COMPANIES' EFFICIENT STRATEGY DEVELOPMENT

Aleksandras Vytautas Rutkauskas[1] and Aleksandr Ostapenko[2]*

[1] Prof. Dr. Habil., Vilnius Gediminas Technical University, Lithuania, aleksandras.rutkauskas@vgtu.lt
[2] PhD. candidate, Vilnius Gediminas Technical University, Lithuania, aleksandr.ostapenko@gmx.com
*Corresponding author

Abstract

It is particularly important for the companies which do not boast the abundance of resources for development to focus their efforts on the optimum use of development resources and to ensure the reliability of change in the development process, which would become a counterbalance for potential losses caused by uncertainty and risk. The paper explores the theoretical substantiation of the integral management system of processes and statuses covered under the concepts of efficiency, reliability and risk of development processes. In order to formulate and solve the management problems of the stochastically described complex system, the stochastic recording of the aims and the existing restrictions and also stochastic optimisation methods were proposed.

Keywords: reliability, risk, stochastic values, stochastic utility function, company's development, stochastically informed expertise.

1 INTRODUCTION

In order for the company to achieve the best performance results, in practice it always has to face various uncertainty manifestations, so the stochastic optimisation logic is used to search for opportunities to create value. The main measures for this is a stochastic network seen as an integral set of stochastic values, stochastic fields and stochastic processes and the adequate network of utility values. The aim of the paper is to offer an idea for forming a problem of allocation of the company's development resources among strategy attributes and specific methods for a solution under uncertainty conditions, through the use of stochastic network models for adequate description of emerging value possibilities. This will be examined by forming a stochastic network of possibilities to create value and also by providing the network of usefulness of possibilities for a variety of subjects, so that the most useful variant change of value creation for a subject could be actually achieved. Together with analytical possibilities, the stochastic network will serve as a visualisation tool for the formation of the problem and search for solutions.

In the introduction it is appropriate to present concretisation of the concepts that are being used to ensure adequacy of problem description and appropriate selection of quantitative solution methods.

The main concepts used in this chapter – stochastic networks, stochastic processes, stochastic fields like the concept of the value creation have already established their prototype in the areas of research in which these concepts were formed (Klibi, Alain and Adel, 2010, pp. 283–293; Lefebvre, 2011, pp. 394–406; Marin, Balsamo and Harrison, 2012, pp. 551–572; Maine, Lubik and Garnsey, 2012, pp. 179–192; Schrödl and Turowski, 2014, pp. 21–30; Weaven, Grace, Dant and Brown, 2014, pp. 97–104; Hou, Chang, Shou and Li, 2014, pp. 5051–5058; Wang, Maen and Adjallah, 2014, pp. 476–490; Hiraishi, 2015, pp. 365–386). When moving away from the areas of research that are structured with respect to these concepts, the ambiguity of these categories and different interpretation of outputs became apparent (Adner and Kapoor, 2010, pp. 306–333; Bechmann and Stine, 2013, pp. 765–781; Bilge, Badurdeen, Seliger and Jawashir, 2014, pp. 106–111). It should be admitted that the perception and use of the above categories in the optimum allocation of development resources has not yet been nurtured to the extent of an unambiguous treatment of these concepts and therefore the unambiguous assessment of the consequences of solutions, therefore it is necessary to discuss the content and substance of the concepts or instruments used in the research to make it possible to adequately understand irreproachability of the solution obtained here and non-contradictoriness of practical consequences. The concept of a stochastic network has already been briefly formulated and will be later examined in greater detail. To understand the values, processes and the related phenomena of random events, their prototype from the probability theory was used.

A broader context is required for the explication of the stochastically informed expertise. When creating decision-making schemes and algorithms and using them to assess the decisions related to future possibilities, inadequate measures for the analysis of the perspective are often formed and misleading solutions are generated. This most frequently manifests in the works of expertise is related to the perspective – the analysis of future possibilities, etc. The vision generated by experts i.e. estimates provided by expert systems are presented as point or interval estimates, by missing from the logic radar the fact that the efficiency of the future possibilities is naturally related to the reliability or disambiguity of possibilities. It can be said that these indicators are accepted as a natural, quantitatively measured feature of future possibilities.

