# KNOWLEDGE-BASED BIOECONOMY: THE USE OF INTELLECTUAL CAPITAL IN FOOD INDUSTRY OF SERBIA

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**Abstract**
The main objective of this exploratory study was to identify and analyse the indicators of intellectual capital in food industry of Serbia. The study investigated managers' perceptions of their usefulness, practical application, and factors that influence them. The respondents were surveyed by means of a questionnaire. They were mainly top managers from 18 food organizations, committed to the bioeconomy paradigm. The survey items were divided into three subcategories, namely human, structural, and relational capital. The data were analysed by the SPSS 21 statistical software. The results show that all indicators were perceived as very important, relational capital indicators being the most useful of all. Of all individual items, employee motivation, market share, and employee satisfaction were perceived as the most important. This study provides a perspective on managing intellectual capital in bioeconomy.

**Keywords:** knowledge-based bioeconomy, intellectual capital, human capital, structural capital, relational capital, intellectual capital indicators, Serbia's food industry

**JEL Classification:** Q57, O34

## Introduction

The Seventh Framework Programme, conceived in 2005, in addition to allocating 2 billion euros for food, agriculture and fisheries and biotechnology research, launched the concept of the Knowledge-Based Bioeconomy (KBBE) in Europe. The strategy (the Europe 2020 Strategy), adopted in 2010, has been aimed at ensuring that sustainable economy becomes an imperative for both current and future commitments of modern states and organisations

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(European Commission, 2017). Evidence of the achievement of this goal can be found in the European Commission report, which shows the bioeconomy related research to be a priority for most European countries and regions in the time period 2014 to 2020.

The Knowledge-Based Bioeconomy (KBBE) is defined as transforming life sciences knowledge into new, sustainable, eco-efficient and competitive products (European Union, 2007). The KBBE brings together the knowledge base and bioeconomy as a "mission oriented research" (Aguilar, Magnjen and Tomas, 2013). Hence frequent overlapping in defining the two terms. In one of the widely cited definitions, bioeconomy and, according to some authors, this applies to the knowledge-based bioeconomy as well, is a sustainable, eco-efficient transformation of renewable biological resources into food, energy and other industrial products (Schmid, Padel and Levidov, 2012). In that context, the Knowledge-Based Bioeconomy links the technological foundation necessary for achieving social goals on the one hand, and addressing social challenges that are deemed critical for future wellbeing, livelihoods and prosperity on the other (Birch, Levidow and Papaioannou, 2012). The KBBE focuses on three major directions in the development of biosystems economy, namely: (1) sustainable production and management of biological resources; (2) food, health and well-being; (3) life sciences, biotechnology and biochemistry (Scarlat et al., 2015). The key factors influencing the development of KBBE are: government policy, regulatory requirements, intellectual capital (IC) and intellectual property rights, human resources, social acceptance and market structure (McCormic and Kautto, 2013).

The Republic of Serbia has adopted various strategies related to green and bioeconomy, such as National Sustainable Development Strategy, National Strategy on Sustainable Use of Natural Resources and Environment, and National Environmental Protection Programme. Many companies are to a greater or lesser extent committed to green economy and bioeconomy (UNDP, 2012), but to the authors' best knowledge, there have been only few pieces of research related to intellectual capital in food industry in Serbia or intellectual capital in general (Kontic and Cabrilo, 2009; Komnenic, Tomic and Tomic, 2010; Djekic, Dimitrijevic and Tomic, 2017). Small number of studies in Serbia, as opposed to numerous pieces of research related to intellectual capital in the European Union, indicates that this field has not been addressed sufficiently. To close the research gap, the main objective of our exploratory study is to identify the indicators of intellectual capital that are relevant and applicable in Serbia. These indicators would help Serbian enterprises manage their intellectual capital, which is of paramount importance for improving organizational performance levels. Managers' perception of the significance and usefulness of IC indicators in food industry organizations in Serbia was explored through the following research questions:

- What IC indicators do managers in food industry perceive as useful?
- What IC indicators do managers use in their everyday activities?
- What factors would influence managers' ability to develop and apply these IC indicators?
- How would managers use IC indicators in their everyday activities?
- What stakeholder groups (internal and external) should food organizations share their IC indicators with?

