Model of Performance Measurement and Management System in "The Visegrad Group"

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***Abstract* – This article summarizes the model of the performance measurement and management systems in Industry 4.0. in the Visegrad Group (V4) countries. The main goal of the research is to suggest a Performance model and management system model (PMMS). Methods of research were focused on using the questionnaires method with the Dillman method and five research questions (RQ1-RQ5). The object of research comprised of 60 industrial V4 companies with the direction of law form, count of the employee, revenues, and type of industry. The return of the questionnaire was 49 respondents of 60 respondents - companies. 42 companies monitor financial performance and 40 companies' employee performance. Information sources for measuring performance are information systems that are use 39 companies and 39 companies use financial statements. 19 companies use less than 10 KPIs, and 28 companies monitor KPIs throughout the year. The new model of performance measurement and management system in Industry 4.0 is a competitive advantage in the global market and in the hyper-competitiveness environment.**

***Keywords* – Performance management model, barriers, efficiency, costs, competitiveness.**

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1. Introduction

Performance is monitored by any organizations that carry out business activities, but also by organizations that are not established for business. Properly defining, implementing, and understanding performance measures can often be a key to properly measure an organization's performance and achievement of the best indicators of the business [1]. On the other side, performance measurement and management systems are affected by more factors such as operating environment, business trends, technologies, and organizational control [2]. Key performance indicators tell what an organization should do to increase performance and continual improvement [3]. The main goal of the research was to suggest a model of systematic performance measurement and management of industrial enterprises, which will be used in various industrial companies and in various countries in the European Union. Sardi, A., et al. contribute to knowledge in the performance measurement field, showing how the efforts for developing performance measurement and management systems could determine evolutionary paths that influence factors of PMMS systems are organizational culture, management style, management information system, national culture, online chats, and social media [4]. Performance management and performance measurement are orientated on corporate social responsibility, employee loyalty, the satisfaction of customers, and the good relationships with suppliers [5]. Zavedeev et al. (2020) claim that smart technologies are part of performance measurement as the tendency for increasing the number of projects based on the postulates of sustainable socio-economic development concept also includes projects based on smart technologies [6]. Cluster analysis of customers increases business performance meaning to orientate to a cluster of customers with the best demand and revenues [7]. The effective tax burden on the profits of the companies is demanded by corporate responsibility [8].

Fiscal management instruments to reduce the tax burden means protecting the interests of investors. This approach creates an environment for business. All those tools support the competitiveness of industrial companies in V4 and in the European Union.

2. Literature review

Performance measurement is part of comprehensive performance management of the companies. Performance management creates the context for the measurement itself. Performance measurement can provide a view of the state of the companies by management information control system [9]. This system does not provide suggestions on what the company must change but gives information about customer satisfaction, product quality, service quality, and process performance. Performance management could not exist without measurement, as it would not be clear in which areas improvement should take place [10]. Suchánek et al. present that innovations in quality from a broad-spectrum perspective are a prerequisite for increasing the performance of companies and their competitiveness in the market [11].

Similarly, performance management is a philosophy that is supported by a performance measurement system too with support by accounting [12]. If we look at performance management in terms of its functions, we can simply define it as the process of planning, organizing, leading, and controlling activities to achieve the set goals [13] Enterprise performance management is seen as a process for planning, managing, and controlling quantified variables that relate to resources (inputs) and their transformation into the performance (outputs) of specific enterprise systems [14].

Performance management is defined as a systematized behaviour that evaluates the work performance of employees and the organization over a period according to specific performance standards. At the same time, it is a two-way management process in which managers and employees work together [15]. Industry 4.0 effects of technology have significance on the organizational performance of businesses. Industry 4.0, the latest phase of the industrial revolution and one which is garnering a lot of attention offer several benefits to businesses such as efficiency, speed, quality, personalized production, and reduced costs [16].

Zheng et.al. (2021), [15] deal with the question of how to promote firms' innovation performance. They propose those instruments as a base for increasing innovative performance: knowledge stock, absorptive capacity, knowledge depth, knowledge breadth, government support, and the business environment. [15].

