

# Advanced Areas of Intellectual Information Capital Development in Educational Organization

Olga Borisovna Bigday<sup>1\*</sup>  
Yury Vladimirovich Rokotov<sup>2</sup>

1. Russian Technological University, Stavropol Branch, 8 Kulakova Prospect, Stavropol, 355035, Russia.
2. Russian Technological University, Stavropol Branch, 8 Kulakova Prospect, Stavropol, 355035, Russia.

\*Corresponding Author. Email: [bigdaj@mirea.ru](mailto:bigdaj@mirea.ru)

**Abstract:** The study sets forth informational intellectual capital as a part of the information-based education system in an educational organization that reflects transformation from mechanical to computerized labor. Russian Technological University (RTU) MIREA – Stavropol Branch exploits the following key components of intellectual information capital: electronic document management, electronic classes' schedule, internal electronic library system. All of that make possible the integration of human and information factors at a new advanced level. Intellectual information capital operates on the following principles: information inclusion in the database, set up of centralized pattern for all formal documents, minimizing documents workflow by means of fixed database decision-making, errors and correction time decrease. Intellectual information capital in an educational organization performs the function of information security for intellectual activities, reflecting the quality of information educational systems. Based on general scientific and special methods, such as: inductive, deductive, analysis, synthesis, observation, system thinking, abstract and logical, monographic, comparative and extrapolation intellectual information capital of an educational organization is formed and developed.

**Keywords:** intellectual information capital, information based educational system, information security, electronic document management, electronic classes' schedule, internal electronic library system.

## 1. INTRODUCTION

Modern education institutions' management refers to multiple problems solution process. It serves costs optimization, bringing documentation flow in accordance with legislation requirements, security, progressive improvement of education quality, and bureaucracy decrease. Most problems are solved via automated information systems. In the studies of I.V. Soloviev (2015) on theory of information management the author presents different approaches to electronic management in an organization. Information management paradigm in higher education institution's environment remains top important and contains its specifics for each educational institution of higher education. Significance of information educational systems cannot be undervalued since before introduction of a compound electronic document management, the same pieces of

information were duplicated, accumulated, and re-processed many times by many employees. For example, up to now, many educational organizations address distribution of training load and compile individual teachers' plans manually using spreadsheets. Such management approach on the one hand provokes multiple errors; on the other hand the process itself is longsome and may continue from 2 weeks to 2 months involving specialists from education management department and other units. Simultaneously, in many educational organizations, training timetable is compiled manually; the process may take not less than 40 hours, provided that an experienced specialist is involved. Sometimes the process is carried up to 1 month because of variations in academic load, staff, and teachers' preferences.

Giving definition to information systems provokes a debatable question on whether they should be identified as components of information management or information intellectual capital. In opinion of the authors of this study, it can rightly be considered as information based educational system, a component of information management, determined by information intellectual capital, and combining human and information factors at a new advanced level.

*The object of the study - RTU MIREA, Stavropol Branch*

The purpose of the study is to identify and develop intellectual information capital of an educational organization based on automated information based educational system. Theoretical and methodological basis of the study is grounded in the works of foreign and Russian scientists, specialists in intellectual capital and information management. Methodological base of the research: logical and process based scientific approaches to study process of intellectual information capital creation and its components. Working hypothesis of the study lays in the need for creation and development of intellectual information capital based on improvement of information based education system that optimally combines human and information capital.

Theoretical significance of the study means expanding and deepening conceptual provisions for creation of intellectual information capital in educational organizations. Certain theoretical and methodological provisions of the study are used during the courses for advanced training and upgrade of educational organizations employees. Practical significance of the study means development and application of specific methods, techniques, tools and recommendations that can form theoretical, methodological and practical basis for alternative development of information based intellectual capital.

## **Method**

### **Creation of intellectual capital on the basis of wage labor**

Representatives of classical and neoclassical economic schools (A. Smith, E. von Boehm – Bawerk, M. J. L. Walras, W. S. Jevons, C. Marx, C. Menger, P. A. Samuelson and other) designated not only material capital but also intangible (labor, variable and personal) capitals. A. Smith (1992) believes that capital represents means of production and specific workers' skills... He suggests inclusion into fixed capital, both tools and human capital, i.e. capitalized value of "acquired and productive abilities of all residents and members of society", considering capital as a cost that secures income by means of wage labor.

