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SUSTAINABLE ENTERPRISE BY SUSTAINABLE PRODUCT? A CASE OF SMART HOME SYSTEMS

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ABSTRACT: The notion of sustainable development becomes an increasingly important element in economic and social development planning. Therefore, in this context, such notions have appeared as: sustainable consumption, sustainable product or sustainable enterprise. The first part of the article contains identification of the notion of a sustainable enterprise and the determinants characterizing such an entity. In the second part an attempt has been made to assess whether the product in the form of an electric energy consumption management system can be considered a sustainable product. This evaluation has been conducted using the analysis of potential economic, social and environmental effects accompanying the use of electric energy consumption management systems in households. This assessment is to estimate the chances for obtaining the sustainability status by IT enterprises.

KEY WORDS: sustainable development, sustainable enterprise, sustainable product, smart home

Introduction

The conversion of the economy into a sustainable economy is becoming a challenge for an increasing number of countries, not only among the EU member states. One of the considered responses to these challenges is the circular economy concept. It is based on the necessity of transforming the production and consumption models towards a decrease in the scale of use of the environment (Korhonen et al., 2018). The transformation process development features formation of postulation concerning the stakeholders participating in the market. Thus, sustainable consumption (Scholl et al., 2010; Lim, 2017) and sustainable enterprise (Sharma, Ruud, 2003; Schaltegger, Wagner, 2010) models are emerging. The models assume, among others, decreasing the negative impact on the environment by reducing the quantity of consumed non-renewable resources (Milligan, O'Keeffe, 2019), decreasing energy consumption (Brown, 2015), promoting increased share of renewable energy sources (del Rio, Gual, 2014). These activities are intended to establish a model of economy with substantially lower natural environment interference, but with maintenance of the economic and competitive potential. In case of many enterprises, the following question arises: how to introduce the postulation of sustainable economy into the conducted activity profile?

This question also concerns the IT branch. IT enterprises are viewed by the society as having minor negative impact on the environment. This view probably has its roots in the subconscious comparison to the sector of heavy industry or mining enterprises. When examining this issue in relative terms, it is possible to conclude that IT enterprises deserve the label of sustainable enterprises. However, public perception is not a determinant which indisputably resolves the issue of classifying an economic entity into a specific category. Therefore, two fundamental research questions are outlined:

1. What are the features of a sustainable enterprise?
2. Can an IT enterprise achieve the status of a sustainable enterprise by offering energy consumption management system solutions?

Providing answers to the above questions is the main purpose of this paper.

Sustainable enterprise characterisation

The interest of enterprises in the concept of sustainable development as well as decision-making in terms of social and environmental issues is related, among others, with the existence of such factors as (Brzozowski, 2015, p. 139):

- changes in the expectation of communities, including consumers and organisation employees, related to increasing awareness and creation of new, sustainable values concerning the model of consumption, safety of products, working conditions, etc.,
- changes in the technological environment and substantial increase in knowledge, thus enabling broad opportunities for creating changes in the methods of organisation functioning, offered products and services,
- institutional and legal conditions which determine the desired directions and framework of development of the economy and particular entities (Przychodzeń, 2013).

The term of sustainable development in relation to enterprises *(Sustainable Enterprise Development)* was firstly used during the World Sustainable Development Summit in Johannesburg in 2002, where attention was paid to the substantial role that enterprises can play in favour of sustainable development (*Business Action for Sustainable Development).* The summit proposed a public-private partnership and the necessity of socially-responsible management, which in consequence contributed to the attempt of adapting the concept of sustainable enterprise development globally. However, the concept of sustainable enterprise development causes a lot of discussion and conflicts, because as of yet the definition of a sustainable enterprise or the possible benefits of incorporating new principles of operation have not been precisely established (Raftowicz-Filipkiewicz, 2013).

When analysing the subject literature, it is possible to assume that the sustainable enterprise development category is presented in many aspects. The *Triple Bottom Line* concept proposed by J. Elkington (2004) assumes that an enterprise's success depends on its economic, ecological and social dimensions. It especially concerns the individual behaviour of entrepreneurs in relation to social and ecological problems, which translates into the ethical dimension of conducting economic activity (*Business Ethics*). Simultaneously, the issue also related to the important role played by an enterprise in a society *(Business and Society*), which is linked to the concept of enterprise citizenship *(Corporate Citizenship*) or enterprise social responsibility (*Corporate Social Responsibility* – CRS) (Paszkiewicz, Szadziewska, 2011).

