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INDUCTIVE TECHNOLOGIES OF SYSTEM-ANALYTICAL RESEARCH AS AN EFFECTIVE TOOLS IN COMPLEX INNOVATIVE PROJECTS

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In this paper the some examples of the real system-analytic search direction projects of high complexity in different areas human activity are presented. The most problematic sides of modern technologies and their implementation have been formulated, in particular the high level of subjectivity in decisions making. Therefore, further improvement of the traditional information technologies and the development of new ones as well as the implementation of appropriate tools of such class of problems arise objectively as an acute problem of practice.

Keywords: technology, business, pricing, management, reengineering.

Розглянуто приклади системно-аналітичних проектів інноваційного спрямування високого ступеня складності із різних сфер людської діяльності. Сформульовані проблемні сторони сучасних технологій виконання таких проектів і, насамперед, високий рівень суб'єктивності в процесах ухвалення рішень. Звідси, вдосконалення традиційних та розробка нових інформаційних технологій і витончених інструментів виконання такого класу завдань виникає об'єктивно, як гостра проблема практики.

Ключові слова: технологія, бізнес, ціноутворення, менеджмент, реінжиніринг.

Рассмотрены примеры реальных системно-аналитических проектов инновационного направления высокой степени сложности из разных сфер человеческой деятельности. Сформулированы проблемные стороны современных технологий выполнения таких проектов и, в первую очередь, высокий уровень субъективности при принятии решений. Поэтому совершенствование традиционных и разработка новых информационных технологий и соответствующего инструментария выполнения такого класса задач возникает объективно, как острая проблема практики.

Ключевые слова: технология, бизнес, ценообразование, менеджмент, реинжиниринг.

INTRODUCTION

The post-industrial epoch, which included human civilization in the last third of the twentieth century, implicitly characterized as *an information society*. This means that in almost all activity areas of modern humans in XXI century the most significant place is very specific information about the problem in a broad interpretation of this term. But not as an abstraction, but as a concrete high-tech product of intellectual activity of professionals in solving the problem.

The Law of Ukraine «On Information», that harmonized with the similar documents of all countries of UN, the information product briefly treated as the documented information prepared and designed to meet the needs of users [1]. There is also the information technology that seen as a deliberate organized set of information processes using computer technologies to provide the high-speed

reception and processing of data, to quick search of information, access to information regardless of their location.

Naturally, to obtain such products, also should be developed the relevant a high technologies and components to finding of the primary information as well as the technologies and sophisticated tools of professional and adequate its processing. And, finally, the such products should have an effective representation system of the final results to the customer.

First of all, among such technologies should be called the system-analytical technologies in the broadest range of applications (technical, humanitarian, search, etc.). Methodological, technological, instrumental and algorithmic trends of these technologies are the subject of numerous works, monographs, research papers, working out dozens of schools around the world and particularly in Ukraine [2], [3] and others.

Fig. 1 provides the classification of modern system-information-analytical researches (SIAR) in two main directions that we conventionally named as:

- 1) system-information-analytical research of compiling direction;
- 2) system-information-analytical research of innovation (searching) direction.

