CASE STUDY: DESIGN VALUE MEASURING BY SYSTEM DYNAMICS

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Abstract: *The aim of the article is to show a way to measure the economic value of design using system dynamic modeling of key processes in an organization. The article fully accepts the complexity of the concept of design and opens up the possibility for employing system dynamics in design value measuring. The definition of design is given as an integral concept for which it is difficult to find a benchmark. The sequential explanatory method was chosen to solve the research problem. Qualitative data is collected first and it is recorded and examined. After that the data is transformed into numeric values and taken for quantitative evaluation in a system dynamic model. The connection of qualitative research data in a tool for quantitative evaluation allows an original interpretation of relationships that have been obtained and are collected only as qualitative data. Qualitative data collection is based on the visualization of a new definition of design: Design is an integration of functional, distribution, emotional and social experience of the customer. The questionnaire is in the form of Design Value Canvas and is used to determine the initial Design Value Algorithm (DVA) coefficient. As an external parameter, the DVA coefficient influences the development of the number of customers and their willingness to order the company's products in the system dynamic model. The main result is the finding that an investment in design, which is confronted with customer preferences, fundamentally changes the economic parameters of business. Economic benefits of a design change in a company are always influenced by a strategic decision made by the entrepreneur who has to know the behaviour of their customers and to correctly choose the field of design in which it pays to invest.*

Keywords: *Algorithm, business model, canvas, customer experience, design management, design value, nonlinearity, system dynamics.*

JEL Classification: *D25, L21, M21, O31.*

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Introduction

Design is an important factor that contributes to the business success thanks to its potential to strengthen their competitiveness (D'Ippolito, 2014). There is a correlation between the use of design and business performance and subsequent macroeconomic growth (Denmark National Agency for Enterprise and Housing, 2003). An example of an economy significantly influenced by design is Great Britain's economy. Design Economy created a gross value added of 85.2 billion GBP in the United Kingdom in 2016, corresponding to 7% of British gross value added. In a long-term perspective, between 2009 and 2016 the economy influenced by design grew by 52% and expanded far beyond fields that are part of creative industries (Benton et al., 2018).

Design is a specific subtype of innovation (OECD/Eurostat, 2018); it is an important business factor and it is integrated into many aspects of production and deliveries of

products. The use of design helps companies to innovate, it increases companies' productivity and turnover (Benton et al., 2018). Various studies, initiatives and research, for instance (Cooper et al., 2009; D'Ippolito, 2014; Design Council, 2018; Roy et al., 1998; Rae, 2014), are the evidence of the economic value brought by design. It is clear that companies in which design is a key topic and which address company processes with the help of both internal and external designers run better (Denmark National Agency for Enterprise and Housing, 2003). A great majority of companies, especially those that use design as a process and a strategy, realizes great advantages from using design in their business activities (Cooper et al., 2017). According to Roy et al. (1998), there is a significant relationship between the management's attitude and the company's growth. All growing companies had managers with a positive approach to investments in product design (and possibly in technical innovations). On the contrary, declining companies had a predominantly limited and narrow understanding of design and innovations and their significance for the company. It is therefore important to promote design to companies' management as it is them who decides on their subsequent investments.

Naturally, the subsequent direction of the research focused on design has been the question whether and how it is possible to measure return on investment, which is the value that a design change will bring to the company. Many research projects have been concerned with research that leads to measuring design value. Moultrie and Livesey (2014) base their research on measuring four dimensions of design in the creation of products and services: (1) Design related to the technical/ engineering aspects of creation of products and services; (2) Design of user experience in creating products and services, design of communication, promotion and deliveries of products and services, or of the overall business activity of a company; (3) Design as part of promotion, communication, branding and distribution of products and services; (4) Design as part of developing support and communication of company identity. A considerable part of the research in this article is based on this concept. € Design | Measuring Value Design project summary report is based on the research by Moultrie and Livesey (2014), and it also lists the limits that complicate design value measuring. The research states that the creation of economic value with the help of a design change is not linear. The result of a design change is not directly proportional to initial investment. It is therefore necessary to create dynamic models (BCD Barcelona Design Center, 2014) to observe the relationship between economic value and design. Research by Denmark National Agency for Enterprise and Housing (2003) states that design is a very broad concept and it is necessary to refuse the possibility of overall feasibility of design quantification. Their research is focused on macroeconomic benefits of design as well as on a possible way of measuring the benefits of companies' investments in design and on the promotion of design. In relation to companies, it is stated at the end of the research that the analysis of research results indicates a very clear correlation between employing designers and the economic success achieved by companies. The correlation is so clear that it cannot be ignored or questioned. The correlation is especially pronounced in companies that have adopted a complex approach to design. Cooper et al. (2017) state that design is too integral to measure return on investment in design easily. Regarding the problem of measurement, Design Management Institute states: *"The value of design is difficult to define. Design is hard to isolate as a function and the design function operates differently by industry. That makes benchmarking to standardized measurement metrics difficult"* (DMI: Design Value Institute, 2015).