In their decision-making process, which includes the estimation of profits and losses, enterprises should take into consideration the so-called social costs of the decisions, responsibility for the natural environment and local community, inclusion of social objectives in the company's strategic objectives, monitoring and measuring the costs of social programs as well as the degree of execution of the assumed achievements, reliable creation and sharing of reports on the degree of execution of social and ecological objectives as

well as reports on the status and expenditure of resources intended for the company's sustainable development system (Adamczyk, 2009).

Enterprises should feature mutual interactions between the achievement of particular groups of objectives. The achievement of economic objectives in the form of, among others, profit is a necessary condition for taking on ecological and social actions. The functioning of an entity also depends on the level of acceptance of its products and activity by the surroundings, which translates into the improvement of economic results. It is therefore important to skilfully coordinate a company's activity in three areas by achieving its main objective of maintenance and development on the market (Szadziewska, 2010). The inclusion of the sustainable development concept in the achievement of an enterprise's objectives is presented in figure 1.

When taking into consideration figure 1, it is also necessary to emphasise that an enterprise's sustainable development is possible only when it includes an integration of economic, ecological and social objectives both in short- and long-term. This translates into the designing of activities that are socially responsible, ecologically friendly and economically valuable (Kryk, 2005, p. 200). These activities include, among others, the following (Szadziewska, 2010):

- rational use of natural resources,
- preventing negative impact on the environment by, among others, using new eco-friendly technologies and devices reducing the quantities of released pollutants,
- taking on initiatives aimed at supporting local communities, e.g. by executing sponsorship and charitable activities,
- taking care for the quality of manufactured products,
- investing in natural environment protection undertakings,
- compliance with the principles of ethics in the relations with employees, partners and consumers.

According to Laville (2004 p. 26), enterprises are sustainable when they aim at achieving long-term sustainable growth and development ideas by, among others, strong engagement in promoting social and ecological values, dialogue with stakeholders (especially in crisis situations), committing to the transparency of actions and diffusion of information about the enterprise or responding to direct (or indirect) effects of conducting economic activity (Raftowicz-Filipkiewicz, 2013). This means that an enterprise which claims to be sustainable should change the current functioning paradigms – from traditional to sustainable development – which is presented in table 1.

