

Life cycle business modelling

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Abstract. The article deals with the task of life cycle business modelling. In the article the strategic orientation of enterprises is examined from the point of estimation view of its possibility to cost creation. A problem consists in development of management mechanism of the difficult mutually concerted multistage complex of tasks in industries of cost creation for a consumer and cost of enterprise, as in turn laid out on the row of the recommended project measures. This task was set forth in terms of the dynamic programming. The brought analysis over of this task allowed forming the comfortable and transparent algorithm of her decision, and her erection in an eventual result to the task of the linear programming.

Key words: enterprise developments strategy, consumer value, enterprise value, dynamic programming, algorithm, task of the linear programming.

INTRODUCTION

Strategic orientation of enterprises in recent years is taken into consideration from the point of view of the enterprise ability to create value. Such business theorists and practitioners as Osterwalder A., Yves P. (2002), Jansen W., Steenbakkens W., Jäegers H. (2007), Chesboro G. (2008), Debalak D. (2009), Dzhonson M., Kristensen K., Kagermann Kh. (2009), Casadesus-Masanell R., Ricart J.E. (2010), Jabłoński M (2011) [1-13] are looking for specific factors and models that distinguish those companies, which consistently achieve success and those which managed to get only a short-term competitive advantage. To a large extent it depends on the well designed and effectively implemented business

model of the enterprise, which should be selected individually for each enterprise.

According to the dominant and widespread today concept of system approach, functions of planning, organizing, regulation, motivation and control are the basic, which are combined by the processes of communication, decision-making and management. The processes of setting goals for the future, tasks projects defining and decision-making for their achievement in the conditions of uncertainty – belong to the initial stage of any entity activity, which depending on the level of detail can be seen as a series of interrelated activities aimed at making the predictions, plans and programs. Its main purpose is to analyze and identify the main trends and tendencies of enterprise developments, predicting of conditions changing and factors of strategic development, creation of scientific base for the development of long-term economic policies and making efficient solutions for its implementation.

If to treat the business model as a management concept to create value for customers and society as well as enhancement of enterprise value based on existing key competencies and chosen strategic set in order to achieve the goals, than in order to ensure sustainable (balanced) enterprise development – there should be the balance between two strategically important concepts (lines) of the enterprise development [14]:

- creating value for customers,
- creation of enterprise value.

These concepts should be cleverly intertwined, parallel initiated and implemented in real development projects. In particular, in order to create value for

consumers, a variety of the following administrative tasks should be coordinated:

- quality of goods / services,
- the price of goods / services,
- customers service.

In turn, for the company value creation there is needs to coordinate the range of design tasks, namely [15]:

- orientation for maximum efficiency,
- orientation for maximum effectiveness,
- creation a positive image and a socially responsible company.

Thus, the set management tasks can be reduced to solving of two “portfolios” of the company business model. The purpose of each “portfolio” is to achieve internal and external competitive advantages, which can be realized in the presence of different directions of activity organization. Both portfolios, in turn, can be united in certain “strategic portfolio” of the business model. With such a “strategic portfolio” it is possible to identify the investment priorities and the basis for allocation of resources, reaching more efficiency of their use.

Clearly, these approaches should be mutually coordinated and alternatively initiated according to the possibility and feasibility of their implementation. A separate problem which arises before the developers of business model “portfolio” of the company – it is synergy achievement between the various activities.

Thus, a reasonable “strategic set” of the enterprise can be formed by using the concept of management problems consistent solution as a tool to ensure the success of the enterprise for the sustainable development and profits maximizing. Only in case of their development and implementation the company can fulfil its

ep productive process, closing the cycle of money circulation in case of a successful sale of goods in the markets.

MATERIALS AND METHODS

In terms of “portfolio” analysis, strategic planning is seen as a building block of enterprise “portfolio”, enabling interchange ability of tasks to performing, depending on the characteristics and the chosen strategies. Such modular approach allows to increase the application flexibility of the developed strategies. Therefore, the following tasks should be considered throughout the life cycle (further LC), namely phases, which are passed by enterprise from development, implementation and initial growth, maturity and decline.

