

BIOECONOMY APPROACH FOR THE COUPLING OF SUSTAINABILITY FOR THE TRADITIONAL CULTIVATIONS: WE CAN (A STUDY CASE OF BARLEY)

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ABSTRACT: In the affirmation of the Sustainable Development Strategy, the agricultural production plays a crucial role in the success of the bio-economy. The European Commission adopted a strategic action plan called: “*Innovate for sustainable growth: a Bio-economy for Europe*”. The bio-economy will be one of the basic topics of the Horizon 2020 program. In this context, very promising results are coming especially for the cycle of barley: it is a cultivation with large diffusion all around the world and with high capability of adaptation regarding to climate and soil variations. Last year, an Italian research project entitled “Process and product innovation in the barley food chain for the improvement of quality and environmental sustainability of food and beverages” started. A part of this aims to create a collaboration between Italy and Romania to measure the potentiality of barley contribute to the Bio-economy Strategy. The specific collaboration is to arrange a bioeconomic evaluation of the barley chain with particular focus on proposals for the supply chain and to boost the role of barley for the initiation of bio-economic development processes at national and European level. In this sense, the paper represents a first contribution about a specific part of the collaboration and, moreover, aims to deliver an example, at the academic level, about the innovative opportunities of bioeconomic research field.

Keywords: Bio-economy, Barley Production Cycle, Green Economy, Sustainable Development, Innovation

INTRODUCTION

The theory of Economics Welfares of Pigou in the permeate management system and in the hierarchy of wealth distribution has put in crisis the development model of the First Industrial Revolution by the first in-depth concrete analysis³. The issue of environmental goods (their increasing scarcity, due to the gradual erosion of a quantitative model of development, and the market failure ,due to the presence of free riders in the use of public goods) was placed in his large economic magnitude⁴.

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The review of the development quantitative model have been evolved since the late 1970, in which the bio-economy and green economy were the most relevant options⁵. The same, was confirmed during the World Summit on Sustainable Development on 22-24th June 2012 in Rio de Janeiro. The agricultural production has a crucial role in the success of the bio-economy⁶. The relevance of this approach, to prospect economic and social development in Europe, is linked to a new strategic pillar. On February 13th, the European Commission adopted a strategy to move the European economy towards a greater and more sustainable use of renewable resources. The Commission's strategy and action plan, "Innovate for sustainable growth: a Bio-economy for Europe", outlines a coherent, inter-sectorial and interdisciplinary approach to the problem. The main goal is a more innovative and low emissions, reconciling the demands for sustainable agriculture and fisheries, food security and sustainable use of renewable biological resources for industrial purposes, while ensuring the protection of biodiversity and environment.

The plan therefore focuses on three key areas: development of new technologies and processes for the bio-economy, the markets in developing and the competitiveness in the fields of bio-economy⁷. The bio-economy will be one of the featured research and theoretical insights fascinating especially from 2000 onwards⁸.

BARLEY AND ITS CHARACTERISTICS, BIOECONOMIC STRATEGY

Barley (*Hordeum vulgare* L.) is an edible annual grass in the family of Poaceae, grows as a cereal grain crop. It is a tall grass with a hairy stem which stands erect and produces spikelets at the head. The head contains the grain.

Barley is an annual plant which is harvested each year and it can range in height from 80 to 100 cm. Barley may also be referred to as four-rowed barley, spring barley or winter barley and it was first domesticated in the Fertile Crescent of the Middle East (<https://www.plantvillage.com/topics/barley/infos/>).

It is a self-pollinating, diploid species with 14 chromosomes. *Hordeum vulgare* subsp. *spontaneum*, the wild ancestor of domesticated barley, is abundant in woodlands and grasslands

⁵ Leonardi E., (2010): **The imprimatur of capital: Gilbert Simondon and the hypothesis of cognitive capitalism**, Ephemera. Theory and politics in organization, vol. 10, n. 3/4.

⁶ Kitchen L., and Marsden T. (2011): *Constructing sustainable communities: a theoretical exploration of the bio-economy and eco-economy paradigms*. Local Environment 16.8: 753-769.