The concept of reliability has deep historical roots for content and quantitative measurement and also practice. The probability that the quantitatively measured effect of possibility under analysis ξ will be not smaller than a certain value that we are interested in X: $P\{\xi \geq x\}$= S(x) is an established measure of reliability of possibilities. S(x) usually identified as the survival function is one of the three main functions involving the understanding of reliability: density function P(x)= $P\{\xi = x\}$, distribution function F(x)= $P\{\xi < x\}$ and $S(x) = 1 - F(x)$ – the said survival function.

Without taking into account the existence objectivity of the reliability concept, the constructiveness of expertise often significantly decreases irrespective of how the estimates are presented – either in point or interval values. Sometimes estimates presented in intervals are treated as a full set of the value or process under analysis, i.e. covering all its possibilities. However, without identifying i.e. disclosing the reliability of each possibility, the interval of possibilities itself would have to be examined as an interval of equally reliable values.

The probability theory that started the basis of its already axiomatically constructed knowledge almost 400 years ago for the evaluation of the reliability of a possibility used the so-called distribution function logic – where the possibility of the estimated value is indicated together with the evaluation of the reliability of the possibility.

2 INVESTMENT STOCHASTIC NETWORK – INVESTMENT TECHNOLOGY GENERATION STUDY

The notion of the stochastic network provided above, stating that it is an integral set of stochastic values, stochastic processes and stochastic fields and an adequate network of utility functions that allows to achieve and compare the usefulness of different random value possibilities (expressed as possibility effect and its reliability) for a subject. It is usually assumed that each subject has its own utility function. The investment stochastic network will be understood already accepted notion of the stochastic network with its enumerated properties. An exclusive feature of the investment stochastic network will be the fact that return on investment will become an analogue to stochastic values, fields and processes (Rutkauskas and Stasytytė, 2011, pp. 291–312; Rutkauskas and Račinskaja, 2013, pp. 205–211; Rutkauskas, Račinskaja and Stasytytė, 2014, pp. 42–52). Figure 1 shows a geometric image of the investment stochastic network that consists of two symmetrical components. The case on the left-hand side is where the possibilities of return on investment are evaluated by the possibility effect and the reliability of the effect through any composition. In the case on the right-hand side the survival function set is replaced with the distribution function set, where these options supplement each other.

