

University doctoral (PhD) dissertation abstract

**DESIGN OF A CONTROLLING-BASED INFORMATION
SYSTEM FOR ENTERPRISES MANUFACTURING
STANDARD PRODUCTS**

György Zsolt Oravecz

Supervisor:
Mrs. Ferenc Kondorosi Dr. habil
university lecturer, PhD



UNIVERSITY OF DEBRECEN
Károly Ihrig Doctoral School of Management and Business

Debrecen, 2015

1. 1. THE PRELIMINARIES, AIMS OF THE RESEARCH AND PRESENTATION OF THE RESEARCH HYPOTHESIS

1.1. 1.1. The social and economic role of enterprises

It is an aim of every country to develop and operate such an economic system (national economy) that promotes the growth of the economy, the increase of incomes, the improvement of the employment situation, i.e. the improvement of living standards. In this economic system enterprises that are capable of successful and efficient business operations while observing the law, play a key role. Enterprises can become successful and effective, i.e. useful players in the national economy, if the entrepreneurs are aware of the aims of the enterprise and perform their economic activities taking into account the opportunities as much as possible.

According to the “going concern principal” the aim of the enterprise is survival in the long term (stability) which can be accomplished if in its economic activities the enterprise generates a positive result in the long term, i.e. an income. In order to accomplish that, in its business activities the inputs brought into the system (enterprise) are transformed in a way that the economic value of the issued outputs should exceed the value of the economic sacrifices. However, generating an income is not the only condition for the survival of the enterprise, other conditions include a series of the necessary supplementary organizational and other activities. It is another feature of stability that in the changing market environment the enterprise is only capable of adapting if it constantly grows and develops. Investments are necessary for growth and development, for which the coverage is provided by the income produced earlier, and which will generate the income to be used as coverage for subsequent investments.

Through their activities enterprises also fulfill important social tasks. They produce the various goods and services that serve to satisfy the ever-increasing consumer needs. They play a special role in the employment of one of the most important economic resources, i.e. the labour force. By paying taxes they contribute to the revenues of the central budget, therefore the quality of the fulfillment of public tasks can also significantly vary depending on their number and efficiency.

The consequence of their successful operation is economic growth, the increase of incomes, improvement of the employment situation, i.e. improvement of living standards. Therefore, it is safe to say that enterprises are the key for our successful future (CORVIN CENTER OF PUBLIC EDUCATION, 2008).

1.2. The entrepreneurial mindset from the political changes to this day

At the end of the 1980s and at the beginning of the 1990s Eastern-Central European countries underwent radical economic and social changes. They broke away for good with the system of planned economy, and embarked on the bumpy road of the development of the market economy. Hungary played a leading role in this process, that way the institutional system necessary for the operation of the market economy was already in place at the beginning of the 1990s. The powerful influx of foreign capital started off, and coupled with the enterprising spirit that had been suppressed for a long decades, it triggered a dynamic and ambitious wave of enterprising.

The enterprises established in the first years of the political changes can be assigned to three large groups according to how the entrepreneurs acquired majority ownership in their own businesses. The first group comprises those entrepreneurs who had been working at the beginning of the political changes for a state owned enterprise in an executive position, and therefore they could utilize their political clout to buy state property at much below the fair market price. The second group comprises those entrepreneurs who acquired major properties during privatization, by starting their own private undertakings during the time of socialism already. These entrepreneurs were able to accumulate such a volume of capital through their private undertakings before the political changes that they could spend on the acquisition of state property at the time of the political changes. The third group comprises those entrepreneurs who could not take advantage of privatization, therefore each of them had to start their business career as owners of small and medium enterprises. It was of these latter entrepreneurs who were in the most difficult situation, as they had to build up their undertakings totally from scratch.

A significant part of the small and medium enterprises established in the first years of the political changes had become sole owners or owners with a controlling interest of medium and large enterprises by the end of the 1990s. Undertakings established with a registered capital of a few tens of thousands of forints employed several hundred persons and produced sales of several hundred million, sometimes several billion forints annually. However, in our time small and medium enterprises are characterized by shrinking market share and an investment activity that is more restricted than the average. This should give an indication to the Hungarian government, since without changing the economic regulations the situation of this group of entrepreneurs could significantly deteriorate in the future. If the profitability, and therefore the accumulation and investment capability, of small enterprises remains persistently lower than those of large enterprises, this could strengthen the traditionally dual enterprising structure of the Hungarian economy (JUHÁSZNÉ, 2011).

There were many people who considered the political changes as the advent of the long-awaited freedom, and those who started their enterprising careers at that time believed that all they had to do was working, and they would be guaranteed a secure livelihood. However, a few years after the political changes they had to awaken to the fact that within the framework of the market economy life is not so simple, and that they would have to overcome several very serious obstacles in order to have a successful business. At first, it was the observation of the rules (especially the tax laws) that caused difficulties, but later on the gradually increasing market competition started imposing challenges to the entrepreneurs. Market competition has become really intensive from the middle of the 1990s, the foreign competitors started to gain more and more influence in the Hungarian market. However, these competitors had much better capitalization, they were much more organized and developed than Hungarian entrepreneurs, owing to the fact that their development had not been arrested by the anti-entrepreneurial regime of 40 years of socialism. In our time this kind of approach is less and less viable. Even though these enterprises had to start competing with the foreign enterprises from a significantly inferior position, it gives them no excuse for the fact that 25 years after the political changes the overwhelming majority of Hungarian

entrepreneurs are still not aware of the fundamental rules of the market economy and business management.

Recently, we could hear more and more about the significance of the entrepreneurial culture, however, there are many people who are not aware of either the meaning of this term or its influencing factors, or its impact on the national economy and living standards. The quality of entrepreneurial culture highly depends on how well the entrepreneurs are able to define the general aims of undertakings, their role in the national economy, furthermore, on how loyal the entrepreneurs are to the taxation regime, the market players (suppliers, customers, competitors, authorities). Accordingly, we can talk about a high-level entrepreneurial culture if there is a high number of such undertakings (entrepreneurs) that are aware of the general aims of enterprises, their role in the national economy, furthermore, if we have a high number of enterprises that do not mainly focus on tax evasion, rather on paying the taxes, and the mindset of “live and let live” is manifest in their market conduct. Since these factors are closely interrelated, therefore their improving trend (even if considered severally) increases the number of successful and efficient enterprises. Thanks to that, the revenues of the state budget will increase, the number of employed persons will go up, which leads to growth of the economy and better living standards.

