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## Universal research approaches in designing development projects

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**Key words:** functional approach, value analysis, expert approach, benchmarking, improvement and base designing, scenario method, foresight concept

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**S u m m a r y:** The objective of the paper is presentation of the basic research approaches which significantly enhance designing the development of an organisation (activities of companies, institutions, larger systems). They constitute concepts of attitudes to problems in designing and, at the same time, express a specific research angle for creating future economic, organisational, technical and others solutions.

The structure of the paper follows a specific chronology of changes in universal research approaches, that is the ones that were relatively most commonly applied. It has to be emphasised that research approaches only give directions to studies and implementations, and the developed formula of analytical instruments is represented by detailed methodologies and their methods, techniques, and algorithms (which corresponds with methodology understood pragmatically).

The research approaches highlighted in the paper are: the functional approach, the methodology of the functional analysis of the product, the value analysis, the expert approach, benchmarking, improvement and base designing, the scenario method and foresight. These approaches are based to a higher or lesser degree on diagnostic research (assessment of the actual situation), relating them then with development of template models. The latter form the basis for preparation of functional solutions, that is various types of designs, products, strategies, plans, scenarios, systems of management and other.

The paper consists of eight sections.

*Preliminary notes* define the review function of text and the reference of the selected research approaches.

*Functional approach* discusses the scope of applications of this concept and the essence of the technique of function study. Then, *Methodology of functional product analysis* presents the characteristics of its individual stages, with special attention paid to determination of the degree of meeting the function. This section is supplemented with presentation of the scope of applications of the *Method of value analysis* and the stages of the research proceedings in this method.

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The next section is dedicated to the *Expert approach*, which presents the Delphic method and the cycle of organisation of expert research. The next section, *Benchmarking*, highlights the template issue and presents types of benchmarking and its methodology (according to R. C. Camp). *Improvement and base designing* discusses the scope of these concepts and explains the essence of the system-based approach, pattern modelling and idealisation.

The last section of the paper deals with the *Scenario method* and the *Foresight concept*. It presents different research attitudes towards the future, the specific nature of the scenario method and its close relation to the foresight concept. As regards the last issue, its features, the scope of applications and methodology are discussed.

## 1. Preliminary notes

The objective of the paper is presentation of the basic research approaches which significantly enhance designing the development of an organisation (activities of companies, institutions, larger systems). They constitute concepts of attitudes to problems in designing and, at the same time, express a specific research angle for creating future economic, organisational, technical and others solutions.

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## 2. Functional approach

The essence of the *functional approach* is the thesis that operational standards and effective behaviour of the system have superior significance in practical use. They are referred to, e.g., the properties of the product, technological operations, function met in the process of management and in administrative work, and the activities which constitute any type of service, including stages of creative work, etc. The functional approach, even though it accepts the structural aspect, which is substantial (behavioural), economic, and ethical in the assessment of systems, yet it gives the priority meaning to the “function”.

The functional approach is mostly visible in the *function study technique*, which is an analytical procedure, is used for diagnosis and perfection of activities and properties of all types of systems. The application of the function study technique is highly varied. It may be used in diagnostics, modelling and designing technical objects, for example machines, equipment, daily use products, and it also may be used in organisation of a working post, in examining procedures and all kinds of processes.

The functional approach has key meaning in the value analysis method, which deals with “adjusting systems to the function and minimisation of costs of meeting the function” (1, p. 9). This approach also plays a significant role in the quality assessment of products, and it has also been fully expressed in the system-based analysis, where, in particular, mutual interaction of the elements of the given entirety are examined, which, in consequence, is to allow finding efficient *functional systems* (system-based solutions) of a specific entirety.

### 3. Methodology of the functional analysis of the product

The simplified procedure in the functional analysis of the product may be described in the following stages (Figure 1):

1. Selection of the subject matter of the examination and collecting the basic information;
2. Application of the function study technique;
3. Finding new solutions and modelling;
4. Development of the project of the solution and its implementation.

