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STRENGTHENING RELATIONSHIPS IN THE VALUE NETWORK THROUGH COORDINATION ACTIVITIES OF PRE-PRODUCTION STAGES

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Abstract. In the current market environment, more successful are usually the companies that seek to create values not only for their own customers, but together with their partners they create a value network. Within the value network there is cooperation in various fields. One of the most important areas of cooperation is delivering products to end customers. But it is not only about coordinating sales, manufacturing and purchasing operations on sales of an established product, i.e. tactical and operational management of these activities. The coordination must also occur in the process of designing the product and the production (or even entire logistics) systems. Only then can the value network partners shorten the time as much as possible in which they provide customers with an opportunity to purchase needed products and accompanying services. This paper looks at how to modify the research and development activities in the company that becomes part of the value network.

Keywords: value network, research, development, production, integration.

Jel classification: O32, M11, M31

1. Introduction

Global competition is stiff in almost every industry and sector (Flint *et al.* 2011). In the current market environment, more successful are usually the companies that seek to create values not only for their own customers, but together with their partners they create a value network. The value network is known as a successful business perspective that embraces both tangible and intangible value exchanges between two or more individuals, groups or organizations aimed at generating economic value and other benefits for a network participant (Albadvi, Hosseini 2011). The value network creation requires us to choose primarily all elements of the network, then to propose all activities leading to the increase of the value for customer and further to decide the responsibilities of the relevant elements to ensure the activities are covered, i.e. which activities are carried by particular chain elements or, as the case may be, if and how certain activities should be carried by all the elements together (Lostakova 2011).

Within the value network there is cooperation in various fields. Collaboration, an organisation's strategic orientation and market turbulence are the three main business performance drivers, and that of this collaboration had the most impact (Frost, Sullivan 2006). Collaboration enables partners to jointly gain a better understanding of future product demand and implement more realistic programmes to satisfy that demand (Sahay 2003). One of the most important areas of cooperation is delivering products to end customers because the growing pressure of the supply chain customers on accelerated reaction of suppliers enforces shortening time periods for processing orders (Vlčková, Paták 2010). In this case coordination activities between business partners mean that interdependent production; logistics, development, and administrative resources are modified and adapted in order to bring about a better match between the cooperating firms (Strandskov 2006).

The coordination must also occur in pre-production stages. If partners coordinate pre-production phases in a value network, they seek together the answers to questions:

- What will the form be of products delivered to end customers and, depending on that, also the form of products produced in the previous production phases (i.e. the form of products supplied by the suppliers to the customers in the value network) and
- What form will individual logistics systems take in the value network, interconnected to each other (and within this, the form of individual production systems).

This will gradually allow making optimum contributions to the value for end customers that mean customer´s perceived benefits and customer´perceived sacrifices (Lostakova 2010).

New product introduction time can be dramatically reduces through the involvement of suppliers in the innovation process (Christopher 2000) and the customers will be allowed to purchase required products in a short time.

In the current context, innovation is not restricted to the manufacturing of new product, but incorporates new solutions to across-market boundaries to cope with the needs of increasingly sophisticated customers. Successful companies are therefore ‘solution’ providers (Liu, Hart 2011). Solutions are defined as individualized offers for complex customer problems that are interactively designed and whose components combine products and/or services where the value exceeds that of the sum of components (Evanschitzky *et al.* 2011).

The aim of this paper is to specify how the process of research and development should proceed in a company, especially in the chemical industry, that is a part of the supply chain or the value network in order to speed up the entire process. The goal of this paper was defined in this way because speed to market and product quality enhance product profitability, but speed to market is more impactful than product quality on product profitability (McNally *et al.* 2011). The main objective will be met partly on the basis of a research of professional literature and partly on the results of a qualitative primary research conducted in selected chemical, food and automotive industry companies. The research was focused on mapping of company process systems of the selected SBU (Strategic Business Unit) and their course, the possibility of acceleration dealing with company process systems. The main aim of the primary research was to map what processes are being realized in the given SBU to provide value to the individual customers, their internal structure and the possibility of their acceleration in order to increase the customer value.

The method used for collecting the primary information was based on personal interviews with the aid of scenarios for interviewing company employees (the specification of the sought information was reflected in the questioning scenario). The respondents consisted of SBU manager, product manager responsible for sales of selected products, SBU production manager, SBU head of purchasing, administrative staff of sales and purchasing and other managers of the individual SBU processes.