In comparison with developed West European countries, the ratio of the gray and black economy in Hungary is extremely high, these sectors produce a GDP of HUF 4800-4900 billion and deprive the state of a tax revenue of almost HUF 2000 billion (INDEX.HU, 2010a). What compounds the problem in Hungary is that even with such large gray and black economies the back taxes assessed by the Tax Office and not paid by enterprises total as much as HUF 1600 billion (INDEX.HU, 2010b). These enterprises are driven by one objective, which is to pay as little tax into the state budget as possible. They can accomplish that by minimizing their legal revenues and maximizing the eligible costs against their legitimate revenues. As a result, they can minimize their corporation tax and value-added tax liabilities, which are considered wrongly as costs by many enterprises. In this case the problem is that without appropriate skills and attention it is difficult to find out that ratio between costs and revenues at which the enterprise can present a credible picture to the Tax Authority. The

aim is once again to minimize liabilities to the state budget in the case of taxes and contributions related to wage type payments, which is accomplished by minimizing wage type payments (wages, allowances, etc.). The result is a high number of employees who are registered with the tax office as receiving minimum wage or working part-time, therefore they are hardly able to take advantage of the services provided by the welfare system (e.g. pension, health care benefits).

The existence of the gray and black economy means a huge problem for any national economy. On the one hand, it strips the state budget of significant revenues, on the other hand, it prevents the development of enterprises that are loyal to the tax regime and could ensure in the long term the constant and balanced development of the economy, thirdly, it also causes damage to the employees. There are two approaches to the suppression of the grey and black economy. On one side, at any time the incumbent government must take the necessary steps by establishing an enterprise-friendly, development-focused macro-economic environment. On the other side, the business profession must develop and disseminate such an accessible and adaptable business management system (e.g. a uniform, controlling-based information system) that will provide assistance with teaching enterprises how to manage their businesses legitimately and efficiently.

1.3. The relation between controlling and cost-conscious business management

After the political changes, a powerful influx of foreign capital started in Hungary, which brought with itself the specific entrepreneurial culture of the investing countries. As a result, they introduced a new type of enterprise resource management method, with controlling as its focus.

By the middle of the 1990s controlling had become increasingly known and accepted in Hungary. However, at the time controlling was nothing else than a "fashionable" concept, which was intended to be used for a lot of things, and often magical powers were attributed to it, making it a panacea for every problem. At the end of the 1990s there was hardly any large corporation in Hungary that did not apply a controller and did not include among its medium-term objectives to

build up and operate an efficient, controlling-based information system. But in most cases the initial enthusiasm ended up in failure. It happened in highly capitalized companies under Hungarian management that the company could not build up an efficiently operating system despite the major investments, since in the investments the focus was placed on establishing the infrastructure (computer network, software), and hardly anyone dealt with the exploration and parameterization of the economic processes. This derived from the fact that there were very few professionals who were aware of the real function of controlling, and there were even less of those who could also develop and operate these systems. These failures had a negative impact on the assessment and development of controlling in Hungary. Enterprises viewed these systems with pessimism, and to this day the professional community has not been able to work out such methods that could be utilized in practice and would make accessible and usable the controlling-based information systems for the enterprises.

It is a fundamental feature of enterprises that in a constantly developing macro-economic environment they pay less attention to conscious business management. The constant increase of demand primarily drives enterprises to fulfill the consumer needs, and in many cases cost consciousness is put on the back burner. This phenomenon could be very well observed in Hungary in the one and a half decades following the political changes. Owing to that, when the difficulties of the global economic crisis manifested themselves, such an unprepared entrepreneurial community had to cope with the situation, which was also significantly behind their Western competitors in the field of entrepreneurial culture.

The question can be raised: why do costs play a central role in the life of an enterprise, and why do they require special attention in order to ensure successful business. According to KÖRMENDI – TÓTH, 1999, in the competitive sector the market price of the product is determined primarily by the buyer, and not the entrepreneur. The buyer will decide himself what is the sacrifice that he is able to make for the characteristics of the goods, and thus what price he is willing to pay for them. Therefore price is a market category. The only way for the entrepreneur to generate business profit is to keep its costs at a lower level than the market price. Strongly simplified, the formula is:

“profit = sales - costs.” Since with appropriate approximation we can consider the price in the market constant with a given functional performance, when the entrepreneur negotiates the price with the customer, he will only be able to undercut the competition if his cost ratio is lower, that is how he can accomplish a price margin and consequently, a profit. Another way to raise the price margin is to increase the price of the product, but with the given cost of the entrepreneur, it can only be accomplished by increasing functional performance, however, this requires a much higher investment than a possible reduction of costs with the given functional performance.

In many cases a particular crisis situation requires the enterprises as well to make a decision. Today this crisis situation is the global economic crisis, in which the enterprises are looking for solutions. A solution for how they could remain competitive, how they could expand their markets despite decreasing demands. A shift towards (cost) conscious business management could be a solution in that, which provides the foundation for controlling-based information systems.

1.4. Aims and hypotheses

In my doctoral thesis I distinguish two groups of aims. The first group includes the foundational aims (C_1 , C_2 , C_3), while the second group the main aim (C_4). By the foundational aims I intend to support the relevance, substantiation of the main aim. By the foundational aims I intend to confirm the lack of professionalism of the entrepreneurs and business experts affected by this matter (controlling-based information systems) (C_1), the low level of application of controlling-based information systems (C_2) and the business benefits of these systems (C_3). Supported by these, the main aim of my doctoral dissertation is the development of such a controlling-based information system for companies manufacturing standard products, that can be applied regardless of the size of the enterprises and the manufactured products, can be enhanced, is adapted to the Hungarian financial and accounting standards, furthermore, enables the categorization of the manufactured products according to their income-generating capabilities (C_4).

Based on my aims, I intend to prove seven hypotheses. The first (**H₁**), the second (**H₂**) and the third (**H₃**) hypothesis is related to the foundational aims, while the fourth (**H₄**), the fifth (**H₅**), the sixth (**H₆**) and the seventh (**H₇**) to the main aim. Of the four hypotheses related to the main aim, the first (**H₄**) one should be assessed as the foundational hypothesis, whose partial or total refutation would make the assessment of the second (**H₅**), third (**H₆**) and fourth (**H₇**) hypothesis irrelevant.

In my research my aim was to demonstrate the following:

- H₁**: The entrepreneurs and the business professionals are not aware of the importance of controlling-based information systems, even twenty-five years after the political changes.
- H₂**: Only a small number of enterprises operate a controlling-based information system in Hungary.
- H₃**: Enterprises that do operate a controlling-based information system manage their business more efficiently and more successfully.
- H₄**: It is possible to develop such a controlling-based information system for companies manufacturing standard products that can be applied and enhanced regardless of the size of the enterprises and the manufactured products.
- H₅**: The installed controlling-based information system enables the definition, in an exact manner, of the cost composition of the individual products according direct eligibility for recognition (direct and indirect costs) and prime cost levels (direct, narrowed and total prime cost).
- H₆**: The installed controlling-based information system enables the definition, in an exact manner, of the cost composition of the individual products depending on the production volume (fixed and variable costs) and their breakeven point.
- H₇**: The installed controlling-based information system enables the definition, in an exact manner, of the income-generating capability of the individual products.