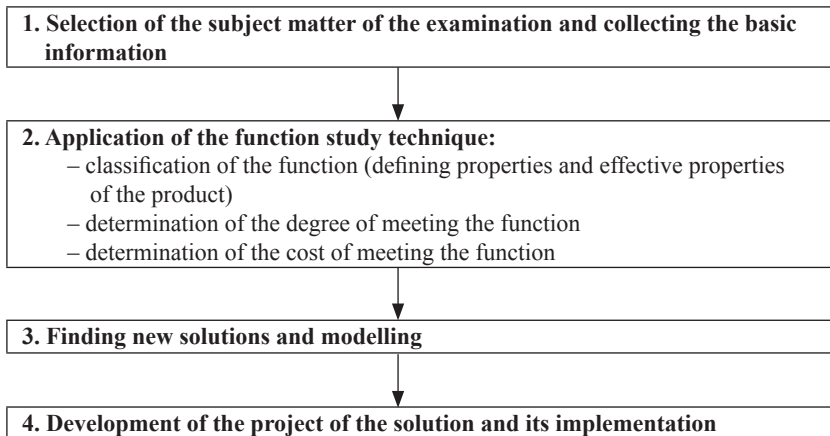


Figure 1. Methodology of the functional analysis of the product

## 4. Value analysis method (VA)

The value analysis method (VA) is one of the examination concepts of wide use, and its origin dates back to World War II. An American engineer, Lawrence D. Miles, is considered to be its creator, as he was the first to use the name *Value analysis* (in 1947). The applications of the VA method were wide: it covered with its scope industrial examinations (*value engineering*), as well as functioning of organisations and administrative work processes (*value organisation* and *value administration*).<sup>1</sup>

The idea of the VA method, referred to technical, organisational and other systems, may be summarised as follows: *In examining and designing any systems, execution of the required functions should be pursued, with the possibly lowest cost of meeting them.* The methodology of examination is structured in the value analysis into the following stages:

1. Preparation of the human factor;
2. Selection of the subject matter of examination;
3. Recognising the system;
4. Collecting information;
5. Analysis of the function and finding new solutions;
6. Development of the detailed project;
7. Implementation of the project (2, p. 147).

In examination of an industrial product, the more functional solutions in terms of construction or use are searched for, at the same time striving to achieve the lowest social cost of meeting the function. This “lowest potentially achievable social cost of meeting the function” is the *value* in the meaning of the VA method. The pursuit to achieve this value of the cost (thus equalling actual costs with the value as the potentially lowest social cost), is thus, along with functionality, the ultimate objective of VA.

Even though the basic direction of practical applications of VA are industrial products (objects of daily use, as well as machines, devices and their elements), VA may be also used in examining operation procedures (e.g. of the client) in administrative and office work, in technological processes. In general, the value analysis may be applied (with appropriate modifications) in examining any systems and their elements. Thus, value analysis may be called the “system-based” method, as it assumes examining *internal and external* relations between elements of the given system and analyses these relationships in multiple layers.

## 5. Expert approach

In the scope of economic and organisational designing, forecasting methodologies have an important place, with heuristic methods among them. However, they differ in a very basic way from the methodologies of research based strictly on analytical

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<sup>1</sup> The general discussion of the VA method is presented by Z. Martyniak (2, p. 144 et seqq.).

materials and quantity methods, as they are based on quality assessment of facts, intuition, and, most of all, on individual association patterns of the researchers, which is a certain type of algorithm of learning and forecasting.

Typical quantity approaches, e.g. forecasting based on time series, econometric and analogue models, mostly use the formula of theoretical functions and empirical characteristics, whose objective is to verify and prove credibility of the research. Heuristic learning is based on flexibility of the search and allowing an assumption in the thinking process about subjective probability of occurrence of specific phenomena and cause-effect relationships between them.