Data were collected via a modified form of the survey, previously used by Miller et al. (1999), and analysed by SPSS Statistics 21 software. The internal consistency of the instruments was tested using Cronbach's alpha coefficient.

The paper is organized as follows: The literature review discusses state-of-the-art in the field of the bioeconomy, especially knowledge-based bioeconomy. The next section is devoted to intellectual capital, its structure and measurement. In the methodological section, the logic behind using the appropriate methods in the context of this study was explained, and the data collection and analysis are described. The "Results and Discussion" section analyses and interprets the results and compares them to previous research. The conclusions are presented in the final section.

## 1. Literature review

As defined by European Commission (2012), bioeconomy is the "production of renewable biological resources and the conversion of these resources and waste streams into value – added products, such as food, feed, bio based products, and bio energy". It relies on different sciences, including life sciences, ecology, biotechnology, agronomy, and ICT (European Commission, 2012). The four cornerstones of bioeconomy are: food production and processing, value-added food and health products, agri-environmental products and services, and energy and bio-processing. As opposed to the traditional agricultural systems, the bioeconomy-oriented systems are focused on integrating environment, natural resources, food and agriculture, energy and industrial development (Socaciu, 2014). Closely related to agriculture, bioeconomy produces food and energy, using sustainable biological resources, enabling resource efficiency and lowering the carbon footprint (European Investment Bank, 2017). Striving for sustainable food production is based on regeneration of natural resources and the assimilation capacity of the environment (Szűcs, Vanó and Korsós-Schlesser, 2017).

The KBBE definitions focus on the connection between biotechnology and economy that generates added value. The important points here are not only the key factors in this process, but also the need for relevant and effective knowledge that will lead to the creation of this value, as well as the way to manage this knowledge (Birch, 2016). In knowledge economy successful knowledge management will give a competitive advantage to companies. This means the ability to grasp and acknowledge the value of an enterprise, and manage its key factors that influence value. Evidently, there is a need for efficient evaluation of those factors that can influence a company's bottom line. It is especially true because, in knowledge based economy, not only long-established financial data are needed to make sound decisions related to investment (Bose and Thomas, 2007).

The role of knowledge management in the bioeconomy is ensuring a free flow of knowledge within an organisation. In that sense, knowledge management means integrating people, processes and technology in order to enable not only knowledge sharing, but also its protection, as well as its smarter use, always in new and innovative ways (Đorđević Boljanović, 2009). An organisation that is committed to sustainable development and bioeconomy-based business needs to focus on its knowledge resources, its intellectual capital and knowledge management. This involves striving for sustainable food production that will be based on regeneration of natural resources and the assimilation capacity of the environment (Szűcs, Vanó and Korsós-Schlesser, 2017).

According to Komnenic, Tomic and Tomic (2010), food industry is "one of the most knowledge-intensive sectors" today. Its main knowledge-related fields are food science (chemistry, biology and physics) and food technology, which incorporates biotechnology, engineering, and electronics. New technologies and innovations are considered one of the crucial factors in gaining competitive edge in food industry. Yaklai, Suwunnamek and Srinuan (2017) claim that IC and knowledge management are indeed main innovation drivers that bring about competitive edge in food industry.

The knowledge economy has shifted its focus from tangible to intangible assets and their management (Bramhandkar, Erickson and Applebee, 2007). From the shareholders' perspective, the intangibles are increasingly gaining importance in business appraisal. Intellectual capital, also referred to as intangible assets, and knowledge assets, are assets that do not have a material or financial manifestation (OECD, 2011). There have been various definitions of the term, encompassing different resources and properties that can be regarded as intellectual capital. Some companies even developed their own definitions of intellectual capital, e.g. Skandia (Edvinsson, 1997).