The originality of the article lies in the fact that it fully accepts the complexity of the concept of design and opens up the possibility for employing dynamic modeling in design value measuring in a company. Precisely for the reason that the definition of design is given as an integral concept for which it is difficult to find a benchmark, all of its elements are consistently applied in the research.

The contribution of the research lies in the reliable definition of the problem from the management point of view. Comparing a managerial decision to invest in design with an optimal decision reveals an imperfect, rather intuitive thinking of the manager. The numerical values of the 'Design Value Algorithm' indicator (DVA) in its three variants inform whether the manager is making the more accurate decision.

The interpretation of research results therefore not only supports correct decision-making but also warns against unprofitable investments.

During the research, a questionnaire is used to promote and explain the concept of design in its wider range according to Oslo Manual (OECD/Eurostat, 2018, p. 243).

The article describes a specific process of measuring the benefits of design as an innovation tool and an economic factor of SME production. First, a theoretical foundation for design measuring is set, and design is defined based on that. After that, the research problem, aim and research methods are formulated. The questionnaire is significantly influenced by the European € Design | Measuring Value Design (BCD Barcelona Design Center, 2014) research project, as well as by Frascati Manual (OECD, 2015). Research questions follow from the research methods and are answered at the end of the article; the answers are proven on a case study of a small manufacturing company. A system dynamic model has been used to achieve the aim of the research. Other research possibilities, contradictions and limits that influence the result of the research are outlined in the article discussion.

1. Theoretical Background

A design is often incorrectly perceived in its narrow form, that means only as external appearance of products (Westerman et al., 2013), however, in reality, its application is much broader. Design is a process that aims to connect aesthetic and functional aspects of the designed product or service (Pavlou, 2013), marketing tools (Cropley & Cropley, 2005) or internal processes of a company (Edquist & Hommen, 1999). Design is closely connected with the concept of creativity (OECD, 2015). Creativity is thus connected with technical requirements and helps to find suitable solutions. Creativity is a tool which connects aesthetic qualities with functionality based on technological and economic limits (Best, 2006). Thus, quality design is not art, it is a business trigger which serves companies to prosper (Kramoliš et al., 2020).

BCD Barcelona Design Center (2014) works with the hypothesis that the importance of the economic benefits of a design change depends on the role of design in the whole innovation process. The crucial initiative of the Europe 2020 strategy (Europe 2020, 2011, p. 20) is based on the assumption that design has a special significance and is recognized as a key factor whose activities bring ideas to the market and transform them into user-friendly and attractive products (Meyerhoefer & Zuvekas, 2008). According to BCD Barcelona Design Center (2014), it is possible to use two interpretations of the process of transformation:

1. Transformation is focused on design as a complement to product appearance or to the appearance of innovative technology. For example, Fahrner and Vossen (1995) investigate the transformation based on the Entity-Relations model. The term transformation is often used also in connection with the word design in the field of software (Tahvildar & Kontogiannis, 2004; Movahedian & Khayyambashi, 2014; Iyer et al., 2005). There are also studies that are concerned with a change of product appearance (design) in accordance with an innovation strategy (Pollock & Williams, 2011), or with the influence of product features on the user (Murphy & Dweck, 2016; Giacomin, 2014), or, specifically, with the influence of packaging design on the user (Raghubir & Greenleaf, 2006). According to this interpretation of 'transformation', design is placed at the end of the production process (Ahire & Dreyfus, 2000) as a change of product appearance or as a complement to the appearance of innovative technology where design does not change their function. In this case, the impact of the economic benefits of design as a complement to the appearance of the resulting product is only marginal.
2. Transformation is focused on design as an integration of functional, distribution, social and emotional tools. According to the second interpretation of 'transformation', design is placed at the beginning of system innovation (Pollock & Williams, 2011; van Mierlo et al., 2010). The integration of functional, distribution, emotional and social experience means that design constitutes a system change (Berkowitz, 1987). In this case, the economic benefits of design as an integrator of the knowledge of all four fields are significant (Best, 2006).