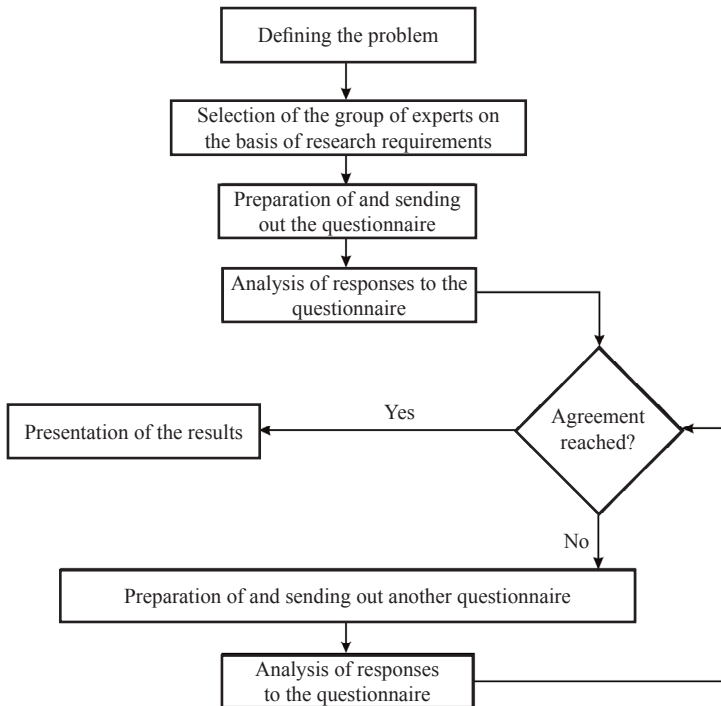


Figure 2. The stages of the procedure in the Delphi method

Source: (4, p. 209).

One of the presented heuristic methods is the *Delphic method*, prepared and applied by Olaf Helmer and his colleagues in 1963 in reference to the research in RAND Corporation (*Research and Development Corporation*). The idea of this approach is formulation of long-term forecasts on the basis of opinions of independent experts. They prepare their own opinions in correspondence discussion (with questionnaires) on economic or political and military forecasts, create perspective projections on technical and organisational solutions (in general concerning changes in various walks of life). The example of applications of the Delphic method may be the search of the answer to the questions: when will the space be conquered, when and

where will natural languages disappear and is it practically possible to replace them with digital communication (including direct contacts), what will be the type of fuel for vehicle motors under the situation of major reduction in the volume of oil and gas, what factors will definitely affect the development of the agricultural and food industry, what model of company management will be dominant in the era of common globalisation, what organisational form will the system of sale assume due to development in computers, what niches will come into existence in the area of services.

The Delphic method has the following features:

- Examination and analysis based on competent opinions of experts in the given field;
- A representative selection of experts;
- Collecting opinions in writing;
- Verification of opinions (expert opinions) with repeated examination (3, p. 29).

The stages of the procedure in the Delphic method are shown in Figure 2.

## 6. Benchmarking

The idea of benchmarking comes down to finding the best organisational, economic, technical and other solutions which constitute patterned models for own activities. With the use of the experience of distinguished entities, learning from leaders constitute a universal guideline for improvement.

The most characteristic function of the discussed approach is focusing on finding “benchmarks”, that is points of reference, for assessment of the results of own activities (e.g. in the scope of competitiveness, sale, level of technology, quality and reliability of products, economic and organisational effectiveness of processes, productivity, costs of labour). Benchmarks are thus standards, optimum indicators which constitute a measuring tool for the outstanding activity.

Benchmarking may be broken down into the following types (5, p. 58):

- Internal benchmarking: which refers to comparisons between organisational units of a company (and also between work stations) and consists in developing one’s own, autonomous formula of master patterns;
- Competitive benchmarking: which uses the available model solutions taken from its rivals (cooperation of competitive entities is also possible);
- Functional benchmarking: which refers to master patterns in execution of specific functions (e.g. technical, logistic, organisational), developed outside of one’s own sector, thus in other areas of business operations.

The above determining factors of benchmarking justify the statement that it is a universal approach with multiple applications. The methodology of benchmarking features relatively high difference from other methodological concepts. The following Table 1 presents one of the distinctive methodologies of benchmarking by Robert C. Camp.

Table 1

Methodology of benchmarking by R. C. Camp

Description
1. Planning
1.1. Identification of the subject matter of the examination
1.2. Identification of companies (partners) for comparisons
1.3. Selection of the method for data acquisition
2. Analysis
2.1. Determination of deviations in the scope of parameters of effectiveness
2.2. Determination of the level of the future results
3. Integration
3.1. Communication of the results of benchmarking and having them accepted
3.2. Determination of functional objectives (in individual levels of the organisational structure)
4. Implementation
4.1. Development of the implementation plan
4.2. Initiation of implementation activities and securing their execution
4.3. Defining new “benchmarks”

Source: (5, p. 62).

