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ECO-INNOVATIONS AS A SEGMENT OF GREEN INTELLECTUAL CAPITAL WITH THE AIM OF STRENGTHENING THE BUSINESS SUSTAINABILITY

Abstract

Sustainable business operations require a long-term perspective that integrates social, economic and environmental goals. Today, enterprises are expected to develop and use environmentally better, eco-efficient ways of producing products and providing services, contributing to the growth of national wealth and employment while respecting changing demands in terms of socially responsible behavior. In order to protect the environment, concepts such as green image, eco-innovation, green innovation, responsible innovation, sustainable innovation, eco-marketing, eco-production and eco-management are becoming more and more popular. Bearing in mind the above, the aim of this paper is to indicate the position of eco-innovation in green intellectual capital concept and identify the importance of eco-innovation for the sustainable goals achieving of a modern enterprise.

Keywords: *eco-innovations, intellectual capital, sustainability, business operations, enterprise*

JEL classification: *Q56*

ЕКО-ИНОВАЦИЈЕ КАО СЕГМЕНТ ЗЕЛЕНОГ ИНТЕЛЕКТУАЛНОГ КАПИТАЛА У ЦИЉУ ЈАЧАЊА ОДРЖИВОСТИ ПОСЛОВАЊА

Апстракт

Одрживо пословање захтева дугорочну перспективу која интегрише друштвене, економске и еколошке циљеве. Данас се од предузећа очекује да развијају и користе еколошки боље, еколошки ефикасне начине производње производа и пружања услуга, доприносећи расту националног богатства и

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запослености, поштујући променљиве захтеве у погледу друштвено одговорног понашања. У циљу заштите животне средине, концепти као што су зелени имидж, еко-иновација, зелена иновација, одговорна иновација, одржива иновација, еко-маркетинг, еко-производња и еко-менџмент постају све популарнији. Имајући у виду наведено, циљ овог рада је да укаже на позицију еко-иновације у концепту зеленог интелектуалног капитала и идентификује значај еко-иновације за постизање одрживих циљева савременог предузећа.

Кључне речи: еко-иновације, зелени интелектуални капитал, одрживост, пословање предузећа, предузеће

Introduction

In modern business conditions, in which society and the planet face challenges such as climate change, environmental degradation, limited resources and social inequalities, eco-innovations are the key to achieving compromises in relation to realizing economic goals and preserving resources for future generations. These innovations, which are also characterized as green, sustainable and responsible, simultaneously contribute to economic growth and the preservation of the environment, without jeopardizing social well-being.

Excessive exploitation of the planet's natural wealth, especially in developed countries, and the pursuit of industrial progress and economic prosperity, have led to excessive pollution of water and soil, reduction of fertile land, endangerment of biodiversity, etc. In the ever-increasing need of society to provide a sufficient amount of resources, there has also been a disparity in the relationship between needs and nature's ability to satisfy those needs. Sustainable, eco-innovation places great importance on reducing the ecological footprint. This means reducing harmful gases, using resources more efficiently, supporting renewable energy sources and promoting cyclical, regenerative thinking about materials and resources.

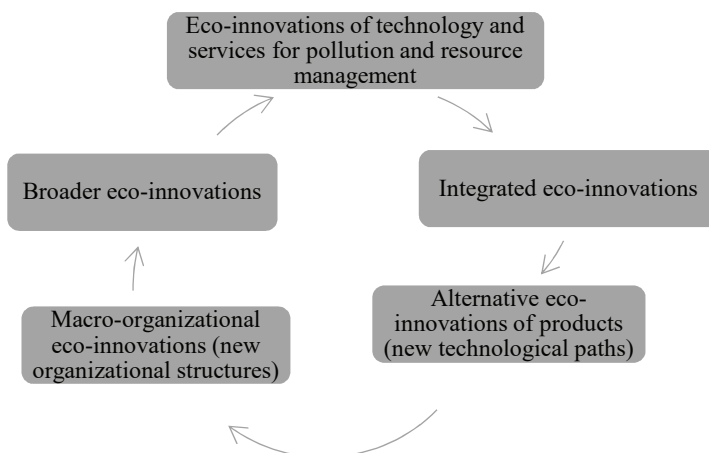
Eco-innovations are closely related to the concept of green intellectual capital of an enterprise. Namely, green human capital implies the knowledge, abilities and attitudes of employees in relation to environmental safety and proper management of environmental issues. Green structural capital refers to organizational culture, corporate image and managerial capabilities for environmental management and development. Green relational capital is key to managing environmental issues in an organization and requires collaboration with external stakeholders regarding the creation and implementation of environmental strategies. Eco-innovations can be seen as a part of the green structural capital of an enterprise.

