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DEVELOPMENT OF MANAGEMENT INFORMATION SYSTEMS

Introduction

On the basis of many years of experience in providing consulting services in the area of management, the author presents **the issues regarding the development of information systems to be applied in business**. The analysis is conducted within the framework of a field of study introduced by the author and referred to as *infornomics*.

1. Data, information and decisions

It belongs to common practical knowledge that the access to information that is useful in making decisions has a crucial impact on the performance of economic entities. In the article, the author differentiates the notions of *information* and *data*. Thus, **data** are the resources in which managers search for the answers to their questions while **information** is the precise answers to these questions. Information is generated through a gradual limitation of the number of options from which, following a decision making process, the answer is selected. Economic entities tend to possess a significant amount of data but they have an insignificant amount of information that would constitute a valuable basis for establishing facts necessary to making proper decisions. Managers usually have problems with the access to data bases and one of the reasons is the lack of time to browse through and analyze the data. As a result, they require synthetic reports that would include conclusions from the data analysis and the information on crucial facts. Only then, on the basis of the reports proper, in other words, effective, decisions can be made. It is a common practice that wrong and coincidental decisions are made due to the lack of access to professionally developed information (reports).

Diagram 1. Decision-making process



Source: Author's research

The access to professional reports by managers is possible when economic entities constantly and systematically develop information systems for the purposes of management, including the search for the solutions to the problems regarding the implementation of change in these systems with the aim to maintain a steady growth of effectiveness. The analysis-based development of the reports with the information necessary to make decisions usually requires creativity that results in discovering new relations between the data. As the term *information* originates from the Latin *informatio* which means presentation and/or image, it should be understood as the **presentation of facts**. Consequently, it can be concluded that the development of information for the purposes of management consists in a diligent search for a real image of conditions and results in better performance.

2. Information systems and IT tools

Current information systems apply, among other elements, IT tools. However, it is a common mistake to search for them without a preparation of the **principles of an information system in a particular organization**. Such a mistake results in significant problems in the course of the implementation of the software and leads to unsatisfactory effects. There are even cases that the effectiveness of an information system decreases after the implementation of IT tools when the concept of an information system which includes IT tools has not developed at the appropriate time.

Diagram 2. The role of the principles of an information system



Source: Author's research

Thus, in practice, it is indispensable to determine IT system principles that include the answers to the following questions:

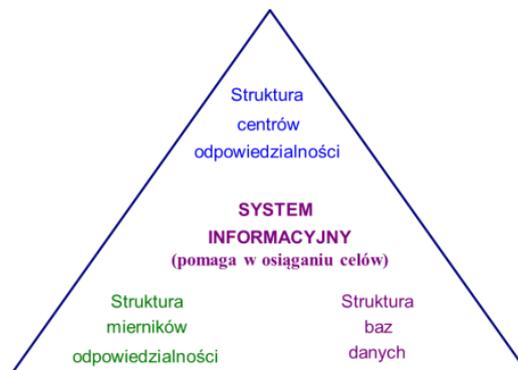
No.	Question
1.	What is the management concept in the organization (including the business model and personnel policy) and, consequently, what are the resulting information needs? What information is necessary to assess the work in particular units and major workstations?
2.	What is the development plan of the information system (what new information is required and what is the order of its acquisition – what is the gradation of information needs) ?
3.	What positions are responsible for managing particular information and its application in the management? What workstations and how will they develop and update the databases?
4.	Where are the same or similar data or information that have to be uniformed developed? How to ensure the consistency of the data and information that come from different organizational units?
5.	What are the definitions of particular types of information from the point of view of management requirements, e.g. what classifications can be adopted for types of products, revenues and physical units so that the information can be applied in particular computational formulas when calculating the accepted kinds of indexes?
6.	What report patterns should be applied to aggregate information?