Intellectual capital is an extensive concept, usually divided into subcategories. Most often they are termed human, structural, and relational capital (Starovic and Marr, 2006), also called individual competence, internal structure, and external structure (Sveiby, 2001). Human capital comprises the competence, knowledge, and creativity of all employees of an organization. Structural or internal capital incorporates procedures, patents, models, databases, and systems belonging to the organization, independent of individuals. And external structure, or relational capital, includes the relationships with customers and partners, marketing channels, brands, and the organization's reputation (Sveiby, 2001; Feleagă et al., 2013).

As defined in "Building the Bioeconomy" annual report 2017 (Pugatch Consilium, 2017), human capital is one of the key drivers of biotech innovation, which is a cornerstone of bioeconomy. This report contains 26 economies from the main regions of the World, belonging to different income groups as defined by the World Bank. Many studies related to biotechnology have demonstrated that without human capital, it is impossible to create innovative environment, crucial for the development of the bioeconomy. In this report human capital is measured by the number of researchers per million population and the percent of population in tertiary education. Israel has the highest number of researchers (8,255 per million), followed by Denmark (7,198), Korea (6,899), and Singapore (6,658). In comparison, the UK has 4,252, the USA 4,019; Ireland 3,732; Russia 3,102; Argentina 1,202; and India 157 researchers per million (Pugatch Consilium, 2017).

The elements of intellectual capital are interrelated and their interaction leads to generation of new values for the company. Their mutual relations are unique for each organization. A recent study by López López and Salazar – Elena (2017) has also shown that the activities of intellectual capital management have different impact across various industrial sectors, and that they should be adapted to a particular context.

Here we also have to mention the VAIC method (the Value Added Intellectual Coefficient), devised by Pulic (2000), based on the data from balance sheets and profit and loss accounts. Although widely used for measuring efficiency of intellectual capital (much more often in the emerging markets than in the developed countries), it is also widely criticized (Andriessen, 2004; Urbanek, 2016). Using this method, the studies performed in Australia

(Clarke, Seng, and Whiting, 2010) and Egypt (Sherif and Elsayed, 2015) demonstrated a direct and positive relationship between IC and organizational performance of the publicly listed companies.

Urbanek (2016) introduced a new method for measuring intellectual capital – intellectual capital efficiency ratio (ICER), based on publicly available data, such as balance sheet, and profit and loss accounts. His research of intellectual capital in Polish food industry showed that ICER is positively related not only to the current profitability of a company, but also to the long term shareholder value creation.

Although there has been relatively little research of this topic in Serbia, there have been some findings relevant to this paper. Djekic, Dimitrijevic and Tomic (2017) interviewed the technical, quality or food safety managers from 75 fruit companies. They reached a conclusion that the most valued IC indicators in fruit industry are customer satisfaction and loyalty. The highest rated items are connected to communication and exchange of ideas, adjustment to market changes, product quality, customer satisfaction, IT, and relationship with partners. After interviewing 109 higher managers from 13 large and medium sized companies belonging to different sectors in Serbia, Kontic and Cabrilo (2009) found that human indicators are more important than relational and structural IC indicators. The study revealed that the main drivers of human capital are motivation, experience, and efficiency. Komnenic, Tomic and Tomic (2010) measured intellectual capital in the agri–food sector of Vojvodina (Serbian northern province) using the VAIC coefficient. The data for this research originated from the financial reports (balance sheets, profit and loss statements) of 37 companies. Their results confirmed the positive relationship between the IC and organizational performance.

