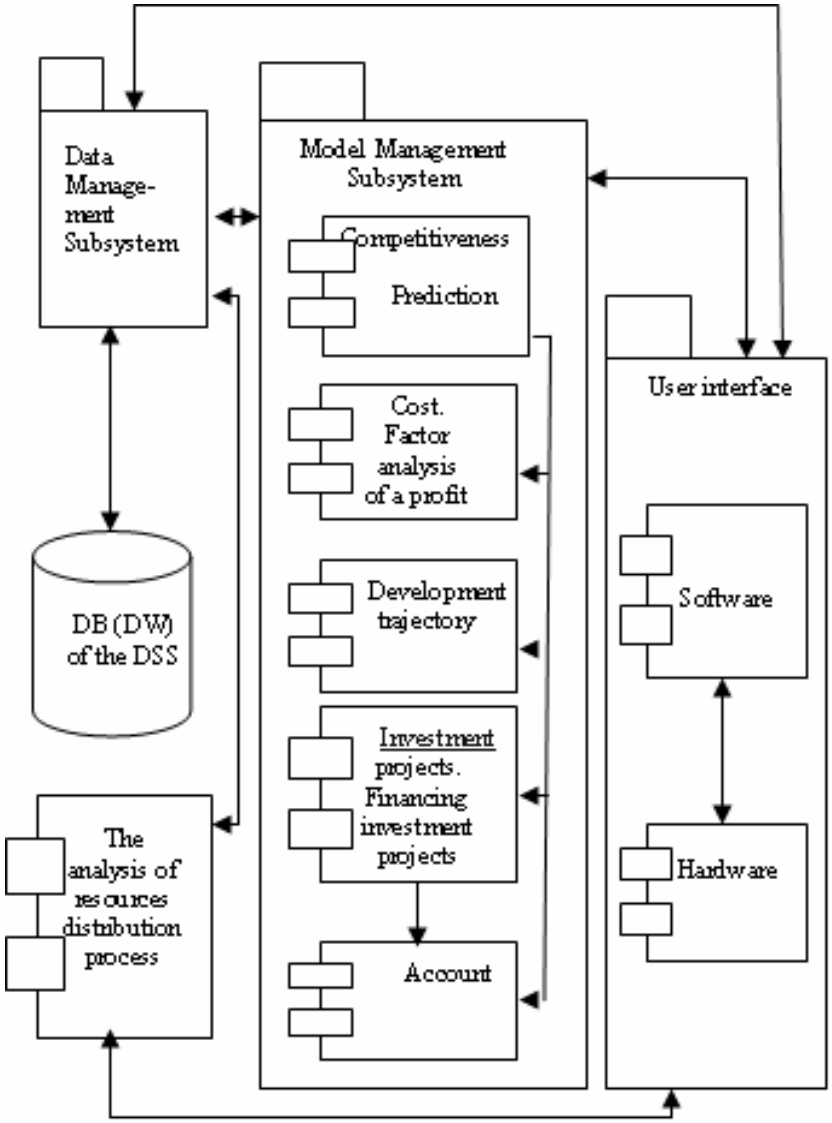

Fig.3 Enterprise resource management DSS

6. Block «Investment projects». The estimation of investment projects is considered in two aspects. The first aspect is the estimation of the efficiency of the investment projects. The second one is evaluation the risk of the investment project.

7. Block «Financing investment projects»: elaboration of different financing schemes for the enterprise investment projects.

8. Block «Reports». Different reports on individual stages of the strategic process are created.

Each of the listed blocks can be used independently. The blocks are oriented for solving local problems. So each block can correspond to decision support system on each direction. For example, for solving local finance problems a database has to keep big volume finance information that is not used for strategy solutions.

It is offered to create a local database that keeps necessary information for realization of blocks of the DSS algorithmic module. For management solutions on enterprise development strategy it is offered to process aggregative information on directions (goods, finances, staff, marketing) in an analytic database (Fig.4).