1. Environmental, sustainable and responsible innovation - a conceptual framework

Eco-innovation or environmental innovation consists of new or modified processes, techniques, systems and products to avoid or reduce environmental degradation (Horbach, 2005). In addition, it can be characterized as green innovation. Andersen (2008) identified five different types of eco-innovation (Figure 1):

1. *Eco-innovations of technology and services for pollution and resource management.* - Products and services that aim to improve environmental performance (not necessarily have to be green, but deals with environmental solutions such as technologies or services that clean, dilute, recycle, control, measure and transport emissions as well as with resources such as natural resource and energy supply and extraction);
2. *Integrated eco-innovations.* - Clean technological processes and clean products that make the product or production process more environmentally efficient than conventional or similar products or processes, enabling energy and resource efficiency, replacing toxic materials and improving recycling (green product is a result of these innovations);
3. *Alternative ecological innovations of products (new technological paths).* – It creates a radical technological discontinuity (based on new theories, capabilities and practices and can initiate a radical shift from the existing pattern of production and consumption to a radically new pattern of production and consumption such as renewable energy technology that contrasts with fossil fuel technologies and organic agriculture);
4. *Macro-organizational eco-innovations (new organizational structures).* – It offers radical, new solutions regarding the efficiency of the organization and society and a new way of managing production and consumption at a systemic level, reflecting the functional interaction between enterprise and organizations, as well as between workplaces and families (industrial symbiosis and urban ecology as a new approach to managing cities and technical infrastructure);
5. *Broader eco-innovations.* - A number of other technological innovations that significantly affect the economy and the innovation process (the use of technology, such as nanotechnology, biotechnology, etc. that have a positive impact on further eco-innovation research).

Figure 1. Typology of eco-innovations



Source: According to Andersen (2008)

Sustainable innovations represent the creation of something improved, which would improve performance in three dimensions of sustainable development: social, environmental and economic. Improvements can refer to changes in processes, operational practices and business models. Sustainable innovation can contribute to the competitive advantage of organizations, because enterprises are in a better position to take into account the opinions of stakeholders (Szekely & Strebel, 2013). Although the term sustainable innovation and eco-innovation are often used as synonyms, eco-innovation only deals with ecological and economic dimensions, while sustainable innovation also includes ethical and social aspects. In addition, sustainable innovation is a broader concept than eco-innovation, since it includes a social dimension and requires three main drivers: at the macro level - government policies and actions, at the enterprise level - the development of new business models, and at the individual level - changes in attitudes and behavior of people (Hansen, Grosse-Dunker & Reichwald, 2009).

A sustainable innovation is the implementation of a new product, process or practice by an enterprise or a modification of an existing product, process or practice that significantly reduces the impact of the enterprise's activities on the environment. It can be distinguished three types of sustainable innovation (Serrano-García et al., 2023):

- innovations that reduce the use of resources or innovations for the efficiency of resource use,
- innovations that eliminate the use of resources and
- innovations that replace the use of resources.

Sustainable innovations include not only the environmental dimension but also economic, social and institutional aspects. They improve the realization of sustainable development goals and represent a segment of all innovation systems. Due to the complexity of the ecological, economic and social system, the simultaneous focus on all those aspects implies the complexity of sustainable innovations and the innovation process, as well as the complexity of their creation and implementation in practice.

The process of creating responsible innovations implies a transparent, interactive process through which social actors and innovators become mutually responsible to each other with the aim of ethical acceptability, sustainability and social desirability of the innovation process and its marketable products in order to enable the proper integration of scientific and technological progress results into society (Smolka & Bösch, 2023). There are four crucial dimensions for the flow of responsible innovation, including: *anticipation, reflection, inclusion and responsiveness*.