According to the Chief Information Officer Council (2001) Enterprise Life Cycle (ELC) in enterprise architecture is the dynamic, iterative process of changing the enterprise over time by incorporating new business processes, new technology, and new capabilities, as well as maintenance, disposition and disposal of existing elements of the enterprise [16]., the life cycle consists of the following five distinct stages (Figure 1).

- *Pre-start-up* – during this period, the company develops and implements a new idea. In this case, sales equal zero, and the volume of investment increases with approaching the final stage.
- *Start-up (Implementation)* – sales are growing slowly.
- *Growth* – sales quantity, consequently, the profit level.
- *Maturity* – sales growth slows down.

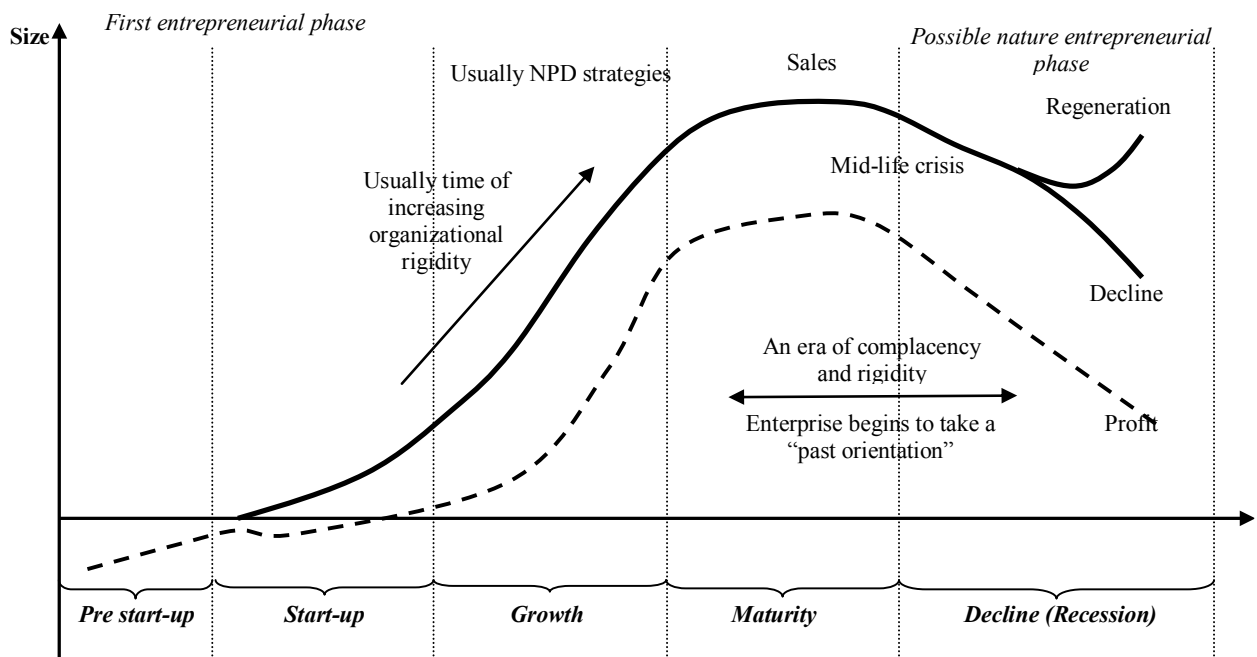


Fig. 1. The Enterprise Life cycle

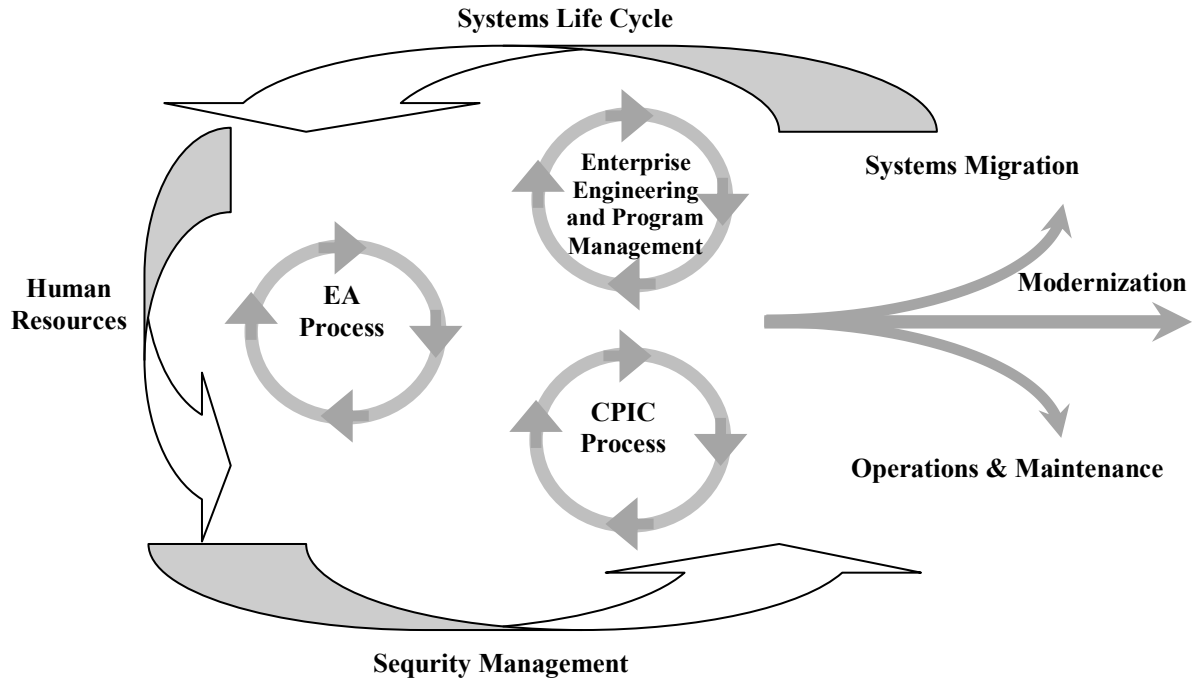


Fig. 2. The Enterprise Lifecycle as a concept in Enterprise Architecture

Decline (Recession) – reducing of sales and reducing of income. The enterprise life cycle is a concept in Enterprise Architecture (EA). The Enterprise Architecture process is closely related to other processes, such as enterprise engineering and program management cycle, more commonly known as the Systems Development Life Cycle. This concept aids in the implementation of an Enterprise Architecture, and the Capital Planning and Investment Control (CPIC) process that selects, controls, and evaluates investments [17]. Overlying these processes are human capital management and information security management. When these processes work together effectively, the enterprise can effectively manage information technology as a strategic resource and business process enabler. When these processes are properly synchronized, systems migrate efficiently from legacy technology environments through evolutionary and incremental developments, and the Agency is able to demonstrate its return on investment (ROI) [17]. The figure 2 above illustrates the interaction of the dynamic and interactive cycles as they would occur over time.

Since the yield at different stages of the life cycle is different, it is necessary to take into account the need to maintain the total profitability. Coordinating rules and life cycles time during the execution of the tasks from “portfolio”, the company is able to increase its competitiveness by complementarities, synergy, which provides additional benefits which cannot be achieved in a situation, when “strategic portfolio” is a simple sum of individual available areas development plans. Synergy is formed by mutual support and complementarities of different tasks.

Sometimes, it is advisable for enterprise managers to build all models to form an overall picture in terms of different perspectives. Each approach has its “for” and “against”, but in any case it is important that, after reaching the analytical completeness and accuracy in describing the situation, we may set the foundation for solving more complex problem – the formation and management of “portfolio” in order to get the best results from the use of enterprise resources.