2. Process of preparation of the production system in a company involved in the supply chain

The main goal of the research and development in a company that is a part of a supply chain or a value network is to develop such a product and design such a solution of the product and form of business processes (especially the manufacturing ones) that will lead to value creation for direct customers and end-customers of the chain. At the same time, it is necessary that a value for the firm itself be created as a result of conduct of production and business operations.

The product development process includes four major development stages: concept generation, product planning, product engineering, and process engineering (Clark, Fujimoto 1991). The given process should run in the company (not only of the chemical industry) according to the following flow chart (Fig. 1):

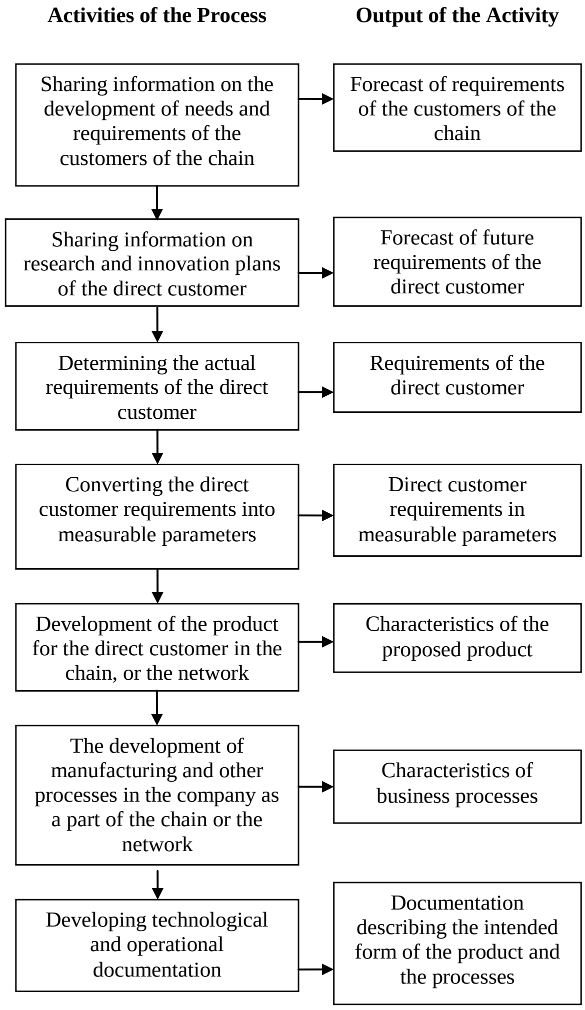

Fig.1. Process of research and development from identification of customer needs and requirements for preparation of instructions for the conduct of business processes (Source: Juran 1988, Nenadál 2002, modified)

Methods to accelerate this process in the company (as a link of the chain or the network) basically focus on two areas (Branská 2011):

- Obtain information as quickly as possible on the need for research and development activities and requirements imposed on them

- Find the time savings in the very process of research and development.

Understanding customer needs and values is fundamental to the definition of a product, particularly a new product (Donaldson *et al.* 2006) because increased use of customer wants and needs information in the development phase was associated with increased market success (Zahay *et al.* 2011). During last years, customers' criterions and requirements are not only focused on functionality of products, but more and more criterions related with sustainable development are empowered (Vávra, Munzarová 2010). At present, the time required for the desired solution of the proposed product and the processes in the enterprise is extended by the fact that the businesses in the chain deficiently share the information on the needs of end customers. Information links in this area could also be closer between two adjacent links of the chain. It is crucial to identify the emerging trends and changes in the behaviour of end customers and consequently provide this information, or at least the information derived therefrom, to the partners in the chain.

Not only must the end producers prepare for product innovation, but they need to be sufficiently supported by their suppliers. It is desirable that innovations of the final manufacturers immediately in turn bring about the derived innovations of the suppliers back in the chain.

Sharing information among partners can bring about other benefits, e.g. removal of duplicate collection of information on the behaviour of the customers.