Technological and marketing capabilities have dominant and positive effects on their performance in the international markets [17].

The key problems such as demotivation and dissatisfaction among employees, organizational culture, and perception of relationships are highlighted [18]. Muhammad et.al. solved agile management upon project performance while considering all its aspects, exploring the mediatory role of project performance, and evaluating the moderating role of leadership competencies in attaining optimum project performance that agile management is a new instrument of increased performance [19]. The supply chain quality management dimensions are examined from the Balanced Scorecard perspective. It is found that supply chains have a significant correlation in four perspectives of BSC and have an impact on organizational performance [20].

The investigation of environmental burden of industrial firms is highlighted because environmental indicators are part of performance indicators [21].

In addition, it is necessary to take the creation of the PMMS model into account of the innovation management and green management as basic prerequisites for improving processes and gaining competitive advantages. Industry 4.0 is built on digitization and digitization is part of the PMMS model. The main pillars for model creation are presented in Figure 1.

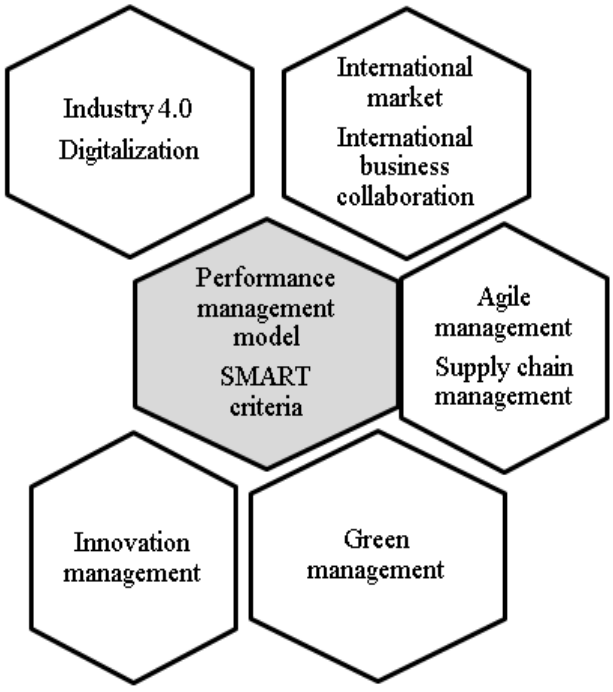

Figure 1. Factors influence to performance management. Source: own source

3. Methodology

As part of the research, we focused on the processing of documents for the design of a system management model in industrial enterprises in V4 because the business environment has a lot of business problems, and it can be creating possibilities for business for foreign partners. We conducted a questionnaire survey to collect the information needed to design the model. 60 industrial companies in V4 were contacted through an online questionnaire created using the Google Form web application. The questionnaire survey focused on the legal form, number of employees, annual turnover, and industry (Table 1).

Table 1. Description of respondents (companies)

LAW FORM	**STRUCTURE (%)**
joint stock company	67%
limited liability company	33%
COUNT OF EMPLOYEE	
0-49	4%
50-249	53%
250 and more	43%
REVENUES OF YEAR	
to 2 mil. euro	5%
2-10 mil. euro	36%
11-50 mil. euro	36%
50 and more mil. euro	23%
TYPE OF INDUSTRY	
Engineering industry	27%
Chemical industry	16%
Automotive industry	20%
Textile industry	10%
Electro technical industry	10%
Building industry	10%
Wood industry	6%
Metalworking industry	4%
Printing industry	4%

Source: own source

In the questionnaires, we pointed out the importance of linking science and research with practice. The return reached 81.6%. Of the 60 questionnaires sent, 49 completed questionnaires were returned and processed in the survey. The questions were created based on the recommendations of the methodology of Franco-Santos and are orientated to the reasons for performance indicators, important areas of performance, resources of performance, creation of key performance indicators (KPI), and barriers to performance in the firms [12].