I apply three methods to verify the aims and to prove the related hypothesis. I apply the first method (M_1) for the first and the second aim and for the first and the second hypothesis. This method of assessment applies a questionnaire survey technique, which is the most common primary method for research and collection of information. I use the second (M_2) method of assessment for the third aim and for the third hypotheses. This assessment method is a research technique that I developed for myself, which enables the ranking of the enterprises involved in the assessment, based on the comparison of their indicators calculated from the annual reports. Finally, the third (M_3) assessment method is related to the fourth aim, and to the fourth, fifth, sixth and seventh hypothesis. This assessment method is the development of a mathematical model, which I will present using an analytical method.

1: Relationships of the aims, hypotheses and methods of the doctoral dissertation

Aims	Hypotheses	Methods
C_1, C_2	H_1, H_2	M_1
C_3	H_3	M_2
C_4	H_4, H_5, H_6, H_7	M_3

Source: The author's compilation, as described in the sub-chapter

2. PRESENTATION OF THE DATABASE AND THE APPLIED METHODS

2.1. How controlling-based information systems are viewed in Hungary

As my first foundational aim, I intend to prove my statement that entrepreneurs and business professionals affected by this matter lack professionalism, and that controlling-based information systems are only used to a small extent. As my method to explore that issue, I chose assessment by questionnaire, which is the most common primary research and information collection technique. Its aim is to ask substantial questions and thereby collect relevant information about a specified group of persons or a specified group of the population.

In the case of the questionnaire assessment technique, it is necessary to prepare a research program that may include the following:

- setting the research task;
- definition of the research method (in this case assessment by questionnaire);
- definition of the population subject to the research;
- identification of the known distributions within the population;
- the exact definition of what the questioner wants to know and what is it that he would like to find out based on the questionnaire;
- formulation of the fundamental questions of the area intended to be explored;
- putting together the questionnaire;
- selection of the representative sample;
- verification of the questionnaire (by some experimental surveys);
- finalization of the questionnaire, obtaining authorization, preparation for printing and printing out in the necessary print run;
- conduct of the actual survey and dispatch of the questionnaires to the individuals of the sample;
- summarization, grouping and verification of the obtained information;
- quantification of the data (conversion into measurable form);
- definition of the assessment method(s) to be applied;

- analysis of the data and presentation of the conclusions (MAJOROS, 2004).

In the questionnaire processed in my doctoral dissertation the questions asked can be assigned to three groups. The questions belonging to the first group (questions no. 1, 2, 3, 4 and 5) are partly closed-ended questions and partly questions applying to numerical data and facts. The questions belonging to the second group (questions no. 6, 7, 8, 9) are fully closed-ended questions, as are those belonging to the third group (questions no. 10, 11). By the questions belonging to the first group, I assess the variations of the questions belonging to the second group, while the questions belonging to the third group are used to verify the credibility of the respondents. The questions belonging to the second group are considered the central (main) questions of the questionnaire, I assess the variations of these questions depending on the questions belonging to the second group.

In the case of questions belonging to the first group I collect information concerning the respondent and the enterprise of the respondent, such as the education of the respondent, as well as the county relevant for the enterprise of the respondent, its type, net sales and the number of employees. In the case of questions belonging to the third group I asked the respondents whether they intended to participate in additional research and whether they would like to receive information on the further results of the research.

Concerning the questions belonging to the second group, first I wanted to find out what the enterprises expect from a controlling-based information system, i.e. how they interpret the controlling mindset. I provided five possible answers to the question, which continuously converge to the right definition. According to the first definition: "Controlling should constantly control the quality of the finished goods and provided services", according to the second definition: "Controlling should quantify the major metrics related to the production of goods and services", according to the third definition: "Controlling should give answers to those business-related questions that the management currently considers important", according to the fourth definition: "Controlling should determine what is the profitability of the branches (cost centres) to be planned and their actual profitability", while according to the fifth definition: "Controlling should determine the cost

needs of goods and/or services to be planned and their actual cost needs."

By the second question my intention was to find out who is the professional to whom the enterprises would assign the task of installing and operating a controlling-based information system. I provided five possible answers to the question, which continuously converge to the right answer. The first answer was "a quality assurance professional", the second was "a logistic (technical) professional", the third was "an IT professional", the fourth was "a business organization professional" and the fifth was "a financial and accounting professional".

Concerning the third question I wanted to find out how important enterprises consider controlling in the life of an enterprise. I provided five possible answers to the question. The first answer was "not important at all", the second was "somewhat important", the third was "fairly important", the fourth was "important" and the fifth was "very important".

By the fourth question my intention was to find out whether a controlling-based information system is operated in the enterprises. I provided five possible answers to the question. The first answer was: "No, and we do not plan to install one", the second answer was: "Yes, but we do not really benefit from it", the third answer was: "No, but we plan to install one in the long term", the fourth answer was: "No, but we plan to install one in the short term", the fifth answer was: "Yes, and it helps our work very much".

I received great assistance with the distribution of the completed questionnaire from László Zara, president of the Association of Tax Consultants, who requested members of the Association (tax consultants, tax professionals, accountants, auditors) to have enterprises within their customer base complete the questionnaire. The sample obtained that way covered all counties, we received answers from the counties from enterprises of various size, type and level of preparedness. I processed the returned data, evaluated them and made them suitable for interpretation using a pie chart. By my method I intend to prove or disprove my hypothesis that the entrepreneurs and the business professionals are not aware of the importance of controlling-based information systems, even twenty-five years after the

political changes, furthermore, only a small number of enterprises operate a controlling-based information system in Hungary.

2.2. The utility of controlling-based information systems

Concerning the foundational aims, the second one that I intend to verify is the utility of controlling-based information systems. For that the assessment method that I applied is a research technique that I developed for myself, which enables the ranking of the enterprises involved in the assessment, based on a comparison of their indicators calculated from the annual reports. The ranking of enterprises created that way enables me to verify my hypothesis connected to the aim.

In order to verify the utility of controlling-based information systems I compared nine enterprises and wanted to find out whether it is possible to demonstrate a favourable difference based on the analysis of the annual reports between enterprises operating a controlling-based information system and those that are not. I assigned the enterprises to three categories. The first category comprises those enterprises that do not operate a controlling-based information system (enterprises no. 1, 2 and 3), the second those that do operate one, but improperly (enterprise no. 4, 5, 6), and finally, the third category comprises those that operate one and properly (enterprises no. 7, 8 and 9). It is important to note that before the research I studied the business management systems of the nine enterprises involved in the survey, and I assigned them to one of the three categories based on the information obtained that way and the conditions declared in advance. According to the conditions declared in advance, the controlling-based information system works improperly if the relations between economic processes (events) have not been developed according to the causal relations, and the controlling-based information system works properly if the relations between economic processes (events) have been developed according to causal relations.

I needed these three categories in order to prove my hypothesis, since my experiences gained so far proved that those enterprises that do not operate a controlling-based information system can be more profitable than those that do operate one, but improperly. Naturally, enterprises operating with a well-parameterized controlling-based information system are more profitable than any other enterprise.

