OPTIONS FOR FINANCING ECO-INNOVATION AVAILABLE TO ENTERPRISES

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Abstract
Any enterprises seeking to adopt eco-innovative solutions aimed at lowering their adverse environmental impacts and protecting natural resources face a high-cost barrier. The barrier precisely is the difficulty that plagues Polish businesses, which commonly suffer from insufficient internal funding and problems accessing external financing. Written in an environment in which new financial instruments, such as venture capital funds operating as public-private partnerships, are now emerging, the publication seeks to describe the latest instruments for financing eco-innovation focused on environmental aspects of furthering the sustainable development of enterprises. The study relies on the critical analysis and synthesis of scientific literature and key Polish and EU documents. Also presented are eco-innovation funding opportunities available to Polish enterprises.
Keywords: *financing of eco-innovation, EU funds, venture capital, eco-innovation.*

1. Introduction

Eco-innovation aimed at achieving the sustainable growth of enterprises by reducing adverse environmental impacts and protecting the existing natural resources requires enormous capital outlays. This capital outlays precisely are the difficulty faced in Poland where, according to many literature sources, the primary hindrance to eco-innovation is the shortage of own funding and insufficient access to external financing. This conclusion has been confirmed by a 2011 Eurobarometer survey of EU businesses carried out by Gallup Institute It was found that the predominant barriers to eco-innovation faced by 38% of Polish-based companies are fund deficiencies, uncertain return on investment in eco-innovation (37%), uncertain market demand (35%) and the lack of external financing (33%) (The Gallup Organization, 2011).

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According to Foundation for the Environment (2010), the key barrier to the use of eco-innovative solutions, faced by 68% of enterprises, is insufficient funding and prohibitive deployment costs (61%). This finding has been backed by the surveys by Zuzek (2015), Mazur-Wierzbicka (2014) and Ryszko (2014). A 2014 study of eco-innovation has placed Poland in the penultimate 27th place in a pan-European-Union ranking which relied on 16 indicators. Poland's lowest scores on such indicators were posted on the inputs side, and specifically on governmental spending on R&D in the fields of environment and energy, green investments by PE/VC funds and employment in the R&D sector. To make things worse, such indicators declined by one-third in the last years (Grodzicka & Wojtach, 2013; Ozdoba, 2015).

The literature on eco-innovation financing instruments classifies them into own resources and financial institution funding (bank loans, private equity funding, e.g. venture capital), internal and external funding by affiliates (subsidiaries and other associated companies). Also, third-party enterprise funding (by non-financial sector businesses), public financing and the funding of international organizations (Wielgórka, 2013; Janik, 2015). Smolorz (2011) proposes a classification into private non-repayable capital (business angels) and share issues (venture capital funding), public-private non-repayable capital (EU subsidies and loan funds) as well as repayable private capital (bank loans and non-bank crediting) and debt-security issues.

The options for financing eco-innovation available to the SME sector in the recent past have been described broadly by Wyrwa (2010). According to the Ministry of the Environment (2008), "Poland's primary sources for funding environmental projects are environmental protection and water management funds (one national, 16 regional, 2489 municipal and 373 county environmental protection and water management funds); own resources of enterprises, municipalities and state agencies; the funds of domestic lending banks; the state budget and the budgets of regional governors; foreign funds, including those of the European Union, whose share has been growing since 2004, and other sources, including the Agency for the Restructuring and Modernization of Agriculture, Fundacja Wspomagania Wsi (Rural Support Foundation), EkoFundusz (EcoFund), and other foundations."

Considering the significance of the issue, the authors of the article have set out on providing an overall description of the latest instruments for financing eco-innovation in businesses, which are aimed at supporting the related projects and furthering the environmental aspect of the sustainable growth of businesses.

2. Significance of eco-innovation for enterprises

Climate change, natural resource depletion and the loss of biodiversity are all major challenges faced by today's world in its bid to protect the environment. According to the European Commission, one way to resolve the issue of environmental degradation is to make environmentally friendly investments (Foltynowicz, 2009). The notion of innovation has gained popularity in recent years thanks to a number of European Union initiatives, including support various programmes. The term is used as defined in the Oslo Manual (Oslo Manual, 2008) whereby an innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations.

