Catia Bastioli

Unlocking the potential of added value products in Europe: an Italian perspective

CATIA BASTIOLI
Chief Executive Officer, NOVAMONT SPA, Via Fauser, 8, 28100, Novara, Italy

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ABSTRACT

This perspective article aims to look at the potential for Europe to build a solid bioeconomy based on added value products. The global and European state of play will be analysed with the aim of showcasing why Europe needs to leverage on the potential of a bioeconomy based on added value products such as bioplastics and biochemicals. A case study on Italy will then sum up the article in order to concretely demonstrate that it is possible even at time of crisis to restore growth and trigger innovation through biorefineries while preserving and enhancing local ecosystems and biodiversity.

STATE OF THE ART TRENDS AND CHALLENGES FACED BY BIOBASED INDUSTRIES WORLDWIDE

In the tough economic climate that the EU currently faces continuing the development of the manufacturing industry is paramount. As global economic competition goes from strength to strength looking to the future, following the "business as usual" scenario simply will not work. Transition from our current resource intensive use growth model to a resource efficient growth model, towards a circular economy, is fundamental. It offers an opportunity to find a large number of local competitive niche sectors in the field of biobased products for Europe to focus on and invest which will be able to deliver growth and jobs at local level. Public authorities, industries, researchers and citizens should be aware that there is a different way of manufacturing the products that we use in everyday life, by minimising waste of energy and natural resources. The economic recovery needed worldwide can benefit from new models of sustainable development that are able to create innovation and new jobs, improve production processes, and put local resources to good use in a "short supply-chain situation". If we want to retain and grow a dynamic industrial base, Europe must start to innovate, invest and specialise in the activities where it will have a comparative advantage in the global context of competition for resources and markets. Only with this looking forward approach Europe will protect local biodiversity and ecosystems and their essential functions and will enable biobased industries to lead the transition towards a post petroleum society. An approach inspired to a bioeconomy model where resources will be channelled towards technologies which requires less quantity of feedstock available locally. In this way Europe will specialise on niche added value products without emulating models of countries which have larger surface of arable land and availability of feedstocks, and which requires different technologies than the one Europe has the lead. This will enable Europe to be competitive and focus resources and investments on products that can be manufactured in a viable way locally

In this respect the bioeconomy focused on the promotion of added value products through a cascading use of biomass represents a powerful catalyst for recovery: spurring growth and jobs through innovation – particularly in rural areas, benefiting European farmers and regions, enabling the creation of local agro industrial value chains and profuse innovation and opportunities for growth to traditional sectors, leading to the production of biochemicals and other added value products like bioplastics in synergy with food and feed.

The potential is expressed in several market projections. The global biobased market and revenue is estimated at € 250 billion by 2020 by the World Economic Forum (1). Moreover the volume growth of EU bio-based chemical products up to 2020, including bio-plastics, bio-lubricants, bio-solvents, bio-surfactants, is estimated at 5.3% p.a., resulting in a market worth € 40 billion and providing over 90,000 jobs within the biochemical industry alone (2).

However these opportunities risk being lost by Europe, despite the fact that the continent leads in the cutting edge development of Industrial Biotech and Green Chemistry, as investments and technologies are deployed instead overseas. This shift is the result of competition from other nations where countries are rapidly putting in place mechanisms to leverage private investment in technologies with higher financial risks such as the building of new demonstration and flagship biorefineries taking excellence in science and research through the commercialisation of biobased products.

Europe must therefore act swiftly and decisively to reverse the trend of deployment and commercialisation of biobased technologies in other leading economies - namely the US, Brazil and China.

Competitor countries (US) offer R&D Incentives, demo and pilot scale incentives and product incentives (green procurement programs, advanced biofuel subsidies). Some of these elements are now also emerging in China, Russia and Brazil (e.g. Biobased chemicals) and Thailand. It is evident that these nations