I conducted the research by the comparison of various indicators, which I calculated from the annual reports of the nine enterprises. I used four indicators for the analysis of the asset position of the enterprises, two for the analysis of their financial position, and once again four indicators for the analysis of their profitability position. I ranked the enterprises according to the values of the individual indicators, then I scored them. I established the final ranking of the enterprises by summarizing the scores obtained that way.

For my research I chose enterprises that manufacture standard products. I have used the following indicators for the assessment of the asset position of the enterprises:

- ratio of non-current assets,
- ratio of shareholder's equity (equity ratio),
- self-financing indicator of capital,
- coverage of non-current assets.

I have used the following indicators for the assessment of the financial position of the enterprises:

- liquidity ratio,
- acid test ratio.

I have used the following indicators for the assessment of the profitability position of the enterprises:

- operating profit on sales,
- profit before tax on sales,
- profit on wages,
- profitability on sales.

The ratio of non-current assets compares non-current assets to all assets. This indicator shows what is the ratio of non-current assets invested permanently of all assets of the enterprise. From the definition it follows that the increase of this ratio is favourable for the enterprise.

$$\text{Ratio of non-current assets} = \frac{\text{Non-current assets}}{\text{Total assets}} \times 100$$

The ratio of shareholder's equity (equity ratio) compares shareholder's equity to the total amount of liabilities and shareholders equity. This indicator shows what is the ratio in which the assets of the enterprise

are financed by shareholder's equity. From the definition it follows that the increase of this ratio is favourable for the enterprise.

$$\text{Ratio of shareholder's equity (equity ratio)} = \frac{\text{Shareholder's equity}}{\text{Total liabilities and shareholder's equity}} \times 100$$

The self-financing ratio of capital compares the profit reserve and the balance sheet earnings to the total amount of liabilities and shareholder's equity. This indicator shows what is the ratio of accumulated earnings within shareholder's equity. From the definition it follows that the increase of this ratio is favourable for the enterprise.

$$\text{Self financing indicator of capital} = \frac{\text{Profit reserve} + \text{Balance sheet earnings}}{\text{Total liabilities and shareholder's equity}} \times 100$$

The coverage of non-current assets compares shareholder's equity to non-current assets. This indicator expresses to what extent the total non-current assets of the company are financed by shareholder's equity. From the definition it follows that the increase of this ratio is favourable for the enterprise, because it means that shareholder's equity finances an increasing ratio of non-current assets.

$$\text{Coverage of employed assets} = \frac{\text{Shareholder's equity}}{\text{Non-current assets}} \times 100$$

The liquidity ratio compares current assets to current liabilities. This indicator shows in what percentage the current assets of the enterprise cover its current liabilities. From the definition it follows that the increase of this ratio is favourable for the enterprise.

$$\text{Liquidity ratio} = \frac{\text{Current assets}}{\text{Current liabilities}} \times 100$$

The acid test ratio compares current assets less inventories to current liabilities. This indicator shows in what percentage the current assets of the enterprise less the uncertain inventory elements cover its current liabilities. From the definition it follows that the increase of this ratio is favourable for the enterprise.

$$\text{Acid test ratio} = \frac{\text{Current assets} - \text{Inventories}}{\text{Current liabilities}} \times 100$$

The operating profit on sales compares the operating (business) level profit to the revenues of the enterprise. This indicator shows the size of the operating (business) profit created by one unit of revenue. From the

definition it follows that the increase of this ratio is favourable for the enterprise.

$$\text{Operating profit on sales} = \frac{\text{Operating (business) profit}}{\text{Net sales revenue} + \text{Other revenues}} \times 100$$

The pre-tax earnings on sales compares the pre-tax earnings to the revenues of the enterprise. This indicator shows the size of the operating (business) profit before tax created by one unit of revenue. From the definition it follows that the increase of this ratio is favourable for the enterprise.

$$\text{Profit before tax on sales} = \frac{\text{Pre-tax profit}}{\text{Net sales revenue} + \text{Other revenues} + \text{Revenues of financial transactions} + \text{Extraordinary revenues}} \times 100$$

The profit on wages compares the operating (business) profit to staff expenditures. This indicator shows the size of the operating profit created by one unit of wage cost. From the definition it follows that the increase of this ratio is favourable for the enterprise.

$$\text{Profit on wages} = \frac{\text{Operating (business) profit}}{\text{Staff expenditures}} \times 100$$

Profit on sales compares the after tax profit to net sales. This indicator shows the size of the after tax profit before tax created by one unit of net sales, i.e. the profitability of sales. From the definition it follows that the increase of this ratio is favourable for the enterprise.

$$\text{Profit on sales} = \frac{\text{After tax profit}}{\text{Net sales}} \times 100$$

2.3. Design of the controlling-based information system of a die casting foundry

Within the framework of my main aim I present the design of the controlling-based information system of manufacturing enterprises using a mathematical model created in Microsoft Excel application. In order to keep it realistic, I will present it through the example of a die casting foundry and explain it using an analytical method.

According to AMBRUS, 2007 the mathematical model is a theoretical scheme presented in a general mathematical form, the study of which facilitates the understanding and assessment of the given phenomenon, situation. On the other hand, GREEFRATH, 2007 states that in modelling or mathematical model creation we resolve some kind of problem or issue, usually outside the realm of mathematics, by placing it in a context within mathematics. It is often difficult and non-linear to formulate a problem in the language of mathematics.

The least costly method of resolving the task is the analytical method. The condition of its application is “only” that we should know the mathematical model of the system and a solution created in a closed form should exist for it, subject to the given conditions of uniqueness. A mathematically exact solution will be adequate with the behaviour of the system to the same extent it was adequate with the formulated mathematical model.

The most important steps (activities) of the analytical solution:

- the verbal (narrative) formulation of the task,
- creation of the mathematical model,
- transformation (simplification) of the mathematical model,
- recording the consecutive steps (algorithm) of the solution,
- definition of the relationships constituting the solution of the mathematical model,
- verification of the solution (SZÜCS, 2001).

The development of the controlling-based information system should be started with the development of the internal cost and performance calculation system. The first task is the detailed survey of the general operation of die casting foundries, i.e. the manufacturing processes, the direct and indirect activities serving the manufacturing processes, the administrative activities performing the direction of business operations, furthermore, the relations of all these to one another and to the finished product must be explored. After that the cost objects can be defined, presented in detail, furthermore, the processes of settlement can be worked out.

It is essential to define what we mean by die casting, and to explore what products are manufactured by die casting foundries and who are the intended buyers.