Sharing of sensitive information, commitment to unique (and costly) investments, and creation of competitors through collaboration are all potential downsides to buyer-supplier collaborative relationships (Cheung *et al.* 2011). Therefore, such a form of cooperation is realized only in chains where suppliers and buyers cannot get into a competitive position or in chains, or networks of property interconnection (such as chemical technology custom productions). In these chains the contractors are not likely to use the information obtained to develop their own product, damaging the business interests of partners in the chain.

Generating great ideas is half the battle. The other half is getting from the concept stage through to development and into the Marketplace (Cooper 2011).

If firms want to reduce the time needed for the actual research and development of the product and the process they can deepen cooperation in other stages of this process. For example, the laboratory research phase can interconnect activities and solve the research project in a mutual cooperation of the partners in the chain or the network. In essence, it is about applying the so called simultaneous engineering in the development where the development process takes place simultaneously with the manufacturer/s of the product and suppliers of inputs. To ensure the best possible synchronization of activities with the both (or more) partners, it is necessary to get developers of the supplier involved in time in the research and development (Keřkovský 2001).

An extremely good opportunity for interconnecting the research and development processes emerges with partners supplying expendable materials. There is only a slim chance that they could become competitors to the customer. For example, a supplier of labels for marking packages to transport and handling of dangerous goods can be easily plugged into the innovation process. Shared or obtained knowledge about the innovation will help them significantly reduce the time for preparation of new labels. It seems desirable also because legislative requirements for labels are changing very rapidly.

Interconnecting research activities will bring additional effects, not only as a result of the introduction of production at the supplier according to the needs and requirements of customers. It also increases the possibility that the contractor develops an input material for the customer with better properties than he/she originally anticipated. It will further increase the value that the contractor provides to him. To achieve this effect it is possible to implement an equivalent of the JIT II method (that consists in involving a sellesperson of a supplier in the purchase team of a customer), i.e. to involve a researcher or technology worker of the customer in the supplier's research team. Or, on the contrary, to involve a supplier's researcher in the customer's research team. These activities are possible especially when applying a high degree of integration of business partners. There is an opportunity for the application especially if the customer participates through investments in the implementation of the supplier's production (as is the case with the custom chemical technology productions).

Collaboration within organisations requires effective and appropriate support, which will usually make the difference between a successful collaboration and an unsuccessful one. Even well-designed teams with good people can perform poorly if they are not provided with the management support and resources they require in order to meet their goals, and collaborate with internal and external colleagues and clients as necessary (Patel *et al.* 2012).

A simple and easy-to-implement way to transmit information allowing product innovation to the needs and requirements of the customer and communicate that information in an appropriate form are regular meetings of marketing research workers from particular companies. In these meetings they can share information that mean that they basically work together and in a synchronized way on the design of the product and introduction of individual consecutive productions. Higher forms of information sharing (e.g. by electronic means) from research and development are certainly technically possible, but feasible only in rare cases as an extraordinary confidence of both the partners is necessary therefore. Usually is willingness for information sharing is based more likely on long-term personal relations (Vlčková 2011).

A special case, affording deep possibilities of interconnecting the research and development activities, is the execution of research and development through own research units (institutes) whose services are used also by partners involved in the same supply chain or network.

Let's leave aside now the question of effective management of the technical quality of the product being developed, despite its high importance. Let's concentrate on the possibility of accelerating the product development and production process itself and the company involved in the chain, or the network. This is a fairly complex matter arising from the nature of this process. It is difficult, if not impossible, to schedule the end of a given process or its sub-activities in the chemical applied research (such as completion of the research, testing of the proposed technological process in the laboratory, proposal of specific technological parameters and their tuning with the aid of testing in a bench scale and/or pilot plant, etc.) because it is a highly creative work of researchers. In some cases, despite the hard work of the research team, they fail to complete a specified research project. To reduce this risk, partial activities can be implemented to support the quickness of process of research and development. ISO 9001:2008 recommends to (ISO 9001:2008, modified):

- Clearly define the customer's requirements on the developed product/products.
- Define the inputs to the research and development process, relating in particular to the specification of the research project, for example through a procurement protocol.
- Specify the outputs from the research and development, i.e. the form of the technical solution developed.
- Plan the timing of activities in the research and development process through:
  - planning the sequence and relations between developmental activities, for example using a network analysis,
  - a setting a timetable of activities as a complement to the network analysis, to guide and control of activities within the process in terms of time and
  - designation of responsible personnel for the timely completion of partial activities.
- Ensure control of the results of research and development phases (verification of the outcomes of the product and process design through its review by the opposition procedure, design verification procedure in a laboratory and a pilot plant, possibly in a bench scale).
- Ensure procedures for the creation of new technical documentation, or procedures for implementing changes thereof.

