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DETERMINANTS OF CONSTRUCTION FOR AN INFORMATION SYSTEM SUPPORTING INNOVATION MANAGEMENT

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Abstract

Issues regarding information needs for managing innovation in a company are presented in the paper. The authors describe the concept of cost classification and practical solutions in typical reporting for assessing analysis of the efficiency of innovation activities in companies. The concept is depicted against the background of general issues related to internal factors which influence the system of innovation process management.

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Introduction

Contemporary companies operate under enormous market and external pressures which lead to a focus on the continuous implementation of change. Different forms of company activity in this area become a factor which determines their competitiveness and survival in the market. P. Drucker was the first who defined an entrepreneur as someone who is looking for change and new solutions, and using them as opportunities. Change, regarded as the intended effect of an entrepreneur's action, can be made in various ways. However, both in literature and practice, change is most often linked to the implementation or application of new methods of operation, new technology, markets, products or management. Such actions are unequivocally associated with the concept of innovation.

Referring to the most classic definition of innovation, we should refer to J.A. Schumpeter, who said that innovation is (Schumpeter, 1960, p. 168): the introduction of new products or new production methods or the entrance to a new market or the procurement of new sources of raw materials or the introduction of organizational changes. S. Kwiatkowski, in turn, emphasizes the social and cultural dimensions of innovation, arguing that it is the result of internal processes, not only the result of technical decisions or behaviours (Kwiatkowski, 2000, p. 84). The concept of innovation is usually associated with two attributes namely: dynamism and willingness to take risks. For this reason a company can be looked at as an evolving organization, passing

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through successive phases of growth - in the wake of the changes taking place in it, whether as a result of internal factors or external.

The purpose of this paper is to present determinants of the construction of information systems which support management of accounting and financial information in company activities connected with innovation. A basic framework for a model of such a system is presented in the paper. Basic reports for internal users about innovation activities within the company are also described.

Intra-organizational conditions for innovation and information needs

Among the effects of innovation for a company which are most frequently mentioned are: increased profits, the continued reduction of operating costs, locating of new markets, increased market share on the markets in which the company previously operated, improved quality of goods and services, as well as the acquisition or preservation of access channels to new manufacturing or organizational technologies (Makiela, 2005; Janasz, 2004).

A company is considered to be innovative, if it systematically allocates specific financial resources for this activity, implementing new organizational, scientific or technological developments conducting their own research and development activities, or simply by purchasing innovative products or technologies (Jasiński, 1995, p. 36).

Among the internal factors which contribute to the success of undertaking innovative activities most often are mentioned: financial strength which allows for sufficient repeated attempts at innovation, willingness and readiness of managers to take risk, the size of the company, and the continuity of the strategy implemented by management. Regularity and consistency in the actions of owners and managers ensures the long-term range of the innovation process. Jasiński A. H. also stresses the importance of managers' knowledge about markets, which may be critical for arousing the interest of customers in a new product. It is also closely related with barriers of entry - which from a company's point of view requires a high accumulation of organizational power (especially while pursuing a large number of projects) and financial concentration (Francik and Poczowski, 1991, p. 27).

Of course other important factors of the success of innovation activity are also: the technological and organizational levels of the company, cooperation with other organizations and research institutions, and intellectual capital (Szatkowski, 2003, p. 247). As far as the external conditions for innovation are considered, most important are (those widely discussed in the literature): the pace of technological progress, economic situation, trends in economic situations, business environment and especially the activity of the competition (Wiszniewski, 1999; Okoń – Horodyńska, 2002).

In the literature, very often innovation is associated with the concept of competitiveness, as one of its basic elements, or conditions for its increase. Among the determinants of competitiveness the IMD (World Competitiveness Yearbook) enumerates among others: effectiveness of organizational structures, infrastructure and business operation efficiency³.

Referring to the above conditions and taking into consideration the topic of this paper, one should pay attention to two elements, namely the effectiveness of management structures and the efficiency of the company. C. Prahalad and Krishan K. emphasize that business processes must be closely linked with each other, and business activity in the field of training, qualification, organizational structure, and finally, performance measurement tools must reflect the new imperatives of competitiveness (Prahalad and Krishan, 2010, p. 12).