## 2. Methodology

The main purpose of this study is to examine and determine the indicators of intellectual capital in food industry of Serbia. The study explored managers' perceptions of those indicators' usefulness, implementation, and factors that affect them. In order to examine the importance of managing intellectual capital in food industry organizations, we focused on managers' perception of the value and usability of IC indicators, explored through research questions stated in the introduction. They were: what IC indicators do managers in food industry perceive as useful; what IC indicators do managers use in their everyday activities; what factors would influence managers' ability to develop and apply these IC indicators; how would managers use IC indicators in their everyday activities; and what stakeholder groups (internal and external) should food organizations share their IC indicators with?

The survey was conducted from January to March 2018. Non probability – purposive sampling was used, and the survey was sent by email to 138 addresses (with the response rate 44.2%). In our research, we focused primarily on food industry organizations which clearly show their commitment to bioeconomy, such as solving problems of biodegradable waste from their own production process, using waste to produce energy, organic manufacturing, non-GMO food, preventing pollution of all ecosystems, environmental protection based on clean production and sustainable development, or the use of sustainable sources of energy. Such information is publicly displayed on their web sites. All of them belong to large (over 250 employees, 83.6%) and medium (50-250 employees, 16.4%) enterprises. The pilot study was conducted in January 2018. Eight managers were asked to

answer the questionnaire. The aim of the pilot study was to ensure that all the terminology used would be understandable in Serbia, specifically in food industry.

The respondents (61 in total) were top and middle managers from 18 companies belonging to food industry in Serbia. Of that number, 54.1% were middle managers, and 45.9% top managers. 45.9% were managers with 11-20 years of work experience, 24.6% with over 20 years, 23% with 6-10 years, and 6.6% with less than 5 years work experience. There were 45.9% respondents with master's degree, bachelor's degree 32.8%, college 9.8%, high school diploma 6.6%, and PhD degree 4.9%. The majority of the respondents fall within the age group 30-44 (67.2%), followed by 45-65 (26.2), and younger than 29 (6.6%). The majority of the respondents were male (63.9%). The managers belonged to different areas of food industry: meat industry (22.2%), fruit and vegetable juices industry (15.6%), fruit and vegetable preservation industry (8.9%), meat processing industry (8.9%), bakery industry (8.8%), dairy industry (6.7%), cocoa, chocolate and confectionary industry (6.7%), flour industry (2.2%), ice-cream industry (2.2%) and 17.8% marked as "other", according to the official Serbian industry classification.

We used a modified form of the survey used in the research by Miller et al. (1999), conducted in various industrial sectors in Canada. The original survey was based on Edvinsson and Malone (1997), Sveiby (1997), and IFAC (1998). We retained the majority of the original questions, leaving out the open-ended questions for easier analysis. The definitions of all relevant terms were provided at the beginning of the survey form: intellectual capital, human capital, structural capital, relational capital (the term used instead of "customer capital", because it emphasizes the importance of relationships with the most important stakeholder groups), customer, product, sales, research and development. As previously mentioned, human capital consists of competence and knowledge of all employees, structural capital consists of procedures, databases and systems belonging to the organization, and relational capital comprises the relationships with stakeholders, brands and organization's image.

The internal consistency of the instruments used was checked using Cronbach's alpha coefficient (table no. 1). The items showed relatively high internal consistency, over 0.8, including the overall (0.889), as well as the separate IC indicators, all over 0.8.

**Table no. 1: Cronbach's alpha coefficient**

| Measured construct | Number of items | Cronbach's alpha coefficient |
|---|---|---|
| Indicator usefulness (all) | 33 | 0.89 |
| Human indicators | 9 | 0.85 |
| Structural indicators | 13 | 0.87 |
| Relational indicators | 11 | 0.85 |

### 3. Results and discussion

Statistical analysis was carried out using SPSS Statistics 21. The results and their interpretation will be presented in the following paragraphs. We start with the overall usefulness of IC indicators, individual IC categories (namely human, structural, and relational capital indicators), perception of IC indicator usefulness, factors influencing their development and application, preferred indicator use, to conclude with sharing indicators with stakeholders.