domestic policies are being developed to tackle barriers that exist in the creation of new value chains within the bioeconomy (ie with a strong focus on bioethanol in US and Brasil and on bioplastics in Thailand) as they aim to leverage the local potential and availability of natural resources.
The US focus on supporting primarily the production of biobased ethanol has created a model largely focused on funding commercial scale biorefineries through loans from the Department of Energy (DOE) that can go up to 250 million dollars. This important support is clearly boosting private investment in cellulosic ethanol by industry players: according to a recent survey by Iowa University at least ten projects on cellulosic ethanol exceeding 20 million gallons per year are expected to begin operations by 2014 with a conglomerate project costs of over 2 billion euros (3).
Moreover the strong support on the deployment in the US is complemented by a scheme dedicated to the market up take of innovative products: the BioPreferred Programme.
Thailand, which is also seeing increased attention and investments from EU companies, approved a framework for promoting investments in the bio plastics industry in 2010. A budget of approximately 10 million euro was set up to support the establishment and operation of small pilot plant (1K-10kt/year). The government also offers a series of incentives in the forms of corporate tax exemption for up to eight years and an additional 50% reduction in corporate income tax for five years. China is even more ambitious and is increasingly strengthening the support of bio based industries and biotechnology. In the nation's 12th Five-Year Plan on National Emerging Industries of Strategic Importance the need to accelerate China's bio-economy to serve major needs in health, agriculture, and environmental protection is clearly stated. Last but not least Brazil with its vast resources of biomass and feedstock and a long tradition in the use of biofuels, aims now to become N°1 Global Bioeconomy. In terms of specific policy, the main item is the PAISS Programme for Supporting Industrial Technological Innovation in the Sugar-based Energy and Chemical Sectors. These policies trends worldwide testify how governments are acting decisively to push the most prominent sectors of the bioeconomy leaving an attractive and high potential niche for Europe in the area of added value products.

THE OPPORTUNITY OFFERED BY ADDED VALUE BIOBASED PRODUCTS: WHY IS THIS A KEY SECTOR FOR EUROPE TO INVEST?

The quest for sustainability is already starting to transform the competitive landscape, which is forcing and stimulating companies to change the way they think about products, technologies, processes, and business models. By now most companies have sustainability programs. They are cutting carbon emissions, reducing waste, and otherwise enhancing operational efficiency. But a mishmash of sustainability tactics does not add up to a comprehensive and coherent *sustainable strategy*. To endure, a strategy must address the interests of all stakeholders: investors, employees, customers, governments, NGOs, and society at large with positive cascade effects in the local areas and ecosystem involved. To succeed in this innovation is key. However, it is important that the innovation focus on niche sector where Europe can have a solid competitive advantage vis a vis global players. As mentioned Brazil, China and the US invest heavily in biorefineries from an economic and global security perspective; however they are mainly focused on 1st and 2nd generation biorefineries with bio ethanol as main output, leaving an attracting and highly strategic niche for Europe for developing biorefineries where the main output is bioproducts and biomaterials which could be key for triggering a revitalisation in the chemical industry.
Indeed, if we take Italy as a case study, the chemical sector which had registered a growth trend until 2008, registered in 2009 a double figure percentage contraction, forcing multinationals to abandon obsolete plants with considerable consequences on the productivity of sector and on the economy of the territories. Moreover for example, in 2010, according to Chemsystem data, the cash cost of ethylene from naphtha was €761 per ton in Italy, and €93 per ton in the Middle East from ethane. This is one of the reason why the investments are heavily concentrated in the Middle East with plants which have capacity of more than 1 million tones/year. The response to this is therefore to integrate and implement new technologies ready to deliver economies of scale based on local raw materials that can leverage on feedstock available locally in Europe in an efficient manner.
It is clear that the chemical sector is of strategic importance for Europe and represents a key investment opportunity. However, the chemical industry remains capital intensive and is now facing several challenges such as growing prices, volatility of raw materials and the constant delocalisation of global manufacturing in Asia, all trends which will see an even higher increase by 2025. The chemical industry is therefore set to face and respond to new structural changes and market demand, focusing on an economic development model capable of preserve the planet limited resources.
In the current landscape specialised SMEs and start up are operating and cooperating more and more with big multinationals. The use of renewable raw materials and the innovation that this require opens hence a series of solid opportunities for growth for the solid network of European SMEs which can leverage on their specialisation on cutting edge added value technologies.
If Europe wants to gain a competitive edge in the field of added value products it will need to do so by focusing on the promotion of high value key niche sectors where know how technology and innovation components are much stronger and solid than those offered by competitive countries. Biorefineries, in this scenario, can play a key role in enabling the manufacturing in Europe of raw material to be cost competitive through the sustainable sourcing of local renewable resources which act in balance with local ecosystems enabling the creation of new agro industrial value chain in synergy with traditional chemistry.

The impact can be also significant in terms of job and growth creation as plants currently not operational can be converted into biorefineries. Those reconversion projects, many of which are ongoing in Italy, are proving to be a key trigger for local growth given the involvement needed by local authorities, farmers, universities, industry and society to achieve results which can leverage local territorial intrinsic and unexploited potentials.