Die casting is a metal-forming technology in which the melted metal is placed into the mould in a very short time and at a very high speed, where it is subjected to high pressure during solidification. Die casting is especially applied for the manufacturing of ingots with a thin wall and sophisticated geometry. In our time different versions of die casting are widely used, mainly in the manufacturing of car parts, electric engines, computer parts, parts of household machinery, handheld tools, etc. The range of weight of ingots manufactured by die casting can be anything between a few grams to approximately 50 kg, these are mainly manufactured from aluminium, magnesium, zinc and copper alloys. Earlier die casting of tin and lead alloys was also significant (DÚL, 2009).

Of the cost objects we should define the cost centres first. The place of the cost center in the hierarchy of cost centres must be identified, along with its cost center ID and name, the major cost types incurred in the cost center together with their characteristics dependent on the volume of production, the content of the cost center, the performance of the cost center together with the presentation of the method of settlement, finally, the characteristics of the original costs incurred in the cost center, according to their eligibility for being allocated to products.

Of the cost objects, in the second round the cost bearers (products, orders) should be defined. In the case of the products (ingots) the production technology data must be identified: the cycle time belonging to the operations, the product quantity manufactured within the cycle time, the percentage of spoiled goods, the quantity of products to be produced in each shift, the number of production lines, and the downtime belonging to the operations. In the case of the orders the ID and name of the order, the content of the order, the method of settlement of the order, finally, the characteristics of how the costs incurred on the order can be allocated to products, should be identified.

Of the cost objects, in the third round the cost types must be defined; this should be started with the development of cost groups. After that, the primary, secondary and calculated cost types belonging to the cost groups must be identified. For that, the ID and name of the cost type, furthermore, in the case of calculated cost types, the method of how the calculated cost type is to be defined from the primarily cost type(s) should be identified.

The allocation of costs issued in the cost centres takes place after the definition of the cost objects. Since the model approaches cost allocation from the side of planning, therefore at first the original costs must be planned on the cost centres (primarily and calculated cost types), in the case of which the characteristics of the cost types dependent on the volume of production and according to eligibility to be allocated to products must be identified. In the entire process of cost recognition the original costs retain this characteristic, thereby providing the cost structure of the products, depending on the volume of production and determining the opportunity to allocate costs to the products.

For the allocation of the costs in each cost center the performance of the cost center must be quantified, which must be determined from data related to operation, furthermore, it must also be determined how much of this performance should be reallocated to another cost object (cost centre, order, product). As a result of the process, the original costs incurred in the cost centres “end up” on the products directly or indirectly, which enables the analysis of the products.

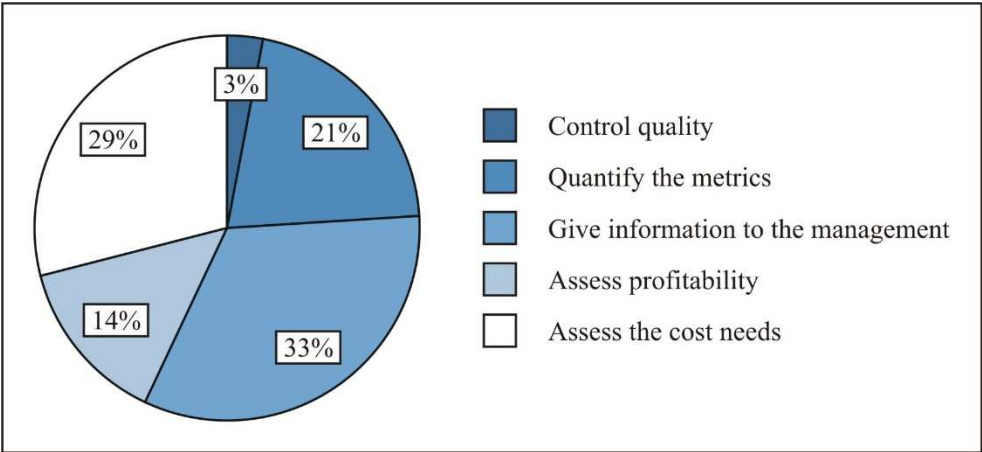
In order to have the internal cost and performance calculation to be a real controlling-based information system, based on the costs allocated to products the management needs to get information that enables them to interfere with production, in order to ensure the efficiency and productivity, or to decide on the termination of the production of certain goods in an effort to reduce the losses. For this I assigned the goods to four categories: economically produced goods, profitably produced goods, goods produced at a loss requiring further production and goods produced at a loss not requiring further production, which I can determine based on the cost composition of the goods depending on production.

3. MAIN CONCLUSIONS OF THE DISSERTATION

3.1. Outcomes of the foundational aims and their evaluation

As my first foundational aim, I intended to prove my statement that entrepreneurs and business professionals affected by this matter lack professionalism, and that controlling-based information systems are only used to a small extent, for which I chose the method of survey by questionnaire, which is the most common primary research and information collection technique.

Concerning the questions belonging to the first group, I wanted to find out what the enterprises expect from a controlling-based information system, i.e. how they interpret the controlling mindset.

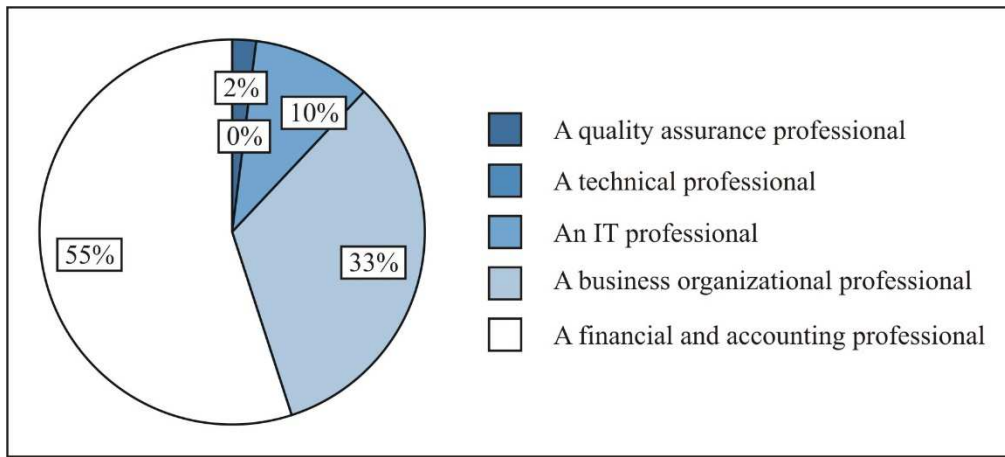


1: What do you expect from a controlling-based information system

Source: The author's compilation, based on the questionnaire

It can be read from the diagram (**Figure 1**), that the ratio of enterprises that could accurately define the essence of the controlling-based mindset is high (29%), and we also have high ratios for those enterprises (14 and 33%, respectively) that could define the concept with good accuracy. However, the ratio of those enterprises that selected their responses from among the first two definitions is relatively low (21 and 3%, respectively).

By the second group of questions my intention was to find out who is the professional to whom the enterprises would assign the task of installing and operating a controlling-based information system.