³ The World Competitiveness Yearbook, IMD 2002

Regarding companies' innovative activities (as one of the factors of competitiveness), one should therefore emphasize the importance of internal solutions that will enable the identification, registration and processing of information about the costs and effects of innovation implementation. Therefore the role of accounting, managerial accounting and auditing systems in this field is growing. The scope, form and range of financial information on innovation activities will depend, among others on:

- 1) innovative potential of the company (or the innovation per se measured by number of deployments or expenditures incurred),
- 2) innovation strategy (usually formulated as one of the main elements of business strategy for each company which is oriented towards innovation),
- 3) types of innovation (technological, product, organizational, etc.),
- 4) methods of acquisition and implementation of innovation (external innovation achieved through e.g. technology transfer or innovation implemented thanks to internal research activities).

The system of accounting and the auditing system will be subjected to the map of innovation processes and innovation strategy. This is because it determines not only the objectives and achievable results, but also the necessary resources.

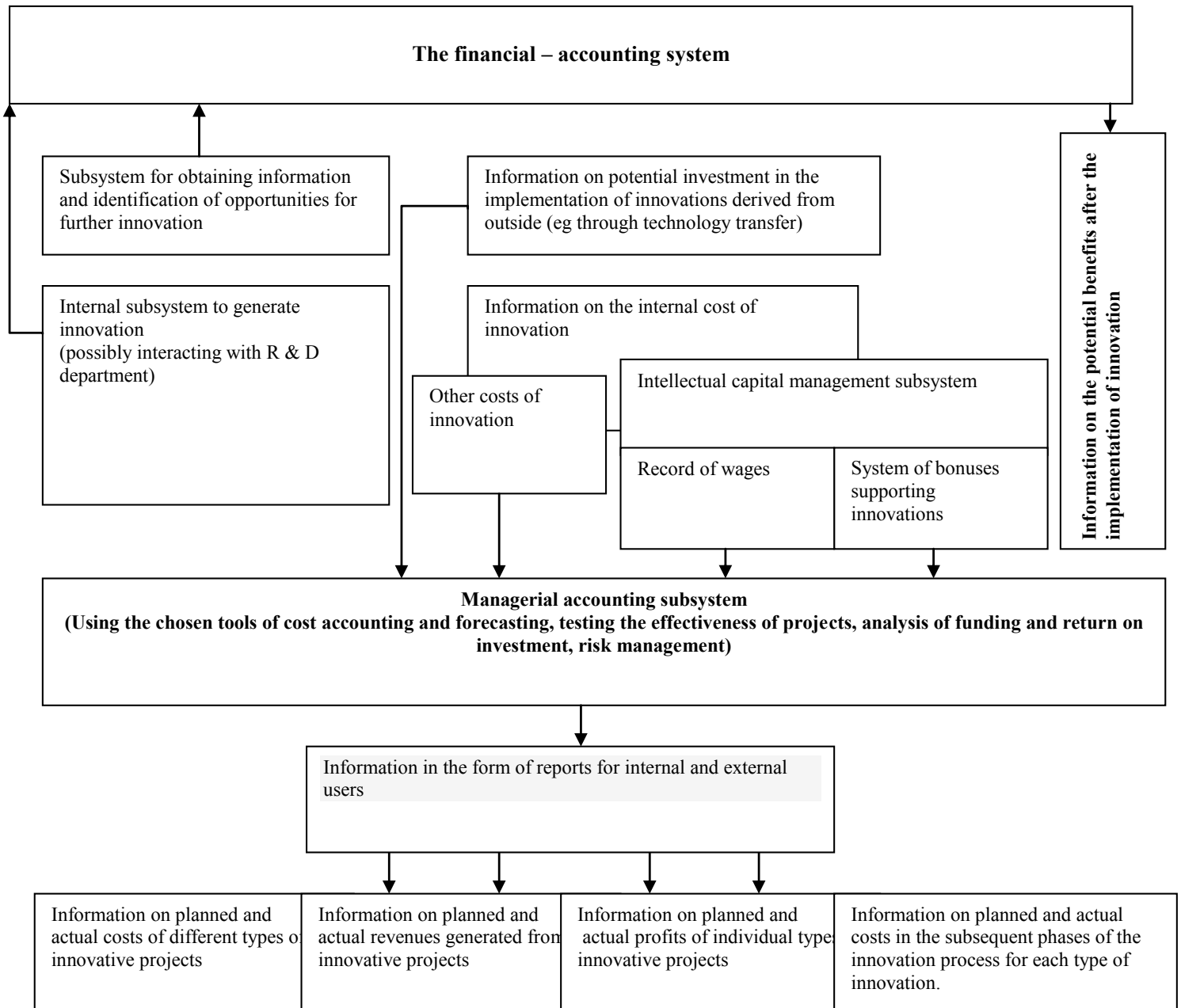
According to M. Strużycki (1992), innovation strategy also covers the subject of innovation activities and the way the innovation process is organized. Models of innovation as a management process are presented by Trott, P. (2002) and Abraham J. L, Knight D. J. (2001).