THE EU POLICY FRAMEWORK AND RELATED POLICY GAPS: THE NEED FOR AN HOLISTIC APPROACH FOCUSED ON COMMON OBJECTIVES AND NICHE PRODUCTS

Despite the clear opportunity for Europe offered by biochemicals and bioplastics there is currently no European policy framework to directly support biobased materials, in contrast to biofuels which are incentivized via subsidies, quotas and mandates, all measures which clearly promote their use in the final market. So far this framework prevented the establishment of a level playing field for all sectors of bio-based economy – bioenergy, biofuels and industrial material use. This in turn has created barriers and limited potential in the industrial material use of biomass, which could, if properly supported, create greater value. Material uses can directly support five to 10 times more employment and four to nine times the value added compared with energy uses, mostly due to the longer process chains, as estimated by Carus at Nova Institut (4).
To promote added value products and enable Europe to benefit from it, policies should therefore be focused more on supporting innovation and scale up of new technologies which can create a solid EU added value and are capable of responding to the societal challenges faced by our planet, together with clear measures aimed at triggering market uptake of those products.
In terms of stimulating innovation, besides individual companies investments in bio-based products, related research in Europe is today mainly funded via various public sources, in a very fragmented way. The main instruments at EU level is the European Framework Programme for Research and Technological Development whilst at member states or regional level specific public research funding for bioplastics and biochemicals is very limited in the EU Member States. In fact, only a few countries are currently running dedicated research programs.
If we look at policies aimed to boost market uptake we see that subsidies and mandates for biofuels are dominating in Europe and worldwide (ie Brasil, US).The focus on stronger and solid market pull measures for added value products is an essential element because the much needed change of paradigm leading to a post petroleum and resource efficient society cannot be just science or technology pushed and needs to be complemented by market driven mechanisms. New knowledge and innovation are essential, but won't win Europe new markets, will not give new high quality jobs in rural areas, growth and prosperity. Without a market, no new product or process can survive. Demand side policies are key to support the introduction of bio-based products and the implementation of the recommendations of the Expert Group on Biobased products of the Lead Market Initiative (5) should be a priority need to be implemented. A positive signal in this direction was the recent Communication on the Update Industrial Policy for Europe (6) and the European Bioeconomy (7) Strategy, where we can see that biobased products are considered a top priority. That said, much more needs to be done.
Wisdom in the way we use renewable resources is key and the EU would benefit from the creation of a framework which favours the allocation of renewable resources to the highest value use. The Bioeconomy, per se, is not a panacea to all challenges faced by our planet and its inhabitants but if we want to enable the bioeconomy to contribute at its best to some of the challenges faced today by Europe we need to think wisely on how to focus the use of natural resources towards productions capable of triggering sustainable economic recovery through local and regional growth without stressing the ecosystems.
The aim is to leverage on the intrinsic capabilities and specialisations of local areas and find collaborative and inclusive ways to valorise them.
An holistic approach, based on case studies which have proven to be already economically viable and sustainable, is therefore essential when looking at the policy frameworks.

Giving the cross cutting nature of the bioeconomy policies in the area of agriculture, innovation, environment, industry, regional development should all be focused on key sectors and converge towards a common central objective: enabling the production in Europe of niche innovative added value products which can themselves contribute to trigger more sustainable consumption patterns amongst citizens and society. This can only be achieved if support to innovation is coupled with measures able to trigger market uptake.

A CASE STUDY ON INCREMENTAL INNOVATION TO LEARN FROM: ITALY AND BIOPLASTICS

Italy has set a case study in motion that testifies how environmental policies directed at leveraging market pull measures for niche bio-based products play a pivotal role since they trigger both new investments in innovative biorefineries and social benefits in terms of waste prevention and sustainable consumption patterns amongst citizens.
This strategy focuses on reducing the use of single use plastic carrier bags and favoring the use of either reusable bags or biodegradable and compostable ones. This measure builds upon the evolution of research and innovation in the biodegradable bioplastics sector on the one hand, and the virtuous development of the quality compost industry and separated municipal waste collection on the other. The connections between these two developments over the years have set in motion a whole series of virtuous modes of action and collaboration initiatives between various stakeholders (enterprises, institutions, research bodies,

trade associations, consultancy companies and regional authorities) generating a connective web that is ideal to promote a change in the development model, putting the efficient use of resources at the centre. Leveraging on these solid pillars, the Italian government promoted then in 2011 a visionary "market pull" measures aimed to boost the production and use of biodegradable products from renewable raw materials in niche markets that are particularly critical from the environmental point of view. The measure hence enabled a scale up of production of innovative technologies for bioplastics which were already tested and economically viable.

