Making the Bioeconomy Market: A Review of International Literature

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Introduction

Bringing bioeconomy products to market, and contributing to the development of a sustainable bioeconomy, involves following a route that commences with identifying and procuring unused or underexploited bio-resources, then transforming these resources into replacements for fossil-based products (e.g. fuel, energy) using new and often untested production technologies, and then bringing these replacement products to markets of which relatively little is known of their receptivity. This route sets out a value chain that is both complex, high risk and with relatively uncertain market projections.

Commercialisation and adoption of new bioeconomy products and their supporting technologies is observed as challenging both in a business to business context due to issues such as high switching costs or a lack of existing quality standards, as well as towards final consumers (McCormick and Kautto 2013; Golembiewski et al 2015). As observed by Frewer et al (1997) and confirmed in later studies, it has been shown that final consumers have been hesitant to embrace products generated from side or waste streams.

This report focuses on a number of the market pull factors, and in particular those that relate to consumer behavior relating to bio-based products. These have implications for issues relating to labels, raising public awareness, and tax incentives for bio-based products, and incentive related to fossil carbon and CHG emissions. Consumer studies are reviewed and observations are drawn from EU and national bioeconomy strategies. It also addresses key policy interventions relating to public procurement.
A Framework for Developing the Bioeconomy

The European Commission has set a long-term goal to develop a competitive, resource efficient and low carbon economy by 2050. The bioeconomy is expected to play an important role in the low carbon economy. Europe has a number of well-established traditional bio-based industries, ranging from agriculture, food, feed, fibre and forest-based industries. Scarlat et al (2015) note that the transition toward a bioeconomy will rely on the advancement in technology of a range of processes, on the achievement of a breakthrough in terms of technical performances and cost effectiveness, and will depend on the availability of sustainable biomass. The emergence and confirmation of key bioeconomy products and markets however requires social acceptance of bio-based products and a willingness by consumers to pay for new and often technology-based products. In this context the transition to bioeconomy must be: (i) technologically feasible; (ii) economically viable; and (iii) socially desirable. This transition is reflected across many national strategy documents for developing national bioeconomies, and is often translated to three policy priorities: (i) feedstock push; (ii) technology push; and (iii) market pull.

![Figure 1: Framework for Developing the Bioeconomy](image_url)
Overview of EU Bioeconomy

Europe has a number of well-established traditional bio-based industries, ranging from agriculture, food, feed, forest-based industries, and paper products, to the biotechnology, chemicals, biofuels and bioenergy sectors. It is already one of the largest and most important components of the European economy. Analysis of Eurostat data from 2013 by Piotrowski et al (2016) shows the turnover of the total bioeconomy, including food and beverages and the primary sectors in agriculture and forestry) in the EU-28 at €2.1 trillion. Roughly half of this is accounted for by the food and beverages sector, with almost a quarter of the turnover created by the primary sectors (agriculture and food), while the other quarter is created by bio-based industries including chemicals and plastics, pharmaceuticals, forest-based industries, textile sectors, biofuels, bioenergy and paper and paper products.

Excluding the food, beverages and tobacco products sectors, a total turnover of €1 trillion is recorded with 43% coming from agriculture and forestry.

Turnover in the EU Bioeconomy (EU-28, 2013)
Total: €2.1 trillion - Source: Piotrowski et al (2016)
Further excluding the primary biomass production/extraction sectors (agriculture, forestry, fishery, food, beverages and tobacco products), the largest shares are then made up of paper and paper products (30%) and forest-based industry (27%), with biofuels and bioenergy together accounting for 15% of the turnover of the EU bio-based economy.
European Union Policy Context

The knowledge based bioeconomy, also referred to as a bio-based economy, offers the opportunity to make significant contributions to global challenges such as providing enough food and healthy food for a growing global population, climate change, and the loss of soil fertility and biodiversity, as well as advance the transition from an economy mainly based on fossil-based raw materials to an advanced economy based on renewable resources and efficient in terms of raw materials.