”Portfolio” of tasks concerning creating of value for customers can be represented as a series of constant – parallel their performance. In this regard, there is need for effective organizing and planning of tasks lifecycle performing for timely decisions management that will reduce the impact of unavoidable disturbances. At the same time, it should be taken into consideration that during the transition from one task to another – the relative value of alternative tasks changes. Therefore, one of the main problems, which occur within strategic management, is to predict the nature and stages of life cycle.

The balance between different tasks depends on the decisions, taken by enterprise management on more or less of their relationship (mutual support). Of course, there may be different variants: balanced portfolio, in which “life cycles” are balanced in terms of passing phases and in terms of volumes. But, the most often we meet with unbalanced portfolios where the volumes are different, and there is a non-compliance of time / cost indicators etc. In such circumstances, it is difficult to take a decision.

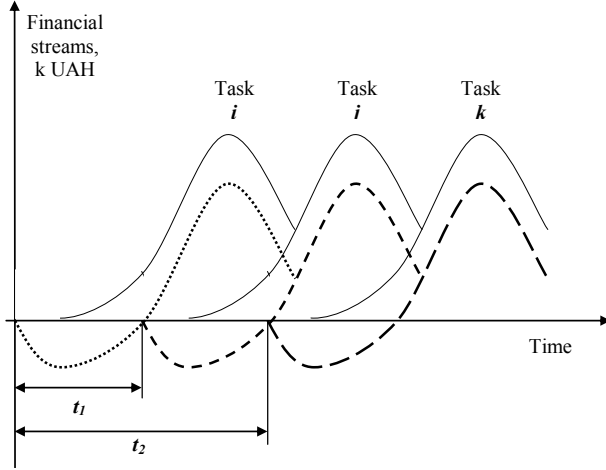


Fig. 3. The model of task realization lifecycles split by strategic management

Unlike most matrix models, which are used for the “portfolio” analysis and planning, it is advisable to use a method of dynamic programming in the analysis of “strategic portfolio”.

RESULTS AND DISCUSSION

Dynamic programming – this is a mathematical apparatus, with the help of which multi steps optimal control problem are solved [18, 19]. In this programming for process control among the set of all feasible solutions – all are looking for the best in terms of certain criteria, namely, such a solution that provides extreme (the highest or the lowest) value of the objective function – some numerical characteristics of the process. Multi – steps system is understood as multi – stages process structure or distribution of management for a number of successive stages that correspond usually to different periods of time.

Their solution will enable to predict measures concerning overcome of critical situations caused by the need to make a decision at some stage of the life cycle, and establish the most effective strategy of the company for implementation and the achievement of its overall objectives. Thus, in general, dynamic programming makes it possible not only to see the future of created new product, but also to set a goal and develop an appropriate plan of action [18].

The dynamic programming uses approach of simplification of difficult problem solving search by splitting it into simpler subproblems, usually by recursion. While some problems cannot be solved in this way, decisions which comprise multiple points in time indeed are often divided recursively into subproblems. Bellman called this as the principle of optimality. Similarly, in economic sciences about planning problem, which can be broken down into sub-problems recursively, we can say that it will have optimal substructure.

In the dynamic programming for the controlled process among the set of all acceptable methods for

strategic management – all are looking for the best in terms of some criterion that is leading to extreme (the largest or the smallest) value of the objective function – some numerical characteristics of the process. Multi-steps of strategic management in this sense are understood as multi-steps program structure which is divided into a series of sequential stages, steps that correspond, usually, to different levels of management. In terms of mathematical optimization, dynamic programming means simplification of finding of overall optimal solution by finding solutions to subproblems obtained by problem partitioning into sequential subproblems ranked by level.

If subtasks can be nested recursively inside larger problems, so that dynamic programming techniques can be applied, there is a relationship between the solution of the general problem, and a solution of subproblems. In the optimization methods this ratio is expressed by Bellman equation [20, 21].