## 7. Improvement and base designing

*Improvement designing* applies to the existing systems and is focused on elimination of the found defects or shortcomings in the solutions applied, it may also be aimed at their improvement. The specific nature of this type of designing is expressed in, among others, the basic significance of identification, diagnosis and programming of changes. These three specific processes combine into analytical and research works which define the area of finding effective design solutions.

*Base designing* refers to newly created systems, and its basic characteristics are as follows:

1. It is based on its own, specific principles and a model concept;
2. It is represented by the system-based approach (comprehensive);
3. It employs the methodology of building patterned models.

• *Own, specific principles of base designing* are the general construction rules according to which the creator (designer, planner, analyst) creates the model concept. These, they are standards which are the guidelines to take in finding a solution for the specific design task. An example of such a set of principles comes in the form of guidelines for designing economic and organisational systems: specialisation of production, diversification of the sale programme, economisation of the scale of production, globalisation of production and market, concentration of production and capital, economic division of labour, outsourcing auxiliary functions, creating flexible net-

work structures, economic optimisation of organisational structures, decentralisation of management, functional integration of the systems of management, algorithmisation of decision and control processes.

The principles constitute the superior directives for rational designing and express both the methodological and practical orientation of the creator which may differ from case to case. These differences are the more clear, the higher degrees of presence of antinomies between particular principles. For example, such opposing principles are: specialisation and diversification, concentration and distribution, production and organisational globalisation and creating flexible network structures, decentralisation and centralisation, designing system uniform in terms of functionality and designing integrated systems (multi-functional).

However, the above opposition of the principles cannot be regarded strictly as an alternative, but should be understood facultatively, that is as connecting specific principles with external situations and internal conditions of the system. It means that the context will be the criterion decisive about the selection of a particular principle due to the need of formulation of the model concept.

- *The model concept* is a vision of the solution for the design task which is expressed with a forecast of reality in a shorter or longer time perspective on the one hand, and the idea and the general view of the result of designing on the other hand. It is assumed that the model concept (in short: the model) is a master pattern, irrespective of the level of idealisation or detail.

- *The system-based approach* is regarded as an immanent feature of base designing and in popular understanding constitutes the strategy of comprehensive research proceedings. The system-based approach applies in entirety the directive of integration, that is synthesis of functions (activities, properties). Tadeusz Kotarbiński, referring integration to synthesis of activities, defines this term as “merging constituent activities into *an entirety* (emphasised by A. S.) as the most useful for the objective” (6, p. 202).

This merging should take into consideration two general stipulations: including in the entirety whatever is necessary, and not including in the entirety or removing from it whatever is unwanted (6, p. 202 et seqq.). However, the comprehensive meaning of the system-based approach cannot be limited only to activities (processes, procedures), it has to be related to all objects analysed statically. Integration will then be the universal principle for base designing (as well as improvement designing).

- *The patterned models construction methodology* is the necessary determinant of base designing. Unlike with reproduction models, creating and using patterned models is mostly related to finding innovative scientific and technical solutions. Models, whether specific or abstract, have to perform the role of standards or stipulations. They are created for comparison in diagnostic research and for the needs of broadly understood planning and design works. In the latter case, models are originals for plans or designs, as they express some sort of a primary solution. Models are subject to verification and detailing during execution of an assumed enterprise.



## 8. Scenario method and *foresight* concept

The concept of scenarios was first popularised by Herman Kahn and Anthony J. Wiener in *The Year 2000* (1967). The essence of this concept comes down to finding that the scenario presents a set of images (projections) of any system or situation expected in the future. Michel Godet regards a scenario as a description of the possible future events and directions of development in the reality (7, p. 19). A more elaborate interpretation of the scenario approach is given by Lucien Gerardin, defining four attitudes towards the future:

- *The passive attitude (opportunist)*, completely subordinate to the flow of events, in a sense being an expression of fatalistic philosophy;
- *The adaptive approach*, which consists in optimisation of present-day activities so as to better adjust its results to the forecast future;
- *The forecast approach*, whose essence is estimation of the possible state of things at the given future time, with the assumption of continuation of present-day trends;
- *The approach creative to the future* (8, p. 328 et seqq.).