2: What professional would you commission to develop and operate the controlling-based information system

Source: The author's compilation, based on the questionnaire

It can be read from the diagram (2), that the ratio of enterprises that could accurately answer the question of what professional should be hired to develop and operate the controlling-based information system is high (55%), and the ratio of those enterprises is also high (33 and 10%, respectively) that could answer these questions with good accuracy. However, the ratio of those enterprises that chose their responses from among the first two options is negligibly low (0 and 2%, respectively).

By the third group of questions I wanted to find out how important enterprises consider controlling-based information systems in the life of an enterprise.

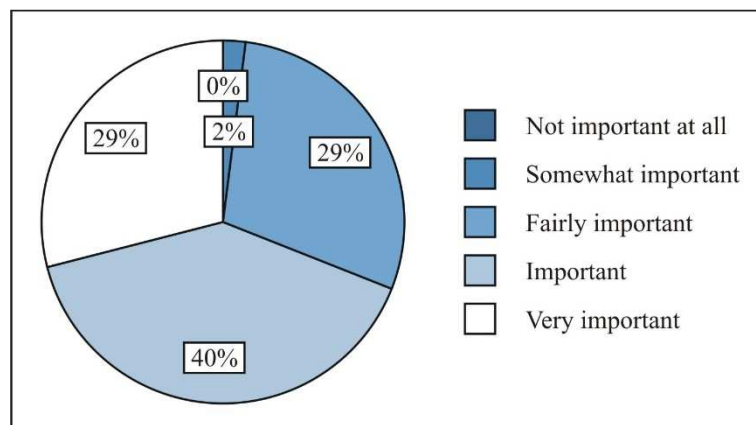


Figure 3: How important do you consider controlling-based information systems in the life of an enterprise

Source: The author's compilation, based on the questionnaire

The diagram (Hiba! A hivatkozási forrás nem található.) shows that the ratio of enterprises that consider controlling-based information systems in the life of an enterprise very important is high (29%), and the ratio of such enterprises is also high (40 and 29%, respectively), who are of the opinion that the controlling-based information system is important or quite important. However, the ratio of those enterprises that selected their responses from among the first two options is negligibly low (2 and 0%, respectively).

In the fourth group of questions my intention was to find out whether a controlling-based information system is operated in the enterprises.

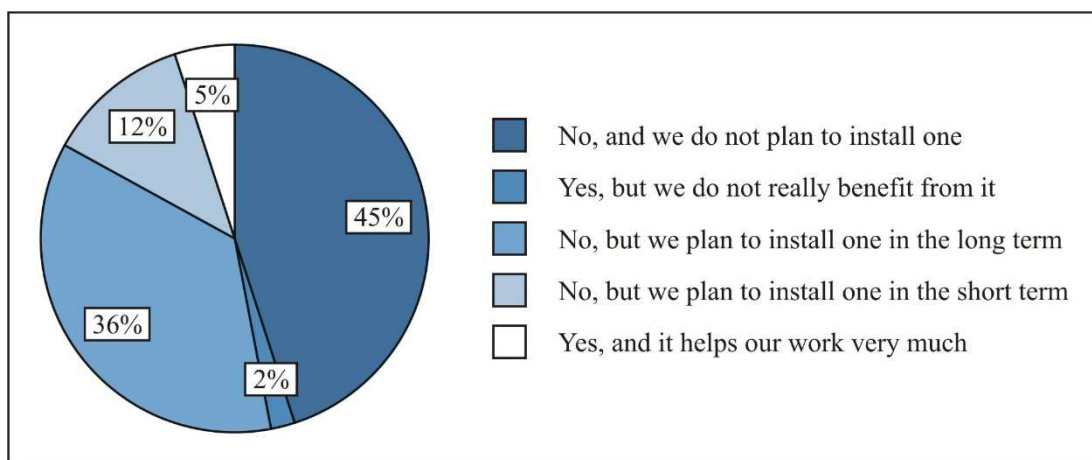


Figure 4: Do you operate a controlling-based information system in your enterprise

Source: The author's compilation, based on the questionnaire

The diagram (**Figure Figure 4**) shows that the ratio of those enterprises that operate a controlling-based information system is extremely low (5%), and the ratio of such enterprises is also quite low (12%) that do not operate such a system, but plan to implement one in the short term. However, it is favourable that the ratio of enterprises that plan to introduce such a system, but in the long term, is high (36%). Unfortunately, there are enterprises (2%) that do operate a controlling-based information system, but do not believe it makes much sense, and the ratio of those that do not plan to implement such a system at all is extremely high (45%).

Based on the responses given to the first, the second and the third questions, we can clearly disprove the hypothesis (H_1) that presumed that even 25 years after the political changes the enterprises are still

not aware of the significance of controlling-based information systems. However, experience shows that enterprises do know the systems, and the reason is that the information and the relevant descriptions are now readily available for everyone without any obstruction (on the Internet, in the form of professional books, training, etc.). The second hypothesis (**H₂**) presumed that only a small number of enterprises exist in Hungary that operate a controlling-based information system, since according to the answers given to the fourth question, it was clearly confirmed that only 7% of enterprises operate such a system, of which 2% stated that despite having such a system, they do not believe it has any benefits.

The contradiction between the two hypotheses can be attributed to the fact that in addition to the information obtained, the enterprises do not or cannot accept the efforts necessitated by the installation of such a system, which is time-consuming, extremely expensive and the return is not ensured. It is also a discouragement that to this day there are not enough professionals in Hungary who could design and operate such systems.

Concerning the foundational aims, the second one that I intended to verify was the utility of controlling-based information systems, for which I applied my own assessment technique as the method of verification. I conducted the research by the comparison of various indicators, which I calculated from the annual reports of the nine enterprises. I used four indicators for the analysis of the asset position of the enterprises, two for the analysis of their financial position, and once again four indicators for the analysis of their profitability position. I ranked the enterprises according to the values of the individual indicators, then I scored them. I established the final ranking of the enterprises by summarizing the scores obtained that way (**Table 2**).

It can be clearly determined from the table that those enterprises (1, 2, 3) that use a well-parameterized and operated controlling-based information system, achieved significantly higher scores than other enterprises, i.e. their businesses were more successful. Relatively high scores were accomplished by those enterprises as well (4, 5, 6) that do not operate a controlling-based information system, however, those enterprises (7, 8, 9) that use improperly parameterized and operated

systems accomplished low scores. This can be explained by pointing out that, as a result of its faulty mechanisms, a badly parameterized and operated system provides wrong information to the management, which results in wrong business decisions base made. The relative effectiveness of enterprises not operating a controlling-based information system is due to the fact that in many cases that the management relies on its experiences and intuition when business decisions are made. And this carries a lower chance for making mistakes than a system that is constantly on the wrong track and conveys wrong information.