Innovation is inextricably linked with sustainable development aimed at ensuring the growth of the economy while affording equal treatment to social and environmental aspects. The link between the two areas is eco-innovation, which seeks to reduce the environmental impact of products, processes and technologies while boosting competitiveness and economic growth (KPKPB UE, 2008).

According to the Oslo Manual, eco-innovation takes the form of either product or marketing innovation. Environmental innovation, as described in (KPKPB UE, 2008) represents "new production processes, technologies, services and products designed to reduce adverse environmental impacts. Environmental innovation is a chance to adopt sustainable solutions that will help use natural resources efficiently and reduce negative environmental impacts while ensuring a high level of innovation".

Jones, Harrisom and McLaren (2001), Fiedor (2002), Woźniak, Trinks and Bącal (2004) offer some definitions of eco-innovation, which largely correspond to the above but differ in their specific approaches. According to Ziółkowski (2008), environmental innovations are innovations "comprised of new processes, techniques, practices, systems and products that help eliminate or mitigate environmental impacts". Eco-innovation is commonly associated with such other notions as ecological, environmental or green technologies, all of which are technologies that provide an environmental benefit.

Eco-innovation, i.e. innovative products, technologies, and services are aimed not only at reducing environmental impact by, among others, preventing pollution and contamination but also at achieving more effective ways of utilizing energy and other natural resources while boosting competitiveness and economic growth. The most common classification refers to eco-innovation that is:

- technological, e.g. products and processes,

- social, e.g. behaviors, consumption patterns,
- organizational, e.g. environmental audits and green R&D,
- institutional, e.g. collaboration platforms, informal groups, and networks established to address environmental issues.

In 2009, OECD published the "Eco-Innovation in Industry: Enabling Green Growth" report (OECD, 2009) presenting, among others, an overview of the concept of sustainable development and eco-innovation, the diversity of eco-innovation in industry, benchmarking based on established indicators performed to attain sustainable growth, strengths and weaknesses analysis in connection with the established methods of measuring eco-innovation on a macro-scale as well as national strategies and initiatives designed to further eco-innovation in OECD countries (Borucka & Foltynowicz, 2010).

By combining innovative solutions with care for the natural environment, eco-innovation caters to the demand of today's economies. The positive influence of eco-innovation on businesses has been described by Ziółkowski (2009), whose starting point in his discussion of the significance of eco-innovation for enterprises was an adverse environmental impact. Eco-innovative technologies make it possible to rule out or minimize negative environmental impacts. Eco-innovation helps enterprises reduce environmental penalties and charges, cut the cost of procuring depleted natural resources and lower their dependence on conventional energy sources. In this manner, eco-innovation exerts a positive impact on the investment capabilities of enterprises.

Needless to say, eco-innovation entails substantial starting outlays as well as uncertainty as to the return on investment. However, the European Union and Poland's national government have launched a number of programes in support of eco-innovation available in the new financial perspective 2014-2020 (Foltynowicz, 2009; Lipińska, 2013). Europe's environmental industry accounts for a significant part of the economy. Its annual revenues are estimated at EUR 319 billion, that is approximately 2.5 times the European Union's GDP (Eco-Innovation Action Plan) (European Economic and Social Committee, 2012).

3. Research methodology

To ensure a comprehensive analysis, a critical review of the relevant literature has been conducted with the use of such electronic scientific databases as Scopus, Google Scholar, and JSTOR as well as the library resources of the Poznań University of Economics. This made it possible to gather information on the possible financial instruments that support eco-innovation, which was then described and used to formulate the research problem (Lisiński, 2016).

Publications were selected by the random snowball sampling method with proper account taken of relevant English-language articles. Of the total of 247 scholarly articles and strategic documents, the authors selected 62, which they classified into the categories of:

- strategic articles and documents on financing eco-innovation with EU funds in the European Union member states,
- strategic articles and documents on financing eco-innovation with EU funds in Poland,
- strategic articles and documents on financing eco-innovation with domestic funds,
- strategic articles and documents on financing eco-innovation with financial sector capital,
- strategic articles and documents on financing eco-innovation with private equity funds.

The problem which initially inspired the research was the capacity of businesses to fund eco-innovation – its identification was the primary condition for launching the project (Malhotra and Birks, 2007). The research output was summarized by bringing together the findings of each part of the project.