Anticipation involves systematic thinking about all the possible implications of the innovation to be developed. It plays a key role in the initiation of innovation and requires that the subjects involved in the innovation process understand the dynamics that help shape the innovation. Also, the complexity and uncertainty that accompany innovation is acknowledged and taken into account. The challenge is to make certain assessments more specific, while being open to other perspectives. This should be done at a time when it can be constructive, but not too late to accommodate the innovation. This requires the early involvement of stakeholders and the general public who engage in a dedicated effort to anticipate potential problems and evaluate possible alternatives.

Reflexivity refers to a critical consideration of one's activities, obligations and assumptions, as well as awareness of the limits of knowledge and the fact that the reality

experienced by an individual may not be universally accepted. Innovators must think about their value systems and theories and how they influence the development of innovation. Observing the underlying values, assumptions and beliefs is a common theme in various conceptualizations of responsible innovation, which can be enhanced by early involvement of stakeholders and the public.

Inclusion is the actual involvement of stakeholders and the general public through dialogue or other means to improve the innovation management process. Different aspects of inclusion are based on the intensity, openness and quality of discussion. Actors must initiate discussions about the social, political and ethical consequences of the innovation.

Responsible innovations require active engagement of various stakeholders in order to improve decision-making and mutual learning process. Responsiveness represents the ability to change shape or direction in response to stakeholder values, the values of the general public and changing circumstances. It refers to responding to new knowledge, perspectives, attitudes and norms that emerge during innovation and requires a collective institutionalized response and co-responsibility for the innovation development process (Burget, Bardone & Pedaste, 2017).

2. The relations between eco-innovation and green intellectual capital elements of an enterprise

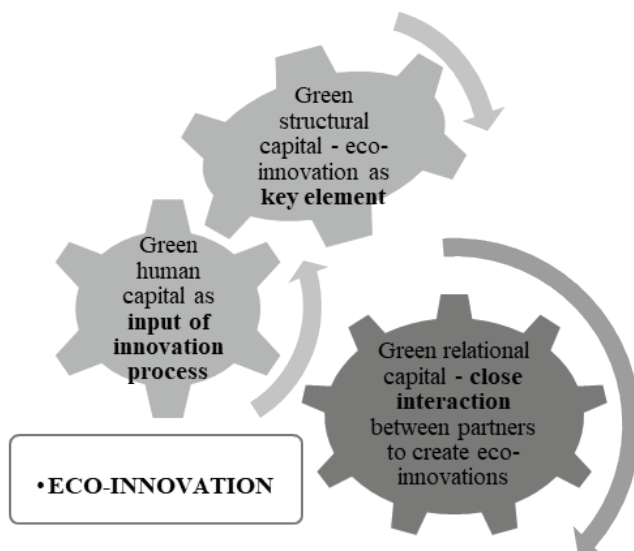
The recent concept of green intellectual capital refers to the intellectual, non-material resources of an enterprise that are aimed at solving environmental protection problems. Training programs that can help develop green capabilities and increase skills of employees involved in operational positions can be considered as a source of creating green human capital of an enterprise. Therefore, green human capital enables an organization to recognize its intangible resources (knowledge, skills and abilities) and can help implement green strategies in a dynamic competitive environment in order to have better business performance. Translating the enterprise's goals to all levels and their realization depends on the commitment of top management. The role of top management's commitment in the adoption of green initiatives is very significant (Chang & Chen, 2012).

Chen (2008) defined green structural capital as organizational assets that demonstrate environmental concern or green innovation within the enterprise and these assets are called strategies related to organizational commitments, organizational capabilities, reward systems, organizational culture, databases, knowledge management systems, information technology, company image, copyrights and trademarks. Environmental concerns are not changed by human capital alone because the support of organizational culture and organizational systems is needed for strategic decisions. Structural capital helps the enterprise organize its processes and systems, which further enables the necessary technological knowledge and turns into organizational capabilities. In addition, organizational capabilities become a precursor to achieving a higher level of sustainable performance. Some authors (Chen, 2008; Chang & Chen, 2012) have highlighted the significant connection between organizational culture and green human resource management due to organizational environmental culture, which is based on a various of assumptions and symbols. Also, information technology has a significant role in the development of green structural capital.

Chen (2008) determined green relational capital as an intangible asset based on the relationship between the organization and suppliers, customers, green innovation, network members and partners in corporate environmental management with the aim of gaining a competitive advantage.