2: Summary of the scores of enterprises

Name	c. 1	c. 2	c. 3	c. 4	c. 5	c. 6	c. 7	c. 8	c. 9
Asset situation	31	26	28	21	13	14	20	12	15
Financial situation	12	2	18	12	16	12	7	7	4
Profitability situation	28	36	23	30	15	22	14	4	8
TOTAL	71	64	69	63	44	48	41	23	27
RANKING	1	3	2	4	6	5	7	9	8

Source: The author's own compilation based on the assessment

Therefore, the survey clearly confirms my hypothesis (**H₃**), which presumed that those enterprises that operate a controlling-based information system can have more efficient and effective business operations.

3.2. Outcomes of the research concerning the main aim and the assessment thereof

The main aim of my doctoral dissertation is the development of such a controlling-based information system for companies manufacturing standard products, that can be applied regardless of the size of the enterprises and the manufactured products, can be enhanced, is adapted to the Hungarian financial and accounting standards, furthermore, enables the categorization of the manufactured products according to their income-generating capabilities. I performed all that using a mathematical model created in Microsoft Excel application, which I presented on the example of a die casting foundry, in order to keep the case realistic, and presented using an analytical method.

By the development of the cost objects of the model, the definition of the data collected on the cost objects, the continuous presentation of the process of cost recognition, furthermore, the presentation of the information that can be extracted from the cost composition of the products, in accordance with the main aim, those hypotheses were proven (**H₄, H₅, H₆, H₇**), that state that it is possible to develop such a controlling-based information system that ensures the definition of the cost composition of the products and the categorization of the products according to their income-generating capability.

Based on the major data that can be extracted from the operation of the model, it is possible to make the appropriate decisions on the continued manufacturing of the products, which is demonstrated by **Table 3**.

3: Cost composition of products depending on their production volume

Product ID	Name	Price (HUF/unit)	Full prime cost (HUF/unit)	Profit (%)	Profit (HUF/unit)	Variable cost (HUF/unit)	Fixed cost (HUF/unit)
41100001	Drum holder	2,834	2,434	16.43	400	1,942	492
41100002	Drum holder	2,874	2,469	16.40	405	1,975	494
41100003	Drum holder	2,916	2,505	16.41	411	2,009	496
41100004	Drum holder	3,000	2,578	16.37	422	2,078	500
41100005	Water pump house	2,160	1,976	9.31	184	1,098	878
41100006	Water pump house	2,180	1,995	9.27	185	1,115	880
41100007	Water pump house	2,221	2,032	9.30	189	1,150	882
41100008	Water pump house	2,242	2,052	9.26	190	1,169	883
41100009	Rear cover	4,975	5,959	-16.51	-984	4,884	1,075
41100010	Rear cover	5,170	6,154	-15.99	-984	5,069	1,085
41100011	Rear cover	5,071	6,256	-18.94	-1,185	5,166	1,090
41100012	Rear cover	5,175	6,359	-18.62	-1,184	5,264	1,095

Source: The author's compilation, based on the model

In the table I summarized the cost composition depending on volume of production for the goods included in the model, by which I defined which are the economically produced goods, profitably produced goods, goods produced at a loss but requiring further production and goods produced at a loss and not requiring further production. In the table used as a basis for the analysis, I indicated the contractual prices

of the individual products, their full prime costs, the values of variable and fixed costs and the profits generated by them, both in value and in percentage terms.

It can be determined easily from the table that orders in the range of 41100001-41100004 (drum holders) are considered economically produced goods, since the contractual prices of these goods exceed the profit level of 14 per cent, defined in the former example and expected. Orders in the range of 41100005-41100008 (water pump houses) are considered profitably produced goods, since although these goods produce a profit, their contractual prices do not exceed the profit level of 14 per cent, defined in the former example and expected. It is important to mention that although various methods exist for the quantification of the risk in the profit, despite these methods the inclusion of provisions for risk in the profit always remains a subjective factor incorporating the expectations of the management.

If we continue the analysis of these goods according to the table, then we can see that orders in the range of 41100009-41100010 (rear covers) are considered goods that produce a loss but need to be further manufactured, since the contractual prices of these goods do not exceed the full prime cost of the goods, i.e. they produce a loss, however, the loss is lower than the level of fixed costs, independent of the volume of production within the entire prime cost of the goods. Orders in the range of 41100011-41100012 (rear covers) are considered goods that produce a loss but do not need to be further manufactured, since the contractual prices of these goods do not exceed the full prime cost of the goods, i.e. they produce a loss, however, the loss is higher than the level of fixed costs, independent of the volume of production within the entire prime cost of the goods.

The categorization of the goods mentioned above is a very important stage of making the final decision, in which several other factors must also be taken into account. Although in the development of the model I defined the contractual prices of the goods in such a manner that every category can contain a few items, however, in reality it happens very rarely that the manufacturing of a particular item is planned to be loss producing to begin with. Starting from that, the plan always reflects an ideal state, to which we can make comparison, and the

necessary steps can be made on that basis. If we determine in the case of a particular product that it is manufactured at a loss and the measure of the loss is higher than, within the entire prime cost of the product, the value of fixed costs independent of the volume of production, i.e. it would be justified to stop manufacturing that particular product, it does not yet mean that we should automatically consider terminating the manufacturing of that product. Prior to terminating manufacturing, we should explore the cause of the loss, for which we first go through the process of cost recognition and compare the budget and actual figures affecting the entire prime cost of the product (price of the raw material, cycle time, downtime, etc.) and use the information obtained that way to make the necessary steps, in order to reduce the costs. If the implemented steps failed to produce the desired results, i.e. the cause of the problem is a bottleneck that we cannot resolve, then it may be time to decide on the final termination of the manufacturing of this product.

Considering the fact that the established system does not only provide for the accounting recognition of costs and performance, but also induces its users for action, intervention, in an effort to improve the results, therefore in this case we can talk about not only a simple internal cost and performance calculation system, rather a controlling-based information system that represents a higher level and is suitable for constant development.

It enables the definition of the cost composition of products depending on the volume of manufacturing, as well as the definition of the breakeven points of the products. Although the doctoral dissertation shows the costs (revenues) and the production figures annualized, however, in reality these data are summarized in shorter intervals (usually in a monthly breakdown). If we assess the cost composition of products depending on the volume of manufacturing and their revenues at monthly level, and we present the results in an accumulated manner, on one diagram, then we can define the breakeven point of the products, i.e. that sold volume of the products at which the accumulated sum of the variable and fixed costs allocated to the products is identical with the accumulated sum of the sales realized by the products. However, it is important to mention that fixed costs should be presented summarized for the contractual volume of the products for manufacturing (selling), since this is the

only method to arrive at a realistic value concerning return on investment. The summarization of fixed costs for the contractual volume to be manufactured (sold) must be performed in such a manner that the fixed costs recognized until the given date must be divided by the number of products manufactured (sold) up to that time, and multiplied by the contractual volume of products to be manufactured (sold).