7.	What are the expected IT tools to support particular information types for the purposes of management (decision making)? How to take a full advantage of the already accessible IT tools?
8.	How can the users participate in the development of information systems and how can computer specialists obtain support from them. What project team should manage the IT system development and what are the individual roles of its members?
9.	What is the appropriate time span for the implementation of substantive and organizational changes in the information system to increase its effectiveness?
10.	How to ensure consistency in information system development to avoid contradictory actions that hinder the development process?
11.	What are the necessary „manuals” for the information system users?
12.	What rules of document and data filing have been adopted and implemented?
13.	What is the organizational culture (including habits) as regards filing and data base development; what is the plan to make the necessary changes in the existing organizational culture?
14.	What data are indispensable for the requirements of the motivational and accounting systems?
15.	What actions result in the creation of mock information that distorts the real picture of situation?
16.	What actions lead to the increase/decrease of the effectiveness of information systems (the cost and benefit analysis)?
17.	What is a comprehensive plan for the information system (its architecture) and what are its fundamental principles?

In order to develop an information management system, it is indispensable, first of all, to establish the concepts of three structures: responsibility **centers**, responsibility **measures** and **databases**, which will enable to calculate the values of the accepted measures.

Diagram 3. Main element of the concept of an information system



Source: Author's research

One has to assume that the information system should be designed as – for example – a building. Before constructing a building, engineers develop architectural designs, functional-utility programs, executive designs and environmental impact reports. However, information systems are frequently developed without architectural designs (designs of corporate architecture), and the more so, without executive designs and reports regarding the impact on the staff environment (on their performance). Nevertheless, IT projects should not be treated as engineering projects but rather as business projects run by specialists in management.

3. Information and capital

The analysis of economic entities implies that information and information systems are the fundamental capital of economic organizations. The commencement of business operation requires the acquisition of appropriate information, for example about:

- a) the customers needs,
- b) the necessary human, technical, technological and organizational resources to meet the needs,
- c) the expected operating costs and benefits,
- d) the financing principles and sources,
- e) legal conditions, etc.

Thus, in fact, the reproduction of capital requires going through several stages: first, the company has to reproduce its information capital, then its human capital and only then does the reproduction of the financial and physical capital occur.

Diagram 4. Stages of capital reproduction



Source: Author's research

Information constitutes the **capital of the organization** and can be turned to money (e.g. by selling the know-how or the shares). In the course of its operations, an organization accumulates information resources which usually increases its value. The organization adds gradually to its information resources such data and information as:

- a) data on customers, suppliers, sub-suppliers and partners,
- b) trends among customers which affect their needs – the demand,
- c) organizational experience and standards,
- d) methods of operation of the competitors,
- e) development strategy, plans of operation, new services and products,
- f) technical and technological knowledge,
- g) opportunities to acquire financial means.

Such rich resources of the above data and information constitute a basis for business plans and create conditions for the acquisition of financial means for further development. Moreover, the collection of such information is necessary to follow the changes in the operating conditions, to operate without problems and constantly provide value added to customers. Thus, the accumulation of information is the condition for an economic organization to survive and to react adequately to changes.

The list of the most valuable companies in the world is a proof that information is the mostly valued product and commodity as the top places are occupied by companies that help their customers to meet their information needs. (e.g. Apple, Microsoft, Google, IBM).

In the last few years, the volume of data that is accessible in the world has been recently doubling every two years. As a result, organizations have to select the data and concentrate on the data that is crucial and of key importance. One can say that economic organizations are surrounded as if by “dark matter”. In the influx of data the decision makers may miss the most important facts – information. It is a frequent case that such information is not accessible to



them. That refers for example to the information on the effectiveness of key investment projects. The acquisition of such information usually requires regular operations that result in the development of professional data analyses. The development of their results consists in a consistent construction of professional information systems that – among other things – enable the development of **the memory of the organization** about its successes and failures, which helps in drawing conclusions for the future.

The introduction of the notion of **capital** and the application of the information both on the assets and the liabilities were crucial in the work on company information systems. However, the existing significant problem of informonomics is the lack of information on the changes in the capital of state and self-government budgets. Due to the fact that the representatives of countries and self-governments do not apply the concept of the capital possessed (as in the state companies in Poland in 1950s and 1960s), it sometimes happens that the completed investment projects have a lower market value than the expenses incurred because as a rule the information on the capital value of the entities is not given. The investments of self-governments are often carried out without reliable analyses, feasibility studies, option analyses or also without the initial selection of an operator of the facility in question. Consequently, there is an impression of the increase of capital as the citizens can see new buildings but they do not realize that their value is infrequently lower than the expenses, which means that the capital of the community has decreased. Such behavior resembles the times when the notion of capital was not used and, as a result, work resulted in waste and the increase of the living standards was significantly more difficult to achieve. That is due to the fact that the application of the information about the assets does not allow for the assessment whether a particular expenditure is rational, i.e. whether there is an increase of liabilities rather than of the capital level. The recently recommended analyses of social costs and benefits (social and economic analyses) frequently complicate the possibility to obtain a clear view of the effects of investment and business projects.