Currently the management of companies does not receive data on design divided according to individual points of view from the very beginning of system innovation (functional,

distribution, communication, relational) (Mustonen-Ollila & Lyytinen, 2003). Company decision-makers need to have quality data at their disposal to be able to observe also the social and economic benefits (Johnson & Myatt, 2006) of design as an integrator. In this context of the need of transformation in a company, it is possible to set a new definition of design (Sanders, 2002; Dorst & Cross, 2001). The definition of design is crucial for further research: Design is an integration of functional, distribution, emotional and social experience of the customer.

2. Aim, Research Methodology

Design strategy and its connection with business prosperity is a crucial issue for the companies that want to succeed in today's strong competitive environment (Kramoliš, 2017). There are successful companies in the market that have attractive products, effective marketing, reliable distribution, and companies whose brand inspires customer confidence. However, companies that are willing to take a risk and invest their very limited resources in design want to measure the effectivity of the invested funds.

There exists no empirical confirmation which shows that creation of economic value with the help of design change can be linear with results directly proportional to initial investment. A large number of variables affects a company's success (Ganzarain et al., 2019) and design is part of them.

If the creation of economic value by design is not directly proportional to its input, the system is nonlinear (Täuscher, 2018). Such system requires dynamic models to understand and observe the relationship between the economic value of a company and design (Moellers, 2019; Cosenz, 2017; Ganzarain et al., 2019; BCD Barcelona Design Center, 2014).

The aim of the article is to prove that the methods of measuring the economic value of design can accept the complexity of its new definition. The aim of the research is to prove that the economic value of design can be measured using system dynamic modeling of key processes in an organization.

A condition for the aim of the article to be achieved is the use of the definition of design in the questionnaire on design value measuring. The questionnaire is used to calculate an original coefficient, which is called 'Design Value Algorithm' (DVA). The coefficient is substituted into a company's model and affects its economic behaviour in a fundamental way.

The article uses the Business Model Canvas visual method which is the basic principle of how a company creates, conveys and gains value (Osterwalder & Pigneur, 2010). The sequential explanatory method has been chosen to solve the research problem (Collins, 2018). Qualitative data is collected first and it is recorded and examined. After that the data is transformed into numeric values and taken for quantitative evaluation in a system dynamic model. The connection of qualitative research data in a tool for quantitative evaluation allows an original interpretation of relationships that have been obtained and are collected only as qualitative data. The explanatory research method is suitable in a situation like this when it is not possible to solve the research problem using only qualitative data or only quantitative data.

The dynamic model includes feedback loops, stocks and flows which are essential for understanding and observing the nonlinear outputs that result from changes in inputs (Sterman, 2001; Täuscher, 2018). It is important to understand and observe the dynamic models which explain the role of design in the process of creation of economic value because a small change in a stock or a flow can cause a significant impact on the result in these nonlinear systems. For example, a small effort that leads to the improvement of a customer's emotional experience can cause a significant increase in the creation of a company's economic value (Täuscher, 2018). For this reason, it is necessary to focus on process modeling in a company as well, and to create scenarios based on which it is possible to evaluate the change in the company's economic value (Warren, 2018) on the basis of the change caused by design, or rather by the DVA coefficient.

Qualitative data collection is based on a visualization of the definition of design: Design is an integration of functional, distribution, emotional and social experience of the customer. The questionnaire is in the form of Design Value Canvas. The questions are structured into three sets. Question set 1 determines in which areas entrepreneurs want to invest to improve design and the management's knowledge of the values that their customers expect from the products

that they buy: their functionality, speed and quality of distribution, the emotional side of the product (whether they like it) and the social status of the company that sells the products. Question set 2 investigates the entrepreneur's decision-making strategy in favor of various types of innovations and use or non-use of design resources internally, externally, or in a combination of both types. Question set 3 requires the management's estimate in five areas (functionality, appearance, brand, speed of distribution and price) so that the company's product can be compared to the competition.

According to the completed Value Design Canvas questionnaire, customer experience is calculated as a simple ratio indicator:

$$E = R/PDV \tag{1}$$

where: E = Customer experience (satisfaction);
R = Reality = comparison with the competition (question set 3);
PDV = Perceived design value = how the research participant (entrepreneur) wants their product to be perceived by customers (question set 1).