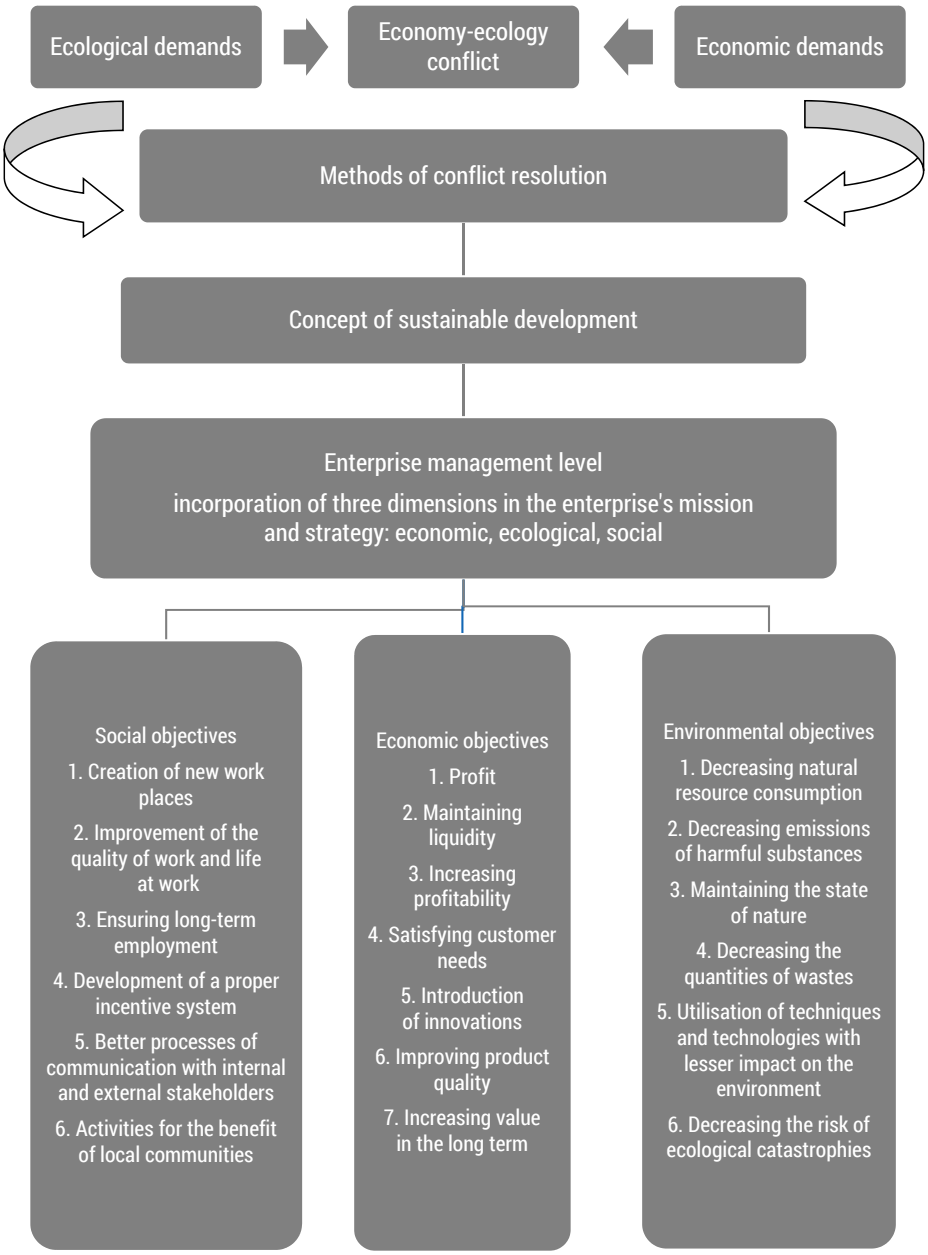

Figure 1. Concept of sustainable development in achieving an enterprise's goals

Source: author's own work based on: Szadziewska, 2010 p. 161; Paszkiewicz, Szadziewska, 2011, p. 630.

Table 1. Comparison of a traditional enterprise with an enterprise oriented on sustainable development

	Enterprise from the neo-classic perspective	Sustainable development-oriented enterprise
Purpose	Profit maximisation	Sustainable development and growth, care for stakeholders and the environment
Product	Functional	Eco-friendly, socially responsible
Manufacturing system	Intensive	Extensive
Organisation	Hierarchical, authoritarian, centralised	Networked, responsible decision-making, decentralised, transparent
Environment	Nature governance	Harmony with nature
Vision	Adequate for the interest rate	Long-term, taking into account the needs of future generations
Values	Material, rational	Immaterial, social and ecological

Source: Raftowicz-Filipkiewicz, 2013.

The stages of enterprise evolution in the course of sustainable development are presented in detail by Klinkers and others (Klinkers, van der Kooy, Wijnen, 1999, pp. 91-10). According to them, the first stage embraces factors that reduce the negative environmental effects created as result of enterprise operations. These include ad hoc activities not oriented on the processes taking place in an enterprise but aimed at reducing pollutant emissions at the end of the production process and improving the state of the environment. At stage II, enterprises focus on the production process and any environmental problems are removed much earlier, even before they occur. In the next stage, processes that take place in a company and the products manufactured during them are controlled in terms of their environmental impact and the occurrence of any interference is corrected systemically (the enterprise possesses an environmental management system). At the next stage, the focus is shifted from a single enterprise to the entire production chain (suppliers and recipients). The last stage of the process is based on responsibility towards society and satisfying its needs. An enterprise does not operate by focusing only on economic benefits, but also reacts to social needs and takes into account ethical criteria (Zuzek, Mickiewicz, 2014).

Currently, western experts believe that enterprises are entering the so-called ecological stage (Bloom et al., 1996). The pro-environmental orientation is becoming especially important in Europe. It is believed that an enterprise's success depends on the degree of its integration with the natural environment and using technology as well as production of products that

meet ecological criteria. The predominant position in subject literature is that the pro-ecological attitude of enterprises, related to their ecological responsibility, positively affects their competitive position. When building an enterprise's competitive position, it is possible to use various environmental management models. Special attention is paid to systems related to the possibility of evaluating achievements utilising the experience of various companies with the use of benchmarking, for instance. The practical possibilities of such a solution are greater than when using natural environment management set mainly on creating strategies and policies. Such models feature the use of particular groups of indicators related to (Chodyński, 2007):

- the natural environment management in relation to the vision, strategy, policy, organisational structure and management system with consideration of the foreseeable effects on the natural environment and communication with internal and external stakeholders,
- the achieved operating results via measurements on processes and technical aspects of products, using these products and servicing activities as well as cooperation with suppliers. The impact on the natural environment, related to the consumption of energy, water, materials, emission of greenhouse gases and total waste quantity should also be subjected to analysis.
- indicators related to the impact on local, national, international conditions and on the ozone layer, increase in global temperature, oceanic fish population, pollution on local and regional level, impact on population density. The noise around enterprises should also be taken into consideration.