They emphasize that management of innovations is a constant process consisting of repetitive phases, which consist of specific actions and related tasks with assigned resources assigned. Through continuous improvement and cyclical repetition of these processes a model of a company's innovation can be developed. During this process, it is possible to create a knowledge bank, which in the future may be, a great source of information. It is worth emphasizing the diversity of factors affecting the success of innovative companies. Among these there are internal factors (which are the main object of analysis of this paper). These factors can be grouped as follows:

- 1) economic and financial,
- 2) those resulting from the adopted strategy,
- 3) those resulting from intellectual capital,
- 4) those resulting from a particular model of company management and its organizational structure (including the flow of information within the company).

Referring to the factors mentioned above, which determine the success of the company and the role and functions of innovation in its development, we can determine the scheme of information needs for the implementation of innovation and for analysis of the effects of this implementation (see Figure 1).

Figure 1: A company's information needs in the field of innovative activity



Source: Own elaboration.

Classification of costs for the analysis of innovative activity in acompany

In the era of the knowledge-based society, no one disputes the enormous importance of information systems in business management. The literature states that information systems play different roles, namely:

- 1) Information systems constitute the main source of information which provides for the execution of activities that shape the situation of the company and its further development,
- 2) Information systems provide interaction between the system of management and the execution system,

- 3) Information systems affect the level of costs incurred to conduct business through feedback that provides for corrective action regarding decisions or a communication process between senders and receivers of information in decision-making task communication between the senders and receivers of information,
- 4) Information systems contribute to the development of competitive products and services that can provide the company a strategic advantage in the global market,
- 5) Information systems are a valuable resource of each company, contributing to finding new, hitherto unknown tangible and intangible resources (Chojnacka-Komorowska and Winnicki, 2011, p. 89-90).

Taking into consideration the importance of management information systems one should very carefully approach its design. The starting point should be identification of the information needs which the system should fulfil, because they ultimately will determine its shape.

Analyzing the information needs for managing innovation as shown in Figure 1, it should be noted that they are extensive and they apply to the problems of strategic and operational management. Strategic management of innovation will be focused primarily on determining the direction of innovative activities, the selection of projects and establishing long-term budgets for innovation (Golej, 2011, p. 204). The main selection criterion for innovative projects is profitability. Therefore it is necessary that the information system, which may support innovation management, might provide useful economic information for that purpose; it is necessary to define methods for assessing the profitability of innovative projects. There is no doubt that in all methods of assessing profitability, information about costs is always very important. Such information is generated by costing. In management of strategic innovation, particularly in selecting innovative projects on the basis of their profitability, the most useful information about costs will be generated by modern cost accounting.

Essential information which supports short-term decision-making will be important in operational management (especially decisions relating to how resources are spent). Major attention will be given to permanent control of projects and updating the changes. There are frequent delays in finishing different phases of implementing innovations; quite often projects are stopped at different stages. Therefore the continuous update of information is necessary, which further determines the organization of the process with an indication of summary places and assessment of the previous progress of work in an innovative project (Golej, 2011, p. 202-203).

