MODERN CONCEPT AND STRATEGY OF SUSTAINABLE TECHNOLOGIES IN THE FOOD INDUSTRY

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Abstract: This paper analyzes the nature and significance of the term "sustainability", emphasizes the importance of carrying out certain activities in food production, with an emphasis on the food industry. A number of developed countries in the world have developed and adopted a strategy for sustainable development and provided appropriate solutions for strengthening sustainable technologies. These documents propose concrete solutions with deadlines within which the industry should achieve the goals set in the strategy. In other countries of the world, this is an issue that is still being discussed between the government and consumers, on the one hand, and industry on the other. In modern thinking, the idea of sustainability has been extended to the requirement to ensure a sustainable future. Several environmental factors are included in the discussion. The modern concept of sustainable development includes a balance between human activities and social, economic and environmental factors. Companies have a threefold role in this: they must take into account their impact on the environment, the fulfillment of social requirements and economic business and accountability to investors and employees.
Keywords: sustainable development, food industry, food.

1. INTRODUCTION

The relationship between man and nature is a kind of constant, ie a theme that dates back to the earliest days of human civilization and which developed in parallel with the development of society, finding its place in the works of ancient and medieval thinkers. Life on Earth changes from year to year. Its population is growing, there is less and less arable land and forests, hectares of deserts are multiplying, while toxic chemicals are released into the environment and various oxides are emitted. The reduction of agricultural land occurs due to decomposition, ie erosion, salinization, alkalization and chemical degradation. In addition to agricultural land and forests, water systems in seas and inland waters have also been degraded, in which harmful substances are found in unacceptable quantities and have a detrimental effect on flora, fauna and man himself. And it is precisely man with his activities that is the main factor in changing the environment, and that is why the readiness of every individual and all social groups and institutions to include radical measures for the preservation of the environment in development plans is needed. These measures include new technologies adapted to environmental requirements, but also a different human understanding of the possibilities and needs of living on Earth (Glišić, 2021). Sustainability is a very broad term. In order to understand that, it is necessary to answer many questions, which are relevant for the environment, the economy and the food chain. The definition of sustainability is somewhat ambiguous and occasionally burdened with political views. The definition, given by the United Nations in 1987 in the Bruntland Commission Report on "Our Common Future" and in the "Declaration of the World Business Council for Sustainability", emphasizes the importance of the environment and the need to improve relations between man, the environment and the global market. Initially, companies responded to these requirements with strict adherence to environmental and environmental management standards. Sustainable development has been interpreted as the need to improve environmental performance and reduce the negative impacts of business on natural resources and systems. The companies were engaged in meeting the requirements and standards prescribed by the governments of individual countries. Contemporary thinking about sustainability extends the idea to securing a sustainable future by including several environmental factors (Azapagić et al., 2003). Now the concept includes a balance between human activities and social, economic and environmental factors. Companies have a threefold task: they must take into account their impact on the environment, with simultaneous social and economic responsibility (Glišić, 2021).

2. SUSTAINABILITY IN THE FOOD SECTOR

The food supply chain affects the diet of every individual on planet Earth. Therefore, sustainable development of the food supply chain is imperative in the present and future times. In this spirit, sustainable development is defined as “meeting current needs, without compromising the ability of future generations to meet their own needs” (WBCSD, 2002). Other names are also used for the food supply chain, such as "food industry" or "food system". In this