The above summary of approaches to the future features the following opposition comparisons:

1. The adaptive approach in long-term planning vs the creative approach in the so-called *the futures creative planning*. The essence of this differences is in the gap between adaptation (with some necessary delay) to an external change and causing (with an obvious advance) of a demanded change. Long-term planning is an activity at the strategic level, while the futures creative planning evolves in a political level. Long-term planning proposes focusing on the most probable development of events. The futures creative planning (*future conditions* or *changes*: A. S.) is aimed at referring each *futurible* (projection: A. S.) to a point of reference in the future, and not to the past projected into the future.

2. The forecast approach vs the creative approach. The classical view that value of forecasts is measured with the accuracy of evolution of the forecast future is in some contradiction to the statement that the value of the forecast is measured with the degrees of the effect it has on the current situation when a decision is made. It is so because *typical forecasts* as regards closer or farther future should not be confused with the futures creative planning. The latter form of planning may be called *creative forecasting*. Creative planning is a new philosophy of making decisions which assumes shared participation in formulation of common objectives and agreeing on views (8, pp. 330–333).

Here are some views of other authors. According to Krystyna Fabiańska and Jerzy Rokita, the scenario concept consists in preparation of many different versions of scenarios which describe the situation of a business organisation and the condition of the environment in which it will function in the future, as well as in building a development plan for each version. The centre of gravity of this planning concept is in *identification and prospective* examining executed in the initial stage of the planning process.

With simple extrapolations of the current trends in changes in a business organisation, its future situation may be determined. In constructing alternative descriptions of the future, certain features of a perfect situation and negative consequences of continuation of the current strategy are the factors which justify the choice of development objectives as a perfect situation and the corresponding strategies. The scope of strategies in the scenario concept depends on meeting the following conditions:

- The business organisation must have an accurate scenario of a real situation (many scenarios do not correspond with the existing reality);
- The undertakings included in the development plan must correspond with the existing situation;
- The time of initiation of the strategic activities included in the development plan must be properly selected (9, pp. 113–114).

The meaning of creativity in scenario planning is also emphasised by Andrzej Klasik. He writes that prospective studies leading to formulation of strategic objectives and problems form a creative reflection about the future of the organisation. He then adds that this approach is used by the management of the organisation to create comprehensive and varied visions of the future, that is scenarios (10, p. 85).

To take a position on the above views and interpretations, especially those of Lucien Gerardin, one should take notice that repeatedly emphasised attitudes towards the future, although clearly different, create in total (probably with the exception of the passive attitude) a certain mutually supplementary entirety. Creative planning, while performing its creative and exploratory function, cannot be devoid of the features of a typical forecast, and cannot be separate from the necessity of adaptation to the existing or changing external and internal conditions.

## Foresight

The *foresight* concept is closely related to the scenario method. This term is interpreted as “prediction”, “caution”, “far-sightedness”. In a more developed way, *foresight* is proposed to be defined as a type of programming development of social, business and technical systems whose main features are:

1. The objective of the research procedure is designing the development strategy at the level of the national, regional and company economy;
2. The subject of the *foresight methodology* is, among others: the level of social and cultural development, the power industry, protection of the environment, information and telecommunication technologies, safety, innovativeness of companies;
3. The research procedure combines forecasting with long- and short-term planning;
4. Management over the process of execution of undertakings uses algorithms for planning experience and control over implementation processes;
5. The applied research methods include, among others, system-based analysis, heuristic methods, optimisation calculus, artificial intelligence, business forecasting (including scenarios), project management, managing security and risk, analysis of

development capacity, economic and financial analysis, SWOT analysis, feasibility study.

The following Table 2 presents the *foresight* methodology.