The problem of strategic portfolio management of design tasks can be presented to maximize the objective function:

$$\Pi = \sum_{i=1}^n \left(\lambda \cdot \sum_{j=1}^n \left(\frac{V_j(t_j^{(V)}, t_i) \cdot \varphi_{i,j}(t_i)}{(1+q)^i} \right) + \mu \cdot \sum_{j=1}^n \left(\frac{W_j(t_j^{(W)}, t_i) \cdot \psi_{i,j}(t_i)}{(1+q)^i} \right) \right) \rightarrow \max, \quad (1)$$

where: $t_j^{(V)}$ – current time of strategic project implementation of j 's customer value creating project, searching value; $t_j^{(W)}$ – current time of strategic project implementation of j 's company value creating project, searching value; $V_j(t_j^{(V)}, t_i)$ – value of the function profit that describes value creation for customers; $W_j(t_j^{(W)}, t_i)$ – value of the function profit that describes the creation of enterprise value; $\varphi_{i,j}(t_i)$ – value of efficiency function in the combination of different projects time realization of creating value for customers; $\psi_{i,j}(t_i)$ – function value of efficiency in the combination of different projects time realization of creating value of enterprise; t_i – current time of strategic project implementation; n – number of time periods that are allocated for the project realization; q – discount rate, w/or losing assumption stakes as a constant for whole the period; k – number of projects are considered in each direction ($k=3$) at branches customer or company value creating; λ, μ – weighting factors, shows comparable weight of branch value for company; satisfy the conditions $\lambda + \mu = 1$, $0 \leq \lambda, \mu \leq 1$.

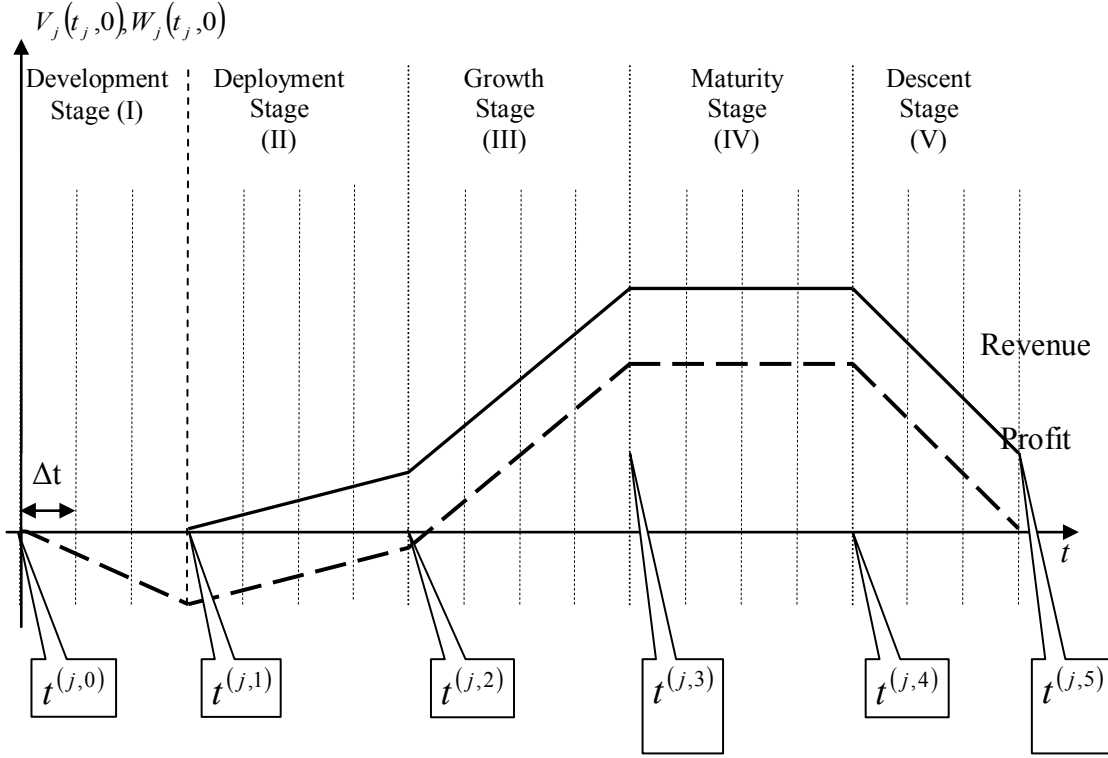


Fig. 4. Discrete model of project objectives life cycle

Additional constraints for this problem of dynamic programming can be the following limitations:

- at the ensuring of a certain level of income during a specified period of the strategic portfolio:

$$V_j(t_j^{(V)}, t_i) + W_j(t_j^{(W)}, t_i) \geq \Pi^{const}, \quad i^{(1)} \leq i \leq i^{(2)}, \quad (2)$$

- at the duration of the project realization:

$$n \leq N. \quad (3)$$

Function $V_j(t_j^{(V)}, 0)$ is shown in Fig. 4.

Function $V_j(t_j^{(V)}, t_i)$ harmonized to:

$$V_j(t_j^{(V)}, t_i) = \begin{cases} 0, & t_i \leq t^{(j,0)} + t_j^{(V)}, \\ a^{(j,0)} + b^{(j,0)} \cdot (t_i - t^{(j,0)} - t_j^{(V)}), & t^{(j,0)} + t_j^{(V)} \leq t_i < t^{(j,1)} + t_j^{(V)}, \\ a^{(j,1)} + b^{(j,1)} \cdot (t_i - t^{(j,1)} - t_j^{(V)}), & t^{(j,1)} + t_j^{(V)} \leq t_i < t^{(j,2)} + t_j^{(V)}, \\ a^{(j,2)} + b^{(j,2)} \cdot (t_i - t^{(j,2)} - t_j^{(V)}), & t^{(j,2)} + t_j^{(V)} \leq t_i < t^{(j,3)} + t_j^{(V)}, \\ a^{(j,3)} + b^{(j,3)} \cdot (t_i - t^{(j,3)} - t_j^{(V)}), & t^{(j,3)} + t_j^{(V)} \leq t_i < t^{(j,4)} + t_j^{(V)}, \\ a^{(j,4)} + b^{(j,4)} \cdot (t_i - t^{(j,4)} - t_j^{(V)}), & t^{(j,4)} + t_j^{(V)} \leq t_i < t^{(j,5)} + t_j^{(V)}, \\ 0, & t_i \leq t^{(j,5)} + t_j^{(V)}. \end{cases}$$

It is clear that the effect will be reduce while few projects aimed making profit will be started at the same time. To account this properly, it is proposed to use functions $\varphi_{i,j}(t_i)$ and $\psi_{i,j}(t_i)$, which acquire different meanings: 1) the absence of overlapping project tasks, 2) combination of two tasks; 3) combination of three tasks. For different project tasks will be use indices $j, \bar{j}, \bar{\bar{j}}$, then function formula $\varphi_{i,j}(t_i)$ for $V_j(t_j^{(V)}, t_i)$ will be shown:

$$\varphi_{i,j}(t_i) = \begin{cases} 1.0, & \left((V_j(t_i) \neq 0) \wedge \left((V_{\bar{j}}(t_i) = 0) \wedge (V_{\bar{\bar{j}}}(t_i) = 0) \right) \right), \\ 0.8, & \left((V_j(t_i) \neq 0) \wedge \left((V_{\bar{j}}(t_i) \neq 0) \wedge (V_{\bar{\bar{j}}}(t_i) = 0) \right) \right) \vee \left((V_{\bar{j}}(t_i) = 0) \wedge (V_{\bar{\bar{j}}}(t_i) \neq 0) \right), \\ 0.6, & \left((V_j(t_i) \neq 0) \wedge \left((V_{\bar{j}}(t_i) \neq 0) \wedge (V_{\bar{\bar{j}}}(t_i) \neq 0) \right) \right), \end{cases}$$

where using the restriction: $j \neq \bar{j} \neq \bar{\bar{j}}$.