4. Financing eco-innovation with EU funds in European Union member states

Eco-innovation has become one of the key priorities of the European Union's social and economic development program. Therefore, its leading documents such as "Europe 2020", "Innovation Union" and "Resource-Efficient Europe" recognize the need to increase investment and identify instruments and resources to be used for that purpose.

As a Europe 2020 flagship initiative, resource-efficient Europe is designed primarily to facilitate the transition to a low-carbon economy, increase resource efficiency and decouple economic growth from resource use. While more stringent environmental protection standards are bound to boost eco-innovation, it is also essential to increase stability and certainty for investment and innovation. The new eco-innovation action plan (EcoAP) is thus to foster the innovation that reduces environmental pressures and facilitates the bringing of innovative products to market. A pivotal part of this effort is to mobilize financial instruments and services to support SMEs (European Economic and Social Committee, 2012).

The above tenets have been expressed in Horizon 2020, the EU's biggest yet research and innovation program. The initiative promotes not only research on new solutions but also its supervision, implementation, commercialization and on-market development. One of the program's innovative instruments is EU Finance for Innovators (InnovFin). This joint project of the European

Commission and the European Investment Bank Group (the European Investment Bank and the European Investment Fund) consists of a wide range of products, including loans and guarantees for large enterprises, research institutions and institutions of higher education, long-term preferential and subordinated loans, as well as mezzanine financing (which usually refers to the financing positioned between senior debt and shareholders' equity) for midcaps and debt financing guarantees for SMEs.

Fast Track to Innovation (FTI) is a pilot associated with e.g. advanced testing, pilots, and demonstrations centered around themes which include climate and environmental protection and resource efficiency, which has received an allocation of EUR 100 million.

Support for the competitiveness of small and medium-sized enterprises is available in the COSME program (Program for the Competitiveness of Small and Medium-Sized Enterprises) aimed mainly at boosting the competitiveness of European SMEs by, among others, supporting activities that promote eco-innovation. A number of guarantee instruments (including free guarantees for financial institutions), as well as equity tools for private equity funds such as venture capital, have been envisioned.

A host of opportunities has been created that facilitate the co-financing of environmental and climate protection projects under the EU financing program LIFE, whose National Contact Point is the National Fund for Environmental Protection and Water Management (NFEPMW). With the support of the European Commission and the NFEPMW, the program funds contributes 95% of eligible expenditures to projects aimed at protecting natural resources, combating climate change and increasing energy efficiency (LIFE, 2016; Regulation (EU) No. 1293/2013 of the European Parliament and of the Council of December 11, 2013).

One of the first trans-national programs carried out under the cohesion policy of the European Union was INTERREG Europe 2014-2020 envisioned for the 28 member states of the EU as well as Norway and Switzerland. Thematically, the program covers low-carbon strategies, supports the transition towards a resource-efficient economy and promotes "green growth" and eco-innovation. Its beneficiaries are public authorities and public institutions as well as privately-held non-profit organizations. Eligibility is limited to partnerships made up of at least three states, two of which are EU member states (INTERREG Europe 2014-2020).

INTERREG Central Europe – Central Europe 2020 Cooperation Programme, in its turn, proposes to strengthen regional innovation capacities with a view to increasing the competitiveness of Central European states. This can be achieved by promoting cooperation among enterprises, R&D institutes, and universities. The funding is available for solutions that foster low-carbon

economies, combat climate change and achieve energy efficiency by, among other things, resorting to renewables, improving energy efficiency in public infrastructure, promoting resource management efficiency and raising the quality of urban environment (Central Europe 2020 Programme).

5. Financing eco-innovation with EU funds in Poland

Due to the cross-cutting nature of eco-innovation, the priority in its financing in Poland is to establish an efficient system for coordinating the work of the public institutions appointed to act as implementing bodies (Szpor & Sniegocki, 2012). Grodzicka-Kozak and Wojtach (2013) notes the need to develop a systemic concept of financial aid for eco-innovation within the framework of a Joint Action Strategy of the National and Regional Environmental Protection and Water Management Funds.