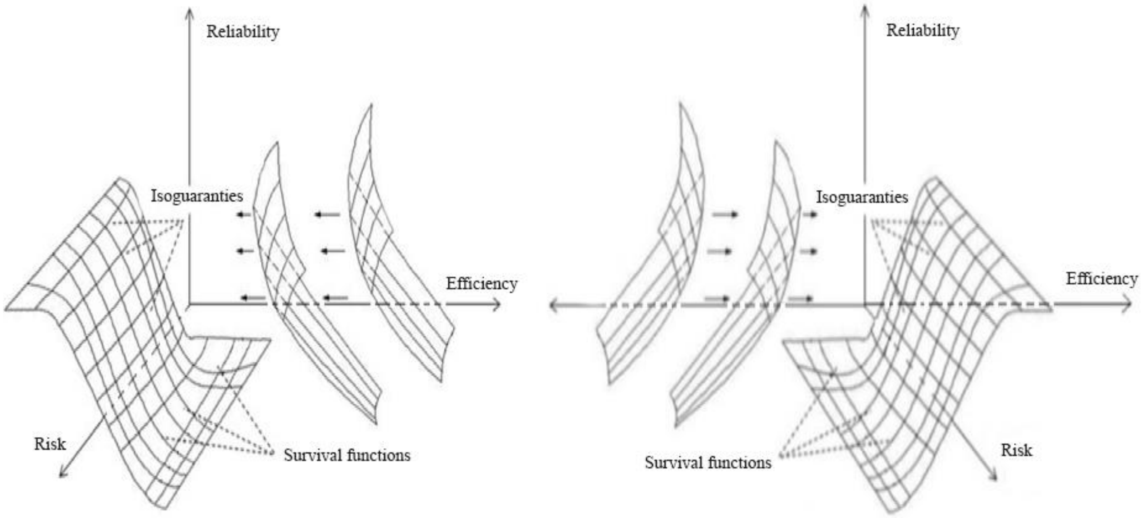


Fig. 1. The investment stochastic network

It should also be noted that, with the help of the investment stochastic network, adequate investment portfolio functions are performed, i.e. the most suitable possibility is established according to the selected utility function network, which ensures the choice of most effective possibility. However, it should be pointed out that when selecting certain proportions of an investment portfolio, only a certain random value oriented to the aim is generated and its real effects depend on the change of market prices.

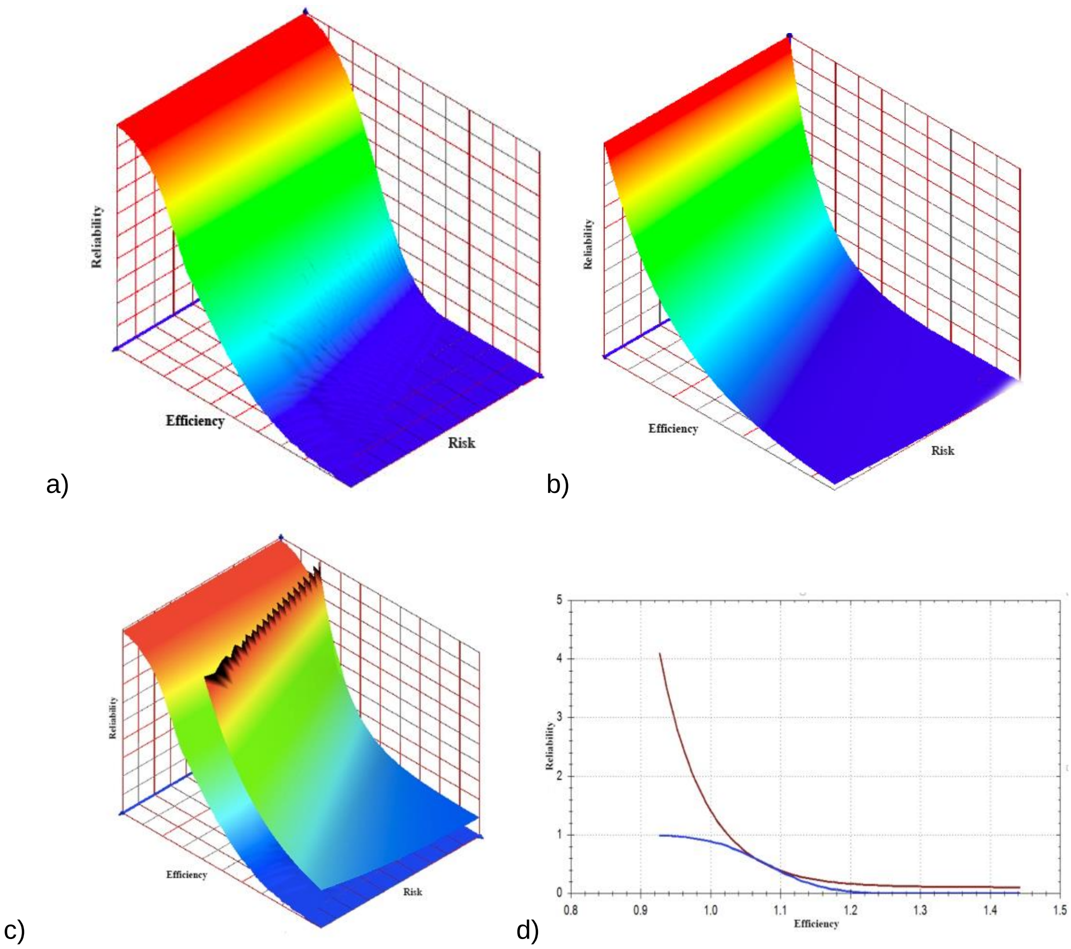
The following actions are performed in Figure 2 which shows the optimal allocation scheme of the marginal investment unit:

- Figure 2a provides a set of return possibilities on a portfolio formed by the coordinate system content. Here the possibility risk level is postponed in the abscissa, in the ordinate – efficiency level; and in the applicate – the reliability level;

- In Figure 2b a utility function of the subject is formed. Its composition is the same as that of the return possibility surface that has just been discussed;

- In Figure 2c we have the surface contact point of two possibilities discussed above (Fig. 2a) and the surface of utility possibilities (Fig. 2b) i.e. an optimal solution. It should be noted that the return possibility surface and surface of utility possibilities are protuberant with respect to each other;

- In Figure 2d a geometric view of the said optimal point is provided. The survival function is excluded from the set of possibilities and its tangent from the utility set tells at what risk level and, above all, under what investment unit allocation structure the optimal solution is obtained, while at the intersection point in the abscissa and the ordinate the effect and reliability values are provided.



(w1=, w2=, w3=, w4=)

Fig. 2. Optimal marginal investment unit allocation scheme: efficiency possibilities (a), utility function (b), surface contact point (c), optimal solution (d)

So with the structure as to how the marginal investment unit must be allocated among individual assets we can identify the distribution of the probability of possibilities of integral return on all assets (see Fig. 3).

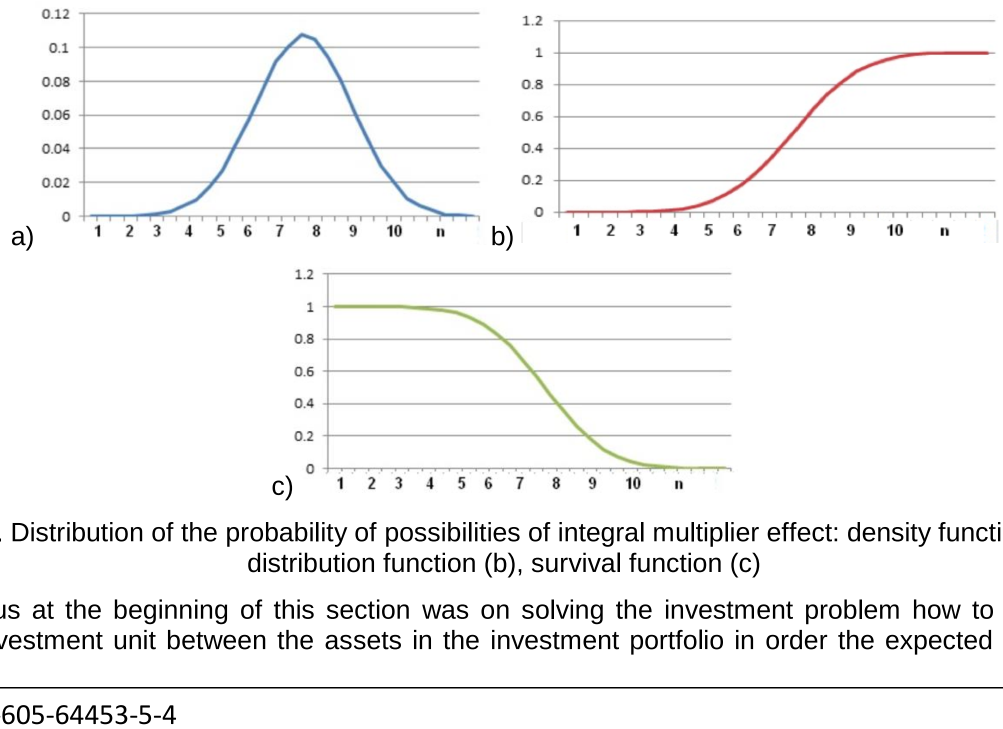


Fig. 3. Distribution of the probability of possibilities of integral multiplier effect: density function (a), distribution function (b), survival function (c)

The focus at the beginning of this section was on solving the investment problem how to allocate the marginal investment unit between the assets in the investment portfolio in order the expected efficiency of the return on the unit would be the highest.