A five-point Likert scale was used, which expresses the degree of agreement with the statement from (1) - least important to (5) - most important. In the questionnaire survey, we look for answers to the research questions:

RQ1. What are the reasons for measuring and managing performance in industrial companies?
RQ2. What are the areas of performance measurement and management in industrial companies?
RQ3. What are the information sources for measuring and managing the performance of industrial companies?
RQ4. What are the possibilities for using KPI indicators for measuring and managing performance?
RQ5. What barriers prevent the implementation of systems for measuring and managing performance in industrial companies?

When evaluating the questionnaires, we used statistical indicators such as frequency, mean deviation, and structure. Those statistical indicators correlate with defined questions RQ1- RQ5. The statistical indicators were sufficient and suitable for evaluating the questionnaires and for creating the performance model. Based on a synthesis of professional literature and definitions, we proposed a basic model of system management and performance measurement. The model was designed in accordance with the framework, which presents in scientific papers the structure of performance management process evaluation [3],[15], [19].

4. Research Results and Discussion

We monitored the current state of performance measurement using 6 research questions. These research questions were answered in a questionnaire of selected companies in V4. The results are valuated according to individual research questions, which are the basis for the development of a model of performance management system in industrial enterprises. **RQ1. What are the reasons for measuring and managing performance in industrial companies?**
This question was rated on a Likert scale from 1-5 in order of importance. The companies had a choice of the 10 most common reasons for measuring performance, which we determined according to the presented professional literature. In addition to the options set, companies had the opportunity to state another reason. Results of this question RQ1 are presented in the Table. 2.

Respondents said the main reasons for measuring performance in the companies are: improving results, improving business activities, achieving performance of process, monitoring business activities, assessing the impacts of the measures taken. This evaluation was on the base of importance which is a very important reason for each company. The results show that the majority of respondents were rather positive about all statements.

Table 2. Reasons for measure of the performance.

Likert scale	1	2	3	4	5
Improving results	4	2	2	19	22
Achieving goals and fulfilling plans	4	6	10	16	13
Improvement of business activities	0	2	6	21	20
Achieving performance of process	0	2	2	24	21
Monitoring of business activities	0	0	4	18	27
Assessing the impacts of the measures taken	2	0	4	16	27
Documents for employee remuneration	2	2	0	34	9
Customer satisfaction survey	2	2	14	13	18
Long term planning	2	5	12	20	10
Employee satisfaction survey	6	6	15	16	6

Source: own source

The Likert scale "4" – it means the important view to PMMS as achieving goals and fulfilling plans, documents for employee remuneration, long-term planning, and employee satisfaction survey. Based on the overall average, they were identified as the least important reasons for measuring performance: assessing the impacts of the measures taken, documents for employee remuneration, customer satisfaction survey, long-term planning, and Employee satisfaction survey (Figure 2).

The literature often mentions the need to measure performance in several areas. We wanted to find out whether in industrial companies they can only measure performance in the financial area, or monitor performance in other areas as well. The companies had a total of eight areas to choose from (finance, employee, product, innovation, customer, supplier, internal processes, and marketing). Respondents answered the question: **RQ2. What are the areas of performance measurement and management in industrial companies?**

According to professional literature and various surveys, performance is measured mainly in the financial field. With the advent of systemic tools for measuring performance, importance is also attached to non-financial areas. In the research, we assumed that the area of measurement in companies will be financial-oriented because this approach is required by the Laws on Accounting and Tax laws.