Similarly, we can introduce the function $W_j(t_j^{(W)}, t_i)$.

$$W_j(t_j^{(W)}, t_i) = \begin{cases} 0, & t_i \leq t^{(j,0)} + t_j^{(W)}, \\ \alpha^{(j,0)} + \beta^{(j,0)} \cdot (t_i - t^{(j,0)} - t_j^{(W)}), & t^{(j,0)} + t_j^{(W)} \leq t_i < t^{(j,1)} + t_j^{(W)}, \\ \alpha^{(j,1)} + \beta^{(j,1)} \cdot (t_i - t^{(j,1)} - t_j^{(W)}), & t^{(j,1)} + t_j^{(W)} \leq t_i < t^{(j,2)} + t_j^{(W)}, \\ \alpha^{(j,2)} + \beta^{(j,2)} \cdot (t_i - t^{(j,2)} - t_j^{(W)}), & t^{(j,2)} + t_j^{(W)} \leq t_i < t^{(j,3)} + t_j^{(W)}, \\ \alpha^{(j,3)} + \beta^{(j,3)} \cdot (t_i - t^{(j,3)} - t_j^{(W)}), & t^{(j,3)} + t_j^{(W)} \leq t_i < t^{(j,4)} + t_j^{(W)}, \\ \alpha^{(j,4)} + \beta^{(j,4)} \cdot (t_i - t^{(j,4)} - t_j^{(W)}), & t^{(j,4)} + t_j^{(W)} \leq t_i < t^{(j,5)} + t_j^{(W)}, \\ 0, & t_i \leq t^{(j,5)} + t_j^{(W)}. \end{cases}$$

Function representing formula $\psi_{i,j}(t_i)$ for $W_j(t_j^{(W)}, t_i)$ shows below:

$$\psi_{i,j}(t_i) = \begin{cases} 1.0, & \left((W_j(t_i) \neq 0) \wedge \left((W_{\bar{j}}(t_i) = 0) \wedge (W_{\bar{\bar{j}}}(t_i) = 0) \right) \right), \\ 0.8, & \left((W_j(t_i) \neq 0) \wedge \left((W_{\bar{j}}(t_i) \neq 0) \wedge (W_{\bar{\bar{j}}}(t_i) = 0) \right) \right) \vee \left((W_{\bar{j}}(t_i) = 0) \wedge (W_{\bar{\bar{j}}}(t_i) \neq 0) \right), \\ 0.6, & \left((W_j(t_i) \neq 0) \wedge \left((W_{\bar{j}}(t_i) \neq 0) \wedge (W_{\bar{\bar{j}}}(t_i) \neq 0) \right) \right). \end{cases}$$

where using the restriction: $j \neq \bar{j} \neq \bar{\bar{j}}$.