Table 2

*Foresight* methodology

Description
1. Development of the strategic directive
1.1. Objectives (expectations of the owners and the management)
1.2. Areas of activities (functions and types of resources)
1.3. Critical points
1.4. Decision rights
1.5. Co-operation of experts
1.6. Operational guidelines
2. Analysis of external situations
2.1. Structure of the environment
2.2. Identification of the effect of the environment
2.3. Diagnosis of external situations
2.4. Forecast of external situations
3. Diagnosis of the internal organisation and of the functioning of the system
3.1. Assessment of the actual situation
3.2. Threshold analysis
3.3. Categorisation of the assessment of the actual situation
3.4. Analysis of causes
3.5. Comparative examination (dynamic, spatial)
4. Forecasting and planning activities
4.1. Vision
4.2. Balances of the production potential
4.3. Performance balance
4.4. Scenarios and selection of the optimum scenario variant
4.5. Chances (risk) of achieving the strategic objectives
4.6. Making the plans of activities probable
5. Implementation of the plans activities
5.1. Assessment of feasibility and risk
5.2. Safety
5.3. The logistic project
5.4. Control over the implementation process

Source: Author’s own study.

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## Uniwersalne podejścia badawcze w projektowaniu przedsięwzięć rozwojowych

**Streszczenie:** Celem artykułu jest przedstawienie podstawowych podejść badawczych, jakie w istotny sposób wspomagają projektowanie rozwoju organizacji (działalności przedsiębiorstw, instytucji, większych systemów). Stanowią one koncepcje ujęcia problemów projektowania, a zarazem wyrażają określoną postawę badawczą względem kreowania przyszłych rozwiązań gospodarczych, organizacyjnych, technicznych i innych.

Struktura artykułu zachowuje określoną chronologię kształtowania się uniwersalnych podejść badawczych, a więc tych, które miały stosunkowo najbardziej powszechne zastosowania. Należy przy tym podkreślić, iż podejścia badawcze ukierunkowują jedynie prace studialne i wdrożenia, natomiast rozwinięta formuła instrumentarium analitycznego jest reprezentowana przez szczegółowe metodyki i właściwe dla nich metody, techniki, algorytmy (czemu odpowiada metodologia rozumiana w sensie pragmatycznym).

Wyróżnione w prezentowanym opracowaniu podejścia badawcze to: podejście funkcjonalne, metodyka analizy funkcjonalnej wyrobu, analiza wartości, podejście eksperckie, benchmarking, projektowanie usprawniające i bazowe, metoda scenariuszowa i foresight. Podejścia te w większym lub mniejszym stopniu opierają się na badaniach diagnostycznych (ocenie stanu faktycznego), wiążąc je następnie z tworzeniem modeli-wzorców. Te ostatnie są podstawą przygotowania rozwiązań użytkowych, a więc różnego rodzaju projektów, wyrobów, strategii, planów, scenariuszy, systemów zarządzania i innych.

Charakterystyka artykułu dotyczy ośmiu punktów.

W *Uwagach wstępnych* sformułowano funkcję przeglądową tekstu oraz przedmiotowe odniesienie wyróżnionych podejść badawczych.

W punkcie *Podejście funkcjonalne* omówiono zakres zastosowań tej koncepcji oraz istotę techniki badania funkcji. W kolejnym punkcie *Metodyka analizy funkcjonalnej wyrobu* przedstawiono charakterystykę poszczególnych jej etapów, zwracając szczególną uwagę na określenie stopnia spełniania funkcji. Dopelnieniem niniejszego punktu jest prezentacja zakresu zastosowań *metody analizy wartości* oraz etapy postępowania badawczego w tej metodzie.

Dalszy punkt artykułu to *Podejście eksperckie*. Tu zaprezentowano metodę delficką oraz cykl organizacji badań eksperckich. W następnym punkcie *Benchmarking* wyeksponowano problem wzorca, a także przedstawiono rodzaje benchmarkingu i jego metodykę (według R.C. Campa). W punkcie *Projektowanie usprawniające i bazowe* omówiono zakres tych koncepcji, jak również wyjaśniono sens podejścia systemowego, modelowania wzorcującego oraz idealizacji.

Ostatni punkt artykułu to *Metoda scenariuszowa i koncepcja foresight*. Tu przedstawiono różne postawy badawcze wobec przyszłości, specyfikę metody scenariuszowej i jej ścisłe powiązanie z koncepcją foresight. W odniesieniu do tej ostatniej scharakteryzowano jego wyróżniki, zakres zastosowań oraz metodykę.

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Sł o w a k l u c z o w e: podejście funkcjonalne, analiza wartości, podejście eksperckie, benchmarking, projektowanie usprawniające i bazowe, metoda scenariuszowa, koncepcja foresight

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