The focus in developing company's efficient strategy remains similar, except for different formulation of the problem of how to allocate the marginal investment unit between company's strategy attributes in order the expected performance of the company would be the highest.

3 ADEQUATE INVESTMENT PORTFOLIO AS A TECHNICAL MEANS FOR IDENTIFYING AN OPTIMAL SOLUTION

The concept of a portfolio is used in many areas of research and practical activities. The traditional perception of the investment portfolio as a set of uniform securities owned by a single subject is replaced by a set of variety of securities owned by a single subject. Diversity of relations between changing securities is becoming very complex. The totality of heterogeneous derivatives in the portfolio alone can create an interaction chain that is hard to unravel. It is therefore not surprising that the portfolio management technique regularly and quickly becomes more complex. The portfolio becomes an exceptionally important instrument of systemic analysis, which by its nature is directed to the examination of complex stochastic systems.

In order to disclose the content and possibilities of the adequate portfolio (Rutkauskas, 2006, pp. 52–76), the portfolio should be treated as a natural continuation of the modern or Markowitz portfolio. Markowitz portfolio could be interpreted in a simplified way as follows: let us have n investment assets A_1, A_2, ..., A_n, which, being owned by the subject, generate income expressed in random values $a_1(\alpha_1,\sigma_1), a_2(\alpha_2,\sigma_2), \ldots, a_n(\alpha_n,\sigma_n)$. Here α_i, σ_i represent: the average α_i of random value a_i and the standard deviation σ_i. The subject may assess as to how it should allocate the capital intended for investment between individual assets, i.e. how to select proportions w_1, w_2, w_3, ..., w_n $\left(\sum_{i=1}^{n} w_i = 1\right)$, according to which all capital must be allocated between assets. To put in a simplified way, we have a large monetary unit (e.g. one million) and w_i will indicate parts of the unit. In order to determine the best opportunities for the diversification of the investment capital, it is worthwhile to examine all possibilities that are interesting to us for the allocation of the capital between assets.

In order to find the best option for the diversification of the investment capital, it is simply necessary to review all structural distribution possibilities, i.e. to demand that the structural vectors $\{w_i^j\}, \quad i = 1, 2, \ldots, n; \quad j = 1, 2, \ldots, m$ would realistically reflect all capital allocation possibilities between the selected investment assets. In practice, the evaluation of the capital possibilities is performed using the following calculations:

$$\begin{cases} w_1^1 a_1 + w_2^1 a_2 + \ldots + w_n^1 a_n = S^1 \\ w_1^2 a_1 + w_2^2 a_2 + \ldots + w_n^2 a_n = S^2 \\ \ldots \\ w_1^m a_1 + w_2^m a_2 + \ldots + w_n^m a_n = S^m \end{cases}, \qquad (1)$$

where $\left(\sum_{i=1}^{n} w_i^j = 1\right)$, for each j = 1, 2, …, m

S^j, j = 1, 2, …, m are well-diversified portfolio values obtained as asset and allocation coefficient functions. These are random values with their parameters – mean, standard deviation, variation, quartiles, deciles and other quintiles, which directly depend on distribution of the probability of asset possibilities and their mutual dependence. Where interplay of assets and its result in the portfolio can be accepted as their weighted arithmetic mean, then it is always possible to select such regulation of the transition from vector {w_2^1} to vector {w_2^m}, so that approaching infinity we could have a consistent chain of random values $S_1, S_2, \ldots, S_m$. As has already been mentioned, interplay of assets in the portfolio may not always be adequately described using only a weighted arithmetic mean. The logic of the adequate portfolio also allows us to examine sufficiently complex situations of asset interplay.