The European Commission (2012) explains “The bioeconomy’s cross-cutting nature offers a unique opportunity to comprehensively address inter-connected societal challenges such as food, security, natural resource scarcity, fossil resource dependence and climate change, while achieving sustainable economic growth”.

At a European level, the European Commission addresses the bioeconomy strongly in its research programme Horizon 2020, and encapsulates its strategy for developing the bioeconomy in *Innovating for Sustainable Growth: A Bioeconomy in Europe* (2012) which seeks to give support to the development of an innovative, low-carbon and more resource efficient economy which is internationally competitive. Amongst a range of actions, this plan targets strengthening of markets and competitiveness with regards to innovative products.

EU Market Making Recommendations

For the preparation of its bioeconomy strategy, the EC conducted a public consultation on the bioeconomy in Europe in 2011, which received over 200 submissions from organisations and individuals across most Members States of the EU. The consultation drew a number of findings. The majority of respondents offered an optimistic outlook on the bioeconomy with more than 60% thinking that potential benefits can be achieved by 2020 or 2030. The majority of respondents also believed that there are a number of risks associated with the
bioeconomy, including potential over-exploitation of natural resources and negative impacts on food security. A lack of public information and understanding of the bioeconomy were also considered important issues, especially regarding benefits and risks as well as ethical issues and sustainable patterns of consumption and production. In this perspective, more than 70% of the respondents called for actions related to communication and dissemination of information on the bioeconomy. Other key themes to emerge in the public consultation included fostering effective governance, promoting collaboration across disciplines and sectors, investing in interdisciplinary education and training, and ensuring robust linkages between research, innovation and implementation.

In its report ‘Where next for the European bioeconomy?’ (2014), the European Bioeconomy Panel and the Standing Committee on Agricultural Research Strategic Working Group (SCAR) set out a number of recommendations to support demand side measures and increase awareness and understanding.

In the first instance the Group proposed that existing measures and recommendations are implemented. These include the demand-side recommendations of the Working group for the Lead Market Initiative on Bio-based Products. It was observed that a number of the priority recommendations remain unimplemented and recommended putting them into practice should be a priority for the immediate future in order to make new markets. Other measures proposed by the Group include:

- **Regulatory and public procurement measures** - Establishing an EU wide public procurement programme to boost awareness and uptake of bioeconomy products. It was recommended that including the adoption of specific and binding targets for best performing and most sustainable products could be considered in addition to enabling member states to grant tax incentives for certain sustainable EU bioeconomy products. The group identifies that existing legislation, including environmental legislation, could be used to promote the use of products from the bioeconomy rather than those from finite sources and the possibility of mandating the use of less environmentally impactful products. Provisions for the collection and
recycling of biomass, residues, wastes and bio-based products could also be incorporated into waste legislation and the gradual substitution of more sustainable products and processes could be encouraged through the reform of existing legislation.

- **Labeling** - Clear European Standards on sustainability, biodegradability and bio-based content could be used to establish labels that might increase consumers’ and businesses’ ability to identify bio-based products. This includes B2B and B2C communications facilitated through the development of sustainable product ‘ecolabels’ and/or a ‘bio-based’ label, linked to sustainability criteria. Certification and labeling could then be incorporated into the implementation of a coherent communications strategy to consumers.

- **Increasing awareness and understanding** - The group confirmed that there is a clear need to develop and implement a coherent communication strategy to raise consumer awareness around the bioeconomy and the opportunities for and barriers to its development. It recommends that this should be done in the context of the grand challenges facing future generations such as climate change, resource efficiency, energy and food security. Among its recommendations are the dissemination of more case studies, and establishing a European Bioeconomy Week.

The focus on public awareness and acceptance of bio-based products mirrors similar recommended interventions featuring in a number of national bioeconomy strategy considerations (e.g. UK, Germany, Sweden and Finland).

