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УНИВЕРЗИТЕТ У БЕОГРАДУ
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Stefan Vukicevic¹, Sanja Milosevic²¹Lund University School of Economics and Management²Microsoft Serbia

IT, Innovations and Sustainability

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Today there is growing need for questioning the usage of resources of every kind based on limitations that inevitably exist regarding that use. This pattern is especially noticeable in dynamic and fast developing industry areas such as the area of information systems and technology. Particularly in this area it is necessary to stress how development and innovation, produced in that process, are affected by sustainability. This is one of the topics which this paper deals with. Also, this paper attempts to highlight the importance of that influence and the manner in which organizations are affected by it. This is done by reviewing the actual research in this field of study. Additional attention is paid to the definition and recognition of terms such as sustainability and innovations, so that consequences and the ways to deal with them could be easily comprehended and accepted. The implication of this paper, that could be both academic and practical, presents us with the goal of sustainability that society and organizations will need to achieve in the future as one of the milestones of progress and development.

Keywords: Sustainability, Innovations, Sustainable development, Information systems and technologies

1. Introduction

One of the key characteristics of every natural resource is the limitation of its usage. This limitation is transferred to today's economy and society as a very strong influence. Limitations have a very important place at the beginning of every business or social activity, but also in the end as a final goal that should be achieved. These influences can be looked at from different perspectives, such as ecological, social, economic, etc. Although they have various approaches, all of them focus on the same problems, and can be covered by one term, that of sustainability.

Today's world is characterized by big progress and innovations, in almost every direction. Maybe the most dynamic one is the field of information technologies and systems. By looking just on previous ten years of innovations in that area it becomes clear why that is true. With information technologies and systems and innovations expansion, interaction between them and sustainability become stronger and more significant. To be able to examine that mutual influence between information technologies and systems, innovations and sustainability, it is important first to explain some key concepts.

2. Sustainability

The term sustainability is widely used and known, but despite that it is not simple to define it. This is the case because sustainability definition is very much determined by our views and beliefs. Thus, sustainability for a biologist means being able to preserve some species, but on the other hand, to an engineer, sustainability will be the possibility to reuse energy.

Therefore we can define sustainability in two different ways, the weak and the strong sustainability. Weak sustainability proposes that general well-being cannot be decreased, which means, for example, that any use of natural resources is not bad while is doing well to people. On the other hand, we have strong sustainability that separates resources that are created by nature, from the ones that people create. This means that natural resources are limited and if people transformed them, their value cannot be reused. (Jamieson, 1998; Vucetich, 2010)

Sustainability could also be observed from other perspectives according to Gladwin, Kennelly and Krause (1995) such as:

- **Technocentric view**
This point of view is similar to strong sustainability. According to this view natural resources are exploitable without special limitations, humans are superior to nature, economy is isolated from nature and it encourages global growth.
- **Ecocentric view**
This point of view is more similar to weak sustainability. The value of this view promotes earth as alive, fragile and sensitive to human's actions, where human population is already reached the maximum.
- **Sustain-centric view**
This point of view is trying to reconcile the previous two. its main characteristics are that earth and humans are connected in one system, population must be stabilized, economy and ecological systems are underpinned.

Besides this definition, sustainability can also be defined as regards different understandings of time line. From one point of view, the period that is important is present, from another, that is the future. In this sense sustainability should satisfy the present needs or satisfy the needs of future generations. (Jamieson, 1998)

Although sustainability can be defined in more than one way, it is important to remark that every one of them is both correct and incorrect, depending on the perspective and beliefs. This is one of the reasons that make it difficult to give one unique definition of sustainability, but common to all of them is that sustainability brings positive things to its creators.

3. Sustainable development

Sustainable development represents the processes or means that are used to achieve the goals of sustainability (Diesendorf, 2000). By observing the previous definitions of sustainability it is easy to notice a connection with economy, industry or, in one word, organizations. The primary goal for almost every organization is to obtain profit. In that way goals of sustainability often do not correspond with goals of the organizations, but still the need for organizations to be sustainable is present.

According to the research, the main reasons for that are: competitiveness, legitimacy, environmental responsibility. These reasons affect organizations in different ways. First, there is competitiveness whose main goal, from the organizations' perspective, is to gain long-term profit and competitive advantage by being sustainable through managing waste and energy matter, obtain higher output for the same inputs, green marketing, etc. The second reason, legitimacy, refers to organizations' need to adopt standards from their area of business, so that they could achieve stakeholders' satisfaction. The third reason is mainly the merit of strong individuals in the company, and as a result gives satisfaction and an effect of a good deed. These and other motivators do not stand alone, but they are affected by many other influences, which twist and change them and accordingly change the perspective and actions of organizations. (Bansal and Roth, 2000)

Once the motivation that drive companies to be sustainable is known, it is necessary to explain how they can achieve that goal through sustainable development. Here again it depends on the different ways in which sustainability is understood. As it was mentioned before, sustainability could be hard or soft. Now, looking on this from the perspective of organizations, some of them pay more attention to sustainability as a goal as well as to the manner in which it can be achieved. As a result of this action it is possible to produce negative ecological impacts.