The network analysis (and the schedule of activities) as a time-tested practice to manage the process completion deadline should be applied with respect to the TOC (Theory of Constraints) principles. The conventional approach to project planning and management is based on the fact that the project is divided by time milestones whose accomplishment in the implementation phase of the project is closely monitored. It is expected that when all the activities are completed in time, so will the project be completed in time, which also serves as a base for evaluating and rewarding employees involved in the process. It naturally forces them to add a reserve to the estimates of the duration of each activity to increase the likelihood of completion as planned (the reserve is further increased by the fact that more reserve time is added by senior managers). It rarely happens, however, that a task is completed before the deadline, even if the plan contains an embedded time reserve. Therefore, the research and development process needs to be controlled not on the basis of the critical path, but the critical chain method. Critical chain is the sequence of task and resource dependent events that prevents a project from being completed in a shorter time, given finite resources. Safety time is aggregated in "buffers" and placed at strategic points on the network to protect due-date performance (Goldratt 1997).

The critical chain differs from the critical path by taking into account the availability of resources in a given time interval. The essence of the method is:

- reduction of the estimated (and overstated) duration of each activity and the determination of the aggregate time reserve on a smaller scale that serves to protect the overall project completion date and

- determination of partial temporal buffers, the so called feeding buffers ensuring protection of the beginning of the critical chain activities (protects the commencement date of the critical activity before the delay of activities standing outside the critical chain) (Goldratt 1997, Basl *et al.* 2003).

When designing a chemical-technological production process, we must respect especially (but not only) environmental and economic aspects. We must choose such a technology that produces the lowest impact on the environment. In many cases it is possible to use the recommended technology within the BAT (Best Available Technologies) register, or possibly to perform the eco-balance of various possible procedures and, on its base, identify the best environmental practice. It is generally assumed that the above mentioned process will also contribute to securing the requirement on the economy of the given manufacturing process, because the effort to reduce the environmental impact usually also means economic savings. For example, raw materials savings, energy savings and production of lower quantities of waste and packaging also means cost savings.

The selected technology directly affects the appearance of the proposed production facility. It must allow the creation of the desired product, but its arrangement must also support the possibility of high speed and flexibility for future delivery of the product. The arrangement of the production equipment must support the optimal material flow that should meet the following requirements:

- maximum possible flow of the movement of the material production process must be reached,
- the material handling must be restricted to a maximum possible extent when entering and exiting the manufacturing facility,
- time loses must be eliminated or limited with the material passing between two operations (Líbal 1980, modified).

Therefore, the directness and the shortest route of the material flow, as well as its simple course, is the basis in determining the spatial distribution of machinery, equipment and facilities inside the building as well as individual buildings in the enterprise. The placement of workplaces and buildings in a continuous mass and usually large-series production is carried out according to the technological sequence of production operations while in the (small) series production it is determined by the technological sequence of production operations of which the major production is composed, i.e. a production in the largest quantities (Líbal 1980) or a production of a product for key customers, or customers in the chain or network.

A difficult problem is associated with the determination of the size and distribution of the production capacity. If the production is primarily intended for one chain or network (which may occur in the case of chemical technology custom-made products), it is necessary to adjust the capacity of production, its distribution and the size of its reserve capacity to the needs of end customers and make this decision in cooperation with other links. The proposed product may also find application with other trading partners. In this case, the size of the production capacity must be adjusted to the anticipated demands of other customers. Subsequently, the distribution of production capacity is solved. The need for flexibility to meet future customers' requirement shows that it may be preferable to distribute the total capacity into several smaller production facilities. If there was a sale forecast 500 tons of the products per year, it might seem appropriate to have one large manufacturing facility for 600 tons, for example, instead of 6 smaller plants by 100 tons. This will allow the company to flexibly adjust the capacity to the actual sales with lower current requirements of the direct customers while maintaining the economy of the manufacturing process (reduction of the production output in the production facility with the total production capacity by 50 % causes, according to a qualified estimate, a reduction of the cost by about 20 %).