context, the food supply chain includes various aspects of production, processing, distribution, customer purchase, consumer use and end-of-life products (Baldwin, 2009). Food production is a process that significantly affects climate change. The literature (Hendrikson, 1996; Bellarby et al., 2008) states that agricultural production is responsible for 17-32% of total greenhouse gases emissions. Livestock is leading in that, and thus the production of meat and milk and the production of meat and milk products. The development of sustainable agriculture and the food industry are essential elements of long-term economic and environmental plans. The population of the Earth is constantly increasing. Increasing the world's population means increasing the consumption of food, fuel and other products, which further means greater dependence on non-renewable natural resources. Most of the phases in the supply chain are large consumers of water (25% of total water consumption in the world and 50-80% of water consumption in industrialized countries) and energy (16% of total energy consumption in the USA falls on the food supply chain). The most important sustainability issues in the food supply chain are: energy use, waste generation, water and gas pollution, climate change, impact on biodiversity, impact on quality, safety, quantity and price of food, employment and employee rights (Kramer, 2003). Sustainable practices benefit, and will continue to benefit, society and the environment on a global scale. Consumer interest in sustainable food production is growing (Grujić, 2003). This interest is reflected, above all, in the desire to improve personal health and family health. Food production and processing in the world is a large sector. In the countries of the Western Balkans, food production and processing is a strategic element of development, and through food production and sale of food products on the world market, primarily the European Union market, the countries of this region see their chance for development. The following questions are sought: sustainability of biodiversity in the conditions of increasing agricultural production (domestic animal breeding, crop production, fisheries), conservation of water resources and prevention of water pollution, solving problems with increasing amounts of different types of waste, possibilities of processing and recycling food industry and primary agricultural production, efficient use of energy (rational use of existing resources, increasing the use of renewable energy sources) and the impact of energy production and use on climate change and related changes (depletion of non-renewable resources, air pollution, smog in cities and the effect greenhouses, etc.), salinity, rational use of land and river degradation, and finally the impact of chemicals on environmental pollution should be analyzed. This is a preliminary list of questions that need to be answered as soon as possible. Many of these sustainability and environmental issues are increasingly intertwined with issues related to food safety, animal welfare and working conditions in the food production process.

3. FOOD PROCESSING AND WASTE

Food processing is a large sector of industry, which is developing rapidly and has a very important role in the economic development of the whole world. There are several reasons that determine the importance of the food industry. First, the food industry processes raw materials produced in primary agricultural production (cereals, fruits and vegetables, sugar beet, coffee, corn, soy, meat, milk, eggs, fish) into new products necessary for human consumption. Second, the food industry is a branch of the economy that provides jobs and employs a large number of people. Third, the value of agricultural products increases significantly during processing in the food industry, which contributes to overall economic development. The processes of the food industry affect the environment in various ways at all stages (from raw materials that are exploited and processed into finished products to the use of finished products by consumers). In accordance with the nature of the food processing process, the main impact on nature / environment is reflected in waste generation, water use and energy use. Most of the waste is generated during primary production (about 21% of the total waste in the supply chain), while a significantly smaller amount of waste is generated during processing (7% of the total waste in the supply chain). In this process, waste is most often generated in the form of solid waste, contaminants that pollute water and air (dust, volatile organic substances and odorous substances). During various technological processes in the food industry, two types of substances are created, which do not belong to the basic products of that industry: wastes and / or by-products. In principle, by-products (by-products) of the food industry include substances created during the process, which as such or with little processing can be used in human or animal nutrition, although the production process was not intended for their production. Waste materials, on the other hand, are products created in the process of food production, which as such are not intended for use in food. For example, whey is a by-product of the dairy processing industry, which is produced during cheese production and can be used in human and livestock nutrition, and further processed to produce very valuable types of cheese and other products. Due to the small number of by-products, some producers collect them, and later process them or release them into nature. In this case, by-products can be considered as waste from the food industry. Discharge of all types of waste, including industrial waste with a high content of toxic substances and hazardous contaminants, into the environment is a dangerous act. This can have major consequences for the environment. Fortunately, according to this criterion, the food industry is one of the mild pollutants, because the content of toxic substances in wastewater and gas emissions is small compared to the chemical and other

branches of industry. Within the food industry sector, the largest producers of waste are dairies, confectionery industry (cocoa and sugar products), fermentation / distillation processes and meat processing (Dieu, 2009). It is known that waste materials generated in the food industry can contain valuable ingredients. The reasons why they are no longer used are: companies do not know how to separate valuable components from waste materials; the economic gain from re-extracting these substances is very small; there are no persons / institutions that want to buy the new products obtained in this way; there is a lack of regulations and initiatives for re-separation and recycling of products. Finally, fines and costs for waste disposal for waste-generating companies are small.