4 CONCLUSIONS

Value-creation capacity is becoming an exceptional indicator of efficiency of both companies and individual activities. Since development resources of companies are limited, their regeneration and rational distribution directly determine companies' performance.

Uncertainty and its consequences require improvement of uncertainty evaluation algorithms by quantitative measurement of uncertainty and its risk consequences. The stochastic network concept proposed in this paper should become a constructive means for value creation through rational allocation of companies' development resources.

The stochastic optimisation scheme discussed in this paper is a multi-criteria optimisation system, because here the stochastic utility function includes efficiency, reliability and risk indicators that are practically formed by taking into account the relevant indicators of operational resources, factors and interoperability.

REFERENCE LIST

Adner, R., & Kapoor, R. (2010). Value creation in innovation ecosystems: how the structure of technological interdependence affects firm performance in new technology generations. *Strategic Management Journal*, 31 (3).

Bechmann, A., & Stine, L. (2013). Mapping actor roles in social media: different perspectives on value creation in theories of user participation. *New Media & Society*, 15 (5).

Bilge, P., Badurdeen, F., Seliger, G., & Jawashir, I. S. (2014). Model-based approach for assessing value creation to enhance sustainability in manufacturing. *Procedia CIRP*, 17.

Hiraishi, K. (2015). Simulating Markovian stochastic Petri Nets by difference equations with interval parameters. *Discrete Event Dynamic Systems*, 25.

Hou, G., Chang, J., Shou, K., & Li, M. (2014). Embedded system modeling and verification based on deterministic and stochastic Petri net. *Journal of Computational Information Systems*, 10 (12).

Klibi, W., Alain, M., & Adel, G. (2010). The design of robust value-creating supply chain networks: a critical review. *European Journal of Operational Research*, 203 (2).

Lefebvre, D. (2011). About the stochastic and continuous Petri Nets equivalence in the long run. *Nonlinear Analysis: Hybrid Systems*, 5.

Maine, E., Lubik, S., & Garnsey, E. (2012). Process-based vs. product-based innovation: value creation by nanotech ventures. *Technovation*, 32 (3–4).

Marin, A., Balsamo, S., & Harrison, P. G. (2012). Analysis of stochastic Petri Nets with signals. *Performance Evaluation*, 69 (11).

Rutkauskas, A. V. (2006). Adequate investment portfolio anatomy and decisions, applying imitative technologies. *Economics*, 75.

Rutkauskas, A. V., & Račinskaja, I. (2013). Integrated intelligence and knowledge, innovation and technology management, nurturing country universal sustainable development. *2nd International Scientific Conference "Problems of Modern Economy: Global, National and Regional Context"*, 23–24 May 2013, Grodno, Belarus.

Rutkauskas, A. V., Račinskaja, I., & Stasytytė, V. (2014). Optimization of integral knowledge, innovation and technologies cluster structure. *Asian Journal of Business and Management*, 2 (1).

Rutkauskas, A. V., & Stasytytė, V. (2011). Optimal portfolio search using efficient surface and three-dimensional utility function. *Technological and Economic Development of Economy*, 17 (2).

Schrödl, H., & Turowski, K. (2014). Risk management in hybrid value creation. *Decision Support Systems,* 58.

Wang, Z., Maen, A., & Adjallah, H. K. (2014). Coloured stochastic Petri Nets modelling for the reliability and maintenance analysis of multi-state multi-unit systems. *Journal of Manufacturing Technology Management*, 25 (4).

Weaven, S., Grace, D., Dant, R., & Brown, J. R. (2014). Value creation through knowledge management in franchising: a multi-level conceptual framework. *Journal of Services Marketing*, 28 (2).