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ASPECTS OF THE DEVELOPMENT OF THE AGRO-INDUSTRIAL COMPLEX IN THE ERA OF DIGITAL ECONOMY

Research article

Abstract

The current paper presents a comparative analysis of the working conditions of the agro-industrial complex (AIC) in the digital and industrial economy, with the digital economy described as the automation of social and information processes related to economy. The trends in differences identified in the article determine the future trajectories of Russian enterprises. The study examines the tasks set for achieving the intended goals while taking into account the influence of trends in the development of information technology markets. The knowledge of an individual along with their scientific and practical experience is examined as a "black box" model. The study defines the concept of a "creative person" from the point of view of the digital economy in a construction enterprise and pays particular attention to the concept of "system thinking". In accordance with these principles, a person is considered as a physiological system, on the one hand, which is inherent, for example, in the circulatory system, while on the other hand, a person is a social system that interacts with other models that form new systems – families, ethnic groups, etc. This interaction occurs at the level of public institutions, individuals, and individual circulatory systems, such as direct blood transfusions.

The study concludes that business requires the use of information technologies, computer networks, and modern communications in unity with the integrity of humans themselves as a living and social being who has the ability to concentrate to achieve the desired goals.

Keywords: information technologies, economy, system thinking, creative person, model, agro-industrial complex.

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ОСОБЕННОСТИ РАЗВИТИЯ АПК В ЭПОХУ ЦИФРОВОЙ ЭКОНОМИКИ

Научная статья

Аннотация

В работе проведён сравнительный анализ условий работы АПК в цифровой и индустриальной экономике. Где цифровая экономика подразумевает автоматизацию социально-информационных процессов, связанных с экономикой. Выявленные тенденции различия определяют целеполагания работы в этом направлении российских предприятий. Поставленные задачи для достижения намеченных целей рассмотрены с учётом влияния тенденций развития рынков информационных технологий. Знания самого человека рассмотрено как модель «чёрного ящика» с учётом научного и практического опыта его. Раскрыто понятие «креативного человека» с точки зрения цифровой экономики в строительной организации. Особое внимание в работе уделено понятию «системное мышление» и в соответствии с этими принципами рассмотрен человек, как система с одной стороны физиологическая, которому присуща, например, система кровообращения, а с другой как социальная, взаимодействующая с другими моделями, образующими новые системы – семьи, этносы и т.д. Это взаимодействие происходит на уровне общественных институтов, отдельных людей, а также отдельных систем кровообращения, например, при прямом переливании крови.

В целом сделан вывод о том, что для ведения бизнеса необходимо применение информационных технологий, компьютерных сетей и современных коммуникаций в единстве с целостностью самого человека, как костного, живого и социального существа, обладающего умением сконцентрироваться для достижения поставленной цели.

Ключевые слова: информационные технологии, экономика, системные мышления, креативный человек, модель, АПК.

1. Introduction

The beginning of the 21st century is defined by the rapid development of cybernetics, computer science, and the introduction of the achievements of automation, digitalization, education, and economy as a whole, socially significant processes in society, including construction companies [1], [2], [3]. Improving computer and communication technology, the development of information technology (IT) as well as the creation of applied information networks all lead to the concept of digital economy, in which computer science plays a crucial role in the industry, construction, design, research, and organizational management [6], [7]. The end of the 20th century saw an economic phenomenon of the dominance of creative work in the production of goods. The products of creative work are informational, not material, and which were observed in the industrial period of the development of society [8]. Creative work is the freedom to apply one's knowledge and skills in a particular field of activity, without violating the constitutional rights of other citizens of the state. This type of work not only changes the physical form of goods by becoming immaterial but also the economic form – by becoming a non-commodity. The term "digital economy" is replacing the "industrial economy". This trajectory is based on the model of a "creative person"[9].

The aim of the research is to improve the model of a creative person as a part of the agro-industrial complex construction company in the era of the digital economy in order to establish leadership and prosperity within it.

2. Methodology

In the course of the study, the authors use the systems theory, a comparative analysis of the industrial and digital economy, and the model of human knowledge as a "black box".

Results and discussion. Russia's transition to a market economy has created an information market in which information acts as a resource and is of a commercial nature.

Information as a process of transition means the redistribution of labor resources from the sphere of material production to the sphere of information. To understand the "creative person" model, let's examine their knowledge in the form of a model (Fig. 1). The "creative person" model is a system of mastering a set of methods with alternative scenarios for the development of the processes under study that are based on critical thinking.