Osuch-Rak and Proczek (2014) have also pointed out the need for complementarity and synergies across EU and national policy instruments as well as comprehensive investment project financing covering the entire track from the conception of ideas to the creation of innovations that respond to the actual needs of entrepreneurs. Godlewska (2014), in her turn, proposes to break funds down into those focused on:

- low-carbon economy, including energy efficiency, renewable energy sources, and eco-innovation,
- sustainable transport,
- environmental infrastructure,
- sustainable agriculture.

With reference to the above categories, the financing extended to public institutions (including local government authorities) and private organizations (mainly large enterprises) for measures aimed at reducing air emissions, protecting the environment, combating and adjusting to climate change and increasing energy efficiency, has been envisioned primarily in the Operational Programme Infrastructure and Environment (OPIE). "Priority I: Reduction of emission levels in the economy," is designed to support "the production and distribution of renewable energy; energy efficiency, enterprises' reliance on renewables as well as energy efficiency, intelligent energy management and the use of renewables in public infrastructure, including in public buildings and housing." Meanwhile, under Priority II: "Environmental protection, including adjustment to climate change", a merger is sought between the two thematic goals of "promoting adjustments to climate change and preventing and managing risks" on the one hand and "environmental conservation and protection and promoting efficient resource management" on the other. In view of the above priorities, enterprises are eligible to receive support for

investment projects that fall within such scope (Operational Programme Infrastructure and Environment, 2014).

Financed in full by the European Regional Development Fund, Operational Programme Smart Growth (OPSG) is principally an investment program. The benefits it offers consist largely in access to funding at the stage of the pre-incubation of start-ups that rely on innovative ideas, VC investment aimed at commercializing R&D outcomes, syndicate (group) financing by business angels, loan financing and investment in infrastructure development and research equipment. The program also offers to finance for advisory services and market research extended to enterprises looking for industry or equity market investors (Stock Exchange, NewConnect and Catalyst markets).

Support for the eco-innovative deployments of (own or purchased) products or processes in enterprises can be provided as long as the entrepreneurs involved hold patent rights, licenses and have the required know-how. The instrument is to be supported under the open innovation formula proposed by Chesbrough (2006) in which enterprises may use the outcomes of not only their research but also of that carried out by other organizations. Furthermore, the plan includes the establishment of a guarantee fund which will provide guarantees to banks extending loans for deployments of R&D outcomes. The assumption of a portion of the risk by a guarantee fund provides an incentive for private equity to finance innovative projects. Such projects will, therefore, be funded with bank loans (with an own contribution of at least 25%). Such loans will be repaid in part with public funds in the form of the so-called technological premium. The instrument is designed for micro, small and medium-sized enterprises. The relevant implementing institutions are the Polish Agency for Enterprise Development and Bank Gospodarstwa Krajowego.

The National Centre for Research and Development is going to serve as an intermediary body that finances research and development "aimed at developing a solution (product, technology and/or service) that helps protect the environment and meets eco-innovation criteria". Such projects will be focused on achieving "cleaner processes, materials, and products; generating cleaner energy; utilizing waste in production; closing the water and sewage circulation loop, etc." and ultimately developing a solution that will lower the consumption of materials and energy in production, reduce pollution, increase materials and waste recycling rates and increase the share of renewables in the energy mix" (Operational Programme Smart Growth, 2015).

6. Financing eco-innovation with domestic funds

The national environmental priorities are defined in such strategic documents as the NFEPMW strategy for 2013-2016 with a view to 2020, the Joint

NFEPMW – RFEPMW Strategy for 2013-2016 with a view to 2020 and the Energy Security and Environment Strategy. The documents express goals for four basic objectives pursued in financing environmental protection in Poland: "sustainable conservation and management of water resources, waste management and soil conservation, atmosphere protection, including combating climate change and the conservation of nature and bio-diversity." The 2020 Mid-Term Development Strategy for Poland (2012) underscores the significance of eco-innovation for "the rational consumption of energy and the supply of clean and safe energy (including renewables and clean energy based on fossil fuels)."

A joint NFEPMW and NCfR&D program named GEKON, which is an acronym for the Polish-language equivalent of Environmental Concept Generator, has been developed in response to the challenges defined in the above documents. The programme supports research and development work as well as the deployment of the resulting innovative environmentally friendly technologies in the five selected areas of "environmental aspects of procuring unconventional gas, energy efficiency and storage, conservation and rational use of water resources, the development of renewables and innovative methods of producing fuel, energy and materials from waste and waste recycling". GEKON is designed for entrepreneurs, the consortia of research institutions and entrepreneurs and groups of enterprises acting together (NCfR&D, NFEPMW, 2013).