Furthermore, it would be possible to meet a higher current demand for another product with the released production facilities. However, this distribution of the total capacity into several facilities will increase investment costs. By a qualified estimate, it will be approximately 1.5 times the cost compared to building one production facility with a production capacity in the total amount.

When addressing the distribution of the total production capacity in sub-components, we can use the queuing analysis.

The queuing analysis leads to answering questions such as (Gros 2003):

- How many requirements for service can be expected?
- What will be the use of the installed service points?
- What is the length of the queue, how long will customers have to wait before they are served?
- How many service points to install so that the logistics output of the company reached a competitive level?

The number of the production facilities must be such as to enable the company to meet the targets it has set as standards of service of direct customers, or which resulted from the coordination of activities among the partners in the chain or the network. The objective of this task is not to find such process conditions that give an optimal effect with regard to the defined criteria function (process costs, proceeds from the process), but to examine at what number of the production facilities will the objectives be met or what level of the objectives could be achieved in the implementation of a certain number of production facilities.

When deciding on the optimal number of the production facilities, we should take into account that the provision of too intensive operation produces excessive costs of acquisition and operation of the production equipment while a little intensity of service due to an insufficient total capacity, however, causes an insufficient level of service of customers whose requirements will begin to queue. This results in delays and inability to meet the set targets, which will threaten the retention of the existing customers and acquiring of new ones. It is therefore necessary to choose a number (of equally powerful apparatuses) with which the sum of operating costs for operating the given production system and the waiting-incurred losses is minimal.

The mathematical tool of queuing analysis is the probability theory. In the considered case, the units of service consist of individual production facilities. A queue of customer requirements is formed before them. The length of intervals between consecutive requirements represents a random variable that is characterized by a certain probability distribution - exponential, Erlang, hyper-exponential or Poisson distribution (Líbal 1980).

Λ denotes the mean number of inputs of customer requirements per unit of time and **1/λ** is the mean length of intervals between consecutive inputs. The time to serve a single customer requirement is also variable and usually characterized by the same probability distribution as the length of input intervals of two consecutive requirements. **M** is the intensity of service as the mean number of services performed per time unit by one manufacturing facility at its uninterrupted work and **1/μ** is the mean service time per requirement.

In order to satisfy all customers, i.e. to make sure that the queue does not only constantly grow, it must be true that: $\mu \geq \lambda$.

To solve the optimal number of production facilities, into which the total production capacity is divided, it is necessary to characterize each element of the service system (Líbal 1980, Gros 2003):

- The total intensity of generation of the requirements in the source is final and virtually not affected by changes in the number of customers in the source.
- All requirements are considered to be patient and without prioritization of the requirements.
- The queue length is unlimited.
- Poisson distribution of the input of requirements is assumed. The random variable is the number of requirements resulting in a fixed time interval of length ΔT as recommended by the authors (Líbal 1980, Gros 2003). The suitability of using this type of the probability distribution can be verified on the basis of experience in selling a similar product.
- The production system is arranged in parallel. The queue is common for all the manufacturing facilities (Fig. 2).

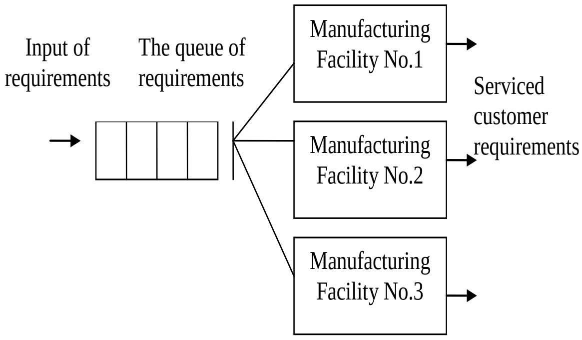

Fig.2. Diagram of the proposed production process (Source: Líbal 1980, modified)

- Each production facility can handle any requirement, but only one at a time.
- The intensity of the service of all production facilities is the same and equal to **μ.**
- The service time on a single manufacturing facility independs on the time of service at other facilities.
- The mean number of inputs of requirements per a unit of time does not change with time nor does the number of services performed per a unit of time, it is true that

$$\frac{\lambda}{r\mu} < 1 \tag{1}$$

where **r** is the number of production facilities.
- The exponential distribution of the service time is assumed, because we consider the random variable to be time intervals between consecutive inputs, which is due to different volume sizes of customer requirement (Líbal 1980, Gros 2003). Also it is desirable to verify this assumption on the basis of the experience with the sale and production of the like product.