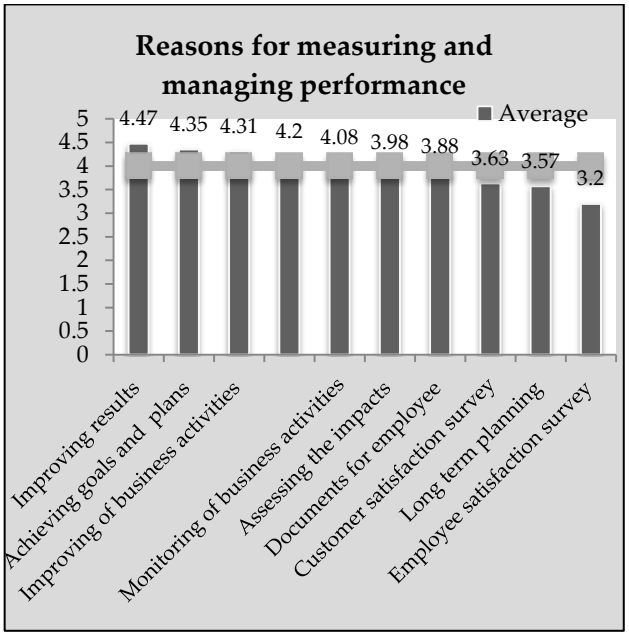

Figure 2. Average count of reasons of performance management.
Source: own processing of survey

Results of this question RQ2 are presented in Table 3. Respondents said the main reasons for measuring performance in the companies are: Improving results, improving business activities, achieving the performance of the process, monitoring business activities, assessing the impacts of the measures taken. This evaluation was on the base of importance which is a very important reason for each company.

Table 3. Areas for measuring and managing performance.

AREAS	n	(%)
Finance	42	86
Employee	40	82
Product	35	71
Innovation	31	63
Customer	28	57
Supplier	24	49
Internal processes	19	39
Marketing	7	14

Source: own processing of survey

As expected, performance is measured mainly in the financial area. Figure 3 shows the results sorted by the most frequent answers. 86% of respondents evaluate performance in the financial area. Similarly, 82% of companies measure performance in employees. Of the sample of 49 companies surveyed, 71% said they were performing measures in the product, 63% monitor the area of technology and innovation and 57% of respondents use data from the customers. The results are in line with our expectations, and we assumed that more than half of companies will measure performance in the field of finance and prefer financial indicators. Less than half, namely 49% of companies monitor performance indicators related to suppliers, 39% of internal processes, and only 14% monitor the area of marketing. Respondents identified areas of finance as the most important areas of performance measurement. Stříteská and Svoboda list finance (93%), customers (71%), and production (71%) as the most common areas for measuring performance. The most important area for performance measurement is considered finance (91%) [9].

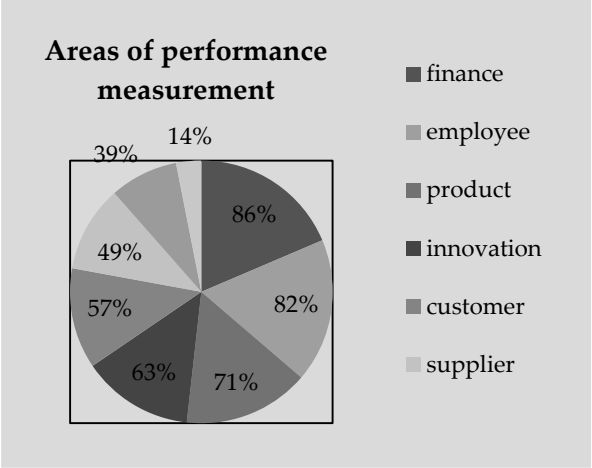

Figure 3. Areas of performance management
Source: own processing of survey

The sources of information that companies use as a basis for monitoring and evaluating performance is of a great interest. Respondents had to answer question: **RQ3. What are the information sources for measuring and managing the performance of industrial companies?** (Table 4) They had default options, which are already based on published surveys, from the applicable legislation for the business environment. However, companies had the opportunity to add other sources of information that they use to evaluate performance. As expected, the most frequent sources that serve as a basis for measuring and evaluating performance were the Information System and Financial Statements, which are used by 80% of the surveyed industrial enterprises.

More than 33 companies had information sources - employee evaluations, meaning 67%. Almost 24 companies used customer questionnaire at 49% as data sources. At 47% was used process documentation.