Another initiative, this time of international scope, is EUREKA, a network associating 40 European states which collaborate in industrial research and development and produce outcomes that can potentially be sold on a commercial basis (NCfR&D, 2016). The GreenEvo Green Technology Accelerator of the Ministry of Environment disseminates green technologies domestically and internationally with a view to attaining a circular economy (Ministry of Environment, 2015).

7. Financing eco-innovation with financial sector capital

A popular vehicle for financing eco-innovation is bank loans and leasing, both of which are offered by a growing number of banks in Poland. The most comprehensive range of such products is being offered by Bank Ochrony Środowiska S.A. (Bank of Environmental Protection) for financing investment in new technologies and energy-consumption-reducing devices as well as projects in the fields of energy efficiency, renewables, thermal improvement of buildings, water and material conservation in production and environmental projects. The bank's loans are backed by contributions from the NFEPMW (or its regional chapters).

One such product is the *Energia na Plus* loan offered under a foreign credit line of the European Investment Bank within the framework of the Energy Efficiency Programme for Small and Medium-Sized Enterprises (SMEFF EE), repaid in part with a European Union grant provided to offer a financial incentive to borrowers. This financing is designed for projects which reduce carbon emissions and energy consumption in industrial and residential buildings and projects of building installations for renewable sources of energy (Żyła, 2014).

A new Bank Gospodarstwa Krajowego (BGK) product which makes it possible to purchase or implement new technologies in enterprises is a technological innovation loan constituting a non-repayable financial support instrument extended to micro-, small- and medium-sized enterprises planning to adopt technological innovations with the support of EU funds. The program is distinguished by the technological premium consisting of EU financial support offered by BGK towards the repayment of a company's debt.

According to Gabryś (2011) and Dziawgo (2010), the financial instruments offered by banks include special-purpose and other deposits, payment cards with a fee that supports an environmental cause, structured products (comprised of the shares and bonds of environmentally friendly issues or stock market indices of corporate social responsibility), shares having a declared environmental purpose (e.g. World Bank Green Bonds), bonds, investment fund units and short-term debt securities.

8. Financing eco-innovation with private equity

The so-called equity gap and difficulties accessing external funding create opportunities for the development of specialized financing such as private equity. Venture capital is designed mainly for young and innovative businesses which need capital to develop rapidly their products (Baygan & Freudenerg, 2000).

The usage of the term venture capital in Poland follows the definition of venture capital offered by the Polish Association of Equity Investors which refers to investments made at early stages of corporate development and designed to start up a company or secure its expansion (PSIK, 2014; Fałat-Kiliańska, 2014, p. 14). Such investments may be conducted to develop new products and technologies, increase working capital, acquire companies or improve and strengthen a company's balance sheet. Note that according to research by Faria and Barbosa (2014), VC financing is at its most effective in later stages of project development as it is more useful for commercializing innovations rather than their creation.

The literature offers ample examples of the benefits to be derived from financing investment with venture capital. Such benefits include:

- appreciation in company value during the investment period, i.e. 5-7 years,
- the ability to carry out projects even despite the high risk involved,
- investment risks diversification resulting from the presence of an investor,
- improvements in the company's balance sheet by changing the ratio of company debt to shareholders' equity and increased creditworthiness,
- better liquidity resulting from being relieved from the obligation to pay interest,
- access to new business contacts,
- boosted competitiveness and improved market position (Przybylska-Kapuścińska & Mozalewski, 2011, pp. 53-54; Rosa, 2008; Sobańska-Helman & Sieradzan, 2004).

Note that numerous reports, such as "The Private Equity Market in Poland: Facts and Opinions" (KPMG, 2014) portray Poland as the region's most important and attractive private equity market (including VC). This results from the pace of the country's economic growth, the stability and the size of its economy as well as the size and liquidity of the share market (Groh et al., 2014). Poland has for years topped the annual ranking of Roland Berger "European Private Equity Outlook" in terms of the anticipated growth of the PE market, including VC.