Taking into account the above assumptions we can directly determine the numerical values of the characteristics related to the mean course of the service process.

The number manufacturing facilities **r** may generally have values

$$r = (1,2,3...n < \infty)$$

and the number of customer requirements

$i = (1,2,3....r)$, or $i = (r, r+1,....)$.

For the number of customer requirements in the interval **(1; r)** we can derive an equation to calculate the probability with which there is just *i* requirements in the system that are serviced and waiting (Líbal 1980):

$$p_i = \frac{1}{i!} \cdot \left(\frac{\lambda}{\mu}\right)^i \cdot p_0 \qquad (2)$$

and for the number of customer requirements $i \geq r$ then it is true that:

$$p_i = \frac{1}{r! \cdot r^{i-r}} \cdot \left(\frac{\lambda}{\mu}\right)^i \cdot p_0 \qquad (3)$$

while for *i* = *r* the both equations give the same value. To calculate the probability with which there is no requirement in the service system (i.e. in the proposed production system) we can use the equation:

$$p_0 = \left[\sum_{i=0}^{r-1} \frac{1}{i!} \cdot \left(\frac{\lambda}{\mu}\right)^i + \frac{1}{r!} \cdot \left(\frac{\lambda}{\mu}\right)^r \cdot \frac{r \cdot \mu}{r \cdot \mu - \lambda}\right]^{-1} \qquad (4)$$

On the basis of these basic equations and probability distribution it is possible to derive formulas for the numerical characteristics of the mean course of the service process (Líbal 1980):

- The mean waiting time of all requirements:

$$\overline{L} = \frac{\lambda \cdot \mu}{(r-1)! \cdot (r\mu - \lambda)^2} \left(\frac{\lambda}{\mu}\right)^r \cdot p_o \qquad (5)$$

- The average number of requirements in the service system, considered for the entire operation of the system:

$$\overline{s} = \overline{L} - \frac{\lambda}{\mu} \qquad (6)$$

- The mean waiting time of one requirement for the beginning of service:

$$\overline{w} = \frac{\mu}{(r-1)! \cdot (r\mu - \lambda)^2} \left(\frac{\lambda}{\mu}\right)^r \cdot p_o = \frac{\overline{L}}{\mu} \qquad (7)$$

- The mean time spent by a requirement in the service system:

$$\overline{v} = \overline{w} + \frac{1}{\mu} = \frac{\overline{L}}{\lambda} + \frac{1}{\mu} = \frac{\overline{s}}{\lambda} \qquad (8)$$

- The average number of vacant production facilities:

$$\overline{z} = r - \frac{\lambda}{\mu} \qquad (9)$$

- The mean load of a single production facility:

$$\overline{u} = 1 - \overline{q} = \frac{\lambda}{\mu \cdot r} \qquad (10)$$

where $\overline{q}$ is

- The average proportion of one idle production facility:

$$\overline{q} = \frac{\overline{z}}{r} = 1 - \frac{\lambda}{\mu \cdot r} = 1 - \overline{u} \qquad (11)$$

- The unavailability probability of all service channels Pc, i.e. the probability that a requirement that has entered the system will have to wait:

$$P_{\check{c}} = \frac{\mu}{(r-1)! \cdot (r\mu - \lambda)} \cdot \left(\frac{\lambda}{\mu}\right)^r \cdot p_o \qquad (12)$$

- The probability that the request will have to wait longer than T:

$$P\{\overline{w} > T\} = P_c.e^{-(r\mu - \lambda)T} \qquad (13)$$

- The probability that the number of requests in the system will be greater than N $(N > r)$:

$$P\{\overline{s} > N\} = \frac{\mu}{r! \cdot r^{N-r} \cdot (r\mu - \lambda)} \cdot \left(\frac{\lambda}{\mu}\right)^{N+1} \cdot p_o, \qquad (14)$$

Using these mathematical equations it is possible to calculate parametric values for various solutions, i.e. for different numbers of production facilities. Subsequently, the calculated values are compared with the objectives defining the required logistic performance of the firm as a part of the chain and a decision is made on the optimal variant.