According to this calculation, customer experience can take values from zero to 100. The indicator is dimensionless. The design value algorithm calculation for a given part of design (x) follows from customer experience calculation: x is (1) the aesthetic side of the product, (2) the functionality of the product, (3) the speed and form of the product distribution, (4) the company's brand.

The formula (2) for the calculation of Design Value Algorithm (DVA) as a dimensionless coefficient:

$$DVA = \sum(DC\,(\mathrm{x}\,1, 2, 3, 4)\,/\,/\,WD\,(\mathrm{x}\,1, 2, 3, 4) * * (1 - E\,(\mathrm{x}\,1, 2, 3, 4)) * DR\,(\mathrm{x}\,1, 2)) \tag{2}$$

where: DC = Decision points;
WD = Weight of decision;
DR = Decision about resources in design.

The decision points are given based on the participant's decision-making and take values from 1 to 4. If the participant rates a decision that influences the area of the lowest customer experience as the most important, they get the highest number of points, which is 4. The weight of decision equals 4 in the "Most important" parameter.

Resources in design (question set 2) influence the first two positions of importance (i.e., the positions of Most important and Very important) in this way:

Tab. 1: Resources in design

In-house designer	Outsourced designer	Coefficient of DVA increase	Note – the increase in a part of a parameter of the DVA in the first two decision-making positions
0	0	1	DVA is not influenced
1	0	1.08	DVA is higher by 8%
0	1	1.05	DVA is higher by 5%
1	1	1.1	DVA is higher by 10%

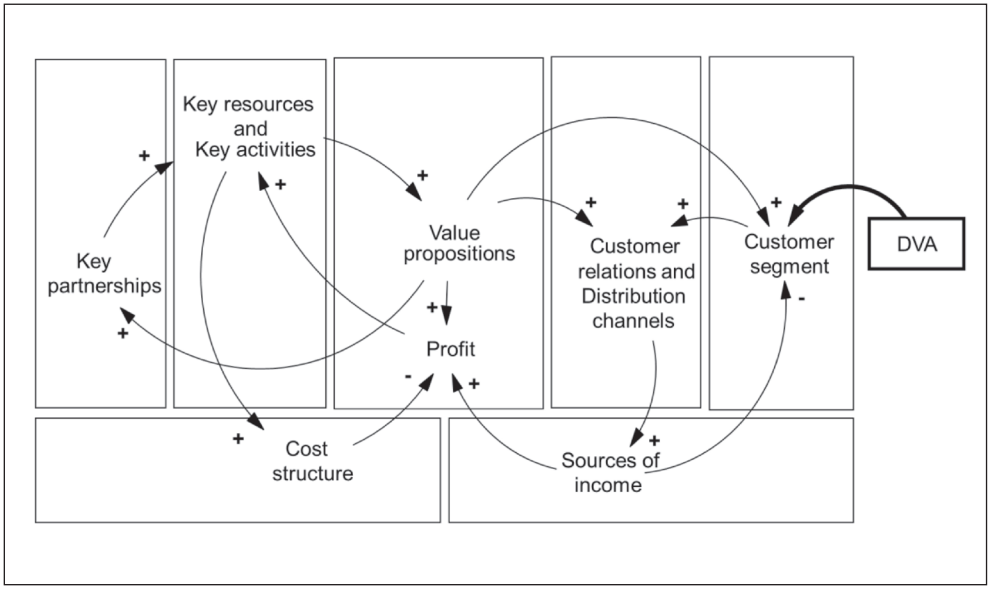
Source: own

The Customer segment element is influenced by the DVA in the system dynamic model because it is not possible to say whether its influence is greater on the number of customers, the productivity of work, the price of the product or another variable in a company's model. As shown in Fig. 1, the Customer segment building element influences all other building elements of the model through feedback causal loops.

The areas of research in the company which has been chosen as a case study in this research are defined according to Osterwalder and Pigneur (2010). The building blocks of the model are connected with the main variables that influence business dynamics. Processes that create value for the customer are based on this dynamic.

Qualitative data collection for the system dynamic model was carried out through

Fig. 1: **Business Model Canvas (Osterwalder & Pigneur, 2010), modification for feedback loop diagram**



Source: own

in-depth interviews with the managers as of the research (September 2019 to May 2020). During this period, 105 companies were contacted. After conducting the research, the managers of these companies received a detailed interpretation of the research data as a basis for further decisions on innovations based by design aspect. A small manufacturing company that entered the market in 2019 (start-up) was chosen as appropriate sample for the research. Economic parameters of the company generated by the system dynamic model were then consulted with the entrepreneur and fine-tuned to be as close as possible to its real parameters.