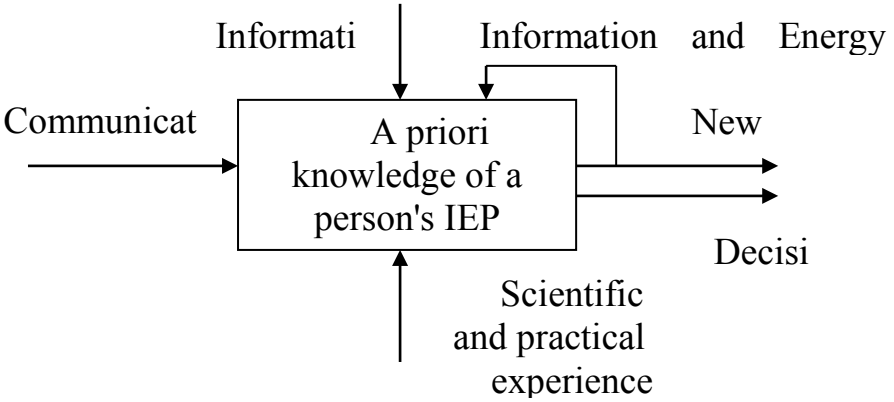

Figure 1 – Human knowledge as a "black box" model

- IEP — information and energy flow;
- ISP — information and synergy flow.

This model serves as the ethical basis of the entire theory of the digital economy, in which the main goal of a modern person is in realizing their creative abilities and developing personal qualities. The creative interpretation of a person also determines the view of information.

A comparative analysis of the main provisions of the examined stages of development of world economies (Fig. 2) shows that Russian enterprises at the current stage of development should pertain to the creation, protection, and maintenance of their information structure of today.