The methods of economic calculation do not keep the pace with the changes in business environment (e.g. the globalization of financial institutions). For example, a temporary increase of the standard of living may sometimes result in an excessive increase in liabilities, due to which the management of debt may become the main item in the state or self-government budgets. Thus, the effects of the present decisions on the standard of living of future generations are invisible. It can be concluded that the methods of economic calculation that have an impact

on the access to reliable information influence significantly the standard of living of the society. That can be exemplified by bank accounting, which did not protect some financial institutions against the distortion of the information about their financial results and, consequently, against the financial crisis.

The information systems of organizations are the **foundation of trust** without which they cannot do any business. The systems are assessed by institutions that decide on their financing. For example, if an Independent Business Report IBR shows that the information system of a company is underdeveloped (unreliable), the institution may not be convinced that the company is managed properly and the managers control the situation, i.e. they can react in emergency and minimize the risk. In business it is the time of reaction to changes that is crucial. A high speed of the access to reliable information means a high degree of organizational agility¹, which is decisive as regards the company's ability to survive. The capital in the form of a good information system increases significantly the level of company's reliability and security.

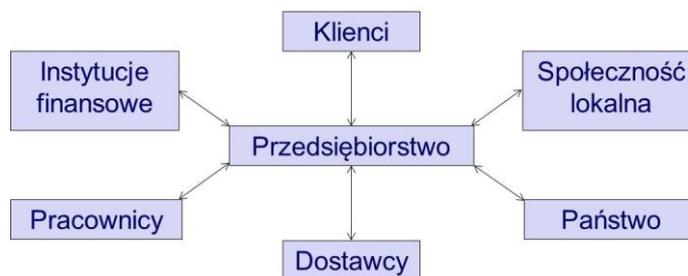
3. Connection between macroeconomic and microeconomic information systems

One of the most significant problems to be solved in practice within the framework of **inforonomics** is the fact that so far the **economic sciences have been trying to describe either the phenomena regarding a particular company (microeconomics) or the economies of a whole state or region (macroeconomics)**. It is difficult to find investigations or ideas that would combine both approaches or would take into consideration the role of other entities influencing companies or state budgets (e.g. the roles of consumers, local communities, self-governments or business environment institutions – agencies, financial institutions, the representatives of future generations). It seems that - like in physics where scientists attempt at combining the laws of quantum theory with space theory – it is also indispensable in the economic sciences to search for the bridge between the rules of macro- and microeconomics. The concept of the so called **polycentric accounting** may constitute a connection between micro- and macroeconomic information systems which aims at maintaining the balance in

¹ J. W. Ross, P. Weill, D. C. Robertson, Architektura korporacyjna jako strategia. Budowanie fundamentu w biznesie. (Enterprise Architecture as Strategy – Creating a Foundation for Business Execution) Harvard Business School Press, Wydawnictwo Studio Emka, Warszawa 2010, p. 36.

economy and stabilization in social structures. It is based on the assumption that a company is an entity which focuses the interests of other entities given in the diagram below.