Human capital is a key input for innovation process while the knowledge, abilities and capacities possessed by employees are important for sustaining an enterprise in the context of currently rapidly developing technology. Differentiation through the need to invest in green human capital can drive significant eco-innovation. If an enterprise has a higher level of green human capital, it will be more successful in eco-innovation creation. Namely, green intellectual capital (Chiou et al., 2012) can be seen as a platform to connect employees' environmental knowledge with eco-innovation, so that enterprises can use their green human resources for green process and product innovation (Figure 2).

Figure 2. Relations among eco-innovation and elements of green intellectual capital



Source: According to Chiou et al. (2012)

In the knowledge economy, innovation is a social process, not the domain of individuals. This indicates that for the creation of eco-innovations, cooperation within the enterprise, between employees, but also cooperation between the enterprise and external stakeholders (relational capital) is important. This is especially referring to cooperation relations with suppliers, consumers, strategic partners, the community, and all in the context of joint solutions to environmental problems. In this sense, the terms green supply chains, green products, green consumers, green procurement, green image appear.

This can foster collective innovative knowledge and improve the achievement of green, eco-innovation. Therefore, enterprises with green relational capital can develop new environmental technologies, ideas and opportunities within a collaborative network. An enterprise with poor systems and an environmental culture could not achieve eco-innovation. Thus, with the integration of environmental knowledge at the organizational level, the

enterprise recognizes a strong supportive environmental culture that motivates it to acquire new environmental knowledge and implement green innovation. When valuable knowledge about environmental protection is codified, it can be systematically transferred and disseminated within the enterprise, so that it can be used for eco-innovation (Subramaniam & Youndt, 2005).

The social community, through legal regulation, also has an important influence on the strengthening of eco-innovations. Enterprises that are not focused on implementing innovative activities face more potentially strict environmental regulations than enterprises that attach great importance to innovation (Kesidou & Demirel, 2012). Based on interaction, motivation, but also the creation of voluntary codes of conduct, states can influence the greater willingness of enterprises to accept and apply eco-politics. Some researchers (Doran & Ryan, 2012) claim that creating eco-innovations and achieving a higher profit margin at the same time is not easy, which points to the fact that policy makers can contribute to the growth of a “greener society”. National regulation greatly influences the decision of enterprises to innovate. Environmental innovation can be encouraged by adopting regulations from other countries. Based on the regulations adopted in the USA, innovative devices to reduce air pollution have been introduced in Japan. One research (del Río González, 2005) found that corporate image and compliance with the regulatory framework were the main determinants of an enterprise’s adoption of “green” technology. In addition, the impact of regulations may vary in different areas of environmental technology (Fronzel, Horbach & Rennings, 2007). The application of technologies “at the end of the production process” is regulated by certain environmental regulations and standards. Also, cost savings as well as the implementation of environmental management systems are imperative for the advancement of “green” technology.

Organizational capital represents the institutionalized knowledge and codified experience embedded in structures, management systems, knowledge management systems and operations that influence enterprise’s innovative capability. On the other hand, organizational structure, culture, policies and guidelines foster innovation-related competencies that lead to improved innovation activities. Similarly, enterprises build organizational capital to develop their organizational learning capability, which improves their innovation performance. Enterprises also implement knowledge transformation and exploitation to improve their green innovation performance. In addition, investing in environmental projects and sharing results and best practices among all business units, functions and employees can also improve enterprises overall eco-innovation performance. Therefore, green organizational capital can increase the level of eco-process innovation performance of enterprises (Sahoo, Kumar & Upadhyay, 2023).

One of the possible classifications of eco-innovations places them in four groups (Jovanović Vujatović, Ognjanović & Popović, 2022):

- Organizational innovations,
- Product and service innovations,
- Green system innovations,
- Ecological technologies.

The given classification of eco-innovations indicates the relationship of these elements with the elements of green intellectual capital. In order to successfully implement eco-innovations in an enterprise, it is necessary to have sufficient knowledge

and skills of employees about environmental problems, as well as the need to solve them. Enterprises with higher quality of green human capital also have a greater chance for the success of green innovations. Also, they are the dominant drivers of eco-innovations in the enterprise. When making strategies and decisions, managers must also take into account some basic issues in order to make the right decisions based on them. It includes the issues related to the problem of global warming, reduction of biodiversity, consumption of resources, water and air pollution.