High scores indicate that managers value the importance of all IC indicators. As shown in table no. 2, relational indicators are considered most useful, while structural indicators are considered least useful. This differs from the results of the research by Kontic and Cabrilo (2009), and Miller et al. (1999), which showed that human capital indicators were regarded as the most useful. Having said that, the latter study's results were similar to ours in a way that relational and human capital indicators were perceived to be more useful than structural capital indicators. The explanation of perceived high usefulness of relational capital indicators may be that, due to the bioeconomy being a relatively new area, organizations are trying to obtain sustainable competitive advantage through networking and relationships with customers and other stakeholder groups. Companies that successfully develop customer relationships are more likely to have more satisfied and more loyal customers.

**Table no. 2: Perception of overall usefulness of IC indicators**

| | N | Min | Max | M | SD |
|---|---|---|---|---|---|
| IC indicators (all) | 61 | 3.1 | 4.97 | 4.12 | 0.39 |
| Human indicators usefulness | 61 | 2.89 | 5 | 4.16 | 0.45 |
| Structural indicators usefulness | 61 | 2.62 | 4.92 | 3.88 | 0.48 |
| Relational indicators usefulness | 61 | 3.09 | 5 | 4.33 | 0.47 |

*Notes: n – sample size, Min – minimum, Max – maximum, M – Mean, SD – standard deviation*

Among human capital indicators (table no. 3), employee motivation, employee satisfaction, and IT literacy of staff are believed to be the most important. They also show the smallest data dispersion, *i.e.* standard deviation. Furthermore, they are the most used indicators. In knowledge economy, employee motivation and satisfaction are of paramount importance. Employee motivation is the most important indicator of all used in this survey (mean 4.79). Motivated and satisfied employees are more responsive to customers, making them more satisfied and loyal (Robbins and Coulter, 2012). Since KBBE is based on knowledge acquisition and sharing, IT literacy of staff is a key factor. This further leads to competitive advantage. The least important are ratio of managers to employees, proportion of challenging assignments and cost per hire.

**Table no. 3: Human capital indicators**

| | N | M | SD | Rank |
|---|---|---|---|---|
| Cost per hire | 61 | 3.95 | 1.16 | 5 |
| Employee satisfaction | 61 | 4.66 | 0.48 | 1 |
| Turnover rate | 61 | 4.02 | 1.15 | 4 |
| IT literacy of staff | 61 | 4.44 | 0.81 | 3 |
| Employee motivation | 61 | 4.79 | 0.41 | 2 |
| Training expense per employee | 61 | 4.05 | 1.02 | 7 |
| % of employee (or managers) with degrees | 61 | 3.64 | 1.23 | 8 |
| Ratio of managers to employees | 61 | 3.75 | 1.09 | 9 |
| Proportion of challenging assignments | 61 | 4.13 | 0.90 | 6 |

*Notes: n – sample size, Min – minimum, Max – maximum, M – Mean, SD – standard deviation*

As previously mentioned, structural capital indicators (table no. 4) are considered least important. This concurs with the results of the research by Miller et al. (1999). Still, number of new product introductions, product life cycle trends, and R&D invested in product design show high scores (more than 4). Number of new product introductions, and product life cycle trends are two of the three most used indicators. This suggests that organizations value innovations, and are focused on creating new products for their customers. That is in accord with the main ideas of the knowledge-based bioeconomy. Similarly, Djekic, Dimitrijevic and Tomic (2017) found that the most valued IC items are linked to product quality. They also found that medium sized companies concentrate on all stakeholder groups, while small enterprises focus mainly on customers. Number of patents or copyrights per employee is considered by far the least important indicator of structural capital.