Many workflows can be analysed using simulation, or linear programming with similar results, depending on the purpose of the analysis. Although simulation is useful in any analyses, queuing analyses and linear programming are more efficient because they have a firm analytical basis (Martin 2008).

In the event that it is necessary to build also a new production plant for the proposed production process, it is necessary to decide on its location with regard to the form of the logistic systems of the firm and also with regard to the entire chain.The aim is to locate the object so that the material flow through the chain and the firm could be considered optimal.

3. Conclusions

If the firm builds linked logistics chain, or network, with its customers and suppliers, it will modify the course of a number of corporate activities, including the research and development process. Its specific form will be influenced both by the number of entities involved both vertically and horizontally in the network, as well as by the tightness of cooperation.

The longer the chain or the more extensive the network and the closer the cooperation will be, the higher synergistic effects can be achieved. These effects can occur both in creating the benefits for the end customer (in creating the customer value) and in increasing the efficiency of its own business activities.

The closest forms of cooperation can result in not only coordination of the research and development activities, but also in integration of this activity. In that case, the possibility arises to use the queuing theory for designing not only the manufacturing facility in one of the enterprises, but also for designing a synchronized manufacturing facility within the entire chain, or the network.

This publication is the starting point for a further follow-up research. It will focus on how to identify crucial links of the value network and their role in the process of creating value for the end customer. It will become the basis for recommendations regarding the management of mutual relations in the value network that should help to create competitive advantage of both the firm and the chain.

References

Albadvi, A.; Hosseini, M. 2011. Mapping B2B value exchange in marketing relationships: a systematic approach, *Journal of Bussiness & Industrial Marketing* 26(7): 503–513. http://dx.doi.org/10.1108/08858621111162307

Basl, J.; Majer, P.; Šmíra, M. 2003. *Teorie omezení v podnikové praxi. Zvyšování výkonnosti podniku nástroji TOC*. Prague, CZ: Grada Publishing, 216 p.

Branska, L. 2011. *Quick Response method application in supply chains involving chemical continuous productions:* Habilitation.Tomas Bata University in Zlin. Zlin: UTB. 179 p.

Clark, K.B.; Fujimoto, T. 1991. *Product Development Performance: Strategy, Organization and Management in Word Auto Industry*. Boston, MA: Harvard Business Review Press. 432 p.

Cooper, R.G. 2011. Perspective: The Innovation Dilemma: How to Innovate When the Market Is Mature, *Journal of Product Innovation Management* 28(1): 2–27. http://dx.doi.org/10.1111/j.1540-5885.2011.00858.x

Cheung, M-S.; Myers, M.B.; Mentzer, J.T. 2011. The Value of Relational Learning in Global Buyer-Supplier exchanges: a Dyadic Perspective and Test of the Pie-sharing Premise, *Strategic Management Journal* 32(10): 1061–1082. http://dx.doi.org/10.1002/smj.926

Christopher, M. 2000. The Agile Supply Chain: Competing in Volatile Markets, *Industrial Marketing Management* 29(1): 37–44. http://dx.doi.org/10.1016/S0019-8501(99)00110-8

Donaldson, K. M.; Ishii, K.; Sheppard, S.D. 2006. Customer Value Chain Analysis, *Research in Engineering Design* 16(4): 174–183. http://dx.doi.org/10.1007/s00163-006-0012-8

Evanschitzky, H.; Wangenheimb, F.V.; Woisetschlägerc, D.M. 2011. Service & solution innovation: Overview and research agenda, *Industrial Marketing Management* 40(5): 657–660. http://dx.doi.org/10.1016/j.indmarman.2011.06.004

Flint, D.J.; Blocker Ch. P.; Boutin, P.J. 2011. Customer value anticipation, customer satisfaction and loyalty:An empirical examination, *Industrial Marketing Management* 40(2): 219–230. http://dx.doi.org/10.1016/j.indmarman.2010.06.034

Frost; Sullivan. 2006. Frost & Sullivan, Meetings around the world: The impact of collaboration on business performance, A Frost & Sullivan white paper sponsored by Verizon Business and Microsoft. [online] [accessed 16 December 2011]. Available from Internet: http://newscenter.verizon.com/kit/collaboration/MAW_WP.pdf

Goldratt, E.M. 1997. *Critical Chain*. Great Barrington, USA: North River Press, 246 p.

