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Bioeconomy growth in Latvia. System-dynamics model for high-value added products in fisheries

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Abstract

The rising environmental issues require higher bioeconomy impact on all sectors. In Latvia as well bioeconomy is starting to play a role in economic growth. The main challenge is to invent a new technology, which can provide sustainability and be economically justified. The target was to investigate how much profit you gain from high-value added products. In this study a system dynamics model was created for 5 high value added products: sunscreen, protein cocktail, skin regeneration cream, glue and facial cream. The main raw material for all products was retrieved from carp waste. The model created allows you to analyze the chosen production technology and its economic benefits. Profit of production depends on the price of the product, demand, production cost and capacity. The results show that the highest economical potential is in the cosmetics industry.

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Keywords: bioeconomy; high-value added products; fish waste; system-dynamics

1. Introduction

Environment provides a certain amount of resources, which can be used for human needs. Globally, population grows rapidly, but change of technology is limited. From the same amount of resources it is necessary to gain more and more products. All these issues are solving bioeconomy [1]. In the near future we must provide innovative resource

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management systems to maintain sustainability [2, 3]. In Latvia and throughout the European Union, the primary attention is focused on climate change [4].

To prevent harmful human impact on the environment, there is one established strategy EU 2020, which is based on bioeconomy [5, 6]. One of the most important factors, that bioeconomy needs to overcome is implementation of innovative technologies and improvement of existing systems [7, 8].

Despite the fact, that bioeconomy includes all economic sectors; the study was based on fisheries. In Latvia total gross added value has decreased from 13.5 million EUR in 2008 to 8.44 million in 2012 [9]. Last year's fisheries had the lowest development for high-value added products and bioeconomy. Only 30 % of all companies that process fish in the last 2008–2010 year period implemented innovative activities. The fish industry in Latvia has the highest growth rate for high-value added product production [10]. Fish resources are rapidly being depleted, and thus the fish industry must adapt to this change to sustain economic competitiveness.

Society is starting to choose environmental friendly products, which consist of natural components. Underwater ecosystems are full of valuable proteins and enzymes for human health. For example, omega 3 fatty acids provide DHS (docosahexaenoic acid) and EPA (eicosapentaentaenoic acid), which contribute to heart, brain and vascular systems cell production [11]. Fish waste is used in secondary production for fuel [12], but in that way they do not reach their full financial potential. In this study the production of 5 high-value added products, which are used for human needs were considered [13].

2. Methodology

2.1. Dynamic hypothesis

High-value added product production and implementation in the market is a long process, the accumulated profit of which expands in S-curve [14]. At the beginning of production profit is low, but after a few years it grows exponentially and reaches stability at a certain point (a).

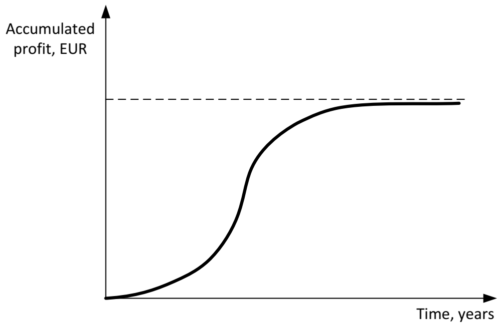

Fig. 1. Dynamic hypothesis.

2.2. System-dynamics model description

The main parameters of the model:

- Annual fish catches – parameter that provides permanent fish supply for production of high-value added products;
- Annual demand of products – decreases produced high-value added products and increases annual income;
- Annual profit – depends on the annual income and outcome, if there is higher income, we can improve production and expand.

The amount of raw materials is described by "processing time". In each process, the different properties of chosen types of fish waste (fishbone, heads, skin, inner organs, etc.) are changed. In the model, the production of 5 different