The construction of the system dynamic model for the purposes of this article is based on research that analyzes a decision-making strategy in a start-up company (Cosenz, 2017). The article proves that system dynamic modeling can be used very effectively to map the structure of a system, to capture the behaviour management process and for relationship quantification. The model is based on the creation of a set of equations which form the basis simulating a possible system of behaviour over time. The system dynamic model is a suitable tool for design value measuring in a company because it rejects the idea of a linear relationship between cause and effect and it requires a system analysis of the company. The 'ceteris paribus' rule is true for model variables in relation to external environment; the variables are only affected by each other. They can be affected positively (i.e., an increase in one corresponds to an increase in the other, and vice versa) or negatively (i.e., an increase in one corresponds to a decrease in the other, and vice versa). If such relationships are closed by links, they are defined as feedback loops. The structure of the whole model, variables and links between them with positive or negative polarity is responsible for the behaviour of the modeled system (Sterman, 2001). In Fig. 1, there is a tool diagram according to Osterwalder and Pigneur (2010) with integrated feedback loops which show how individual building elements of the model relate to each other. DVA enters the model as an external parameter and affects all other Business Model elements through its effect on the Customer segment building element.

Tab. 2: Calculation of ratio indicator E (customer experience)

Field of design	PDV	R	E	DR
Appearance and aesthetics	85	90	1.059	1.08
Functionality	80	60	0.75	1.08
Distribution	40	25	0.625	–
Brand	70	50	0.71	–

Source: own

Tab. 3: Design Value Algorithm Calculations

No. of scenario	Scenario characteristics	Participant's decision	DVA
1.	No design	–	1
2.	Management's decision	(1) product functionality; (2) appearance and aesthetics; (3) distribution; (4) brand	1.22
3.	Ideal decision	(1) distribution; (2) brand; (3) functionality; (4) appearance and aesthetics	2.23
4.	The worst possible decision	(1) appearance and aesthetics; (2) product functionality; (3) brand; (4) distribution	0.87

Source: own

2.1 Research Questions

Two research questions have been formulated to achieve the aim:

RQ_1: Make investments in design always increase the economic value of a company?

RQ_2: Is it possible to measure design value using system dynamic modeling of company processes in a way that design value is measured by usual economic indicators?

3. Results

The research results are based on a case study sample. Based on the completed Design Value Canvas questionnaire, all measurable DVA coefficient values have been calculated in three scenarios: the entrepreneur's decision, the ideal decision and the worst possible decision. The first scenario corresponds to a situation in which the entrepreneur refuses to invest in design.

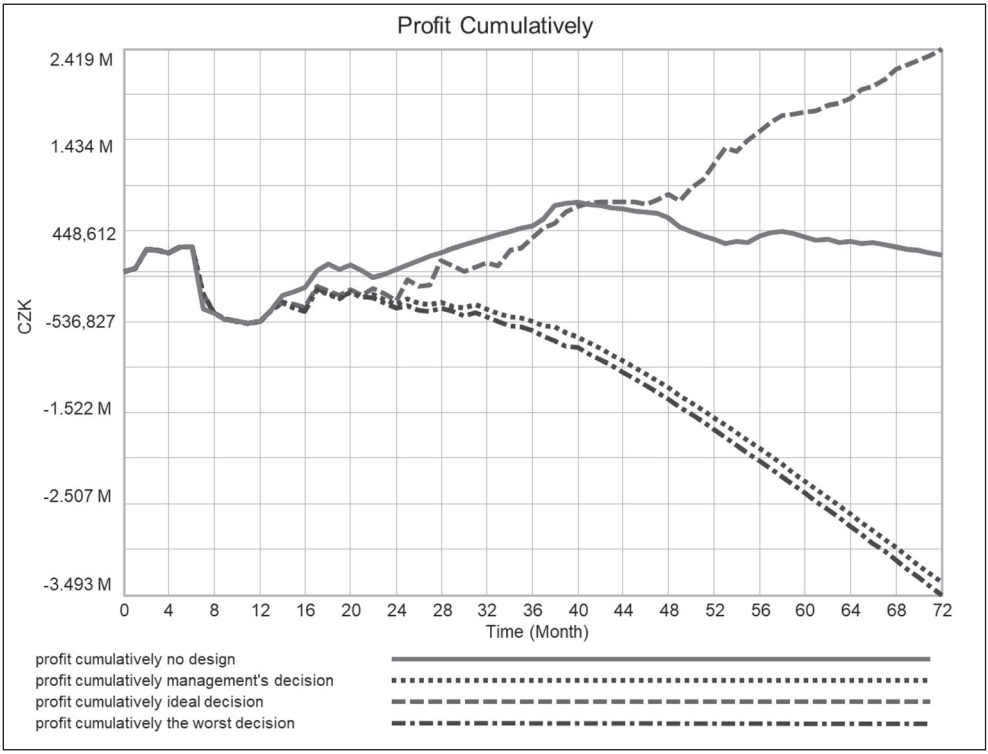
Participant's decision – legend: (1) The most important; (2) Very important; (3) Less important; (4) The least important. Profit = revenues minus costs; ROI – Return on Investment: Ratio indicator measures the return of assets and all other costs, which means ROI = (assets + total cost)/profit.