Gros, I. 2003. *Kvantitativní metody v manažerském rozhodování*. Prague, CZ: Grada Publishing, 432 p.

ISO 9001:2008: Quality management systems – Requirements. International Organization for Standardization.2008.

Juran, J.M.; Gryna, F.M. 1988. *Juran´s Quality Control Handbook*. New York, USA: McGraw-Hill, 1774 p.

Keřkovský, M. 2001. *Moderní přístupy k řízení výroby*. Praque, CZ: C.H.Beck, 115 p.

Líbal, V. et al. 1980. *Organizace a řízení výroby*. Praque, CZ: SNTL, 496 p.

Liu, R.; Hart, S. 2011. Does experience matter? A study of knowledge processes and uncertainty reduction in solution innovation, *Industrial Marketing Management* 40(5): 691–698. http://dx.doi.org/10.1016/j.indmarman.2011.05.004

Lostakova, H. 2010. Identification and quantification of the value provided to customers:The case of B2B markets, in *The 6th International Scientific Conference „Business and Management-2010“*. Vilnius, Lithuania 13–14 May 2010. Selected papers. Vilnius: Technika, 2010, 414–420. ISSN 2029-4441. http://dx.doi.org/10.3846/bm.2010.056

Lostakova, H. 2011. Creation of the customer's value within the value network of products determined for production consumption, in *The 20 th International Scientific Conference „Metal 2011"*.Brno, Czech Republic 18–20 May 2011. In press.

Martin, J.W. 2008. *Operational Excellence. Using Lean Six Sigma to Translate Customer Value through Global Supply Chains.* New York, USA: Auerbach Publications. Taylor&Francis Group. 638 p.

Mc McNally, R. C.; Akdeniz, M. B.; Calantone, R. J. 2011. New Product Development Processes and New Product Profitability: Exploring the Mediating Role of Speed to Market and Product Quality, *Journal of Product Innovation Management* 28(1): 63–77. http://dx.doi.org/10.1111/j.1540-5885.2011.00861.x

Nenadál, J. et al. 2002. *Modern systems of quality management.* Praque, CZ: Management Press, 282 p.

Patel, H.; Pettitt, M.;Wilson, J.R. 2012. Factors of collaborative working: A framework for a collaboration model, *Applied* 3(1): 1–26. http://dx.doi.org/10.1016/j.apergo.2011.04.009

Sahay, B.S. 2003. Supply chain collaboration: the key to value creation, *Work study* 52(2): 76–83. http://dx.doi.org/10.1108/00438020310462872

Strandskov, J. 2006. Sources of competitive advantages and business performance, *Journal of Business Economics and Management 7*(3): 119–129. http://dx.doi.org/10.1080/16111699.2006.9636132

Vavra, J.; Munzarova, S. 2010. Life cycle engineering and relationship with customers, in *The 6th International Scientific Conference „Business and Management-2010"*. Vilnius, Lithuania 13–14 May 2010. Selected papers. Vilnius: Technika, 2010, 738–747. ISSN 2029-4441. http://dx.doi.org/10.3846/bm.2010.097

Vlckova, V. 2011: Reasons of insufficient cooperation in information sharing within Czech entrepreneurial environment and its impact on supply chain, in *The 20 th International Scientific Conference „Metal 2011"*. Brno, Czech Republic 18–20 May 2011. In press.

Vlckova, V.; Patak, M. 2010. Role of demand planning in business process management, in *The 6th International Scientific Conference „Business and Management-2010"*. Vilnius, Lithuania 13–14 May 2010. Selected papers. Vilnius: Technika, 2010, 1119–1126. ISSN 2029-4441. http://dx.doi.org/10.3846/bm.2010.151

Zahay, D.; Griffin, A.; Fredericks, E. 2011. Information Use in New Product Development: An Initial Exploratory Empirical Investigation in the Chemical Industry, *Journal of Product Innovation Management* 28(4): 485–502. http://dx.doi.org/10.1111/j.1540-5885.2011.00821.x

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