Diagram 5. Company and its environment

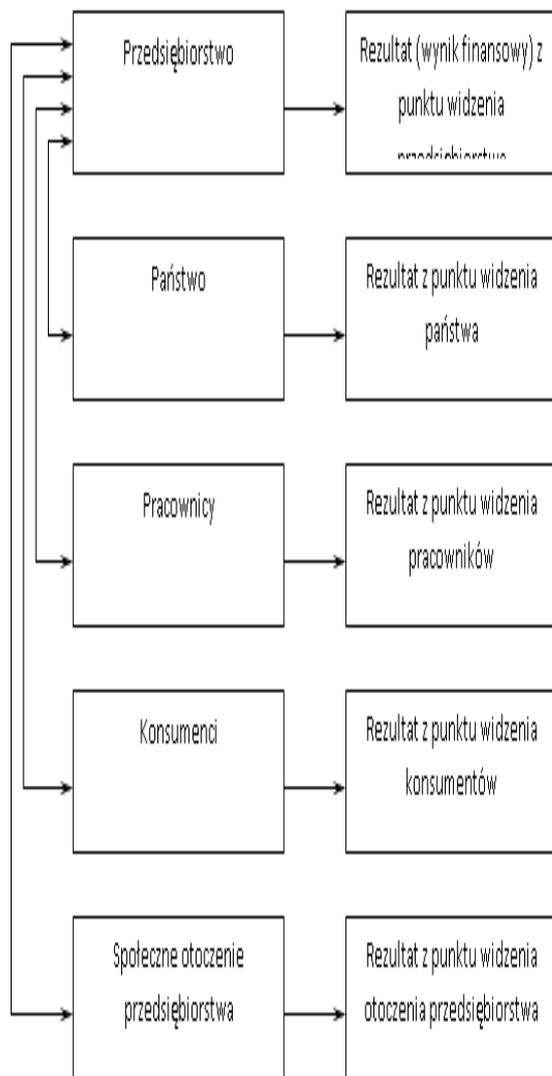


Source: Author's research

Practically, a company operates as long as it implements the interests of all of the above entities.

Polycentric accounting consists in a simultaneous determination of the performance of business operations from several viewpoints.

Diagram 6. Concept of polycentric account



Source: Author's research

Usually, the costs and the performance of company operations concern simultaneously several entities that have separate objectives. Thus, it is justified to determine, as far as possible, the effects of business operations from the perspectives of different entities at the same time rather than to aim at finding a single “objective” effect of operations. Only such a presentation of the effects makes it possible to monitor the true results of economic operations and to widen the view on economic processes by looking at them from several points of view.

The concept of the economic account presented in Diagram 6 is in a way the consequence of the withdrawal from a monocentric view on economy and a suggestion of accepting a polycentric view and resignation from a hierarchical structure of economic objectives. That also leads to the withdrawal of the idea of the hierarchical structure of the economic information system in which the information on the level of companies constitutes the material to be aggregated on a state (macroeconomic) level. Instead, the idea has been adopted of the equivalence of particular participating social entities and of the equivalence of the significance of the information that is generated for the needs of the above listed entities. Thus, this is a concept of an economic information system in which the results of business operations are presented parallelly from different perspectives with the aim to determine the effects of the operations for each of the social entities separately, in order to obtain a more complete and useful view of the results of economic management.

The emergence of such social organizations as consumer federations, environmental movements, self-governments, trade unions, etc. makes it possible (and the information needs of companies make is necessary) to create a third development trend in accounting, which is in-between the micro- and macroeconomic approaches, in order to move from its *monocentric* structure for the sake of a *polycentric* one. Such an approach helps monitor the effects of the operations of economic entities from the perspective of several social entities at the same time, which means that the desired and more complete view of economic operations can be obtained.

The development of a polycentric structure of accounting enables in decision making processes the application of “clusters” of financial results that show various aspects of economic activity. Such a model of accounting constitutes an instrument that facilitates the presentation and integration of the aims of particular social groups and consequently it is an element that mitigates the contradictions between group interests.

The economic account run by consumer federations, trade unions, environmental movements, local self-governments, etc. constitutes a tool for exerting social pressure on companies with poor performance.

Moreover, the development of a polycentric structure of accounting leads to the accomplishment of the *information balance* idea between the players on the market, which may result in a more sustainable economic development.

The Guide to Cost-Benefit Analysis of Investment Projects published by the European Commission (Directorate-General for Regional and Urban Policy) is a practical example of implementing the above concept. CBA is a commonly used method to assess the effectiveness of economic projects². Its objective is to present the costs and benefits of a project from the perspective of other entities than the investor's. CBA is a supplement of an investment-effectiveness analysis and it presents additional information on the effects of the project. The method is interesting from the point of view of local communities, self-governments, consumers and state budgets.

The objectives of individual entities should be verified within the framework of obligatory appraisals of investment project completion. Such a procedure facilitates a serious dialogue between (direct and indirect) project participants that have different information resources and objectives. The Guide (p.12) mentions, among other things, the issue of *multi-level governance* on the part of investment project participants and the necessity to agree on harmonized rules on the calculation of some performance indicators (e.g. the project economic net present value), and use them to steer the decision making process.