In operational management the role of information about real costs is growing (they provide for the verification of the assumptions). The source of this information may be traditional or modern cost accounting and reporting, which is a part of the accounting system. The undeniable advantage of this costing is the fact that as an integral part of the accounting system, it is run continuously and systematically, which means that it provides the current recording of amount of real costs incurred. A disadvantage is its focus on financial accounting purposes. It means that the requirements of the law are taken into account when building such a system (and its structure of accounts, cost classification, documentation of business operations and rules of evidence and so on). The high complexity of innovation processes and the variety of decisions mean that in the process of resolving decision making problems regarding innovations, various systems of classification of costs may be useful (examples in Table 1). Such cost classifications may often go beyond the scheme of cost classification which are used in traditional cost accounting and reporting. Even substantial modification of the structure of a chart of accounts may be insufficient to meet the specific needs of management of innovative activities in company.

Apart from that, it should also be noted that the benefits from information about the real costs of innovation will be fully revealed only when such information will be generated in a cost scheme compatible with the cost scheme at the planning stage (for example, in the budget of the innovative projects costs).

Table 1: Classification of innovation costs

Criterion for the allocation of innovation costs	Division of costs	Characteristic
type of cost	depreciation materials and energy external services taxes and fees salaries social insurance and other benefits	Costs by type are classified according to the substance of the economic elements of various production inputs. The innovative activities are all generic costs.
type of innovation according to the criterion of originality	incremental innovation breakthrough innovations	Classification of costs according to the degree of novelty of innovation will determine how much cost was incurred for incremental innovation and how much where incurred for breakthrough innovation. It can be used in assessing the capacity of a company's innovation, in assessing the effectiveness and accuracy of decisions, especially in the long run.
type of innovation according to the criterion of area of company operations	product innovations process innovations organizational innovations marketing innovations	Classification of costs according to the criterion of substantive innovation will determine how much cost was incurred for product innovation, process innovation, organizational or marketing innovation. This classification provides valuable information in assessing the innovative activity of companies, but in practice it is sometimes very difficult to use because some innovation can be classified simultaneously in different categories (for example innovation can be both organizational and process, or product and marketing).
period to which the costs refer	the cost of one period costs of several periods	This classification enables division of costs of innovation within the costs of one period, i.e. those which were incurred during the specific period (accruals basis) and costs incurred for more than one period and requiring settlement in time.
relationship with achieved revenues	deductible costs expenses not deductible for tax	Deductible costs, according to tax regulations, shall be the costs incurred in order to achieve revenues or maintain or secure sources of revenue. Classification of costs of innovation according to this criterion is useful especially for tax settlement. Outside of this area use of such information from this classification is limited.

Table 1: Classification of innovation cost - continued

Criterion for the allocation of innovation costs	Division of costs	Characteristic
relationship with the carrier cost (the cost of the reference object)	direct costs indirect costs	Division of costs to direct costs (i.e. those which based on source documents can be clearly attributed to the object reference) and indirect costs (those which are assigned to an object of reference based on indexing keys) depending on the object of reference costs. Taking innovation projects costs as a reference subject for total costs, costs such as salaries of people working on various innovative projects can be considered direct, and costs such as costs of premises can be considered as indirect.
response to changing the size of the carrier (reference object for cost)	variable costs fixed costs	Costs of innovation may be divided according to the criterion of variability taking as a reference point the scope of work (scope of innovation activity). Fixed costs of innovative activity will be recognized as the costs which will not be changed along with the scope of innovation activity, while variable costs are costs that will vary with the scope of the work (proportional, degressive, progressive).
importance when decision is made	significant costs (relevant, decision-making) insignificant costs	Significant costs of innovative activity are those which will depend on decisions about selection of different action options. Insignificant costs of innovative activity are those which are not dependent on decisions
moment when the decision was made	foregone costs (sunk, irreversible) future costs	The foregone costs of innovative activity are those that are the result of previous decisions. These costs are inevitable. The future costs of innovative activity are those which will be dependent on a future decision.
desirability and possibility of control	controlled costs uncontrollable costs	Controlled costs of innovative activity are those which can be influenced by the decision maker. Uncontrolled costs of innovation are those which can not be influenced by the decision-maker.
phase of the life cycle of innovation	the cost of the initiation phase the cost of the planning phase the costs of the implementation phase costs of liquidation phase	Classification of costs according to the phases of the life cycle of innovation provides useful information for analysis of cost structure during different phases of the life cycle of innovation.