Table 4. Information sources of the performance

Information sources	n	(%)
Information system	39	80%
Financial statements	39	80%
Employee evaluation	33	67%
Customer survey	24	49%
Process documentation	23	47%
Project documentation	16	33%
Competition data	16	33%
Analysis of consulting companies	10	20%

Source: own processing of survey

One-third of the 49 companies surveyed use Project Documentation and competitive data options as a basis for measuring performance. Only 20% of companies use the services of consulting companies at monitoring and evaluate their performance. Other company information options were not mentioned in the questionnaire. Several authors state that the optimal number of KPIs in a company is a maximum of 25 indicators. Companies that have implemented system tools such as the Balanced Scorecard, EFQM-excellence model monitor an average of 18 key indicators, while other companies average 11 key indicators [1]. The need for regular monitoring is often mentioned in the literature and evaluation of key performance indicators.

The following question concerned key performance indicators (KPIs) and their use in enterprises. The aim of the question was to find out the number of KPI indicators, the time of evaluation of indicators(Table5), setting KPIs based on business goals, setting target values for KPIs. Respondents had to answer question: **RQ4. What are the possibilities for using KPI indicators for measuring and managing performance?** The structure of 39% of industrial companies surveyed monitor less than 10 key performance indicators.

Almost a quarter follow 16-20 key indicators. 16% of respondents follow 10-15 KPIs and more than 20 KPIs. Two respondents chose not to comment on the question. More than half of the surveyed companies 57% monitor key indicators continuously throughout the year, which is in line with the recommendations in the professional literature.

Table 5. Key performance indicators

Count of KPI indicators		**n**	**(%)**
Less than 10 KPI		19	39%
10-15 KPI		8	16%
16-20 KPI		12	24%
More than 20 KPI		8	16%
Do not know		2	4%
Periodicity of evaluation		n	(%)
Continuously throughout the year		28	57%
The end of accounting period		21	43%
Before project		9	18%
Before general meeting		8	16%
Market change		5	10%
Loan application (grant)		4	8%

Source: own processing of survey.

The second most common opportunity for companies to evaluate their key indicators is the end of the accounting period, where 43% of respondents came forward. 18% of companies chose other options before investing or project, before the general meeting 16% of companies, and in the event of changes in the market situation 10% of companies. In applications for a loan, grant, or subsidy, only four addressed companies evaluate the key indicators, which represent 8%.

The aim of the question - RQ4 was to find out what are the possibilities for using KPI indicators for measuring and managing performance based on business goals and setting target values for KPIs (Table 6).

The structure 59% of respondents set key indicators performance based on business goals, as it should be according to theoretical knowledge. Only some key indicators are based on the targets of the 15 companies surveyed.

Only five companies stated that the key performance indicators they monitored were not directly related to the set business goals. The indicators are based on the strategy and goals of 50% of companies [9]. Each key performance indicator should have set targets for comparing and meeting set targets. Almost two-thirds of respondents (65%) said that they set target values for their key indicators, which is in line with the findings from the theoretical literature. The 12 companies surveyed set targets for only some key indicators. Only 10% of companies analyze only the achieved result and do not have a set target value.

Table 6. Key performance indicators for measuring

Synergy to business goals	**n**	**(%)**
YES, ALL KPI	29	59%
YES, JUST SOME	15	31%
NO	5	10%
Target values for KPI	n	(%)
YES, FOR ALL KPI	32	65%
YES, JUST SOME KPI	12	24%
NO	5	10%

Source: own processing of survey.

The implementation of new methods in evaluating the performance of companies represents major barriers, which we analysed in the survey. Respondents were asked to comment on **RQ5. What barriers prevent the implementation of systems for measuring and managing performance in industrial companies?** Respondents had eight options to choose from, which were to indicate agreement or disagreement with the above obstacles on a five-point Likert scale, where "1" denotes strongly disagree and "5" strongly agree. The results are presented in Table 7.