⁷ Fumagalli A., (2007): *Bio-economy and cognitive capitalism. Towards a new paradigm of accumulation*, Carocci Publisher, Page 240.

⁸ Jordan N., et al. (2007): *Sustainable development of the agricultural bio-economy*. SCIENCE-NEW YORK THEN WASHINGTON- 316.5831: 1570.

throughout the Fertile Crescent area of Western Asia and northeast Africa, and it is abundant in habitats and orchards. The wild barley, outside this region, is less common and is usually found in disturbed habitats. However, in a study of genome-wide diversity markers, Tibet was found to be an additional center of domestication of cultivated barley (<http://en.wikipedia.org/wiki/Barley>). Barley is a major cereal grain, used as a source of fermentable material for beer and certain distilled beverages, as animal fodder and as a component of various health foods. It is used in stews and soups, and in barley bread of various cultures. Barley is a widely adaptable crop⁹. In temperate areas it is currently popular where it is grown as a summer crop and tropical areas where it is sown as a winter crop. Its germination time is one to three days. Barley grows under cool conditions, but is not particularly winter hardy. Barley is more tolerant of soil salinity than wheat, which might explain the increase of barley cultivation in Mesopotamia from the second millennium BC onwards. Barley is not as cold tolerant as the winter wheats (*Triticum aestivum*), winter triticale (*Triticosecale* Wittm. ex A. Camus.), or fall rye (*Secale cereale*) but may be sown as a winter crop in warmer areas of Australia and Great Britain.

Barley has a short growing season and is also relatively drought tolerant. It is known or likely to be susceptible to bymovirus, as well as bacterial blight. Barley can be susceptible to many diseases, but plant breeders have been working hard to incorporate resistance. The devastation caused by any one disease will depend upon the susceptibility of the variety being grown and the environmental conditions during disease development. Serious diseases of barley include powdery mildew caused by *Blumeria graminis* f.sp. *hordei*, leaf scald caused by *Rhynchosporium secalis*, barley rust caused by *Puccinia hordei*, and various diseases caused by *Cochliobolus sativus*. Barley is also susceptible to head blight.

MATERIALS AND METHODS

Concerning the materials and methods, the authors describe the activities of the Unit 1 – WP3 assigned. The research activities aim to boost the role of barley for the initiation of bio-economic development processes at national and European levels.

The barley is well suited in European areas thanks to its characteristics of hardiness: it has a comparatively low environmental impact and the production (green or dry) has already shown considerable interest and potential uses ranging from seedling, grass juice, bread, cakes, packaging, bio-mass, till in the art of decorative design.

⁹ Axinte M., Gh.V. Roman, I. Borcean, L.S. Muntean, 2006. *Fitotehnie*. Editura “Ion Ionescu de la Brad” Iași.

The approach to the Tradi-Ovation (tradition-innovation) can stand for “Territory, Rural Areas, through Development, Innovation, Organization, valorization, user friendly, Technology, ICT sharing, Online Networking”. Concerning the materials, the units research intends to work closely with the technological options for process and product innovation that will emerge from the whole project; it aims to achieve a contribution to the overall results of the project so that those most technologically promising have been given the appropriate assessment to identify the character “of current execution” for a quick transferability and repeatability in the territories in which barley culture is already present and/or adoptable as new areas potentially suitable. The work is identified in three phases:

Phase 1- survey phase, with indexing of technical and economic contents of the various technological options and features of short chain and innovative packaging that will be activated in the project (3 months);

Phase 2- development and evaluation of bio-economic models at farm level and regional commercial and technological options adopted (3 months);

Phase 3- evaluation of the value chain at the supply and territorial chain (6 months).

RESULTS AND DISCUSSION

This paper aims to explain an “exercise” transformed in project to create a model that can be replicated in other contexts. The research tries to verify if, in the chain of lifecycle of the barley, the production can reach the capability level to stimulate the concrete best practice of the paradigm of sustainable development strategy, the affirmation of the green economy and the improvement of the imprinting of the agriculture to be a pillar of the new horizon of the bioeconomy.