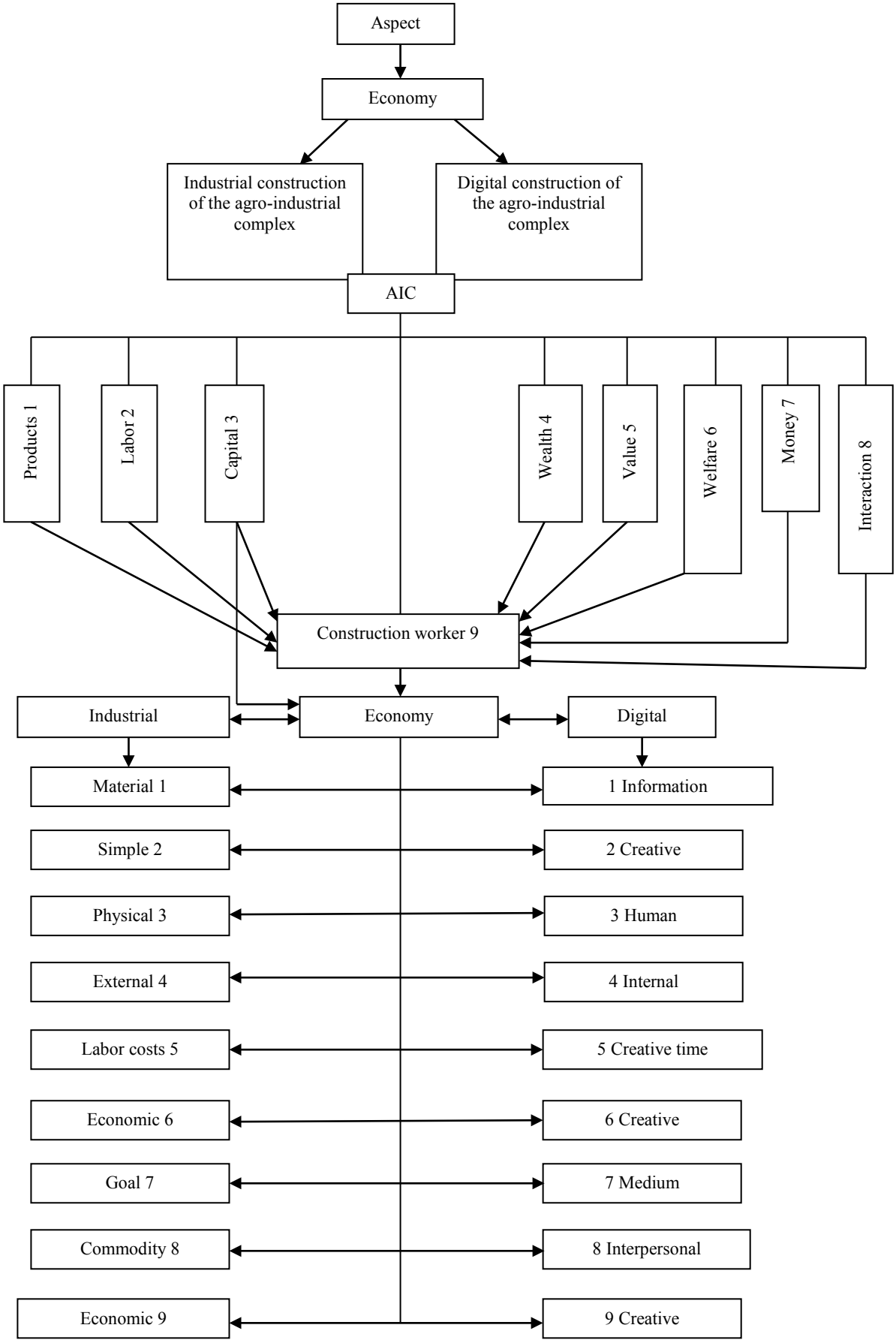

Figure 2 – Agro-industrial complex in the industrial and digital economy

3. Discussion

As can be seen from Figure 2, to conduct business in the digital economy of the agro-industrial complex, the construction industry requires the use of IT, computer networks and modern communications.

Therefore, in order to achieve the goal of a construction organization in the era of the digital economy in creating, protecting and maintaining its information structure at the current level, it is necessary to solve the tasks (Fig. 3).