Identifying public perception as a major barrier to the development of the UK bioeconomy, Burns et al (2016) make several recommendations to gain public acceptance of bio-based products: (i) clearer benefits relayed to customers, to put risk and benefit in perspective; (ii) stronger regulation to improve public trust and ethical application of new technology; and (iii) greater transparency and more genuine public engagement.
Communications relating to the bioeconomy and the bio-based industries has been identified as a key area for developing the bioeconomy by the European Commission Expert Group for Bio-based Products. Communication actions were included among the Expert Group’s Lead Market Initiative (LMI) priority recommendations. The LMI noted that communications for the bioeconomy refer to informing different stakeholders of bio-based products, their characteristics, their benefits and their contribution to sustainable production and consumption. The LMI notes that communication should be based on scientific facts to help to increase transparency both within market and towards the wider public. They observe that the term “bio-based products” comprises a wide variety of innovative products, most of these products are not easily identified and recognised as such by users and consumers with the specific features of the bio-based products mostly invisible to the purchaser.

The LMI identifies this lack of awareness and knowledge as a major obstacle to increasing market uptake of bio-based products and sets out the following recommendations:

1. **Create conditions for informed consumer behaviour**: With ethical and environmental considerations playing an increasing role in purchasing decisions by consumers, there is a requirement to create awareness and knowledge of the characteristics of bio-based products amongst consumers. This requires addressing the lack of knowledge of bio-based products with meaningful labels and information campaigns. The recommendation recognises the influence of consumer purchasing decision criteria on retailers and manufacturers.

2. **Facilitate well-informed value chains that work hand-in-hand**: It is important to communicate the benefits of bio-based products across the value chain participants including producers, distributors, users and consumers, public authorities and NGOs.

3. **Develop trusted business-to-business (B2B) guidelines and understandable labels for substantiation of chains in business-to-consumers communications**：
National Bioeconomy Strategies

A 2015 study by the German Bioeconomy Council identified almost 50 national strategies pertaining to certain facets of the bioeconomy as well as a number of transnational and regional strategies. A review of national strategies is complicated as they use their own definitions with some focused on narrow interpretations that equate the bioeconomy to biotechnology (e.g. OECD) and others taking account of the wider societal transformation offered by the bioeconomy (e.g. Germany). Across the different national strategies a range of motivations for development of the bioeconomy are put forward. These include economic motivations including enhancing competitiveness of domestic industries, create new jobs, and contributing to the revitalising of rural areas (Staffas et al 2013; Vandermeulen et al 2012).

De Besi and McCormick (2015) identify that national bioeconomy strategies can typically be separated into five development areas: (i) research and innovation, (ii) biomass and land use, (iii) economy and finance, (iv) governance; and (v) social change. Social change represents the need identified by strategy authors for a “transformation in the mind-sets of society, industries and governments”. In this context they observe a theme which explains “a transition to an economy predominately based on biomass will require cooperation of all sectors of society and a change toward sustainable consumption and production patterns, both on the demand side and on the supply side of the economy”.

In the context of initiating the necessary social change to support the demand side of the bioeconomy, their study finds that a number of strategies highlight increasing dialogue with the public as a crucial requirement for addressing the “issue of over-consumption in society”. The German strategy measures for addressing consumer behaviour by providing information on sustainable consumption and food waste are an example of the required dialogue. Swedish and Finnish measures to communicate the benefits of the bioeconomy and bio-based products in society as a means of shifting consumption away from fossil-based products are also highlighted. The Swedish strategy extends its consideration of the societal
challenge in a whole system perspective where a reduced societal consumption levels require a life cycle perspective is needed for the production and consumption of bio-based products.

A review of national bioeconomy strategies by Priefer et al (2017) found that relatively few had any significant consideration of sustainable consumption issues (e.g. Germany and Sweden). Others have argued in response to the limited consideration of consumer behaviour issues in national and transnational strategies, that a societal transition towards a bioeconomy will only provide solutions to the broader global challenges if it also includes changes in consumer behaviour (Zwier et al 2015; Birch et al 2010).

From a review of German and Finnish national strategies (Davies et al, 2016), the BioSTEP project, funded by Horizon 2020 research and innovation programme, identified a number of ways to encourage more active citizen participation:

i. A stronger focus on specific issues which directly affect citizens;

ii. Long-term communication campaigns (including use of social media) to engage with citizens about the range and complexity of the bioeconomy;

iii. Funding for projects which encourage public awareness;

iv. More discussion of sustainable development in the education system;

v. Emphasis on the potential environmental benefits of the bioeconomy; and

vi. Genuine dialogue with citizens, aimed not only at informing but also at listening to and engaging with people’s concerns.