K. Marx (1969) in his doctrine of surplus value defines wage workers labor as an initiator of surplus value increase, noting special part of intellectual capital in surplus value formation. As a result, both K. Marx and A. Smith recognize value of intellectual capital. Marginalists M.E. L. Walras (2000), W.S. Jevons (1905), C. Menger, E. von Böhm-Bawerk, F. Wieser (1992), when characterizing capital, identified labor as a necessary factor of production, and determined capital as intermediate product created by nature and labor. P. A. Samuelson, V. D. Nordhaus (2015) considered capital as wealth and result of previous labor in private ownership.

Followers of intellectual capital concept: G.S. Becker (1975), P. Gutmann (1977), L.K. Turrow, R. Heilbroner (1994), E. H. Hansen (1997), T. U. Shultz (1971) defined human capital as industry factor that synthesized physical, intellectual and mental forces, both innate and obtained during training or labor... Labor - including intellectual - is the second driving force of production that unites organizations for obtaining certain product, it is obtained if necessary. The team of authors, lead by A. V. Gukova (2006), distinguishes as important previous labor in creating investment capital.

In the above definitions, creation of intellectual capital is based on hired labor, and unfortunately, only of a mechanical nature. That complicates development of intellectual information capital.

### **Identification of information capital within intellectual capital**

In developing countries, communication technologies, their ownership and use by organizations are well recognized. In 1972, K. D. Arrow (2012) revealed a connection between specific economic behavior of intellectual resources and processes of creation and use of information. V. L. Inozemtsev (1998) identified databases as components of intellectual structural capital; B. B. Leontiev (2009), L. Edvinsson, M. S Malone (1997) identified information systems as components of organizational capital, and B. B Leontiev (2009) recognized accumulated knowledge databases.

Intellectual information capital should include information, administrative systems and organizational structures, information products, technologies and etc. I.e., information capital demonstrates quality of information systems and databases, performing the function of information security for intellectual activity. At the same time, it is important to consider significance level of information sources. Information systems quality can be assessed at relatively low costs by means of internal and external users' opinions, which also can serve to identify wide range of problem areas and act as an effective tool for information capital development.

Managers of business entities need to open access to sources of knowledge and information, which subsequently transform into specific production resources for explicit use. Importance and relevance of information under constant monitoring transform into a valuable business resource. That is ensured exclusively when creation and development of information and communication infrastructure are supported with modern information technologies for data exchange and processing, as well as IT-specialists included in the category of intellectual workers. Accordingly, the existence and functioning of intellectual information capital is very specific in modern conditions.

Among priority modernization projects business entities list automation of information systems, improvement of information transparency and quality, on-date information availability, regular and on-time access to information, taking into account regional interests in information systems operation in view of global trends. It is also

important that business entities culture would conform to the information systems they use (Ermakova, 2018).

In modern conditions, coded and materialized information is presented in human capital. P. F. Drucker (1999) believes that knowledge is “information” that changes something, someone or represents outgoing cause of an action, providing opportunities for different and efficient actions. In view of the foregoing, it is important to develop intellectual information capital in educational organizations that includes information systems, information products, technologies, and etc.

### **Principles of intellectual information capital development**

Development of intellectual information capital that includes information educational systems must be carried out based on the following principles that outline special methods: centralized information inclusion in the database, set up of centralized pattern for all formal documents, minimizing documents workflow by means of fixed database decision-making, errors and correction time decrease. As noted earlier, information capital reflects quality of information based educational systems, ensuring information security of intellectual activity. Accordingly, operation of information based educational system requires information security.

### **Information security of intellectual activity**

Technically ensuring information security in the Branch is provided by means of electronic pass remote access of control systems, video surveillance, fire extinguishing systems, alarm systems, as well as security company services. It should be noted that data obtained via electronic badge system is used repeatedly. The key components of intellectual information capital in an educational organization – part of an information educational system – are electronic workflow, schedule automation, and an internal electronic library system.