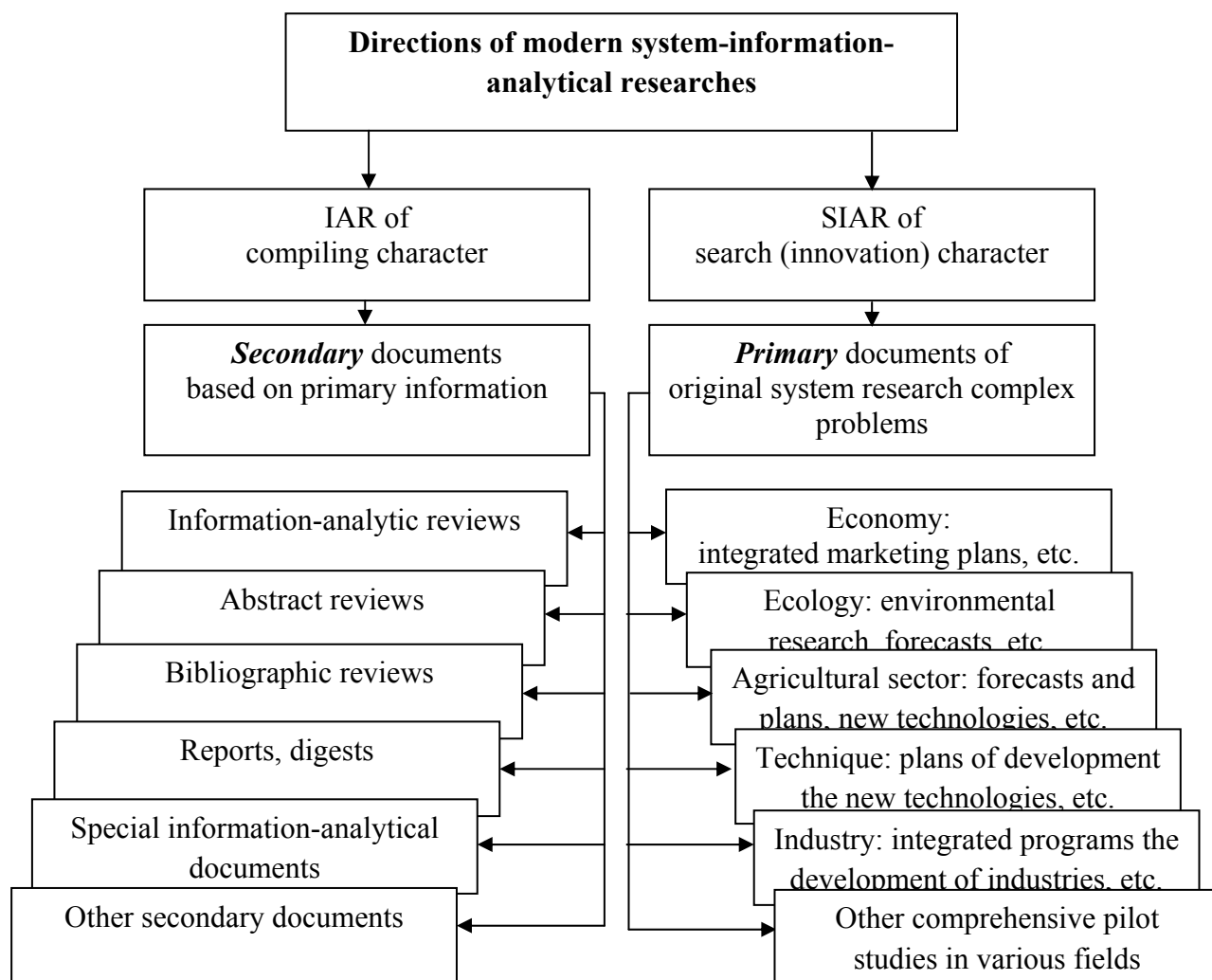


Fig.1. Classification of destinations (types) of modern SIAR.

The results of these two directions have the fundamental differences.

The first type of research generates so-called *secondary information products* synthesized on information and knowledge from previously received primary sources.

The second type is aimed at creation of such primary sources, i.e., aimed at *creation of new knowledge*.

Both types (directions) are belong to the general field of system-analytical studies. In the future, we will consider only the second type SIAR of innovation, or search character.

In Fig. 2, a generalized traditional procedure of system-information-analytical study of the problem is shown.