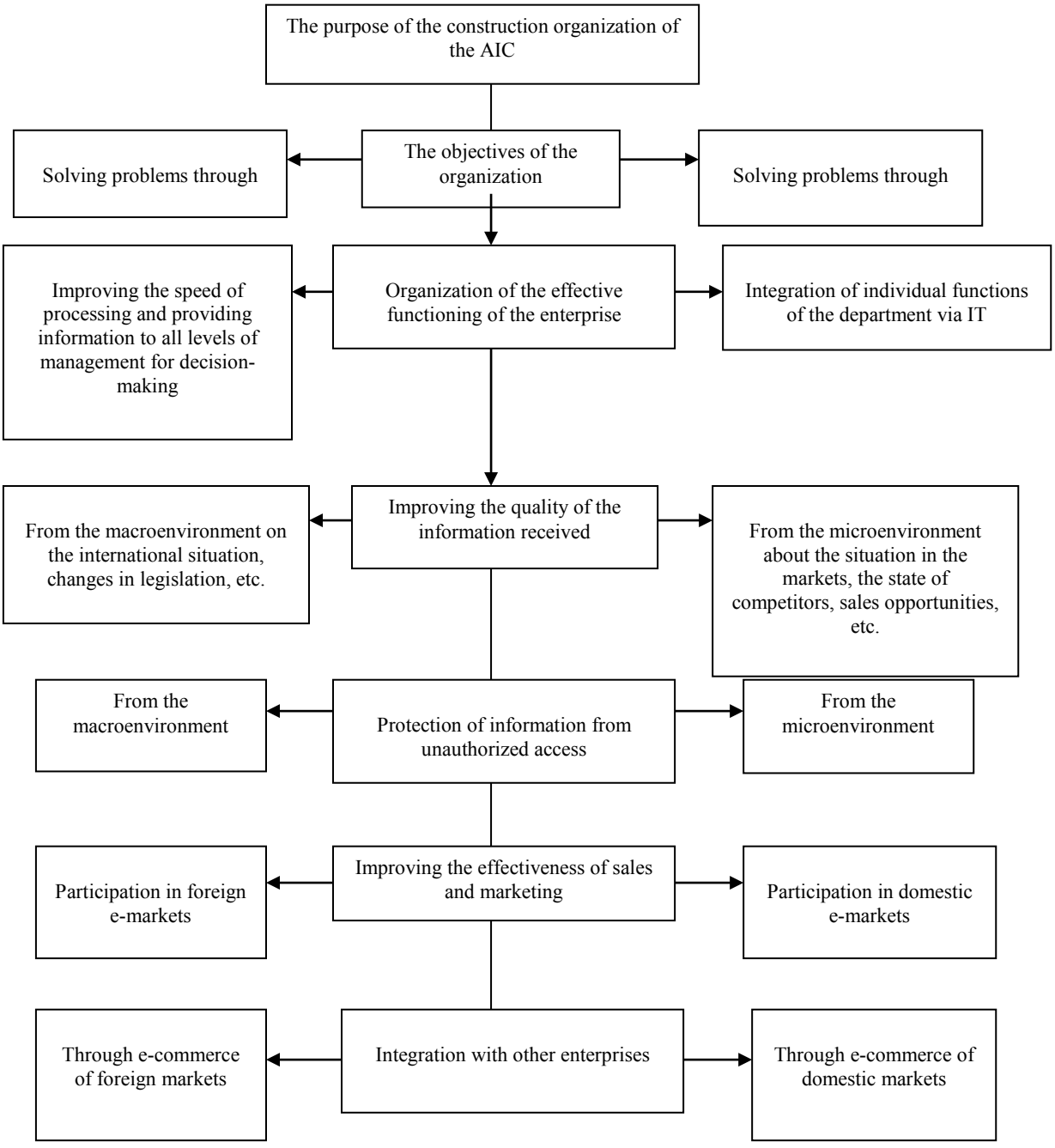

Figure 3 – Problems and their solutions to achieve the set objectives in today's conditions

In Figure 3, the vertical links from goal setting are aimed at solving problems in order to achieve the set objectives. These tasks include the organization of effective functioning, improving the quality of information, protecting information from unauthorized access, improving the efficiency of sales and marketing, integration with other enterprises.

Horizontal links indicate the sources that determine the way these tasks will be solved, and their different levels of management that take into account external and internal reserves.

The solution of the presented tasks is influenced by the trends in the development of digital technology markets (Fig. 4).

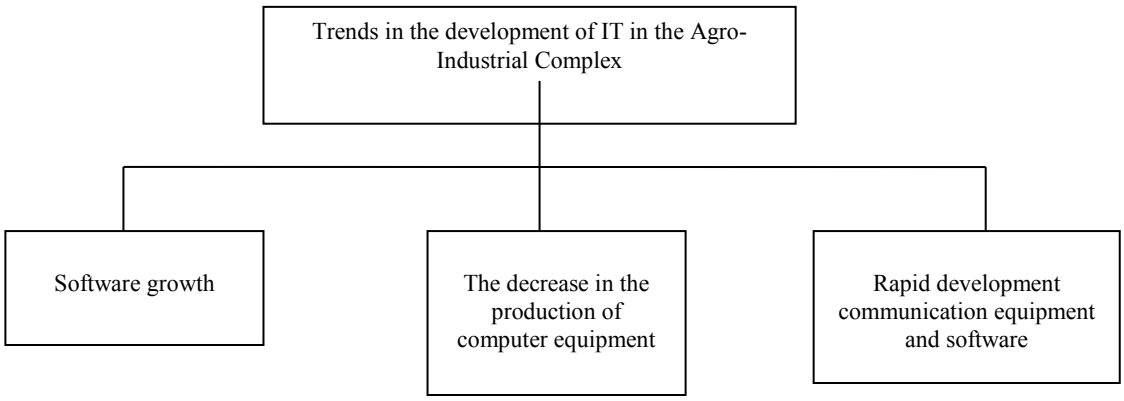

Figure 4 – Trends in the development of IT in the Agro-Industrial Complex

The first block in Figure 4 represents a large share of the entire global information and digital technology sector. The second block tends to slightly decrease, which is due to the growth of home software. The third block is the most dynamic and rapidly developing IT market related to e-commerce applications (Business – to – Business – B2B)

The general structure of the automated information system (AIS) of the agro-industrial complex is viewed as a set of supporting subsystems (Fig. 5): technical support (TS), software (S), mathematical support (MS), information support (IS), organizational support (OS), legal support (LS).