While there have been several reviews of national strategies, including by this author, it is difficult to make an evaluation on the effectiveness of specific interventions, including public awareness interventions, because most of these interventions are still in the process of being rolled out or have only been relatively recently rolled out and there are few studies measuring their impact. For example a list of national strategies below indicates that they have only recently come into play:

- The Spanish Bioeconomy Strategy: 2030 Horizon (2016)
Review of Bioeconomy Related Consumer Studies

Knowledge on the part of the consumer about the existence of a product is fundamental. Blackwell et al (2002) explain that consumers must be aware of the new or innovative products before they become clients and that one is unlikely to acquire any new product if there is insufficient information about it or how to use it.

According to Wilson and Dowlatabadi (2007) social communication processes are essential, with the mass media known to influence the decisions relating to the adoption of individual technology. Mass media communications create awareness and knowledge about new products such as bio-based products, however Mahapatara and Gustavsson (2008) explain that personal channels are more effective in forming and modifying attitudes toward it and are likely to be more influential in decisions to adopt new products.

In relation to energy solutions, a review by Radics et al (2016) found that nearly all studies found that consumers are more willing to support and accept solar, wind and hydro-energy...
sources relative to biomass-based energy. Their review explains that this is in large part due to the relatively recent introduction of bioenergy options in the market place compared to other options and the associated lack of knowledge of biomass-based energy impacts. Interestingly their review also found that the type of feedstock used for producing biomass-based energy also impacted on public support, with higher levels of support for energy produced from landfill wastes, wood waste and grasses with corn stover, trees, GMOs, and corn-based bioethanol having lower levels of support.

In relation to biomass-fuels, Radics et al (2016) review of consumer fuel studies found that convenience, availability and price were considered the most important factors governing consumer choices. Studies focused on the attitudes of general public indicate a moderate and sometimes low to ambivalent support towards renewable energy including biomass energy.

A major five country study by Sijtsema et al (2016) explored perceptions regarding the concept of bio-based in general and in relation to specific bio-based products. Focus groups were organised in Denmark, Italy, Germany, the Netherlands and Czech Republic. Results of the focus groups indicated that the definition of bio-based is not clear. The focus group participants were generally unfamiliar with concept of ‘bio-based’ and bio-based products’, although the study did measure consumer associations with a number of bio-related terms, finding a number of inconsistencies with how participants in the study responded.

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<thead>
<tr>
<th>Feelings</th>
<th>Participants’ associations</th>
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<tr>
<td>Positive feelings</td>
<td>Bio, Environmentally friendly, Natural, Health, Agricultural development, Energy, Future, Ideal, Shopping criteria, Sustainable</td>
</tr>
<tr>
<td>Negative feelings</td>
<td>Buzzword, Unknown, Waste</td>
</tr>
<tr>
<td>Mixed feelings</td>
<td>Organic, Bio, Biological, Environment, Health, Marketing, Distrust</td>
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Consumer perceptions of bio-based products depend mainly on the answer to the question “what is in it for me?”. The respondents were less convinced on perceived benefits of bio-based production methods. Environmental friendliness benefit relates to personal benefits such as feeling good, and ‘bio-based’ was regarded as an additional value with other more important aspects requiring fulfillment before bio-based benefits came in for consideration. The focus groups demonstrated that when confronted by new products consumers will buy what they see, need and regard as beneficial. In this context, communication about bio-based need to be as context-specific and concrete as possible.

The focus groups also confirmed that a lack of knowledge can create distrust. People were more positive towards bio-based products that use 100% bio-based materials and distrust was noted for partially bio-based products. These findings underpin the requirement for bio-based products to be supported by coherent product concepts as bio-based claims bring high expectations and consumers do not like inconsistencies in a product’s image.