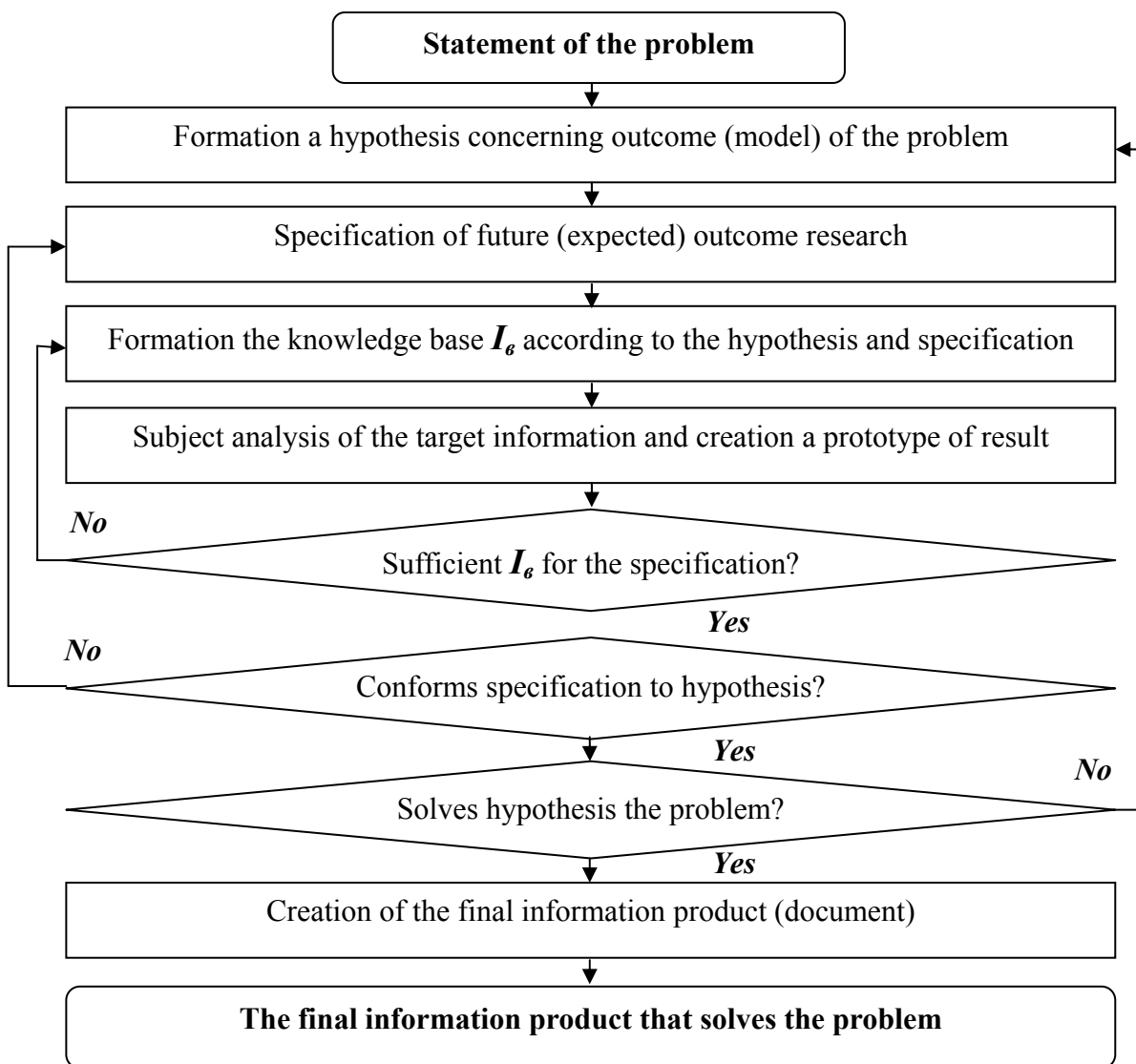


Fig. 2. The Generalized traditional procedure of system-information-analytical research of the problem.

Nowadays the information products are one of the most demanded by society «elements of consumption» because the large requirement for them arises from the urgent need practice in various areas of human activity.

1. APPLIED RESEARCH PROBLEMS OF VARIOUS NATURE AS A SCOPE OF SIAR APPLICATION

Below are briefly described the several examples of real complex analytic projects. These problems considered from the standpoint of the second tasks or innovative type presented above classification SIAR. The examples submitted from different areas of practical human activity in particular are needed:

- for development of the pricing system in a regional network of filling stations;
- when developing of strategic project documents for making a decision to build its own filling complex taking into account the analytical evaluation of the existing network of filling stations;
- when creating a comprehensive marketing plan of the development of firm trade refrigerated meat products;
- when reengineering an integrated consulting package to supporting of logistics processes harvesting and transporting the grain from combines to elevators or to other ports, and in many other cases.