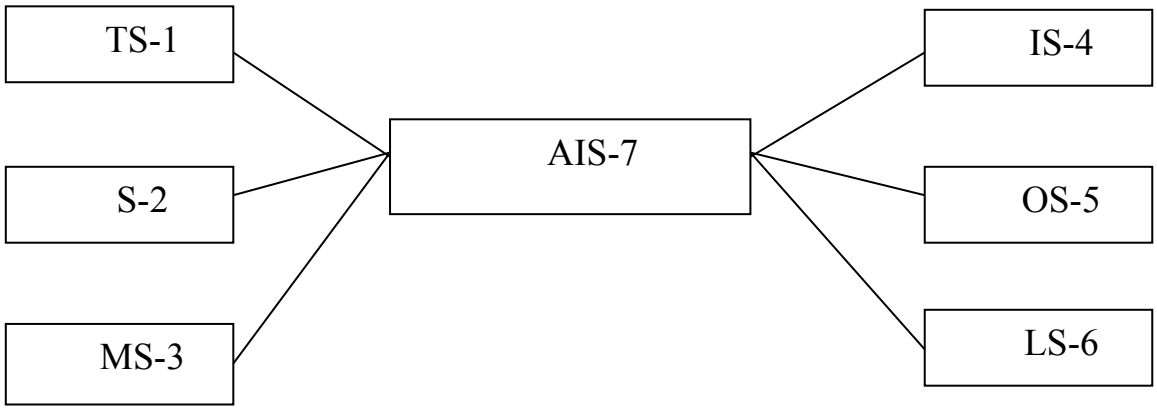

Figure 5 – Structure of the automated information system of the agro-industrial complex

TS is a complex of technical means that includes the following: computers of different models and classes; devices for recording, collecting, accumulating, storing, processing and reproducing information (automatic sensors, scanners, printers, plotting devices, etc.); data transmission and communication lines (local, corporate and global computer networks) (Block 1, Fig. 5) and used for the operation of the system of the agro-industrial complex as well as the relevant documentation for the aforementioned devices and technological processes.

S is a set of system-wide and special products that include general-purpose software packages that organize typical computing and technological data processing processes (operating systems, service programs, programming systems) as well as relevant documentation (Block 2, Figure 5).

MS is a set of economic-mathematical methods, models, and algorithms that implement automated tasks of the agro-industrial complex for the purpose of achieving the system's objectives to ensure the normal functioning of the complex of technical means. For example, CNC machines for the manufacture of parts for the vehicle and tractor fleet (Block 3, fig. 5).

IS is a set of unified documentation, classification systems, coding and protection of information, schemes of information flows in the organization, databases, and methodologies for their construction designed for the prompt formation and provision of reliable and complete information to the management staff of the organization that drives the decisions. (Block 4, Figure 5)

OS is a set of methods, tools, and documentation. For example, approval protocols, work schedules, regulating the interaction of personnel with technical and software tools as well as among themselves during the development and operation of AIS (Block 5, block 7, Fig. 5).

LS is a set of legal norms and regulatory documents that determine the need to create and the legal status of the results of the functioning of the AIS of the agro-industrial complex (block 7, Fig. 5) that regulate the procedure for obtaining, converting, and using information, as well as the rights and obligations of the system users and personnel of the agro-industrial complex (Block 6, Figure 5).

Let's examine the current requirements for personnel working in the industry of agriculture, including the agro-industrial complex. Achieving high productivity (A) requires those employees who possess communication skills (H_1), competence (H_2), creativity (H_3), teamwork capabilities (H_4), and health (H_5). Let us assume that when creating a group (team) to solve a certain production task at the initial stage, these were equivalent hypotheses with a probability of $P(H_1) = P(H_2) = P(H_3) = P(H_4) = P(H_5) = 0.2$, forming a complete group of events, i.e.

$$\sum_{i=1}^{5} P(H_i) = 1$$

Let's enter an event [11]:

$A|H_1$-achieving high productivity through communication skills;

$A|H_2$-achieving high productivity through competence;

$A|H_3$-achieving high productivity through creativity;

$A|H_4$-achieving high productivity through teamwork capabilities;

$A|H_5$-achieving high productivity through health condition.

Their probabilities will be: $P(A|H_1) = 0.75$; $P(A|H_2) = 0.8$; $P(A|H_3)=0.85$; $P(A|H_4) = 0.95$; $P(A|H_5) = 0.9$.

In this scenario, we will find the share of achieving high productivity in the agro-industrial complex using the total probability formula.

Note that A is the achievement of high performance.

$$P(A) = \sum_{i=1}^{n} P(H_i) \cdot P(A|H_i) \quad (1)$$

$P(A)=P(H_1)\cdot P(A|H_1)+P(H_2)\cdot P(A|H_2)+P(H_3)\cdot P(A|H_3)+P(H_4)\cdot P(A|H_4)+P(H_5)\cdot P(A|H_5)$

$P(A)=0,2\cdot 0,75+0,2\cdot 0,8 + 0,2\cdot 0,85 +0,2\cdot 0,95 +0,2\cdot 0,9=0,85$

The results demonstrate that with these qualities, high productivity is achieved with 85% probability.