The solution for this could be the ecologically sustainable development, which is trying to reconcile hard and soft tendencies from organizations' perspective. There are four mechanisms in which organizations can reach ecologically sustainable development:

- Total quality environmental management
- Ecologically sustainable competitive strategies
- Technology transfer
- Corporate population impact controls

This will give to companies quality guide lines, but unfortunately this it is not often enough, because besides this, there are also external factors as governments and consumers that must be involved, so that true ecological sustainable development could be achieved. (Shrivastava, 1995)

4. Sustainability and IST

The above description of sustainability and organizations refers to a more general approach to this topic, but there is one more specific part that is very important, not only for organizations, but also for other parts of society, and that is Information Systems and Technologies (IST). Not so long ago the field of IST was not of big interest for sustainability, but thanks to the fast progress in that field things are now changed. ISTs were first perceived as the means to help sustainability; now there are a lot of reasons that question that point of view (Ijab, Molla, Kassahun and Teoh, 2010). Because of this, today there is a strong bond between IST and sustainability, as well as the need to research that bond better. As information systems and information technologies complement each other, further below they will be looked at as a unity. (Hevner, March and Park, 2004)

The relationship between IST and sustainability can be divided into two parts. The first part concerns the negative effects that production, usage and disposal of IST can have on sustainability. Besides, IST can effect sustainability in other, totally opposite, directions, as a great force that drive companies and society to achieve goals of sustainability. (Watson, Boudreau and Chen, 2010; Davison, 2004)

To explain how IST can help achieve sustainability in organizations, further in the text, institutional theory will be explained. Information systems supported by information technologies can act in three ways:

- Automate
- Informate
- Transfere

Automation improves the efficiency of processes by replacing manual labor with cheaper and faster automated IST processes. IST helps inform individuals and organizations by connecting different parts of a system. Transfer have important role in the reorganization of systems, where the application of the Internet can be used as a good example. (Chen, Boudreau and Watson, 2008)

Now, when the actions of IST are known, the question is where these actions should be directed so that they could help in achieving the goals of sustainability? The answer to this question, according to Thomas and Kai (2002), is: eco-efficiency, eco-equity and eco-effectiveness. Those are the three goals of sustainability that IST can improve. Eco-efficiency represents an economic pressure on companies or individuals that forces them to be sustainable so that they could achieve bigger profits. Eco-equity is time-oriented and suggests that all generations should have the same chance and right to consume common recourses and effects on surroundings. Eco-effectiveness represent a complete change of approaches and beliefs that are connected with sustainability, rather than improving individual parts of systems. (Watson, Boudreau and Chen, 2010)

Bearing in mind the properties of the previous IST actions and goals that could be improved, it is easy to notice how they can be paired up. So there are: automate and eco-efficiency, informate and eco-equity, transfer and eco-effectiveness. According to the institutional theory, applying different types of pressures like mimetic, coercive and normative to these actions of IST, individual goals can be accomplished and at the same time sustainability can be achieved. It is important to say that these types of pressures are not the only one or necessarily the right motivators. (Chen, Boudreau and Watson, 2008)

This is the case because they could be differently structured; according to Kuo and Dick (2009) there are: competitive pressures, legitimation pressures, social responsibility pressures, organizational factors and technological constraint.

In addition to the positive effect that IST can generate, there is also a negative one. This dimension is especially important, because of the growth that IST industry undergoes. This statement supports the facts that IST industry created 5.4% of global GDP in 2008 and predictions are that in 2020 this would be 8.7% of global GDP. (Soumitra and Irene, 2010)

The best way to overcome the problems that IST can create in the field of sustainability is to distinguish them first. According to Vykoukal, Wolf and Beck (2009) there are three fields of IST that can affect sustainability and those are:

- Green Design and Manufacturing
- Green Use
- Green Disposal

Every one of those fields refers to different aspects of IST life cycle, which means that IST is always a possible threat for sustainability. For example, production processes can be inefficient during production, then during the usage, power consumption is not managed appropriately and in the end of the life cycle there could be irregular disposal. For dealing with these problems we could say that there is no wrong way to do that, only a more or less efficient one. So by improving individual aspects of the life cycle, or by suggesting special approaches as implementation of Grid infrastructure, some efforts will be made toward removal of threats to sustainability. (Vykoukal, Wolf and Beck, 2009)

5. Innovations

The term innovation is used very widely and often today, but this does not mean that it is used correctly and in the right context. Simply said, innovations represent something new or some newness. But newness is not necessarily an innovation and other way around. So some newness could be innovation, despite the fact that all elements of that newness are very well known, but the different application and understanding made that newness an innovation. (Slappendel, 1996)

From this it is possible to conclude that the definition of innovation is a more relative than strictly defined term. To be able to put a definition into a theoretical frame, Johannessen, Olsen and Lumpkin (2001) propose that three dimensions of newness should be examined:

- What is new?
This question should define true values that distinguish innovation.