**Table no. 4: Structural capital indicators**

| | N | M | SD | Rank |
|---|---|---|---|---|
| Number of patents or copyrights per employee | 61 | 2.92 | 1.02 | 12 |
| Revenue generated per R&D expense | 61 | 4.03 | 0.73 | 4 |
| Ratio of R&D expense to administrative | 61 | 3.61 | 0.95 | 10 |
| R&D invested in product design | 61 | 4.16 | 0.73 | 5 |
| No. of computer links to corporate database | 61 | 3.89 | 0.90 | 2 |
| No. of times corporate database is accessed | 61 | 3.8 | 0.83 | 6 |
| Volume of information system (IS) use | 61 | 4.11 | 0.71 | 8 |
| Ratio of IS to total revenue | 61 | 3.89 | 0.90 | 10 |
| No. of software licenses | 61 | 3.7 | 1.04 | 7 |
| No. of multifunctional project teams | 61 | 3.82 | 0.79 | 9 |
| No. of new product introductions | 61 | 4.41 | 0.70 | 1 |
| Product life cycle trends | 61 | 4.26 | 0.68 | 3 |
| Average length of time for product design | 61 | 3.8 | 0.83 | 11 |

*Notes: n – sample size, Min – minimum, Max – maximum, M – Mean, SD – standard deviation*

Overall, relational capital indicators (table no. 5) are deemed most important of all IC indicators. Market share, customer loyalty, and customer satisfaction are perceived as the three most important indicators, althogh the number of supplier/customer networks is used most frequently. This agrees with the previously mentioned structural indicators related to innovations, and shows that these companies put great effort in managing relationships with their customers. Ratio of customers to employees and number of alliances or partnerships are considered the least important (less than 4). The research of Datta and De (2017) showed that relational capital indicators can be predictors of organizational performance.

**Table no. 5: Relational capital indicators**

| | N | M | SD | Rank |
|---|---|---|---|---|
| Growth in business or service volume | 61 | 4.43 | 0.67 | 4 |
| % of sales by repeat customers | 61 | 4.34 | 0.73 | 7 |
| Ratio of sales to total customers | 61 | 4.38 | 0.73 | 8 |

| | N | M | SD | Rank |
|---|---|---|---|---|
| Customer loyalty | 61 | 4.59 | 0.59 | 5 |
| Customer satisfaction | 61 | 4.57 | 0.62 | 6 |
| No. of customer complaints | 61 | 4.48 | 0.67 | 3 |
| Number of supplier/customer networks | 61 | 4.56 | 0.59 | 1 |
| No. of alliances or partnerships | 61 | 3.93 | 0.83 | 9 |
| Ratio of customers to employees | 61 | 3.51 | 1.11 | 11 |
| Market share | 61 | 4.7 | 0.50 | 2 |
| Profits per employee | 61 | 4.16 | 0.99 | 10 |

*Notes: n – sample size, Min – minimum, Max – maximum, M – Mean, SD – standard deviation*

Pearson Correlation was performed in order to learn whether age, working experience, and job level impact the perception of usefulness of IC indicators (table no. 6). No statistically significant correlation was shown between these factors. All things considered, we can conclude that IC indicators are equally important to all participants, regardless their age group, job level or years of working experience.

**Table no. 6: Pearson correlation of age, years of experience and job level, and perception of usefulness of IC indicators**

| | Working experience | Position in the company | HC | SC | RC |
|---|---|---|---|---|---|
| Age | 0.801** | 0.153 | 0.045 | -0.019 | -0.118 |
| Years of experience | | 0.172 | 0.043 | -0.013 | -0.028 |
| Job level | | | 0.119 | 0.012 | -0.048 |

*Notes: ** Correlation is significant at the 0.01 level (2-tailed).*

*HC – Human capital indicators, SC – Structural capital indicators, RC – Relational capital indicators*

Additionally, ANOVA did not demonstrate any statistically significant effect of the area of food industry on the perception of usefulness of IC indicators at the $p<.05$ level for all the factors: Human capital indicators [$F(12, 32) = 1.90$, $p = 0.07$], Structural capital indicators [$F(12, 32) = 1.49$, $p = 0.18$], Relational capital indicators [$F(12, 32) = 1.02$, $p = 0.46$].