The aim of the global project is to improve the innovation of products and process along all the lifecycle of barley. In this approach it is possible to improve the traditional transformed products, introducing the experimentation for the innovative food and no-food products. At the moment, many countries, companies, cities and citizens recognize that this narrow concept of wealth is not sufficient to explain the extraordinary losses that are occurring, basing their assumptions about levels flourishing of science and more sophisticated economic analysis.

In the global approach the aim of the project is to study the raw materials with high nutritional value, from barley chain used in the formulation of food and fermented beverages with improved sensory and functional properties to the satisfaction of consumers. Furthermore, a specific

result is the improve the management of food safety in the supply chain. Finally, the by-products obtained along the chain could assure greater environmental sustainability. Another target is to enhance the barley grain for food use by process, product innovations and the improvement of dietary and nutritional features, quality and safety of the products obtained (functional products with health claims, in accordance with directives and validation of the European Food Safety Authority, EFSA).

The carbon foot-printing will be evaluated and measured on samples of: beer from different production scales (from industrial to hand-crafted) and different packaging (bottle, keg, cans), dried pasta and biscuits on the basis of agronomic inputs. Finally, a specific expected result is the study of chemical and nutritional features of spent grains that will be carried out, with particular attention to the carbohydrates structure, antioxidant fraction, and their effects on performance, health and quality of growing lambs and rabbits meat.

CONCLUSION

Over the past 25 years, while the world economy has have more than doubled, up to 60 percent of the world's ecosystem services covered by the Millennium Ecosystem Assessment are being degraded or used unsustainably. Each year, 13 million hectares of the world's forests - the size of Greece – disappear. Hence, the need to think to root an economy that points to a new vision of wealth return to the center with the aim for an happy democracy¹⁰ (Meadows *et al.*, 1972). The global goal should be a flexible and inclusive economy, which provides a better quality of life for all within the ecological limits of the planet. We tried to highlight the key principles on the Green Economy emerged from the work of various institutions and scholars¹¹.

The European bioeconomy, today, has an annual turnover of about € 2 trillion and employs more than 22 million people, approximately 9% of the total EU workforce. Its further development will significantly contribute to reducing the dependency on fossil resources and offers opportunities for growth and jobs.

Building the bioeconomy is one of the great research and innovation challenges within Horizon 2020, the proposed European Union Framework Programme for Research and Innovation for the years 2014 - 2020.

¹⁰ Meadows Donella H., Meadows Dennis L., Randers J., Behrens III, William W., (1972): *The Limits to Growth* (Club of Rome), Universe Books.

¹¹ Carlson R. (2007): *Laying the foundations for a bio-economy*. Systems and synthetic biology 1.3: 109-117.

The Bioeconomy Strategy “Innovating for Sustainable Growth: A Bioeconomy for Europe”, adopted by the European Commission on 13 February 2012, wants to make this vision a reality for Europe by addressing bioeconomy related challenges in a comprehensive and sustainable manner¹². The concept of the bioeconomy should be more strongly integrated into European policies. In particular, the Common Agricultural Policy should take the bioeconomy much more into account. This economic concept is composed of numerous new value chains to which farmers, fishermen, and forest and aquaculture managers will add significant value¹³. This objectives require an higher degree of training for new skills and competences which undoubtedly will lead to higher earnings and the creation of new businesses. New facilities and infrastructure will be required to effectively use the available biomass resources. Investments in establishing and optimizing infrastructures and logistical capabilities are crucial to ensure that all biomass can be mobile. In particular, the target of the WP3, assigned at the authors, is to also verify how are the possible new products, alongside all of the barley productive chains, in the approach of low input process and reduce-reuse-recycle (3R Regulation). This not to follow the hypothesis of the degrowing economy, but to leave a true impulse for the creation of new high level of wealth by the agriculture in a sustainable way. In this option, could be possible that the future generations, that in 2050 will be about 9 billion in our planet, are able to live in a desirable happiness era. Particularly, the WP3 group has a revolutionary content and wants to be a step to contribute to transform the logic overtake approach of the welfare measurement of the Nations with the GNP (Gross National Product) in that more attractive of the GNH (Gross National Happiness) and to achieve a concrete target of the affirmation of the bioeconomy strategy.

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