Wood Pellet Consumer Studies

García-Maroto et al’s (2015) survey found that Spanish consumers knew very little about pellets, and that the knowledge they did have about biofuels was directly related to their knowledge about pellets. Friends were the principal information source, followed by family members. While environmental concern had a limited weighting in the decision to adopt these heating systems, the existence of subsidies for their purchase was more important in consumers’ ultimate decision

Mahapatra et al (2008) study of Swedish consumers found that the cost of pellet heating system investment is the most important factor for consumers, along with the price of the biofuel, the specific advantages of the product, and the need for information about the product and its relative advantages.

In an attempt to better understand the psychological determinants involved in the adoption of wood pellet technology for home heating, Sopha and Klockner (2011), surveyed 737
Norwegian households. Their findings suggest that for Norwegian adopters of wood pellet heating found early adopters more likely to be influenced by environmental concerns but this motivation moves to subsidies and operating costs with late adopters and non-adopters. However, the influence of these personal values and norms only has a weak impact on attitudes, and they conclude that strengthening environmental values and norms is not a promising driver for the diffusion of wood pellet heating.

**Bioenergy and Biofuel Consumer Studies**

A review of a number biofuel studies by Radics et al (2016) observed that attitudes of the general public indicate a moderate to ambivalent support towards renewable energy including biomass-based energy. Some studies show acceptance can relate to social benefits to community – including jobs – and ability to contribute to national security, however threats to land availability for food production and increased food prices are seen as negative attributes to bioeconomy growth. As with other studies, low acceptance and support for bio-based energy was attributed to the lack of awareness and knowledge about this industry. The studies show that citizens are more likely to support solar, wind and hydro energy sources relative to bio-mass energy. They conclude that this is in large part due to the relatively recent introduction of bioenergy alternatives.

In their own survey of transport fuel consumers in the US, Radics et al (2016) found that convenience and availability key choice criteria. Additionally, there were concerns regarding compatibility with cars. The research concluded that the confusion was strongly related to a lack of knowledge among the transport fuel consumers and recommended that there is a need to have a consistent and simpler message delivered to consumers.

In their study of the Swedish green electricity market, Ek and Soderholm (2008) found that social influence affects individual consumption behavior in the green energy market.

The lack of widely accepted quality standards for biodiesel is problematic. Van de Velde et al (2009) investigated the perception of Belgian consumers with respect to the use of biodiesels
and identified four consumer segments based on the perceived importance of different fuel characteristics. They found if companies want to convince the performance-oriented and environment-oriented consumers to use bio-fuels, they must supply information about biodiesel’s quality and performance standards. Since biodiesel is produced from varying origins and qualities, it is necessary to install a standard of fuel quality in order to guarantee an engine performance without any difficulties and ensure better criteria of biodiesel for successful commercialisation of biodiesel. Separately a Spanish study by Kallas and Gil (2016) found car manufacturers unwilling to recommend its use as it may lead to engine failure. Interestingly, there survey also found that consumers were not willing to pay for biodiesel, especially when its production may negatively affect food prices. Ma et al (2014) also report that quality and safety standard are pivotal factors in consumer choice of vehicle fuel. Arguments regularly put to consumers for biodiesel include: (i) biodiesel prolongs engine life and reduces the need for maintenance and it is much safer; (ii) biodiesel is better than conventional diesel in aspects of sulfur content, flash point, aromatic content and biodegradability; (iii) biodiesel is non-flammable and cleaner. Despite these benefits, Bomb et al (2007), observing across German and British experiences, note that equal price amongst competing fuel types is a necessary condition for the expansion of the biodiesel market.

Although biofuels are not new, usage remains low in certain western countries and public opinion of biofuels is still divided. According to Savvanidou et al. (2010), 80% of respondents who owned vehicles were willing to use biofuels, of which 44.8% were willing to pay more for them. There is a need to educate people on the positive impacts of biofuels through campaigns (Savvanidou et al., 2010). Marra (2010) revealed that, in general, consumers were willing to pay for reductions in greenhouse gas emissions. Anderson (2012) and Petrolia et al. (2010) both found consumers willing to pay a premium for ethanol and blended ethanol, respectively.