## **RESULTS**

### **Electronic workflow as part of intellectual information capital**

The electronic workflow of organization ensures unanimous entrance of information about students. Joint plan of information based educational system is presented in Figure 1. Electronic workflow is implemented in 2 main areas.

Area one: students’ personal data is entered into database during selection committee. Documents provided to a student (i.e., agreement, applications and etc.) are automatically and instantly generated, which is especially important during admission since it eliminates bottlenecks. Education management department and faculties have automatic access to this data to perform their functions: automatic orders, printing, issuing certificates and other documents based on students’ personal data, which minimizes errors caused by the human factor. As a result, an opportunity is created for development of intellectual information capital, which rationally combines human and information factors.

Area two: education process data. Curricula compose its primary data; the parts and pieces of work plan are prepared by university departments and are accumulated in

education management department. After curriculum work plans are checked, education management department distributes work load for teachers. RTU MIREA Stavropol Branch applies its own module. After curricula, time standards and training groups are loaded into the system the workload is calculated in a few seconds. Non automated process of work load distribution between teachers takes several hours, depending on the volume of load. The document stipulating distributed load represents an individual teacher’s plan. This document is very complicated if manually generated, it may contain errors and inconsistency of numbers and other data if related to activities during “2nd half of the day”. RTU MIREA Stavropol Branch module allows instant filling out required fields and print an individual plan of a teacher that corresponds to the workload and regulatory acts - Figure 2. Staff structure of educational institution may be formed by means of this module.

### Teacher attendance

Start Date: 2019-12-01      End Date: 2019-12-10      Structure: MIREA

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Full name	Total	Visited	Percent	Information	Turnstile
Teacher 1	11	11	100%	<a href="#">More details</a>	<a href="#">Turnstile</a>
Teacher 2	0	0	0%	<a href="#">More details</a>	<a href="#">Turnstile</a>
Teacher 3	10	7	70%	<a href="#">More details</a>	<a href="#">Turnstile</a>
Teacher 4	0	0	0%	<a href="#">More details</a>	<a href="#">Turnstile</a>
Teacher 5	14	14	100%	<a href="#">More details</a>	<a href="#">Turnstile</a>
Teacher 6	8	7	87%	<a href="#">More details</a>	<a href="#">Turnstile</a>
Teacher 7	7	7	100%	<a href="#">More details</a>	<a href="#">Turnstile</a>
Teacher 8	0	0	0%	<a href="#">More details</a>	<a href="#">Turnstile</a>
Teacher 9	0	0	0%	<a href="#">More details</a>	<a href="#">Turnstile</a>

Figure 1. Information educational system plan – information intellectual capital part (fragment).

### Plan

STUDY LOAD: 99.1 H      EDUCATIONAL AND METHODOLOGICAL WORK: 140 H      RESEARCH WORK: 0 H      ORGANIZATIONAL, METHODOLOGICAL AND EDUCATIONAL WORK: 0 H

TOTAL ANNUAL LOAD - 238.1 hours (according to an individual plan) (147 hours = 1470 hours x 0.1 st. - normal)

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Teacher	Type of work	Norms of time	According to plan qty	Hours according to plan	Actual qty	Hours upon	Deadline (date) planned	Deadline (date) actual	Note
Rokotov Yu.V.	Work related to the use of information technology in the educational process (task development, program debugging, etc.) - 100 hours. time is determined by the head of the department	100	1	100	0	0	09/02/2019	11/02/2019	Preparation of equipment and specialized software, development of individual tasks and criteria for their assessment for students during the practice of obtaining professional skills and experience of professional activity and orientation practice
Rokotov Yu.V.	Development of a work program, training and practical training programs - 20 hours.	20	1	20	0	0	09/02/2019	07/05/2020	The practice of obtaining professional skills and professional experience
Rokotov Yu.V.	Development of a work program, training and practical training programs - 20 hours.	20	1	20	0	0	09/02/2019	07/05/2020	Introductory practice

Beginning of the school year   [Download XLS](#)

Figure 2. Individual work plan of a teacher, fragment.