3. The role of eco-innovation in achieving sustainable business performance of an enterprise

Enterprises establish relationships with various stakeholders. A healthy environment is one of the “stakeholders” because successful work and the survival of society depend on a healthy environment. The environment as a “stakeholder” will be preserved if (Krstić, 2022):

- Shareholders do not put their profit goal and the goal of increasing their wealth before social goals,
- Potential investors and financial analysts highly value every effort made in terms of investing resources in the implementation of environmental programs,
- Employees and enterprise management rise environmental awareness through the support of various environmental programs,
- Consumers, by choosing an ecological product of the enterprise, give an impetus to its development and growth,
- Suppliers base their activities on the principles of ecological supply,
- State authorities, through various legal forms.

In all these segments, the goals of eco-innovation and the goals of achieving sustainable enterprise performance coincide.

Various studies show that the application of eco-innovations has a positive effect on business operations and the reputation of enterprises. Through eco-innovations, enterprises also influence the reduction of the negative effects of business on the environment in order to achieve the following sustainable performances (Jovanović Vujatović, Ognjanović & Popović, 2022):

- a) presenting as market leaders, responsible and innovative,
- b) avoiding surprises in the future - to anticipate changes in regulation and the market environment, instead of reacting to changes when they happen,
- c) creating a positive image of the enterprises on the market,
- d) securing investments thanks to the appropriate regulation.

Eco-innovations represent an answer to environmental problems, but at the same time it can also be a natural reaction to high resource prices. As such, it is closely related to the way of using limited natural resources, with their efficiency and sustainable performance (Andabaka, Basarac Sertić & Harc, 2019). In order to reduce the risk of environmental disasters, increase the reputation and create the trust of the social community, many enterprises apply green technologies and explore innovative ways to reduce the negative impact on the environment. This also applies to the application of eco-innovations in the enterprise’s sustainable operations.

Eco-innovation includes technological improvements that can lead to energy savings, pollution minimization, waste recycling, green product development and management of environmental protection (Cheng, Yang & Sheu, 2014). Enterprises that pioneer green innovation will improve their corporate image and gain a sustainable competitive advantage. Leading enterprises have built their approaches to sustainable development on sustainable, green, eco-innovations including the following: 1) the enterprise understands what society expects of it, in turn clearly expressing what the enterprise itself stands for; 2) developing tools and approaches to improve performance in the social, environmental and economic pillars of sustainable development and incorporating these tools into routine business processes; 3) setting focused goals and establishing means of measuring performance, as well as confirming that goals are achieved.

The final results of eco-innovations can appear in many forms, including the achievement of various sustainable goals of business operations. They can be technological (as in the case of eco-innovations), service-related (also known as servitization), as well as innovations that shape systems and consist of related sets of innovations. The implications of innovations that shape systems are to change cities, sectors, economies or other systems towards more sustainable development, which is necessary considering the challenges of the modern age: climate change, excessive emissions and the greenhouse effect (Draper, 2013).

Conclusion

Enterprises should spread the concept of sustainability throughout the enterprise and consider themselves part of society, not separate from it. This requires that the values and aspirations of the top management and owners are aligned with the concept of sustainability. This conception implies that sustainability is not an attribute of an individual enterprise, but can only be applied at the system level, which requires cooperation with actors from the private sector, the public sector and includes civil society partners (green relational capital) and investment in system solutions. This new approach to innovation should be communicated throughout the enterprise and integrated into the employee reward system, in order to improve green human and structural capital.

Collaboration with different stakeholders helps to engage in dialogue, gain social legitimacy, find opportunities to acquire new knowledge and also helps to find creative and responsive solutions such as eco-innovations. Stakeholders need to learn how they can find, form and operate within new innovation systems, which are characterized as eco, green and sustainable. This can be achieved by experimenting and learning with new approaches to sustainability, while maintaining the existing business model. This allows enterprises to adapt knowledge management processes risk-free to their business model, while developing an effective management approach that integrates foresight and new stakeholder collaborations. It is also important to note that not only the environmental and economic implications are taken into account, but also the social, political and ethical implications of the innovation.

The challenge for enterprises is to find new ways to align innovation with public expectations and thereby provide a governance framework that is based on discussion, decision making and then delivering sustainable value. Leading enterprises have realized that this depends on understanding the evolving nature of society and redefining

the relationships they want to build with customers, employees and suppliers, with governments and the public at large. This approach implies recognizing the connection between rights, roles and responsibilities in society.

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