Table 7. Barriers of performance

Likert scale	1	2	3	4	5
Satisfaction with performance measurement	4	0	14	23	8
High implementation costs	6	9	16	12	6
Modern tools are unnecessary for company	12	14	10	5	8
Implementation is time consuming	4	15	8	16	6
Tools are only fashion trend	10	16	7	8	8
No benefits of tools for company	12	11	8	8	10
Lack of interest in systemic changes	11	10	10	10	8
Personnel intensity	9	10	12	10	8

Source: own processing of survey

The most common obstacle in the implementation of a new management tools is the fact that companies are satisfied with the way of measuring performance and see no reason to introduce new tools. The second most important obstacle is the high costs arising from the introduction of new tools and the time required to implement them. Other barriers represent staff demands, no benefits of new methods, no need for methods for the company, the risk associated with their implementation. 16 companies consider these tools only as a fashion trend, or they are unnecessary for them and in their opinion ineffective. Similar results and satisfaction with the current performance measurement system, lack of financial, personnel and other resources as the main barriers to the implementation of the performance measurement system are presented in [22]. Zhang identified lack of time and resources, ignorance of performance measurement, shortcomings in formality, and the fact that certain tools are not appropriate for a particular business as the most significant barriers [10]. Based on the analysis of the current state of measuring the performance of industrial enterprises, we concluded that: Based on the analysis of theoretical literature, world research and studies and our own survey on the state of measuring business performance, we can suggest system performance management model (Figure 4).

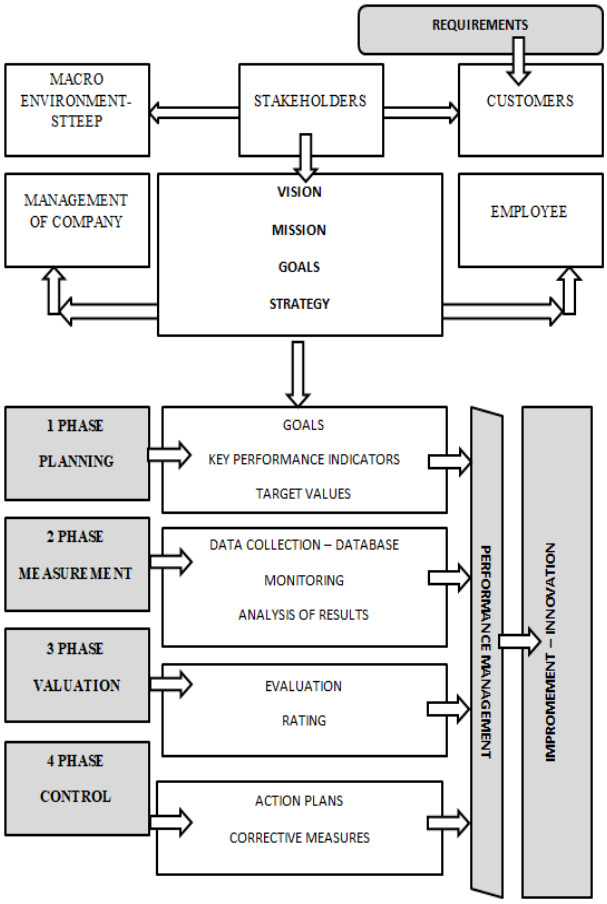

Figure 4. Suggestion of the PMMS model
Source: own source

5. Conclusion

The field of measurement and performance management is a very large area. Obviously, there is no one-size-fits-all tool for all businesses, but there are some commonalities that proper performance measurement and management should include. For the business environment it is important to use phases such as planning, measurement, valuation, and control for performance management. The second recommendation is orientated to business goals of business strategy, and requirements of customers and employees, which is presented by the model of the performance management system. The results of the research presented that the return of the questionnaire was 81.6%. 22 companies consider the most important reason for measuring performance financial indicators. Companies monitor financial performance at 86% and employee performance at 82%. Resources for measuring performance are 80% information systems and 80% financial statements. 39% of companies use less than 10 KPIs, and 52% of companies monitor KPIs throughout the year. 59% of companies set KPIs based on links to business goals. 65% of companies set target values for KPIs.

The authors agree that measuring performance only in the financial area and the area of economic value is insufficient and value-creating non-financial areas must also be monitored. Industrial companies make extensive use of a set of financial and non-financial key indicators to measure performance in several areas. The biggest barriers to implementing these tools are most often satisfied with the current way of measuring performance, high implementation costs, and a lack of human and time resources. The design of a system performance management model considers all research issues and business preferences.

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