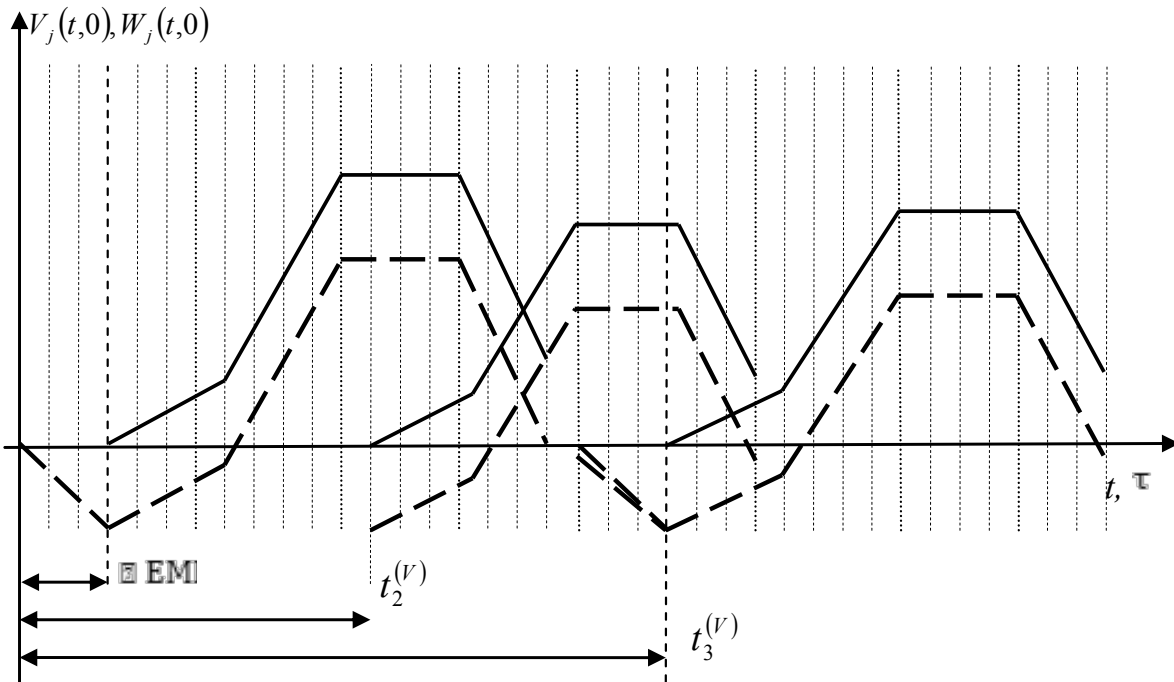


Fig. 5. Combining project tasks in one chosen direction

Thus, the problem dynamic programming can be represented as the date of the start of the project tasks $t_j^{(V)}$, $t_j^{(W)}$ in the following form:

- objective function:

$$\Pi = \sum_{i=1}^n \left(\lambda \cdot \sum_{j=1}^n \left(\frac{V_j(t_j^{(V)}, t_i) \cdot \varphi_{i,j}(t_i)}{(1+q)^i} \right) + \mu \cdot \sum_{j=1}^n \left(\frac{W_j(t_j^{(W)}, t_i) \cdot \psi_{i,j}(t_i)}{(1+q)^i} \right) \right) \rightarrow \max; \quad (4)$$

- limitations:

$$V_j(t_j^{(V)}, t_i) + W_j(t_j^{(W)}, t_i) \geq \Pi^{const}, \quad i^{(1)} \leq i \leq i^{(2)}, \quad (5)$$

$$n \leq N. \quad (6)$$

The list of specified limits may be increased for clarifying and making more strict requirements if needed for the implementation of the proposed measures.

To solve dynamic problem of dynamic programming it is proposed to use the following algorithm.

I. In this case, at the first stage during problems solving occurs at the level of two strategic concepts allocation of enterprise development:

- creation of value for customers, is described by the equation $V_j(t_j^{(V)}, t_i)$,

- creation of value of enterprise, described by the equation $W_j(t_j^{(W)}, t_i)$.

Each of these lines can be developed independently, only with regard to the total capacity of the enterprise.

II. At the second stage it is enough to select the sequence of the set tasks. For this $k! = 6$ possible variants are consistently calculated of project activities consecutive implementation in each component of the portfolio in a certain direction. As a result, this one is selected – which provides maximization of the expected result.

III. At the third stage, the problem is reduced to a linear programming problem with a search of unknown quantities $t_j^{(V)}$, $t_j^{(W)}$, which in their content define the execution combination of design tasks (Figure 4).

Being aware of the management role and place of such strategic portfolio of enterprise development as part of the overall business planning of the enterprise, it is necessary to choose correctly the methods for its implementation, taking into account the chosen prediction horizon, the existing knowledge base, restrictions criteria, existing and probable factors of influencing etc.

CONCLUSIONS

The analysis result of the presented algorithm of “strategic portfolio” is the following:

- developments of overall strategic recommendations on spectrum management of development objectives,
- the problem solving of the type and extent of “portfolio” diversification,
- providing of synergistic interaction of project activities,
- possibility of system prompt review of strategic objectives and general strategies of the company.

Thus, this is the unique way according to which all elements are combined, creating value for both the consumer and the enterprise, and is a competitive advantage core which is achieved through implementation of the business model of the enterprise activity.

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