Revaluating the hypotheses after achieving high performance according to the Bayes formula [14], we obtain:

$$P_A(H_i) = \frac{P(H_i) \cdot P(A|H_i)}{P(A)} \quad (2)$$

where P (A) is found via formula (1)

$P_A(H_1) = \frac{0,2\cdot 0,75}{0,85} = 0,176$, i. e., 17.6%, 20 % initially.

$P_A(H_2) = \frac{0,2\cdot 0,8}{0,85} = 0,188$, i. e., 18.8%, 20 % initially.

$P_A(H_3) = \frac{0,2\cdot 0,85}{0,85} = 0,2$, i. e., 20% as it was in the beginning.

$P_A(H_4) = \frac{0,2\cdot 0,95}{0,85} = 0,224$, i. e., 22.4% with initial 20 %. Compared to 20%, there was an increase by 2.4%, meaning that achievement will occur with this exact hypothesis.

$P_A(H_5) = \frac{0,2\cdot 0,9}{0,85} = 0,212$, i. e., 21.2%, also more than 20%.

Then we check the results obtained after reassessing the hypotheses for the exhaustive events.

$$\sum_{i=1}^{5} P_A(H_i) = 0,176 + 0,188 + 0,2 + 0,224 + 0,212 = 1$$

The reassessment showed the importance of creativity, teamwork, and health. When creating a team, If the employer initially takes the bigger probability value, namely: $P(A|H_1) = 0.9$; $P(A|H_2)=0.95$; $P (A|H_3)=0,98$; $P(A|H_4)=0,99$; $P(A|H_5)=0.95$ then they will obtain the 0.954 or 95.4% share of the achievements.

Analyzing this situation, we see that in order to achieve high labor productivity in the field of agro-industrial complex, the probability of hypotheses, which is the qualities that an employee should possess, should be at least 90% while the chosen quality characterizes the training of a specialist in the current environment. The employer can increase or decrease the number of hypotheses (qualities), depending on the objectives set. In the era of the industrial economy, individuals were comprehensively developed with a creative streak, while to succeed in the digital economy, individuals require to be trained in STREAM fields that include science, technology, research, engineering, art, mathematics. The abbreviation STREAM in English means the synthesis of science, technology, research, engineering, various types of arts, and mathematics. A new educational technology that combines several subject areas as a tool for developing critical thinking, research competencies, and teamwork skills. This is a set of the aforementioned concepts that are used in the training of personnel in the digitalization of the educational system at different levels. For example, Leonardo da Vinci, who drew both Mona Lisa and an airship with all its structural elements, was both an artist and a designer who was two centuries ahead of his time. In teaching specialists at different levels of areas of training of personnel of the agro-industrial complex, the society will focus on technical and natural science disciplines instead of humanities. Digitalization of education allows for using the difficulties that arise as additional opportunities for managing and owning the intellectual capital of each student, which strengthens the promotion of ideas along the pipeline: creating projects, evaluating them, punching and implementing them in practice, and to no extent canceling state support for the development of the agro-industrial complex and advanced personnel training. By creating unified platforms for the exchange of long-range information we all become participants in a single process, evolving with the times.

4. Conclusions

The results of the research lead to the following conclusions: to become the leader of an organization in the current environment, the following is necessary:

- creating opportunities for profit growth and expanding the markets of construction companies;
- reducing risks and uncertainties;
- achieving power and obtaining the means to influence other enterprises of construction companies;
- monitoring and evaluating the organization's or enterprise's performance and efficiency;
- achieving high labor productivity in agriculture and the agro-industrial complex as a whole is ensured by the selection of teams with the necessary set of qualities.
- scientific motivation of the employees.

The relationship between the digital economy and construction companies opens up new prospects for the implementation of advanced technologies developed by construction companies related to the construction of lightweight, reinforced structures [12], [13]. Furthermore, with the help of computer experiments and automated calculations, it is possible to show a more accurate and reliable application with savings in the cost of additional materials and the time of their launch into production.

It is always necessary to be aware of the fact that money is only a means to achieve the development of creative abilities and capabilities of today's workers of the agro-industrial complex.

Conflict of Interest **Конфликт интересов**

None declared. Не указан.

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