- How new?
Here the orientation is to a degree to which newness contributes to innovation, for example there are radical or incremental innovations.

- New to whom?
The main purpose of this question is to explain that innovation can affect different sides, such as for example: company that created innovation, customers and competitors.

As mentioned above, innovations can be looked at from different perspectives. Most important are the perspectives of organizations' and users'. Organizations are among the biggest creators of innovations. Besides, organizations that do not embrace innovations, risk to fail in achieving their goals (Bower and Christensen, 1995). Because of these it is important to evaluate their relation with innovations.

The relation between innovation and organization can be viewed from the individualist perspective, the structuralist perspective and the interactive process perspective. The first perspective assumes that the main forces of innovation in an organization are individuals. For this to happen, individuals need to have a predisposition for innovative behaviour. The second perspective, totally opposite from the first one, defines the source of innovation from organizational characteristics. In the end there is a perspective that tries to account for both and explain that innovations in organization are produced by combining actions of individuals and structural influences. (Slappendel, 1996)

The main problem with the above quoted explanation of sources of innovation in an organization is that only inner factors are included, without taking into consideration very important outer ones, such as users. According to Bogers, Afuah and Bastian (2010), users are very often the source of innovations and their influence rises all the time. Also, Von Hippel (2007) suggests that very often users of goods are the ones that initiate the development of new products, which can be best seen on the example of rapidly changing industries such as mobile industry and open source industry.

In addition to the mentioned field of innovation creators, there is also one more dimension that is very important. This is the relation between innovation and sustainability. Especially today, the mutual relationship between innovations and sustainability is very much apparent (Davison, 2008).

As sustainability today presents a very actual question, companies are trying to get involved in that area. One of the reasons is measures of governments, but a more important one is competition. In this field companies struggle with a dilemma to choose sustainability and then to be in a disadvantage in comparison with the competition that did not chose that way. The solution as to overcoming this dilemma faster lies in innovations. This connection has a reciprocal character, because sustainability also represents the strong encouragement to innovate. A model that supports achieving both sustainability and innovation suggest five stages for that:

- Viewing compliance as opportunity
- Making value chains sustainable
- Designing sustainable products and services
- Developing new business model
- Creating next-practice platforms

By going through these stages and achieving sustainability, the company will gain different opportunities to innovate, such as to experiment with new sustainable materials, to use clean energy, develop new packaging, create business models that combine digital and physical infrastructure, use by-product energy. (Nimolu, Prahalad and Rangaswami, 2009)

Conclusion

Summing what was already above mentioned mentioned it is obvious that sustainability, information systems and technologies and innovation advance at a high speed. In that way, the fact is that they are becoming closer and more connected every day. Although that mutual relationship could also have some negative effects, they are just small obstacles that will eventually be overcome. If this trend continues to rise at the same rate, it is very possible that in the future there will be no need to talk about this topic. The reason for that is because both innovations and information systems and technology will already have included the goal, namely, achieving sustainability in every one of their activities. Researching these topics from a theoretical point of view helped us recognize the future trends that will inevitably occur. This will help organizations direct their efforts to progress in a way that will be beneficial both for themselves and for others around them. Most research into some topic starts with a theoretical overview, therefore this research will highly benefit from further qualitative and quantitative research that will support this topic with appropriate data in order to gain in-depth understanding about it. These efforts will speed up shifting and applying of mentioned principles to practice.

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About the Author

Stefan Vukićević

Lund University School of Economics and Management
email: stefa086@gmail.com

Stefan Vukićević is a recent MSc graduate in Information Systems at Lund University School of Economics and Management. He proceeded with his education after a year and a half work experience in retail in Serbia, with a focus on application of information technologies and systems in business environment. He previously graduated at the Faculty of Organizational Sciences, University of Belgrade.



Sanja Milošević

Microsoft Serbia
email: sanja.milosevic@microsoft.com

Sanja Milosevic is currently employed at Microsoft Serbia as Partner Account Manager at the department of Small and Midmarket Solutions and Partners, engaged in working with partners on developing their solutions and growth of their business on local market of small and medium enterprises. She obtained a BSc degree as well as a MSc degree from the Faculty of Organizational Sciences, University of Belgrade majoring in Project management.