4. PRODUCTION AND PROCESSING MEAT AND SUSTAINBLE DEVELOPMENT

The modern food industry, in order to be sustainable, must apply processes and systems that will, with the maximum use of raw materials and other materials, provide adequate protection of the environment from its own pollution. However, the concept of sustainable technologies is not only satisfied with that, producers must find ways to maximize the processing of waste materials in their own factory or to prepare them for processing at another location with the possibility of making finished products. The meat processing industry is required to strengthen the social dimension of its activities (employment of more workers, employment of subcontractors, involvement in scientific and innovative research, etc.). The meat processing industry uses significant amounts of various natural resources, on the one hand, and emits various by-products and waste into the environment, on the other hand. It is one of the largest "producers" of organic waste in the food industry, in general. Every year, the meat industry in the world produces over 140 million tons of various products. The largest single meat processor in the world is China with 36% of total world production. The amount of protein of animal origin is one of the methods for determining the living standard of the population (Grujić and Miletić, 2006). The process of processing animals, in order to use it in human nutrition, affects the generation of large amounts of waste, which must be handled properly. The meat processing industry of slaughter cattle produces primary products in the form of carcasses, pieces of meat obtained by cutting carcasses and various by-products. Some of the products from this industry are not used in human nutrition, but are used for technical purposes or used as animal feed. Waste from the meat processing industry is divided into solid waste, water pollutants and air pollutants. The treatment of these three categories of waste is regulated by different regulations. The consequence is that different people take care of different categories of waste, often without mutual cooperation and the necessary consultations. All types of waste generated in the food industry interact with each other, are generated in the same industrial plants and affect the environment.

5. WASTE GENERATION

During all technological phases, the meat industry (slaughterhouses, meat processing factories, meat warehouses, plants for the production of ready meals) generates certain quantities of by-products and certain quantities of various waste wastes. The characteristics of the generated waste depend on the type of animal, the type of technological operation identified as the place of waste generation, the size of the factory and other factors. These factors are reflected in the type and amount of waste generated. More than 50% by weight of live beef cannot be processed into commercial products, 25% by weight of beef needs to be incinerated or requires special disposal conditions. 25% of the live weight of beef is not suitable for burning, because it contains a large amount of water. For that reason, the meat industry must find methods for the safe disposal of garbage, intestinal contents, blood and other ingredients. The amount of waste generated by slaughtering sheep is also about 50% of live weight, while slaughtering pigs produces less waste (25% compared to live weight). Environmental care, within the meat processing plant, should include answers to the following questions: solid waste and by-products generation, wastewater generation, air pollution, waste minimization, resource use, waste treatment (Banks and Wang, 2006). Technological operations in slaughterhouses lead to the generation of large amounts of solid waste, large amounts of polluted air and large amounts of polluted water. Even if all by-products are retained and processed in an adequate manner, large amounts of solid waste can still be generated from the garbage and sludge mixture. Many substances are emitted during the work process, which after spraying in the air give off an unpleasant odor. A large amount of strong air pollutants comes from the blood and from the water that was used to wash the plant. These substances evaporate easily and create an unpleasant odor. Finally, the processing of inedible by-products and solid waste should be mentioned. This waste is incinerated inside the slaughterhouse or outside the slaughterhouse in the rendering plant. During combustion, substances are formed which, in the form of an unpleasant odor, pollute the air (Banks and Wang, 2006).