The subsequent interview with the participant was conducted with the aim to find out information about the business and make a Business Model based on the collected qualitative data.

3.1 Visualization of the Results of Design Value Measuring in Four Scenarios

Based on the above-mentioned data collected in a qualitative research, we gathered the design strategy opinion from management. The management (research participant) decided that in the next period he will invest the most in improving the functionality of the product he supplies to the customers. He ranked product aesthetics in the second place and product distribution in the third place in order of importance. He considers the efforts aimed at building the company's brand to be the least important. The participant's incorrect decision had an impact on the company's Business Model. The level of manufactured and

Fig. 2: The visualization of a business performance (Profit)



Source: own

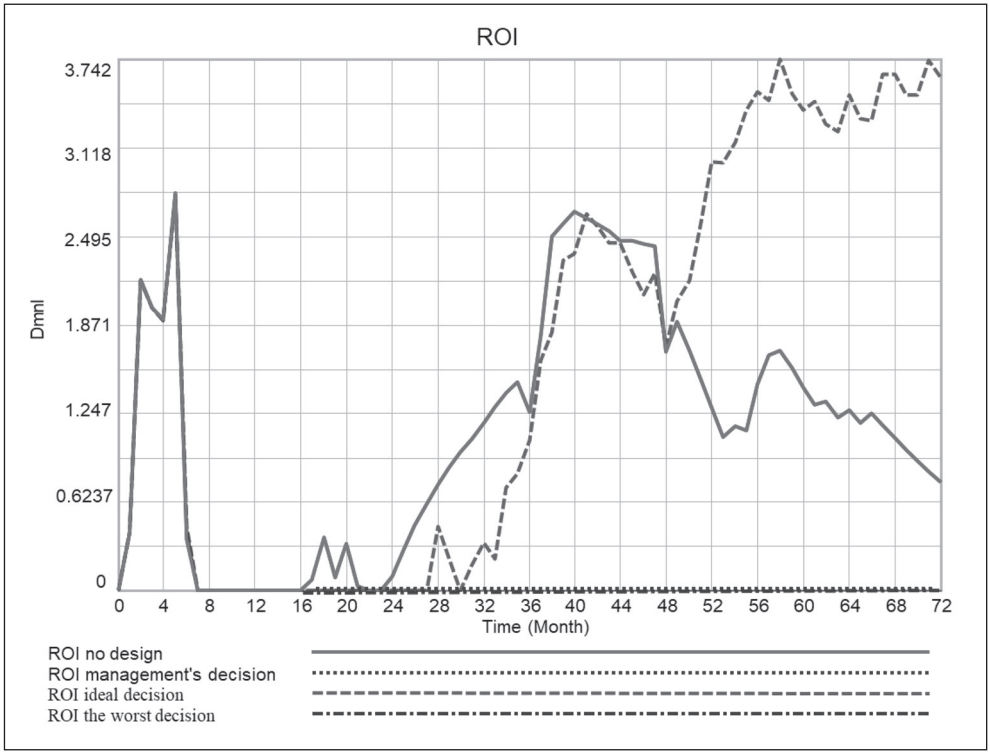
supplied products is high even without further investments. An entrepreneur who wants to innovate using design has to strengthen the field that will have the biggest impact on customer experience, which means their satisfaction with the way that the product is distributed.