On pages 12 and 13 the Guide states that “the systematic use of CBA, will also increase the learning mechanism among all the players. A consistent use of social CBA should be seen as the common language for this learning mechanism, which should be structured around the interplay between several actors... It is largely based on approximations, working hypotheses and shortcuts because of lack of data or because of constraints on the resources of evaluators. It needs intuition and not just data crunching and should be based on the right incentives for the evaluators to do their job in the most independent and honest environment.”

It is recommended on p.52 that each Member State of the EU should develop its CBA guidelines focusing on the estimation of a set of national parameters, including some key shadow prices or conversion factors, in the context of the EU Cohesion Policy priorities.

The aim of CBA (based on cash flow analysis) is to calculate the following indexes:

- a) Economic Net Present Value (ENPV),

² See: e.g. Guide to cost-benefit Analysis of Investment Projects. Structural Funds, Cohesion Fund and Instrument for Pre-Accession, Final report submitted by TRT Trasporti e Territorio and CSIL Centre for Industrial Studies 16.6.2008

- b) Economic Rate of Return (ERR),
- c) Discounted Return Period
- d) Simple Return Period
- e) B/C indicator (total of discounted benefits/total of discounted costs)

Exemplary calculation of ERR and ENPV (wstawić element podane poniżej na zielono)

	A	B	C	D	E	F
	Wyszczególnienie w tys. zł	Prognoza				
		2014	2015	2016	2017	2018
	Okres prognozy	0	1	2	3	4
5	Nakłady inwestycyjne	-20 000	0	0	0	0
7	Przepływy pieniężne z działalności operacyjnej	80	3 824	4 249	4 593	4 897
8	EBIT (Przychody - Koszty)	1 000	1 400	1 900	2 300	2 650
9	Przychody	8 000	8 600	9 200	9 800	10 400
10	Koszty	7 000	7 200	7 300	7 500	7 750
11	Podatek dochodowy (19% od EBIT)	190	266	361	437	504
12	Amortyzacja	1 400	2 800	2 800	2 800	2 800
13	Zmiana stanu zapasów	-1 100	-100	-100	-100	-100
14	Zmiana stanu należności	-5 050	-50	-50	-50	-50
15	Zmiana stanu zobowiązań bieżących	4 020	40	60	80	100
16	Wartość rezydualna					7 400
18	Finansowe przepływy pieniężne netto	-19 920	3 824	4 249	4 593	12 297
20	Wpływy z tytułu korzyści społecznych	1 500	1 500	1 500	1 500	1 500
21	Korzyści społeczne I	1 000	1 000	1 000	1 000	1 000
22	Korzyści społeczne II	500	500	500	500	500
24	Wydatki z tytułu kosztów społecznych	200	200	200	200	200
25	Koszty społeczne I	100	100	100	100	100
26	Koszty społeczne II	100	100	100	100	100
28	Ekonomiczne przepływy pieniężne netto	-18 620	5 124	5 549	5 893	13 597
30	Stopa dyskontowa	10,00%	10,00%	10,00%	10,00%	10,00%
35	Zdyskontowane ekonomiczne przepływy pieniężne netto	-18 620	4 658	4 586	4 427	9 287
37	FRR	7,90%				
38	FNPV	-1 083				
39	ERR	18,72%				
40	ENPV	4 338				

Conclusion

The following conclusions can be drawn on the basis of the hand-on experience in the development of management information systems:

- a) **Data** are the resources where answers to managers' questions can be searched, while **information** is the precise answers to these questions. Economic entities usually possess

- a significant amount of data but an insignificant amount of information that would constitute a valuable basis for determining facts necessary to make effective decisions;
- b) The search for information tools **without the development of the principles of an information system** in an organization is a common mistake that results in serious problems when implementing the software and leads to unsatisfactory results of the implementation;
- c) In order to construct a management information system it is indispensable to **determine the following three structures**: responsibility centers, responsibility measures and databases that will facilitate the calculation of the accepted indicators;
- d) Information and information systems are the fundamental **capital** of an economic entity;
- e) The concept of **polycentric accounting**, which helps maintain sustainability and stabilization in social structures may constitute a connection between micro- and macroeconomic information systems.

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- [3] Szot-Gabryś, *Koncepcja rachunku kosztów i korzyści w rachunkowości odpowiedzialności społecznej przedsiębiorstwa*, Difin SA, Warszawa 2013