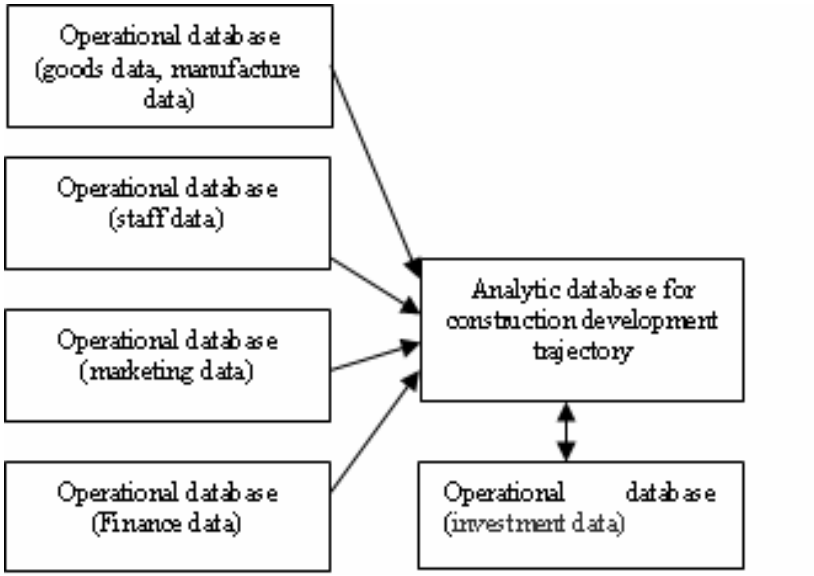

Fig.4. Schematic presentation of architecture of an analytic information system

Analytical Processing. OLAP technology is a tool of the DSS design. Today OLAP mechanism is one most spread methods of data analysis. As opposed to classic techniques, the database inquiry is formed not on basic of strictly specified forms but with the help of flexible unregulated approach. OLAP provides revelation of associations, appropriateness, trends, classification, generalization or detalization, making forecasts. OLAP gives a tool for management of an enterprise in real time [7]. Today a whole number of different OLAP systems is available: ROLAP (relational OLAP), MOLAP (multidimensional OLAP) — Oracle Express, Essbase (Arbor Software), MetaCube (Informix) and other.

There are two principal approaches: Multidimensional OLAP (MOLAP) realizes mechanism of multidimensional database on the side of the server and Relational OLAP (ROLAP) suppose to construct cubes on the basis of SQL inquiry to a relational database. It is suggested to use ROLAP technology.

4. Conclusions. DSS developed allows to plan on the basis of analysis of information on competitors and consumers in the market, to define and choose strategies for an enterprise development, and analyze consequences of the decisions made. In this way the presented DSS allows to improve effectiveness of planning at an enterprise. In order to speed up data processing and to reduce the acceptance time for the strategic decisions, it is rational to divide the selected labour resource, financial and material resources.

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TOWARDS DEVELOPING A DECISION SUPPORT SYSTEM FOR STRATEGIC INVESTMENT APPLICATIONS

В даній статті пропонується система підтримки прийняття інвестиційних рішень. Ця система дає можливість оцінки ефективності та ризику інвестиційних проектів. Також система має можливість провести аналіз чутливості інвестиційного проекту, розробляючи рекомендації по збільшенню ефективності та зменшенню ризику проекту та формування портфелю.

In this paper the investment decision support system is offered. This system gives the opportunity of estimation of the efficiency and risk of investment projects. The system can also carry out the sensitivity analysis of the investment project working out the recommendations for increasing the efficiency of the project and portfolio foundation.

1. **Introduction.** Any enterprise in a certain extent is connected with the investment activity. The investment decisions are carried out almost every day at large and small enterprises. They are current decisions on purchasing fixed capital, variation the funds, changing the equipment and purchasing the technologies etc. Special attention is devoted to the strategic planning decisions, which are touched on a long-term period and connected with huge capital investments. They are characterized as the decisions with high risk.

Real investment is the main form of realization of the strategy of economic development of the enterprise. The process of strategic development of the enterprise represents the totality of investment projects which are realized during a period. Exactly this form of investment allows the enterprise successfully penetrates into new trade and regional markets and secures constantly increasing its market cost [1].

Making up the investment decisions, as any other kind of administrative activity, is based on using different formalized and unformalized methods. For transformation huge volume of data, storing the data, its processing and solution difficult management tasks with the help of different mathematic methods the decision support systems (DSS) are used. Modern DSS is the instrument of strategic management. The elaboration of investment decision support system is considered in this paper.

2. **The task and algorithms of its solving.**The problem of formation of the investment decisions is examined. For its solution the tasks of estimation of the