The interpretation of research results is based on the fine-tuning of functional, distribution, emotional and social customer experience. The economic importance of the benefits of design as an integrator of knowledge of all four areas is significant under the condition that the design field that will have the most significant impact on customer satisfaction is strengthened (leverage effect).

Under otherwise unchanged conditions (ceteris paribus), the entrepreneur has two options, only one of which leads to an improvement of the company's economic parameters:

1. Purposely do not invest in design, design is an integral part of products, the products are fine-tuned to the customers' wishes. The company's economic results are balanced, and in the horizon of the next four years they are on a sustainable level of profit of 200,000 CZK to 900,000 CZK (continuous red curve);
2. Focus on fine-tuning of the product distribution to the customer. Distribution design has the most substantial leverage effect on the improvement of sales parameters. Strengthening of the company's brand is in the second place for design fine-tuning, and product functionality is only in the third place in the possible impact on the company's higher profits. The entrepreneur may focus on design innovations in the field of product aesthetics only marginally. A decision in the proposed order of priorities

Fig. 3: The visualization of a business performance (ROI)



Source: own

is ideal and has the following coefficient: DVA best decision = 2.23; broken green curve in the company's economic results, Fig. 2 and 3.

3.2 Answering Research Questions

RQ_1: Make investments in design always increase the economic value of a company?

Investments in design do not always increase the economic value of a company. Investment in design is not successful in business when the entrepreneur does not find out their customer's preferences during the decision-making process and invests in design in the fields where the customer has already been saturated. The calculations of two economic indicators (Profit, ROI) are represented graphically (Fig. 2, 3). The economic benefits of design to a company are always significantly influenced by the entrepreneur's strategic decision. In the case study of a small manufacturing company, only the ideal entrepreneur's decision on investments in design leads to a higher profit. On the contrary, an incorrect decision can lead the company to a loss. The right investment in design is the entrepreneur's decision and is based on the understanding of customer expectations and on the comparison of the company's product with the competition in four parameters of design that must be influenced in a way that achieves mutual harmony: appearance, functionality, product distribution and company brand.

RQ_2: Is it possible to measure design value using system dynamic modeling of company processes in a way that design value is measured by usual economic indicators?

Design is too integral to measure the return on investment in design easily. The answer

to the research question is affirmative. It is possible to measure design by substituting it into the company's system of economy, into its business algorithms. The graphs (Fig. 3, 4) comprehensibly show the entrepreneur the prediction of profit development and of the ROI indicator development in four possible scenarios. The Design Value Algorithm coefficient is quantified as a dimensionless indicator and it is substituted into the company model. It is a comprehensible way of design value measuring which shows the value of design using selected economic performance indicators (Profit, ROI).

4. Discussion

The resulting definition of design published in this article is extended to the product distribution aspect, as compared to the definition of design (BCD Barcelona Design Centre, 2014). Design means to create, improve or implement a quality product, a good service, marketing or organizational method which balances functional, distribution, emotional and social tools designed to saturate customer needs. The article formulates a new tool for design value measuring which encompasses all aspects of this new definition of DVA.

It is not possible to interpret functional, distribution, emotional and social values as isolated skills that are used by companies as input factors for their production. Instead, it is necessary to interpret these values as a complex tool which affects the customer's perception and, at the same time, as a tool that must be used correctly in a company. In a specific calculation and fine-tuning of the economic value of design, two perspectives meet: one of them is the consumer's/customer's perspective (to saturate their needs) and the other one is the company's perspective (to generate sales by understanding and acknowledging customer needs).

While the definition of design offered by this article matches the study (BCD Barcelona Design Centre, 2014), the definition for determining the design value in a company proved to be more difficult during the research. The research presented in this article goes beyond the definition of design and addresses the benchmark of the economic value of design as its main problem. An interesting opinion on this issue is that of DMI: Design Value Institute (2015). Design value is hard to define as a function because design has different meanings in different industries. This makes it difficult to compare standardized metrics of measuring of the return on investment in design. A group of researchers from the € Design | Measuring Value Design project is of a similar opinion: the initial investment in design is not directly proportional to the benefits of design for the company, which is why it is necessary to create a dynamic model to calculate design value. However, the dynamic model is not part of the output created by the key project (BCD Barcelona Design Centre, 2014).