Any activities taken on by an enterprise, which minimise the negative impact on the natural environment can be deemed as a manifestation of the sustainable development concept. Companies thus contribute to the maintenance of the proper quantity and quality of natural capital, which is essential for the satisfaction of the needs of current and future generations as well as adapting the scale of the economy to the ecosystems in which it operates (Zuzek, Mickiewicz, 2014). In the case of sustainable development, enterprises can also determine specific, unique, ecological competing instruments. These instruments include the following (Jabłoński, 2010):

- ecological quality of products and technologies,
- ecological innovation meaning the organisation's ability to introduce innovation in relation to the market in terms of external ecological tendencies and internal company conditions,
- flexibility in adapting ecological products to customer needs in relation to marketing mix activities,

- creating a pro-ecological company image in relation to the positive perception of an ecological product brand,
- lowering the costs of activity through pro-ecological management.

The best-known way of implementing the sustainable development concept at the level of enterprises is the cleaner production programme. This idea dates back to 1980s (USA), and makes the need to protect the health of people and the environment considered in the organisation and the technology used. This applies to the production phase as well as other product life stages (Rybak, 2004). Suitability and effectiveness of the clean production concept can be examined using the European programme for management and environmental audits (EMAS). EMAS is a concept of environmentally-oriented management of a business entity, incorporating continuous monitoring of the condition of the environment, associated with or exposed to the effects of the entity. EMAS encourages reduction in harmful actions, obligates to comply with the requirements formulated by the law as well as enforces accountability for preserving environmental standards. It makes it possible to implement corrective programmes, providing subsequent stages of improvements, determining the schedule of activities and appointing the persons responsible for their implementation. EMAS implements environmental management systems, orders notifications for the society concerning the effects of activities (reporting), imposes obligations on the employees, subcontractors, business partners with regard to eco-management (Rybak, 2004; Brzozowski, 2010).

However, this is not the only instrument for verifying performance in implementing the sustainable development concept. Other, equally universal ones should also be remembered, as, for example, the Global Reporting Initiative (a popular framework reporting model for economic, social and environmental performance), UN Global Compact (human rights, labour standards), Sullivan Principles (global social responsibility), OECD Guidelines for multinational corporations, INNOVAST (investment analysis in the scope of sustainable value, or standards of the Caux Round Table: CA8000, ISO14000 ISO14063, ISO26000, AA1000) (Brzozowski, 2010).

Energy consumption management systems as a sustainable product

Energy consumption is of key importance for the introduction of sustainable development. A general tendency associated with sustainable development is the decrease in energy consumption. This decrease should concern both the sector of enterprises and individual recipients. In the case of indi-

vidual recipients, the reduction in energy consumption is related to many factors. These factors can include: presence of individual sources of energy, type of used equipment and technical parameters of buildings. Therefore, making the choices resulting in actual reduction of energy consumption requires relatively vast knowledge in various disciplines. An equally important and complex issue in this case is the monitoring, management and forecasting of energy consumption including the related costs. Presence of energy sources, the performance of which is related to weather conditions, existence of habits unnoticed by the recipient, which cause excessive energy consumption, use of household appliances in an unskilful, ineffective manner are the factors that have substantial impact on the final level of energy consumption. High hopes were related in this aspect to the dissemination of smart meters as tools supporting better energy consumption management. Unfortunately, in general, the devices provide access to collective energy consumption statistics in the scale of a household and do not allow identifying the critical areas of its use (Kugler et al., 2013). Therefore, this solution had to be evaluated as insufficient. In the view of this fact, the concept of integrated energy consumption management systems was becoming formulated as an element associated with the idea of the so-called smart home. The concept of household energy consumption management support systems was mainly described from a technical point of view (Barbato et al., 2014; Fernandez et al., 2016; Martellotta et al., 2017; Anandalakshmi et al., 2014; Bouhafs et al., 2014; Beaudin et al., 2017). The primary functionalities of an energy consumption management system are as follows (Bouhafs et al., 2014):

- improvement of the effectiveness of electricity consumption,
- ensuring exchange of information for the purpose of better management of the household infrastructure operation,
- designation of an optimal scheme of resident functioning and their activities with the purpose of achieving the highest possible level of savings,
- changing the functioning of a household without violating the users' comfort of life.