Obviously, to solve such complex problems it is necessary to carry out the long-term and high-budget research. The aim of such studies would be creating a specific document that would have contained the meaningful findings and recommendations regarding the best solution caused problem as well the qualitative and quantitative predictions of applicable solutions, etc. At the same time, the beginning of such research in almost all areas of application characterized by a significant lack of information base. This fundamentally distinguishes the technology execution of SIAR from modern processing technologies of experimental data. Although recent also often forced to «work» under insufficient and noisy information. In addition, almost all SIAR- technologies, unlike the vast majority technologies of data processing, a significant role plays a man – the head of research, that in many cases brings a significant subjective component in the achieved results [4], [5] and others.

1.1. Economics. The Task of pricing in the retail business. Retail business in various fields, especially in fast moving costumer goods direction (FMCG), has some very similar problems. One of the pivots of them is the issue of pricing. This issue is the subject of numerous books [6], research papers, monographs [7], [8], etc. Today there are many approaches and methods of pricing, combined with large classes, for example, marketing, economic, geographic, consumer mentality, political and other. Informative providing procedures for pricing is almost always is not sufficient and therefore a decision concerning the price of particular product in the retail system adopted in some information hunger. This means that at such decisions the significant

impact have a sufficient experience and intuition of manager. Especially it concerns of products that belong to the groups already mentioned as FMCG.

In these circumstances, a significant tool could be developed clear rules and criteria for setting prices and certain groups of products specifically for a particular market operator that operates in specific market conditions (legislation, location, purely market forces, consumer mentality, etc.). Obviously, such rules, criteria and procedures should combine the certain document of information and recommending character and, of course, with sufficient degree of commercial secrets. In our persistent mind, it significantly can reduce the manager subjective pressure and even all responsible for this area group. For the sake of objectivity should say that such documents developed in almost all respectable trading companies by special analytic-consulting groups usually within system-information-analytical research.

1.2. The choice of petrol station perspective dislocation. This problem is very closely related to the problem 1.1, because the location of such very costly facilities like filling stations (complexes) significantly influence the processes of pricing and the overall economic efficiency of the business. World practice has the strong achievements in this direction. From the standpoint of national specifics, perhaps, it should be called a study [9] to identify the best location for the new filling complexes. Generally accepted criteria (factors) to estimate the location of filling complexes can be taken the catalog of about 30 items [10], although in [9] the authors identified such factors until 57.

One of the primary reasons for such large differences in the number of effective factors, in our opinion, is the high level of subjectivity in the decision-making processes that are adopted or one person (project manager), or one group of specialists. At once we should say that such specialists are highly qualified professionals and a document [9] was developed by analytic-marketing team of experienced professionals within large system-information-analytical project of corporation «Lukoil» development, which continues to this day.

Note that in [11], the number of effective system factors significantly reduced without loss of result quality.

1.3. Investment and innovative planning of business. Another striking example of the use of technology integrated information-analytical research is a wide stratum of projects of investment and innovation planning of business. Let us illustrate this class of research on real example of the firm trade network development in the agricultural sector [12].

Construction of integrated marketing to ensure effective distribution, including proprietary trading should include basic required elements and processes. In particular: organization of the core business processes of sales, personnel and motivation policy, the promotional activity system, organization of collecting statistics system as well as the information-analytical supporting of the project. Such

support system should include the subsystem of forecasting, planning and pricing, the management of all types of logistics and so on. In addition, this system should provide the interaction of main system elements with each other and with the environment.

Now, briefly about one of the many projects. In 2007, the holding company «Financial-Consulting Group UM», having subordinated nearly two dozen meat-plants, started to develop a large ambitious investment project on development of its own firm trade refrigerated meat products network. It was supposed to sell only own resources, i.e. products that were produced on its own or affiliated meat processing industrial complexes under own retail branded.

Naturally, it was necessary in a very short time to develop an integrated marketing plan (IMP) of investment development of such network at the national level and the appropriate system of project comprehensive supporting operation in the lucrative self-sufficient mode.