A new publication recently launched at European Parliament by Kyoto Club "Bioplastics: a case study of Bioeconomy in Italy" goes deep into analysing all the benefits and cascade effects triggered by this legislative measure providing sound evidence and data. It shows clearly how the new regulation, conceived primarily to tackle the serious problem of waste and landfill management, has already provided a number of benefits for the environment: an overall decrease in the consumption of disposable bags in supermarkets of around 50%, with the ensuing raising of public awareness (over 90% of Italian citizens consider the law to be a step forward in safeguarding the environment, source ISPO 2012); a 20.7% reduction in waste sent to landfills with resulting annual savings of around 5.1 million euro; a 29% cut in CO2 emissions and a 39% reduction in oil used. In addition, around 50% of the bags used for the collection of organic waste are biodegradable and compostable shopping bags and provide an opportunity to extend separated collection of organic waste to municipalities that have not yet started it, or generating savings for those virtuous communities that have already been implementing it for years.

As a result bioplastics became a driver for spurring national growth triggering development of related biobased products such as tyres additives, bio lubricants and biochemicals building blocks. Confidence levels of potential in investors increased given the supportive legislative framework in place and for 2013 investments for about 1 billion euro are planned in the field of biobased products in Italy, many of which are based on reconversion of abandoned and not operational plants into biorefineries with plans to re employ local workers with few prospects. Foreign companies such as DSM and Roquette given the dynamic growth potential of the sectors decided to establish in Italy new plants for the production of biochemicals and bioplastics, proving that Italy can still be an attractive environment for foreign investors when supportive framework conditions are in place. In terms of reconversion projects it is worth mentioning Matrica, a 50/50 Joint Venture between Novamont and Eni Versalis, whose aim is to convert in Porto Torres an old petrolchemical plant into 7 new plants, 3 flagships, for the production of bioplastics and building blocks as well as for bio-additives for rubber with an investment of around 500 million euro and a direct job creation potential by 2016 of more than 680 workplaces in the plants and around 1400 direct and indirect workplaces in the agricultural sector connected to the cultivation of the crops for Matrica.

Another cutting edge project is ongoing in Adria. Work is underway by Materbiotech, the biotechnological platform of Novamont, on the modification and redevelopment of an old fermentation plant, formerly owned by Ajinomoto. The aim is to produce a biobased chemical building block used in bioplastics (bio BDO) through a technology that will be implemented on an industrial scale for the first time worldwide in Italy. This is the first major industrial biotechnology project in Italy, and marks the beginning of an important biotechnology platform that will involve large and small players in Italian industry in several aspects, and absorbing personnel who would otherwise be unemployed.

Moreover the government recently launched a Cluster dedicated to green chemistry whose aim will be research and innovation on added value products gathering critical mass and building on the key know how and skills available in the country.

In conclusion the Italian legislation on plastic bags is acting as a catalyst for change, promoting a process of incremental innovation capitalising and enhancing existing knowledge and competences. Opportunities are being provided to test and assess the effective repercussions on the local area, creating competences and bridges between otherwise divergent sectors: chemistry, agriculture, biotechnology, the petrochemical industry, the processing industry, the waste industry, public authorities, research centres, associations, compulsory and voluntary consortia, environmentalist forces and the voluntary work sector.

These developments will allow us to tackle the economic crisis with greater determination, and the phenomenon of the deindustrialisation of national chemical sites due to the loss of competitiveness of the oil commodities sector in Europe. It will also provide an answer to the problem of the desertification of some areas in Italy, through industries connected to biorefineries integrated in the local area, with due respect for local biodiversity and the greater availability of quality compost.

The Italian case study is followed closely by one of the major EU member states: France. On 4 February 2013 the French Minister for Economic Development Arnaud Montebourg outlined to the press the intention and willingness to follow the Italian model and promote the use of biodegradable and compostable bags given the potential in terms of growth that a measure similar to the Italian one would have in triggering the creation of local value chain dedicated to the production of bioplastics and added value products.

The Italy case study could, if replicated in other EU member states, be an example capable of generating multiple direct and indirect benefits. In this way, with the right investment and support Europe would stand a real chance at becoming the undisputed leader in the field of the Bioeconomy, showing that leveraging and triggering private investments, even at times of crisis, can be easier than we think.

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