**Bio-packaging Consumer Studies**

Research by Van Winkle et al (2013) found a mixed image of bio-products and a high level of uncertainty (particularly regarding the benefits and risks of using agricultural products as an
alternative to petroleum). Importantly, they found that consumers’ uncertain opinions of bio-products are likely the result of a lack of exposure to information about bio-products. Their survey showed that, on average, consumers are willing to pay 10% more for household products and packaged goods made from biologically-derived plastic alternatives, although, similar to concerns regarding biofuels, they did not feel strongly that bio-products were of better quality than traditional products.

Koenig et al’s (2014) survey of 312 Norwegian consumer focused on consumers’ cognitive and affective responses to ecological packaging (in this case a bottle made partly of plant-based material). Their survey found that purchasing intentions were significantly influenced by general environmental concern, but not by rational evaluations of benefits. In the context of packaging the implication is that marketers should not only rely on consumers’ cognitive responses to advertising but also emphasise the positive emotions evoked by using ecological packaging. This is consistent with research by Hartmann et al (2012) who found that functional and emotional strategies should be complementary rather than as alternatives, as the rational benefits of pro-environmental consumption alone might not be sufficient as a motivating factor to adopt pro-environmental purchasing behavior. Their research found that for consumers to perceive a significant level of utilitarian benefits, brand communications should supply relevant and sufficiently detailed information. In this context energy labelling schemes are limited and there is a need to appeal to the consumer’s sense of community, stressing that they can feel good by behaving in a socially and environmentally responsible way. This is particularly important for biofuels where the private and invisible nature of the product does not otherwise offer social visibility.

**Business-to-Business Marketing of Bio-Based Products**

The Open-Bio Project (Peuckert and Quitzow, 2015) carried out a Delphi survey involving 320 business-to-business buyers from 17 EU countries on the market acceptance of bio-based products. The most important market drivers observed among business-to-business buyers included:

i. a positive public image related to environmentally friendly;
ii. independence from fossil sources;
iii. savings in CO2 emissions; and
iv. compliance with environmental regulation

These market drivers strongly related to corporate social responsibility targets of businesses and a perception that consumers were shifting to supporting sustainable consumption. In this context the B2B market uptake of bio-based products is driven by their positive public image as well as the potential environmental benefits.

The most important market barriers observed among business-to-business buyers included:

i. higher cost of production;
ii. uncertainty about future regulation;
iii. uncertainty regarding volatility of feedstock prices; and
iv. an unsupportive regulatory environment.

Knowledge on the part of the consumer about the existence of a product is fundamental. Blackwell et al (2002) explain that consumers need to be made aware of new or innovative products and that one is unlikely to become a consumer of a product if there is insufficient information on how to use it. Thorgersen and Schrader (2012) observe that this is particularly the case for encouraging consumer to make pro-environmental actions in their consumer decision making, with greater knowledge for initiation, diffusion and enhancement of such actions.

Public Procurement as a Market Pull Measure

With expenditure on the procurement of goods, works and services by public authorities in the EU represents approximately 19% of EU GDP which equates to €2.1 trillion, it is not surprising that from its earliest policy submissions on developing a sustainable bioeconomy, the European Commission has promoted the large potential of public procurement as an instrument for creating demand for innovative and environmentally friendly bio-based products (European Commission, 2008). The European Commission has also consistently
encouraged Member States to give preference to bio-based products in tender specifications.

This potential has also been included within national bioeconomy strategies and in contributions to national strategy development. For example, Burns et al (2016) recommend that the UK Government is under-utilising its public procurement power to drive market demand for bio-based products and argue that public procurement targets for bio-based products would drive markets of bio-based products directly, and indirectly improve awareness of bio-based products.

The rationale for using public procurement to support the development of bioeconomy markets is similar to the case made for using public procurement to support business innovation policies. This is not surprising given the common challenges of bio-based products and new technology based products. These include:

i. a lack of demand;
ii. a lack of consumer awareness;
iii. high switching costs;
iv. absence of standards and buyer lack of knowledge; and
v. high initial costs (lower competitiveness).