Two areas of document flow intersect at the point of creation of documents for intermediate certification. Developed module creates intermediate certification documents according to the number of groups and approved curricula. Sheets are instantly printed and handed to the teacher who has to fill them out during the test or exam and return back to the directorate.

A directorate specialist adds the marks into the database, which provides students with an opportunity to see their marks at personal accounts opened in the overall educational information system. Any possible errors caused by the human factor are eliminated. At the last stage, a ready-made education certificate is compiled set to print, which minimizes manual labor and errors. As a result, intellectual information capital is developed in educational organization.

### **Electronic classes' schedule as a part of intellectual information capital**

Electronic classes' schedules become important aspect of educational work in educational institutions. The module applied in RTU MIREA Stavropol Branch allows reducing scheduling time down to several hours while considering verification, correction of errors, inclusion of training work load, location of rooms taking into account their capacity and specialization, teachers' preferences and training schedules.

The process of scheduling for 150 teachers takes 4 minutes 30 seconds of the working time. Subsequently, the schedule is checked for correct data, if necessary, initial data is changed, and the schedule is redone. The module of RTU MIREA Stavropol Branch ensures absence of errors and overlaps in the schedule. By decision of the management the schedule may be displayed on the official website, in personal accounts of students and teachers. Changes in the schedule are notified by e-mail and in social network "Contact".

Schedule data is used in electronic log where teachers evaluate students' knowledge shown in practical classes. Teachers do not issue paper versions of the log, it is done automatically. A list of students forms a particular group; dates of classes are taken from the schedule. Remote access control system allows identify students absent from the class, and teacher periodically grades students on-line.

### **Creation of internal electronic library system as a part of intellectual information capital**

To complete overall educational process, internal electronic library system has been created. In accordance with the curriculum, teachers accumulate materials, the compliance of which is checked automatically on formal grounds (ex., practical classes on a particular subject require guidelines or other materials available in the library).

The module applied in RTU MIREA Stavropol Branch provides the student with opportunity to have a full access to methodological support as required by the curriculum - Figure 1. That excludes handover of materials from a teacher to each student. And at the same time the educational institution avoids print out materials in large amounts. Testing of students is carried out in a special testing system.

Electronic library system

Choose semester Semester: 1 semester

**Basketball**

Title	A type	Part	The size
Guidelines for practical training and independent work in the discipline "Physical Culture and Sports (Elective Discipline): Basketball" for students of the field of study: Jurisprudence	Guidelines for practical classes and independent work of students	1	1.31 MB

**Introduction to the legal profession**

Title	A type	Part	The size
Guidelines for practical training and independent work in the discipline "Introduction to the legal profession"	Guidelines for practical classes and independent work of students	1	0.09 MB

**Foreign language**

Title	A type	Part	The size
Foreign language	Guidelines for practical classes and independent work of students	1	0.21 MB

**Computer science**

Figure 3. Compiling of electronic library system – fragment.

The authors believe that developed educational information system as part of intellectual information capital can be further developed for subsequent computerization of educational, training and scientific processes. That may improve its quality; expand the list of performed functions, one of which is reputational, i.e., image. Computerization of decision-making process may lead to the new quality level, and introduce modern information technologies into educational processes, contributing in the end to development of intellectual information capital.

## CONCLUSIONS

Big volume of data accumulated in information based educational system as a part of intellectual information capital provides for analysis of most institutional processes and for correct management decision making. Development of intellectual information capital via introduction of the module applied in RTU MIREA Stavropol Branch serves solving multiple problems related to reduction of overlays and schedule errors (before the module was applied frequent schedule changes were noted).

The study revealed that:

1. information based educational system represents part of information management, and is identified by information intellectual capital, which integrates human and information factors at a new advanced level;
2. most interpretations of intellectual capital are based on definition of hired labor of exclusively mechanical nature that complicates development of intellectual information capital;

3. components of intellectual information capital in educational organizations are: information systems, products, technologies and etc.; they must be carried out based on the following principles that outline special methods: centralized information inclusion in the database, set up of centralized pattern for all formal documents, minimizing documents workflow by means of fixed database decision-making, errors and correction time decrease;

4. information capital, reflecting quality of information based educational systems performs the function of ensuring information security of intellectual activity;

5. specifically in RTU MIREA Stavropol Branch key components of intellectual information capital are represented with electronic document management, electronic schedule and internal electronic library system.