Source: Own elaboration based on Nóżka, A. (2008). Rachunek kosztów w zarządzaniu jednostkami badawczo-rozwojowymi. Lublin: Wydawnictwo UMCS, p. 16-18

Since rarely is the registration system of costs within the cost accounting system in line with costs in the budgets of innovative projects, carrying out a financial audit of the project forces companies to keep additional records of the actual cost of innovation exclusive to these needs, beyond the cost accounting system.

Designing an information system to support the management of innovation activities, one should remember that it should be based on both financial information (related to inputs, costs, revenues related to innovation activities) and non-financial (e.g. reports of irregularities, reports on the status of the work). In the strategic context non-financial information may be more important. In the context of tactical and operational management of innovation, financial information may have a more significant role. This is because the main reason why the company is undertaking innovation activity is its striving to increase value.

The use of management information systems enables managers to make decisions on the basis of reliable reports, statements and economic indicators, thanks to current accounting and processing of data. The sample reports that can be generated by an information system supporting the management of innovation are presented in Tables 2 to 4 .

Table 2: Report of the completed innovative projects during the period from 31.12. YYYY to 01.01.XXXX

Type of innovation	The total expected revenue	Total real revenue	Deviation in revenue	The total expected cost	The total real cost	Deviation in the cost	Total expected profit	The total real profit	Deviation of the profit
Breakthrough product innovations, including:									
innovation A									
innovation B									
innovation C									
Incremental product innovations, including:									
innovation A									
innovation B									
innovation C									
In total									

Source: Own elaboration

On the basis of the report presented in Table 2 managers will be able to assess, among other things, which of the implemented innovations brought the greatest profit during the relevant period. Managers will also have information as to which projects and positions saw deviations (and the amount of deviation).

Table 3: Report of ongoing innovation projects costs at the date of inspection - xx.xx.xxxx

Type of innovation	Planned costs (till the day of inspection)	Actual costs (till the day of inspection)	Deviation	Total planned costs	Implementation of the plan in %
Breakthrough innovations, including:					
product innovations					
process innovations					
organizational innovations					
marketnig innovations					
Incremental innovations, including:					
product innovations					
process innovations					
organizational innovations					
marketnig innovations					
In total					

Source: Own elaboration

The report presented in Table 3 allows the company on the day of the audit to figure out the status of selected project implementation. The report focuses primarily on the size of cost deviations from previous plans and also concentrates on the percentage of completed cost.

Table 4: Report of the ongoing innovation project costs at the date of inspection - 30 September 2012

Innovation Project Title: modification of the product A					
Type of innovation: incremental					
Duration of project: from 4 January 2012 to 30 April 2013					
Day of inspection: 30 September 2012					
Phases of the project life cycle	Planned costs (till date of inspection)	Actual costs (till date of inspection)	Deviation	The total planned costs	% Implementation of the plan
The definition phase of the project					
Activity A					
costs by type, including:					
....					
Activity X					
costs by type, including:					
....					
Phase ...					
Activity...					
costs by type, including:					
....					
IN TOTAL					

Source: Own elaboration

Table 4 shows, in turn, a report which describes the status of selected innovation implementation in the system life cycle phases of innovation and cost generics.

The sample of the reports on innovation process were presented in the paper. They were prepared in accordance with the needs and factors which impact the success of innovation processes within companies (which were defined previously in the paper). It is worth noticing that this description and analysis of costs and revenues is possible with an extended system of accounting about the innovation and management processes in the enterprise. As already mentioned, the architecture of innovation management systems should take into consideration accounting, auditing and risk management tools. It is also important to effectively acquire and process external information and manage intellectual capital.

Conclusions

Designing an information system which supports innovation management involves paying special attention to the diversity of decision problems which it will have to meet, as well as the recipients of such information. One should approach with caution the data selection and presentation, taking into consideration their usefulness, completeness, quoting the relevant comparative data and related non-financial information, the use of diagrams, tables and comments. It should be remembered that the information system which supports the management of innovation should be integrated. It means that the information system should be complete, systematic, logical, consistent, both internally and with other managerial information, and also should accurately reflect the real situation (Wyczółkowska, 2009, p. 3,7). Undoubtedly, in constructing an information system which supports the management of innovation one should also be guided by the rationality of its operation i.e. the relation of the costs of generating information to their value. Therefore one should endeavor to achieve to the greatest possible extent integration with existing systems, such as the accounting system to increase efficiency.

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