Despite the limits given by DMI: Design Management Institute, the measurement metrics which set the economic value of design have been derived and the method of its calculation is described in the article. The DVA coefficient is a variable that captures the definition of design in its whole concept and calculates its value based on the definition. The value of the coefficient is different in every company and is based on the questionnaire with which the company's management works. The resulting DVA coefficient value is substituted into the system dynamic model. As design is considered from the customer's perspective, the DVA coefficient influences the model's building element: Customer segment. All other building elements of a business model are influenced by this element (Osterwalder & Pigneur, 2010).

The research results are confirmed by their correspondence with the definition of design according to BCD Barcelona Design Centre (2014), Moultrie and Livesey (2014), Rae (2014). The definition of design has been extended to include distribution and this aspect of design-related activities has been included in the questionnaire in an appropriate way. The article follows the recommendations for design value measuring and extends the ways to calculate the economic value of design according to the (BCD Barcelona Design Centre, 2014) concept. The economic value of design is given by common indicators, which are the company's profit and ROI.

It has been stated by Best (2015) in her publication focused on Design Management that a company should invest in product design innovation in the phase of maturity and plan a new redesign or facelift of the product. If this matter is addressed as late as in the phase of decline, the company may not manage to

launch the innovatived product in time. It will always depend on how delayed the effect of underinvestment is. This is a typical archetype according to Senge (2006), Business growth and Underinvestment. The leading principle for the archetype is the following: If there is realistic potential for growth, create capacity ahead of demand, as part of a strategy for its creation. According to the Growth and Underinvestment archetype, only one entrepreneur's decision is correct: to invest in design during the company's growth. Without proper investment in design, the company will face a struggle for survival in the market. The system dynamic business model which shows further development of the company's activities using scenarios is a suitable tool that can help the company's management to make the right decision at the right time.

A significant added value of the article is the use of visual tools in the process of qualitative data collection. The Design Value Canvas tool, which works with visual elements, was the main one to be used, together with Business Model Canvas according to Osterwalder and Pigneur (2010). The approach to the calculation of the DVA coefficient, which measures the impact of design on the economic prosperity of a company, as well as the appearance of the questionnaire, which evokes a board game, is in accordance with the principles of design thinking in which the customer is always in the limelight. The questionnaire in the Canvas form stirs positive emotions and contributes to the comprehensibility of the complex definition of design and of the parameters of the calculation of economic value of design.

Conclusion

The correlation between a company's investments in design and the business success is so clear that it cannot be ignored or questioned (Denmark National Agency for Enterprise and Housing, 2003). The companies that base the change of their manufacturing program on a complex approach to design are significantly more successful in markets than companies that have not incorporated design in the portfolio of their business, manufacturing or marketing activities. The complex approach required in design includes steps that lead to the formulation of a new definition of design: Design is an integration of functional, distribution, social and emotional tools focused on the customer. It follows from the definition that design is not narrowly focused solely on the emotional side of a product, but it is a broader concept, i.e. progressive design of products, technologies and processes in a company, focused on increasing customer satisfaction. The creation of economic value is a system whose elements mutually influence one another and show nonlinear behaviour. Such a system requires economic analysis using dynamic models to understand and observe the relationship between the economic value of a company and investments in design (BCD Barcelona Design Centre, 2014).

The aim of the article is a proof that methods of measuring the economic value of design can accept the complexity of its new definition. The aim of the research, a set of tools for measuring the economic value of design in an only coefficient based on the definition of design, has been achieved. The DVA coefficient is an external parameter which is used in the system dynamic model of key processes in a company and it calculates economic parameters of a company using scenarios. The benchmark of the economic value of design thus moves to comprehensible company indicators: Profit, ROI. The DVA coefficient input data is collected using qualitative research in a company and with the help of the Design Value Canvas questionnaire which proves the interconnectedness of individual elements of the definition of design in a comprehensible way. The way the DVA coefficient is calculated is universally valid for any company regardless of its industry. Its applicability has been proven on a case study of a small manufacturing company which provided its data for the research.

This issue has its limitations. Firstly, a possible distortion, that the management may unknowingly commit when answering the questions in the questionnaire. In particular, the comparison with the competition in the four areas of design is very often overestimated, the company feels in a better position compared to the competition than it really is. Secondly, the E (Customer Experience) indicator could be by management inappropriately increased, which is a crucial parameter for further calculations and influences the correctness of decision-making.

Further research of this issue may focus on confirming the role of design as a separate economic factor in production development

companies. It may be determined whether the companies used the knowledge about the measured value of the design and whether they improved their market position according to the assumptions as they were interpreted based on the research.

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