6. WASTE MANAGEMENT

The impact of waste, the generation of which has been previously described, should be controlled, i.e., it should be managed in order to a) reduce the amount of waste generated, b) recover resources and use them, and c) treat and

dispose of waste. The benefits of waste management are broader than the benefits to the environment itself. It includes additional savings resulting from cost reduction and resource renewal. In order to reduce waste materials in food production processes, it is necessary to act in a domestic way, use the equipment correctly and plan changes in order to increase efficiency. Domestic business means that the management and employees of the company are diligent during the fulfillment of legal regulations related to environmental protection. Improving the management system of raw materials and stocks of products, reducing losses of raw materials and products, and educating employees can be very effective measures of domestic business. An example of domestic business is the process of thawing meat, where blood from the halves that are thawed is simply placed in appropriate blood collection vessels, thus preventing the blood from passing into the washing water. In this way, the amount of water that eventually needs to be treated will be significantly reduced. Only through the proper use of equipment and the application of innovations in the work process, which affect the reduction of waste, the company can reduce costs by 20-30%. Statistics show that companies in the meat industry have losses of up to 4% of the value of products due to inefficiencies in the packaging line. Methods for reducing waste include: recycling, finishing (recovery) of products and reuse. The paper (Dieu, 2009) cites several examples in the food industry, where products can be reused in one of these ways and thus can reduce waste costs and total operating costs of the company. Molasses is a by-product of the sugar production process, but it can be used in many ways. The use of molasses in the production of animal feed has been known for decades. Domestic animal nutritionists claim that this improves the nutritional value of animal feed, which has a very positive effect on milk production in cows. Waste materials from the process of fruit and vegetable processing are biodegradable. Therefore, they can be used as raw materials for composting or biogas production. Cellulosic materials remain as waste in various branches of the food industry. These materials can be converted into sugars by fermentation, and sugars can be used in the production of various finished products (ethanol, organic acids, special types of oils). Anaerobic fermenters are often used to reduce waste in the food industry. The final products of this process are products that can be used for various purposes (methane for energy production, special chemicals - esters and food ingredients - organic acids. Methane produced in this way is a high-quality fuel. Converting food industry by-products into fuel has multiple benefits. Waste materials are converted into biodiesel, which is generally less polluting than diesel. Biodiesel is a product that can be used instead of diesel to start the engine. 50-60% of wastewater from the food industry can be reused. Water must be treated appropriately before reuse. Finishing and reuse of waste materials implies the inclusion of additional technological operations in the process: separation, concentration (centrifugation or filtration), conversion (biological or chemical) and biodegradation.

7. ZERO EMISSION CONCEPT

The analysis of various wastes generated in industry starts from the description of the source, ie the place where a certain type of waste was generated, and then describes some of the techniques that can be used to minimize waste as part of prevention programs. At the end of the process, however, a certain amount of waste is generated, which needs to be rehabilitated in a certain way so as not to endanger the environment (installation of air purification filters, installation of water purification systems and other solutions). This approach reduces the amount of waste generated is known as the "end-of-pipe" procedure (Glišić, 2021). In this case, a certain amount of waste is generated, which must be disposed of somewhere. However, all waste materials can in some way be considered as potential resources for the same factory and the same type of production or for another factory and some other type of production. In that case, waste materials can be used as raw materials for the production of other products, either in the factory or elsewhere. In some cases, waste can be used as a means of treating other waste materials. In any case, waste generation can be minimized by conscientious and domestic work of employees, aggressive preventive measures, replacement of hazardous substances with harmless substances, and smart replacement of old inefficient technologies with technologies that will create less pollution. The new concept, which is increasingly accepted in industry, and thus in the food industry, is based on the concept of "zero emission" (Glišić, 2021). The concept of "zero emissions" advocates a significant reduction in emissions in industry. By applying the zero-emission model, today's environmental issues can eventually be resolved. The cost of energy in the food industry is lower than the cost of raw materials, but, with the increase in price, energy occupies an increasingly important place in total costs. The largest consumers of energy in the food industry are: corn mills, sugar beet production, mills in soybean oil factories, malt-based beverage production, meat processing and packaging factories, fruit and vegetable canning, fruit and vegetable freezing, production of bread, biscuits and related products (ICF, 2007). Heating processes and cooling systems consume large amounts of energy. 75% of the energy in food processing factories is consumed by cooling and heating systems. In addition, energy (12%) in the food industry is spent on starting various machines (pumps, converters, mixers, crushers, fans, dryers, propellers), and on ventilation systems and lighting about 8% (ICF, 2007).