Such document consisting of dozens of reference essential parts dealing with different directions (economics, law, logistics, full of information-analytical supporting, management rules, etc.) project has been establish already through 3 months [13].

Practical implementation of the project proved the high effectiveness and objectivity of the developed IMP. It have been confirmed by the main fact: for the short period of project implementation the branded network already consisted of 200 retail outlets of which almost half were self-supporting.

At the time, this project required subsequent colossal investments. Therefore, in the same period the project was necessary to suspend or even significantly reduce because of the strong negative influence of the global financial crisis. Conditions of force-majeure in 2008 for this project were more than obvious.

1.4. The Task of synthesis of grain transportation logistics technologies from grain harvesters to elevators. As another of the many examples of SIAR can be considered the quite important and difficult task of designing the logistics technology transportation of grain from harvester to the destination, so-called ports, such as elevators, for example. Naturally, this problem has repeatedly solved by many researchers using different approaches.

In the works [13] - [14] a new look at this problem has been proposed and applied the new approach to solve it. During research process, the authors developed the initial information bases and logistical principles for solving this problem. As a result of SIAR, by inductive technology [15] for 4 months was established the layout of consulting document and appropriate software that substantially almost completely opened formal benchmark of final document, as described in [13].

This synthesized information base allowed to construct a system of econometric models of the type:

$$I_{b,s}^* = \{W_k / x_1, Q_n / x_2, Q_a / x_3, V_a / x_4, T_{pa} / x_5, U / x_6, S / x_7, \dot{O} / x_8, L / x_9\},$$

where:

W_k / x_1 – performance combine harvester, t / h;

Q_n / x_2 – load capacity of the trailer-conveyors, t;

Q_a / x_3 – load capacity of the vehicle, t;

V_a / x_4 – technical vehicle speed, km / h;

T_{pa} / x_5 – length of the vehicle stay on the elevator, h;

U / x_6 – grain crop capacity, t / ha;

S / x_7 – area of harvesting crops, ha;

\dot{O} / x_8 – duration of the combine per day, h;

L / x_9 – transportation distance of grain from the field to the elevator, km.

Output value $I_{b,s}^*$ directly pointed fate logistics component in tons of grain already delivered to the elevator and had accordingly dimension UAH / ton. In addition, the user, depending on the specific conditions of their own land plot, crop capacity, etc., can construct such a logistical scheme that would grant at the output the minimum values of fate logistics component per tone of grain.

1.5. The examples of other diverse application fields of SIAR. Thus, now one can make an important and natural conclusion that the system-information-analytical researches of the second type and the appropriate technologies are needed in all spheres of searching human activity (including the above), where must be obtained the result (as specific document), which would contain the necessary new knowledge to solve difficult complex problems.

In confirmation of this, fragmentary shall list just a few subjects with very different and distant from each other spheres of human intellectual activity. But all of these areas brings together the necessity of SIAR application.

1. *Applied scientific and technological researches of new consumer products* – the highest level of competition in achieving results generates execution of such studies by several groups of different companies in different parts of the world simultaneously. Evaluates the result a broad consumer audience and can say that largely objectively. But such an assessment, unfortunately, often occurs already after the subjective evaluation of the developers themselves or even customers such works.
2. *Medicine* – holding consultations, including multistage – is a striking example of the direction, which was named a system-information-analytical research. The result is a conclusion that taken collectively and that gives in this case the best forecast of the situation. Hence, it significantly increases the chance of choosing the optimal treatment plan. Therefore, such technology can be considered in this

sphere as one of the best, and the results are to a certain extent can be considered as objective.

3. *Legislation* – in parliaments generally parallel are prepared two or three and more draft laws concerning the same issue. But in the absence of a formal independent assessment mechanism as a result (despite the powerful other control systems) in this area, often being taken quite subjectively and conjunctively not the best option, even after numerous revisions.
4. *Ecology* – climate change of recent decades significantly increased the interest of the scientific community to carry out large-scale system of information-analytical research in this area. In addition, it is acute request all mankind. But the results are often contradictory, and sometimes just wrong. Although sake of justice it should be noted that the proximity of the findings, results and new knowledge, sometimes obtained by different research groups allows to perceive them as objective.