The rationale for using public procurement to accelerate the development of bioeconomy markets is that it allows the public sector to act as launching customer, early adopter, or first buyer. The public sector also acts as market development facilitator by establishing a buyers group for the market with critical mass that triggers industry to scale up its production chain to bring products on the market with desired quality / price ratio within a specific time.

A requirement or a recommendation to give preference can be laid down in a national action plan adopted by the government. Within this, buyer values can include criteria neglected by private consumers such as criteria related to climate or the environment. An additional advantage is that while public procurement is fragmented across thousands of buyers, public
procurement processes tend to be codified from centralised principles. As well as creating markets through their own purchasing, public procurement also serves as a tool for raising awareness of bio-based products. This is demonstrated through use of bio-fuels in public transport and development of demonstration bio-initiatives.

**Case 1: Gothenburg**

Gothenburg’s sewage water-treatment system produces 65 GWh of biogas which is almost exclusively sold for use in cars and buses in the Gothenburg area as a blend of 50% biogas/natural gas or as 100% biogas.

The city of Gothenburg encourages the use of alternative fuels by: (i) making it a requirement in public procurement; (ii) allowing free parking for cars using biogas – the so-called ‘eco cars’; and (iii) by deploying a municipal car fleet made up of 90% ‘eco cars’. By 2020 the entire Gothenburg bus fleet will use this alternative fuel.

**Case 2: Barcelona**

In 2009 Barcelona City Council implemented its new contract for street cleaning and rubbish collection. The tender procedure introduced a number of requirements to enhance the quality and sustainability of the service.

- More frequent rubbish collection, environmentally-friendly vehicles, separate collection of organic waste and recycling containers which are accessible to all users were implemented under the contract, which is worth approximately €250 million per year.
- Requires vehicles which operate on non-contaminating combustible fuels and/or renewables, such as biofuels (bioethanol B-85, biodiesel or biogas).
The Open-Bio Project (Peuckert and Quitzow, 2015) survey of public procurement buyers were asked whether specifications on bio-based content could be utilised as a basis for public procurement in their own organisation. One-third of the respondents said it was possible, however the majority of responding public procurement buyers indicated that they were not sure or did not answer the question. A second round of the survey sought an explanation for difficulties using public procurement and the most common reasons included (i) problem of verifying related claims; (ii) lack of information about biomass standards available; and (iii) lack of relevance as a product attribute.

The respondents also noted that other environmental benefits were considered more important as criteria in green public procurement than aspects related to raw materials/bio-based content. A large majority of respondents consider a label for bio-based product as an important instrument for promoting the uptake of bio-based products. They also found that the incorporation of criteria for bio-based content in such labels can play an important role for their uptake in public procurement. A clear finding of the survey is that bioeconomy benefits require additional consideration in existing green public procurement processes.

The most important reasons identified by the public procurement buyers for the limited use of specifications on bio-based content in public procurement were:

i. The available bio-based products are frequently too expensive.
ii. Specifications on bio-based content are difficult to verify.
iii. Information about available biobased products as alternative for fossil-based products is not easy to find.
iv. Bio-based content is not considered a relevant product attribute.

Asked what were the most effective measures for promoting bio-based products in public procurement, the respondents identified the following:

i. A political decision to promote bio-based products via public procurement
ii. Practical guidance for incorporating specifications on bio-based content in public procurement (e.g. text blocks for tender requirements)
In terms of cost- and performance-related aspects for the practice of green public procurement, the survey found the price of product and impact on operating costs were currently ranked most important by public procurement buyers. Important in the context of bio-based procurement is the shift towards increased relative importance being assigned to a life cycle perspective.