Table no. 7 shows what factors managers see as the main impediments to developing and applying IC indicators. Using/interpreting indicators and communicating their value within the company are regarded to have the highest impact on managers' ability to develop and apply IC indicators. Communicating the value of indicators internally is perceived to have a higher impact than communicating them externally, which is regarded as a factor with the smallest influence on developing IC indicators. By contrast, Miller et al. (1999) found cost and time associated with developing indicators to be the greatest barriers in development and application of IC indicators. Wee and Chua (2015) found that, in general, there is a high correlation between communication of IC and organizational performance.

**Table no. 7: Factors influencing managers' ability to develop and apply IC indicators**

| | N | Min | Max | M | | SD | Rank |
|---|---|---|---|---|---|---|---|
| | Statistic | Statistic | Statistic | Statistic | SE | Statistic | |
| Cost of developing indicators | 61 | 2 | 5 | 3.67 | 0.08 | 0.63 | 5 |
| Time of developing indicators | 61 | 2 | 5 | 3.79 | 0.09 | 0.73 | 4 |
| Using/interpreting indicators | 61 | 2 | 5 | 4.00 | 0.11 | 0.88 | 3 |
| Communicating the value of indicators (internally) | 61 | 3 | 5 | 4.30 | 0.09 | 0.67 | 1 |
| Communicating the value of indicators (externally) | 61 | 2 | 5 | 3.61 | 0.10 | 0.80 | 6 |
| Comparability (internally) | 61 | 2 | 5 | 4.07 | 0.11 | 0.83 | 2 |
| Comparability (externally) | 61 | 2 | 5 | 3.57 | 0.11 | 0.85 | 7 |

*Notes: n – sample size, Min – minimum, Max – maximum, M – Mean, SD – standard deviation, SE – standard*

The answers about preferred indicators vary greatly across three groups of indicators (table no. 8). The majority of managers (more than 57%) agreed they would use all three groups of IC indicators only to increase shareholder value. As expected, almost all managers (96.7%) would use human capital indicators to manage human resources. Additionally, two thirds of managers would use these indicators to improve operational efficiency.

**Table no. 8: Prefered indicator use**

| Use indicator to | N | Human capital | Structural capital | Relational capital |
|---|---|---|---|---|
| Manage human resources | 61 | 96.70% | 24.60% | 23.00% |
| Market product | 61 | 31.10% | 50.80% | 68.90% |
| Secure funding/capital | 61 | 31.10% | 70.50% | 52.50% |
| Gain competitive edge | 61 | 47.50% | 57.40% | 78.70% |
| Increase shareholder value | 61 | 57.40% | 68.90% | 63.90% |
| Improve quality of product | 61 | 47.50% | 62.30% | 59.00% |
| Improve operational efficiency | 61 | 65.60% | 68.90% | 32.80% |
| Allocate resources | 61 | 50.80% | 70.50% | 32.80% |
| Facilitate budget planning | 61 | 55.70% | 68.90% | 42.60% |
| Influence government policy | 61 | 33.30% | 50.00% | 60.00% |

*Note: n – sample size*

Structural capital indicators would be used in the largest number of activities. This is not consistent with answers to previous questions (tables no. 2 and 4), which showed that structural capital indicators are the least important and useful of all IC indicators. One explanation may be that structural capital "what remains when employees go home for the night" is easier to quantify than human capital, due to the nature of its elements (licenses, data bases, information systems, and patents are easier to quantify), and is owned by the company. In contrast, employees work for the company, which does not own their skills and knowledge. Structural capital is generally perceived to be a support for human capital.

As expected, three quarters of the respondents would use relational capital indicators to gain competitive edge. Also, the majority would use relational capital indicators to market products, increase shareholder value, influence government policy and improve product quality.

More than 70% of all managers feel that all groups of indicators should be shared with internal managers, board of directors, and investors/shareholders (table no. 9).