Thus, such studies arise objectively as directly and an acute requirement of practice. This in turn causes urgent need to improve the traditional and the development of new information technologies and sophisticated tools to supporting the solving of such class of problems.

2. MAIN DISADVANTAGES OF TRADITIONAL TECHNOLOGIES OF SIAR AND WAYS OF THEM OVERCOMING

Modern can be said traditional, complex technologies of or system information and analyzes and procedures provide for their execution practically always a single group, and often by just one expert. This, in our opinion, causes in such technologies presence of significant drawbacks.

In [16], among such shortcomings, the greatest negative impact on the results of the research, have been allocated as follows.

1. *Lack of real competition in the group of analysts* – makes it impossible to objectively evaluate the results within the group itself and generates strong conformity specialists.
2. *High redundancy of information on the stages of finding and collecting* – a principal uncertainty the final optimal information basis and conceptual uncertainty at the initial stages of the research compels analysts to gathering the much information about the «problem», than is actually needed. It significantly increases the expenses time and funds in the budget of the research project;
3. *Insufficiently developed formalized tools and criteria for objective assessing* the intermediate and, especially, the final results – creates the considerable subjective impact of project SIAR-manager on individual performers as well as on whole group, especially when assessing the final result of research.
4. *Low «convergence rate to the target outcome»* due to the high degree of subjectivity in making decisions about the quality of the final studies outcome

makes impossible objective and specific the budget definition of information-analytical research.

Naturally, the diversity and intellectual orientation of direction considered in principle actually generates a lot of problems that for researchers in this field are well known, and such about which they are not even aware. Only the major ones were identified above. The adequate solutions and outputs from this are and such that, as we believe, can significantly improve the efficiency of system-analytical informational research project as in a complex format as well as many individual subject areas in particular.

Exit from such state and elimination of those shortcomings is seen in application of an inductive approach [17] and the relevant techniques to designing of a *new inductive technology of system-analytical-information research (IT SIAR)*.

3. CONCEPTUAL PRINCIPLES OF DESIGN THE INDUCTIVE TECHNOLOGIES OF SIAR

The basis of the paradigm of inductive technology SIAR embedded three main principles of inductive modeling complex systems.

1. The principle of heuristic self-organization: inductive technology of SIAR should based on the analogy with multistage schemes of algorithms used in inductive modeling complex systems using so called «external criteria» in order to significantly reduce the interference of the subject (head of research or moderator) in the process of problem solving.
2. The principle of external additions: in inductive technology of SIAR shall be employed the criteria that would have the properties of external criteria. Such criteria would borrow from the inductive theory of complex systems modeling for assess the degree of closeness of the results achieved in the process:
 - not less than between two independent groups of specialists,
 - between the results of each group and a with certain benchmark,
 - comprehensively.
3. Principle incompleteness decisions: in inductive technology of SIAR on the basis a previously given initial information base and additional targeted «portions» of information at each stage of research should be synthesized the certain set of \mathfrak{R} results in order to find the best subset of \mathfrak{R}^{δ} results. This subset should generate the optimal final result \mathbf{R}^* under the system of special criteria, whose properties are listed in the previous point 2.

CONCLUSION

This article has a certain extent of the overview character with tinge of problem statement. Here was presented the classification of information-analytical researches directions. The some examples of innovative oriented system-analytical projects of high complexity on very different and distant from each other spheres of human

intellectual activity have been shortly summarized. But also, it was shown that all of these spheres brings together the necessity of application the SIAR.

In this paper has been made also an important conclusion that the system-information-analytical researches of the second type lodged from above classification and related technologies are needed in all areas of human activity search, which it is necessary to obtain the result (usually in of specific document form), that would contains a new knowledge for complex problems solving.

Here were formulated the most the problematic sides of modern technologies implementation of such projects and, first of all, a very high level of subjectivity in decision-making in relation to the intermediate and especially the final results.

Hence, the improving of traditional and development the new information technologies as well as sophisticated instruments to supporting of above class of problems arises objectively and as acute problem of practice.

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