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<thead>
<tr>
<th>Current Importance</th>
<th>Future Importance</th>
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<tbody>
<tr>
<td>1. Price of product</td>
<td>1. Impact on maintenance costs</td>
</tr>
<tr>
<td>2. Impact on operating costs</td>
<td>2. Expected life time of the product</td>
</tr>
<tr>
<td>3. Impact on maintenance costs</td>
<td>3. Impact on operating costs</td>
</tr>
<tr>
<td>4. Demonstrated suitability for intended use</td>
<td>4. Disposal costs</td>
</tr>
<tr>
<td>5. Safety requirements related to the product use</td>
<td>5. Demonstrated suitability for intended use</td>
</tr>
<tr>
<td>6. Expected life time of the product</td>
<td>6. Safety requirements related to the product use</td>
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When it comes to assessing the importance of environmental aspects for the practice of green public procurement, the priorities included (i) energy efficiency; (ii) savings in CO2; (iii) Recyclability; (iv) reduction of environmental pollutants (other than CO2); (v) use of recycled material/waste; and (iv) bio-based content. These factors were considered likely to retain their importance in the future.

As previously mentioned, a lack of information was observed as an important inhibitor of public procurement of bio-based alternatives. Sought information in order of importance to facilitate purchasing bio-based products includes information pertaining to:
i. Toxicity;
ii. environmental life cycle impacts;
iii. percentage of bio-based content;
iv. life cycle costs; and
v. CO2 emissions.
vi. Biodegradability

Conclusions

There are numerous challenges for researchers investigating market opportunities for the bioeconomy. In the first instance, official statistics tend to only report on traditional sectors with no distinction between synthetic and bio-based production (e.g. manufacture of synthetic textile vs bio-based textile). This results in many of the market-related indicators for the bioeconomy being estimated based on a combination of multiple sources. Not surprisingly, a review undertaken by this author of a number of commercially available bioeconomy market reports from international market research agencies yielded significant variations in market estimates. The picture is further complicated by the fact that there are thousands of product streams and that external influences – particularly political factors and movements in commodity prices – also have a strong impact on the status, feasibility and growth momentum of bioeconomy markets. For example, in the case of the European bioenergy markets, the key policies changing the face of the energy mix in Europe are Promotion of Renewable Electricity, European Emissions Trading Schemes, and Biofuels and Landfill Directives. Further difficulties emerge from the fact that many bioeconomy markets have not yet been made, and are dependent on innovation outcomes to establish their feasibility. In this context, the development of markets will continue to depend on the development of new supporting technologies and regulatory reform.

A requirement to educate the general public, including prospective customers, through public awareness initiatives is generally supported. As observed in a number of the studies reviewed, public debate has led to the notion that biofuels might lead to engine problems
and increased food shortage. Such considerations follow through in other areas also (e.g. packaging). This observations demonstrate that there is a strong need for public information regarding the benefits of biofuels both for the climate and the economy of the EU.

At issue is that bio-based products are often based on new technologies and as an outcome suffer the same impediments in market entry as new generation technology products in most domains. Therefore similar interventions are relevant. In Ireland, public procurement expenditure is estimated at between 10% and 12% of GDP. In today’s terms this equates to approximately €9.5 billion. Given the value and variety of goods, works and services procured by public authorities, the public procurement market provides significant opportunities for developing bioeconomy markets, and would be particularly beneficial for indigenous SMEs working in these markets. It is useful to observe that as in the case of next generation technology products, the market for bioeconomy can be segmented into early adopters and followers.

The research also shows that consumers are influenced by a variety of factors in their decision to purchase bio-based products. Social communication, from friends and family, are a key influencer with personal channels having a significant impact on consumer choices. Variations are also observed in the willingness of different consumers to commit to bio-based consumption, with a lack of knowledge leading to mistrust in bio-claims. The ‘what is in it for me?’ question is invariably more important than the potential ‘what is in it for the planet?’ question.

The review of international literature also observed a dearth of empirical data on bioeconomy markets in Ireland. Very little is known about Irish consumer perceptions of bio-based products, and given the diversity and range of conflicting observations gathered from this survey of international literature, it is clear that Ireland cannot rely on an evidence base gathered from other countries to guide market-making strategies in Ireland. Research is required at consumer level, business-to-business procurement and public procurement in order to shape more effective green procurement policies and processes, inform marketing
strategies, and provide public and commercial buyers with the appropriate data, guidelines and tools to facilitate their consideration of alternatives to fossil-based products.
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