8. CURRENT (EXISTING) INITIATIVES RELATED TO SUSTAINBLE DEVELOPMENT IN FOOD PRODUCTION

Many organizations and governments of some countries in the world have launched initiatives and / or adopted documents that seek to stop the process of endangering the environment while fully meeting the economic and social needs of the population. The Food Industry Development Strategy of Australia outlines steps to adapt to sustainable development, including the following activities: implementation of an environmental management system (EMS), Clean Production, research, innovation, industry standards for sustainability (Industry wide standards for sustainability), introduction of a quality assurance system and introduction of a new way of marking / declaring / labeling products (Allen Consulting Group Pty Ltd, 2004). Acceptance and greater promotion of Tripple Bottom Line reporting (accounting practices) is required, which means highlighting data on economic, social and environmental costs and benefits for industry. The Association of Food Producers, Processors and Distributors in the UK is gathered around The Food Industry Sustainability Strategy (FISS, 2006). This network employs more than 3.2 million workers. Its goal is to improve the sustainability effect of the sector through voluntary measures, based on criteria and implementation of competition systems for ranking and selection of the best companies in various industries and cooperation of the industry with government bodies in charge of best sustainable techniques (BAT). One of the priorities (FISS, 2006) is to reduce carbon dioxide emissions. In particular, the food industry in the UK is being asked to reduce energy use by 20%. As regards waste management priorities, significant progress is expected from existing incentives, including landfill tax, processing, recycling and packaging of waste, and reduction of packaging.

9. PROPOSED ACTIVITIES THAT MAY BE PART OF STRATEGIC IN THE FUTURE

In order to solve and develop a strategy for sustainable development, it is necessary to propose at the state level a strategic framework for the analysis of the situation in the food industry and to propose appropriate measures, which are imposed on the basis of that analysis. Among the activities that need to be addressed in order to introduce sustainable technologies, among others, are the following: improve knowledge in this area, provide funding for investment in new sustainable practices (better way of working), overcome difficulties in market development and communication with consumers on products obtained through the use of sustainable technologies, remove barriers to achieving the best price for these products, overcome difficulties in finding investors to finance more sustainable practices, simplify procedures in the food supply chain, which may hinder or obscure the flow of information between producers and the environment. the value of food products obtained by clean technologies and strengthen the aspirations of consumers and the community for sustainability. Although the key focus is on strengthening production and markets, it is clear that the state/government has a role to play in adopting more sustainable practices and activities to introduce sustainable technologies. Examples of activities on the side of the state related to environmental sustainability in various aspects of the food industry include the following: adoption of regulations on the use of chemicals, defining methods of land and water use, adoption of regulations on health and safety of food products, adoption of laws on business and consumer protection, prescribing actions, adopting industry process standards (focusing on pollution control), providing a voluntary certification system for manufacturers to provide consumers with product information (eg Organics certification), funding science, research, innovation and development activities, education of industry employees in the field of sustainable practice, which connects industry with the latest technology, assistance in sustainable agriculture and adoption of sustainable food production techniques, import control (to protect the integrity of domestic production) and export control (for example, issuing fish export licenses as a measure to protect the environment and preserve biodiversity).

10. CONCLUSION

Sustainable technologies are those that promote social trends towards sustainability and technologies that fit into the goals of sustainable development. Sustainable technologies are practical solutions for achieving economic development and human satisfaction in harmony with the environment. These technologies contribute to and support the advancement of sustainable development through risk reduction, cost-effectiveness, process efficiency, and the creation of environmentally friendly processes, products or services. In order for a technology to be considered sustainable, in addition to existing requirements and constraints (for example, economic sustainability), it must meet the following: minimal use of non-renewable and natural energy sources, meeting human needs and expectations related to the cultural context and minimally negatively Earth. Increasing the sustainability of the food industry is reflected, primarily in reducing the use of natural and non-renewable energy sources, increasing the share of energy obtained from renewable sources, closing the production cycle according to the "zero emission" principle, and meeting social needs. In well-organized industrial production, such a concept should contribute to economic prosperity, because the part of waste from which new products will be obtained will increase.

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