4. NEW OR NOVEL CONCLUSIONS OF THE DISSERTATION

Based on the conclusions of my research related to the aims and hypotheses formulated in my doctoral dissertation, here are the major conclusions, new or novel results of my doctoral dissertation:

1. By using the method of survey by questionnaire, I clearly disproved the hypothesis that assumed that even 25 years after the political changes the enterprises are still not aware of the significance of controlling-based information systems. However, experiences does not prove that. The reason is that the information and the relevant descriptions are now readily available for everyone without any obstruction. By using the method of survey by questionnaire, I clearly proved the hypothesis that assumed that only at small number of enterprises exist in Hungary that operate a controlling-based information system. A mere 7% of the enterprises involved in the survey operate such a system, and within that, the representatives of that 2% stated that even though they do operate such a system, they do not believe they benefit much from it.
2. By using the assessment method developed by myself, I clearly proved the hypothesis which presumed that those enterprises that operate a controlling-based information system can have more efficient and effective business operations. In fact, those enterprises that use a well-parameterized and operated controlling-based information system, achieved significantly higher scores than other enterprises, i.e. their businesses were more successful.
3. By the mathematical model I clearly proved the hypothesis that presumed it was possible to develop such a controlling-based information system for companies manufacturing standard products that can be applied and enhanced regardless of the size of the enterprises and the manufactured products. The established model is capable of passing on the costs incurred on the cost centres to the products through the cost centres and the orders, furthermore, it contains those features that make it applicable and enhanceable for enterprises manufacturing

standard products (independent of their size and the products manufactured by them).

4. By the mathematical model I clearly proved the hypothesis that presumed that an installed controlling-based information system enables the definition, in an exact manner, the cost composition of the individual products according direct eligibility for recognition (direct and indirect costs) and prime cost levels (direct, narrowed and total prime cost). This is presented in detail in sub-chapter 3.2 and shown in Table 3.
5. By the mathematical model I clearly proved the hypothesis that presumed that the installed controlling-based information system enables the definition, in an exact manner, the cost composition of the individual products depending on the production volume (fixed and variable costs) and their breakeven point. This is presented in detail in sub-chapter 3.2 and shown in Table 3
6. By the mathematical model I clearly proved the hypothesis that presumed that the installed controlling-based information system enables the clear definition of the income-generating capability of the individual products. This is presented in detail in sub-chapter 3.2 and shown in Table 3.

The novelty of my doctoral dissertation lies in the fact that it presents a method by which controlling-based information systems can be developed. Although large (multinational) corporations operating in German-speaking areas and those that come from German-speaking areas operate their controlling-based information system similarly to the method outlined in my doctoral dissertation, in the market there is still no professional literature that would present how they should be designed. The literature currently available on controlling is focused on theory and provides little practical information on controlling-based information systems. My doctoral dissertation fills in these gaps by giving a tool for the managers and professionals of enterprises planning to develop a controlling-based information system.

5. THE THEORETICAL / PRACTICAL OPPORTUNITY TO UTILIZE THE RESULTS

I had worked for several years as a controller, then as head of controlling for a manufacturing company, that way I gained sufficient practical experiences in the field of designing controlling-based information systems. In addition to obtaining my practical experiences, I also studied a large amount of professional literature on controlling, and as a combined result of these, I developed within myself a marked guideline that places the practical applicability of controlling in focus. While dealing with this matter, I came to the conclusion that although in Hungary the managers of enterprises do realize the benefits provided by the application of controlling, still, they do not devote either time, or energy to exploring the actual essence of controlling, and even less to its applicability in practice. In my opinion, understanding the essence of controlling and the controlling-oriented development of enterprises would not only improve the efficiency of business operations and strengthen the market position of the enterprises, it would also promote the establishment of a community of entrepreneurs based on a higher level of entrepreneurial culture, which could become a real asset of the national economy.

In my doctoral dissertation I presented the development and operation of controlling-based information systems of enterprises manufacturing standard goods. I consider this as a first step in the implementation of a project spanning several years. My aim is the development of such a uniform controlling-based information system that could be independently applied regardless of the size of the enterprise or the type of its activity.

From the aspect of the development of controlling-based information systems enterprises can be assigned to five groups. For the next few years I plan to develop a controlling-based information system applying the method developed in my doctoral dissertation for enterprises manufacturing unique goods, for those involved in trading, for enterprises operating in agriculture and for those providing services. Naturally, within the community of enterprises dealing with agriculture the controlling-based information system will be different for enterprises dealing with plant growing, fruit growing, forest

management, game and fish management, since the characteristic features of these activities must be taken into account.

This will be followed by the development of a controlling-based information system, which would provide a tool for executive accounting as well, following the model of the uniform system (general ledger accounting) applied in financial accounting, for a uniform treatment of enterprises.



Registry number: DEENK/180/2015.PL
Subject: Ph.D. List of Publications

Candidate: György Zsolt Oravecz

Neptun ID: G80SEO

Doctoral School: Ihrig Károly Doctoral School of Management and Business Administration

List of publications related to the dissertation

Article(s), studies (6)

1. **Oravecz, G.Z.:** Controlling-based information systems in Hungary.
In: Controller Info Studies. Szerk.: Zéman Zoltán, Copy & Consulting Kft., Budapest, 139-143, 2014. ISBN: 9789630897518
2. **Oravecz G.:** A controllingnak a vállalkozói kultúra fejlődésére gyakorolt hatása.
Controll. info. 1 (10), 7-11, 2013. ISSN: 2063-9309.
3. Kondorosi F., **Oravecz G.Z.:** Controllingalapú információs rendszerek Magyarországon.
A controller. 8 (11-12), 19-22, 2012. ISSN: 1787-3983.
4. Kondorosi F., **Oravecz G.Z.:** Controlling alapú információs rendszerek a gyakorlatban.
A controller. 8 (3), 4-7, 2012. ISSN: 1787-3983.
5. Kondorosi F., **Oravecz G.Z.:** Típusterméket gyártó vállalkozások controllingalapú információs rendszerének kialakítása (1).
A controller. 6 (6), 9-12, 2010. ISSN: 1787-3983.
6. Kondorosi F., **Oravecz G.Z.:** Típusterméket gyártó vállalkozások controllingalapú információs rendszerének kialakítása (2).
A controller. 6 (10), 11-12, 2010. ISSN: 1787-3983.





List of other publications

Article(s), studies (2)

7. **Oravecz G.**, Rózsa A.: Belső költség - és teljesítményszámítási rendszer - kialakítása nyomásos öntödében II..
Controll. info. 1 (9), 25-30, 2013. ISSN: 2063-9309.
8. **Oravecz G.**, Rózsa A.: A belső költség - és teljesítmény - számítási rendszer kialakítása egy nyomásos öntödében I. rész.
Controll. info. 1 (8), 35-42, 2013. ISSN: 2063-9309.

The Candidate's publication data submitted to the iDEa Tudóstér have been validated by DEENK on the basis of Web of Science, Scopus and Journal Citation Report (Impact Factor) databases.

08 September, 2015