Efficient intellectual information capital functioning requires detection and management of risks. In some respect it is reflected in independent studies of intellectual capital by S.S. Galazova, V.V. Manuylenko (2017), it contributes to development of innovations - Manuylenko (2015) - and, accordingly, development of their efficient assessment - Manuylenko (2017). It can be achieved based on forecast of intellectual and innovative activity markets: A. Leshchinsky, V. A. Podlepa (2016).

## REFERENCES

1. Arrow, K.D. (2012). Information as a commodity. *HSE Journal of Economics*, 2, 161-171.
2. Becker, G.S. (1975). *Human capital: Theoretical and Epical Analysis with Special Reference to Education*. N.Y.: Columbia University Press, 101.
3. Drucker, P. F. (1999). Knowledge Worker Productivity. *Calif. Manag*, 41(2), 78-94.
4. Edvinsson, L., Malone, M.S. (1997). *Intellectual Capital. Realizing Your Company True Value by Finding Its Hidden Brainpower*. New York: HarperBusiness.
5. Ermakova, G.A. (2018). Identification of promising types of intellectual capital in corporations as basis of an objective assessment. *Problems of Economics and Legal Practice*, 6, 280-282.
6. Galazova, S.S., Manuylenko, V.V., Morgoev, B.T., Lipchiu, N.V., Biganova, M.A. (2017). Formation of stakeholders' client capital of trade institutions. *European Research Studies Journal*, 20(4B), 398-411.
7. Gukova, A.V., Egorov, A.Yu. (2006). *Enterprises investment capital*. Moscow: KNORUS, 276.
8. Gutmann, P. (1977). Subterranean economy. *Financial Analysts Journal*, 33(6), 26-27.
9. Hansen, E.H. (1997). Keynesian classics. *Business cycles and national income*, 2, 848.
10. Inozemtsev, V.L. (1998). *Outside economic society*. Moscow: Academia-Science, 640.
11. Jevons, W.C. (1905). *Political Economy: Monograph*. Saint Petersburg: National benefits, 121.



12. Leontiev, B.B. (2009). Intellectual cost. Intellectual capital in Russian business. Moscow: Publishing Center "Shareholder", 200.
13. Leshchinsky, A.F., Podlepa, V.A. (2016). Features of forecasting financial characteristics of the market. *Financial Management*, 1, 67-78.
14. Manuylenko, V.V., Mishchenko, A.A., Bigday, O.B., Putrenok, Y.L., Savtsova, A.V. (2015). A Comprehensive Definition of the Concept of Innovation in Russian and International Science. *International Journal of Economics and Financial Issues*, 5(4), 1029-1037.
15. Manuylenko, V.V., Mishchenko, A.A., Bigday, O.B., Sadovskaya, T.A., Lisitskaya, T.S. (2017). Evaluation Method for Efficiency of Financial and Innovative Activities in Commercial Organizations Based on Stochastic Modeling. *Journal of Applied Economic Sciences*, 12(4(50)), 1226 - 1246.
16. Marx, K. (1969). *Capital*. Moscow: Publishing house of political literature.
17. Menger, K., von Boehm-Bawerk, E., Wieser, F. (1992). *Initial political economics*. Moscow: Economics, 242.
18. Samuelson, P.A., Nordhaus, V.D. (2015). *Economics*. Moscow: Publisher: "Williams", 1358.
19. Shultz, T.U. (1971). *Investment in Human Capital*. N.Y.: London, 26-28.
20. Smith, A. (1992). *Research of nature and causes of national wealth*. Moscow: "Sotsekgiz", 688.
21. Soloviev, I.V. (2015). Information organization and informational management. *Perspectives of Science and Education*, 5(17), 114-118.
22. Turrow, L.K., Heilbroner, R. (1994). *Economics for everyone*. Moscow: Ekor, 315.
23. Walras, M.E. L. (2000). *Elements of pure political economy*. Moscow: Isograph, 448.