**Table no. 9: IC indicator sharing**

| | N | Human capital | Structural capital | Relational capital |
|---|---|---|---|---|
| All employees within your organization | 61 | 77.00% | 44.30% | 32.80% |
| Internal managers only | 61 | 73.80% | 77.00% | 70.50% |
| Current and potential funders/business and educational partners | 61 | 39.30% | 62.30% | 65.60% |
| Customers | 61 | 31.70% | 36.70% | 65.00% |
| Board of directors | 61 | 78.70% | 82.00% | 75.40% |
| Investors/shareholders | 61 | 75.40% | 82.00% | 73.80% |
| Suppliers | 61 | 26.20% | 59.00% | 54.10% |

*Note: n – sample size*

This is not surprising, because these three stakeholder groups create innovative environment and allocate resources for managing intellectual capital. Unlike in Miller et al. (1999), three quarters would share human capital indicators with all employees, and fewer than half would share structural and relational capital indicators with all employees. This might be because human capital indicators are related to all employees and their career development, regardless of their job and hierarchical level.

## Conclusions

The research objective of this paper was to identify the IC indicators that are relevant and useful in Serbian food companies that are dedicated to bioeconomy. This being an exploratory study, it does not attempt to give final and conclusive solutions. It requires further investigation.

The answers to our research questions are as follows: In general, the managers found IC indicators very useful (overall higher than 4.1). Based on literature review, we expected the indicators of human capital to be seen as most beneficial. Contrary to our expectations, the results have shown that relational capital indicators (overall) are perceived as the most useful. Nevertheless, employee motivation and satisfaction (belonging to human capital) are two of the three single highest rated indicators of all, with 4.79 and 4.66 means, respectively (the third one being market share, with 4.7). Employee satisfaction influences not only productivity and turnover, but also customer satisfaction and loyalty. Satisfied workers are more friendly and proactive towards customers.

In addition, IT literacy of staff, challenging assignments, new product introductions, product life cycle trends, R&D invested in product design, customer loyalty and satisfaction, customer complaints and number of supplier/customer networks all scored significantly higher than 4. This shows organizations' dedication to constant innovation and product improvement on the one hand, and commitment to promoting customer loyalty and building relationships with stakeholders on the other.

In everyday managerial activities, the most used IC indicators are employee motivation, employee satisfaction, and IT literacy of staff. The majority of managers would use all three groups of IC indicators to increase shareholder value. Surprisingly, although managers deemed structural capital indicators least important, they would still use them in almost all managerial activities (except managing human resources). The explanation could be in the perception of structural capital as a basis and support for human capital, something more visible and owned by the organization.

Using and/or interpreting indicators and communicating them within the company are deemed to have the highest impact on managers' ability to develop and apply IC indicators. Consistently, almost three quarters of all managers think that all groups of indicators should be shared with internal managers, board of directors, and investors/shareholders.

There are several limitations to this research. Firstly, the sample was limited to one sector only (food industry). Moreover, only a limited number of companies in food industry was surveyed, namely the organizations committed to bioeconomy. The results may vary if compared to the other studies that belong to different industry sectors. Another limitation was the response rate (44.2%). The research sample was too small for generalizing results on the industry or country level. We do not propose a definite model for measuring IC. Our research should be regarded as a starting point in identification and use of IC indicators in managing intellectual capital in Serbian food organizations committed to bioeconomy.

Future research could expand across other industrial sectors in Serbia, with a larger sample. It could also expand within the framework of bioeconomy in other European countries. Since previous studies have clearly shown a positive relationship between intellectual capital and organizational performance, further research should be dedicated to defining a model for measuring and managing intellectual capital in bioeconomy. Business strategy which incorporates the concept of intellectual capital is of critical importance for succeeding in the contemporary business environment. That is why having clearly defined, comprehendible and applicable IC indicators is essential for managers, especially top managers.

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