It should also be mentioned that according to the European Venture Capital Association (EVCA), investment in the energy and raw materials sector amounted to 7% of all PE investments in Poland in 2007-2010, while the energy sector and the environment accounted for 4% in 2014, which shows there is still tremendous investment potential in these areas. This triggered the emergence of new public-private mechanisms involving equity funds such as the BRIDGE program of the National Centre for Research and Science aimed at supporting the effective marketing of scientific and R&D outputs. BRIdge Alfa targets ideas found to be at the seed phase at which the risk of investment failure is the highest but can be verified at a relatively low cost. Investors are provided with non-repayable support extended by NCfR&D for the development of new ideas having a vast commercialization potential.

One of the key links in the chain of SME financing is business angels which close the funding source gap between equity acquired from friends and family members and VC funds. According to studies by the European Commission, the total annual volume of investment carried out with the help of business angels amounts to an estimated EUR 10-20 billion (compared to the value of all private equity funds in Europe in 2002 and 2003 which amounted to EUR 27.6 and 29 billion respectively) (Mikołajczyk & Krawczyk, 2007).

In Poland, business angels are still in their infancy due in part to insufficient recognition and a poor understanding of the nature of their work (Brzozowska, 2008). There are opportunities to remedy this through projects that support private investor networks with the structural funds of the EU, e.g. within the framework of the aforesaid Operational Programme Smart Growth.

One should also take a note of suggestions to use unconventional eco-innovation financing such as crowdfunding (Chrzanowski & Dziedzic, 2014) and crowdsourcing (Woźniak, Dziedzic & Chrzanowski, 2014).

A summary of all eco-innovation financing mechanisms available in Poland is provided in Table 1.

Table 1. Selected eco-innovation financing mechanisms in Poland

Type	Support mechanism
EU funds available to EU member states	Horizon 2020, including InnoFin, FTI and COSME LIFE INTERREG Europe 2014-2020 Central Europe 2020 Cooperation Programme
EU funds in Poland	Operational Programme Infrastructure and Environment (OPIE) Operational Programme Smart Growth (OPSG)
Domestic funding	the GEKON –Environmental Concept Generator program the EUREKA initiative GreenEvo Green Technology Accelerator initiative
Funds provided by financial sector organizations	Loans such as BOŚ loans under the *Energia na Plus* program, the "Loan for technological innovation" program Loans from the Environmental Protection Fund
Private equity funding	Venture capital Public-private mechanisms involving equity funds such as BridgeVC Business angels Crowdfunding, crowdsourcing

9. Conclusions

An overview of scientific literature and key documents suggests the following conclusions:

- Research, development and deployment spending in the field of eco-innovation in Poland remains below the level that guarantees the related growth and effective utilization of the existing opportunities.
- The primary objective of the national policy on environment is to increase "research and development spending in the fields of environmental protection and the deployment of eco-innovation in industry as a precondition for the success of the policy on environment, as projects of this kind are currently greatly underinvested" (State

Policy on Environment in 2009-2012 with a view to 2016) (Ministry of Environment, 2008).

- The equity gap is one of the highest barriers to the development of Polish entrepreneurship and to the implementation of development projects, not only with respect to eco-innovation (Szulczewska-Remi, 2014). As a consequence, it is critical to adopt new intervention instruments.
- The plans to increase eco-innovation spending enshrined in Polish and European strategic documents for the coming years do provide financing options. Nevertheless, some authors believe that a more serious weakness of the public administration lies in its misunderstanding of the essence of eco-innovation. As a result, Poland has not been utilizing the full potential of EU financing to stimulate its eco-innovation (Szpor & Śniegocki, 2012, p.18).
- The key eco-innovation financing mechanisms are EU funds extended to the member states of the European Union as well as the EU funds distributed in Poland in the new financial perspective 2014-2020, domestic funding and funding provided by financial institutions.
- In addition to financial instruments in the form of donations and loans granted on preferential or market terms, other significant potential sources of eco-innovation financing are available in the form of private equity funding, particularly for financing the early stages of eco-innovative investment projects.
- The huge potential for developing eco-innovation in Poland, especially in the energy and environment fields, may turn out to be pivotal for boosting the competitiveness of the Polish economy. It may, therefore, become possible to "promote an economy that is more resource efficient, more competitive and more environmentally friendly" (Commission Communication Europe 2020, 2010).

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