The system user can therefore use such information as detailed reports on energy consumption (Ford et al., 2017) or forecasts on the future energy demand and the related costs (Shakeri et al., 2018). This information is aimed at providing recommendations concerning possible activities resulting in a reduced energy demand. The energy consumption management system elements can also include modules ensuring the optimal use of renewable energy source systems (Hemmati, 2017). One of the newest trends concerning this topic is the use of the so-called Internet of Things (IoT) idea (Sha et al., 2018), which is deemed as one of the most important contemporary technological trends (Lopez et al., 2017). This term is understood as a collection

of devices connected with one another via an Internet interface and communicating autonomously without any intervention of a human operator (Conti et al., 2018). The utilisation of this idea in the case of energy consumption management systems would allow to substantially facilitate executing many activities. In would allow in turn to acquire data and centralise the control of the operation of executive elements (in this case household appliances). This concept is related to specific expectations, but also risks.

Not questioning the importance of the technical issues, focusing only on them does not allow a comprehensive evaluation of the project assumptions in terms of meeting the sustainability paradigm. In order to conduct such an evaluation, it is also necessary to consider issues related to social aspects and whether is it actually possible to achieve an environmental effect. This evaluation is all the more justified that even the intended use of such a system, i.e. reduction of energy consumption, was cast in doubt (van Dam et al., 2013). Overall evaluation of the energy consumption management system product requires synthetic inclusion of all factor groups taken into account: environmental, social and economic. The overview of the factors taken into account is presented in the table 2.

Table 2. Comparison of the potential positive and negative effects in terms of balancing energy consumption management systems

	positive effects	negative effects
environmental	smaller energy consumption in buildings, potentially better use of the renewable energy sources system, increase in demand for energy-saving devices	necessity of replacement and disposal of obsolete household appliances
social	potential increase in interest in energy effectiveness issues	narrower possibility of use for economically weaker social groups and persons affected by energy poverty, potential transfer of hazards related to malicious software to the area of use of household appliances, interference in the users' private life
economic	financial benefits for system providers	possibility of incurring unjustified costs by the users

Source: author's own work.

When considering a synthetic inclusion of factors affecting the balancing of energy consumption management systems, it is possible to notice a heterogeneity of the impact of the factor groups. The weakest side of the discussed systems is definitely the social effects. Positive social aspects of the introduc-

tion and use must be evaluated as very modest in relation to potential negative effects. It is however necessary to state that several different variants can occur. In the case of a certain part of consumers demonstrating strong orientation towards pro-environmental attitudes, the system utilisation can contribute to the formation of a tendency to increase knowledge and awareness concerning environmental hazards and activities available for the individual to counteract them. These activities will mainly include ones aimed at energy savings, but it cannot be excluded that consumers can also be interested in other environmental aspects of their lifestyle. In other cases, achieving environmental benefits seems rather doubtful.

Slightly smaller doubt can be expressed towards environmental benefits. Indeed, the reduction of energy consumption in an individual scale constitutes one of the substantial trends in the European environmental policy. Thus, the energy consumption management system is consistent with the role of a tools that supports achieving the assumptions of the policy mentioned. The overall environmental effect is not however dependent only on the reduction of energy consumption. For the overall evaluation, it is also necessary to consider the environmental costs related to the replacement of obsolete household equipment. Due to the fact that the scale of this phenomenon is unknown, it is difficult to provide more detailed estimations.

Relatively smallest controversies are related to economic effects. The described solutions, as commercial products, are planned up to a specific level of risk. The economic benefits of users seem to be lightly more uncertain. These benefits depend on the fulfilment of a series of conditions resulting from the circumstances associated with the system utilisation.

Conclusions

When developing a final account of the presented deliberations, it is necessary to state that offering energy consumption management systems can bring an IT enterprise closer to achieving the status of a sustainable enterprise. However, such undertaking involves a very high level of risk. The risk is related to the unstable status of energy consumption management systems as a sustainable product. The balancing of such systems depends on the fulfilment of a series of hard-to-guarantee assumptions related mainly to negative social and (despite all) environmental effects. The occurrence of such effects must be deemed as probable.

There is no doubt that falling into the category of sustainable enterprises is an extremely valuable image factor. The fact allows for easier acquisition of various clients. An especially susceptible group includes clients attaching

great importance to social and environmental aspects. However, clients with a more indifferent attitude towards such problems are usually more inclined to trust such enterprises. Not surprisingly, various companies seek this label, including companies which have nothing in common with the concept. In the near future, it will become necessary to develop methods of enterprise auditing and verification in these terms.

The contribution of the authors

Sylwia **Słupik** – 50% (conception, literature review, analysis and interpretation of data).

Paweł **Lorek** – 50% (conception, literature review, analysis and interpretation of data).

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