



Qualitative assessment of economic impacts



Deliverable D5.2

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List of Acronyms

ADF: Advanced Disposal Fees
B2C: Business to Consumer
CAP: Common Agricultural Policy
DIY: Do It Yourself
EPR: Extended Producer Responsibility
ETR Environmental Tax Reform
GDP: Gross Domestic Product
GFR: green fiscal reforms
GHG: Green house Gasses
GTR: green tax reform
ISDS: (Investor-to-State Dispute Settlement
LULUCF: Regulation for Land Use, Land Use Change and Forestry ()
NECD: National Emissions Ceilings Directive
NGO: Non Governmental Organisation
PES: Promotion of Payment for Ecosystem Services
PM: Policy Mix
PM-LU: the policy mix for land use
PM-MOM: policy mix for metals and other materials
PM-O: the overarching policy mix
PRO Producer Responsibility Organizations
R&D: Research and Development
RMC: Raw Material Consumption
SSM: Social Supermarkets
TTIP: Transatlantic Trade and Investment Partnership,
UCTS: Upstream Combination Tax/Subsidy
VAT: Value added tax

1 Introduction

The ultimate goal of the DYNAMIX project is to put forward a consistent and comprehensive mix of policies that has the concrete potential to bring the EU on a path leading to absolute decoupling of resource use and economic growth by 2050, for a selected group of key resources. Through a careful design and selection process, based partly on lessons from best practices across the EU and worldwide and partly on the policy recommendation by the state-of-the-art in the academic and gray literature, the DYNAMIX team has selected a number of promising policies and grouped them into three policy mixes (an overarching policy mix, a policy mix for land use and a policy mix for metals and other materials). These policy mixes and the policy instruments they contain are described in Deliverable 4.2 (Ekvall et al., 2015).

There is no ex-ante guarantee, however that these policies will have the intended effects in the real world. For this reason, passing the policy mixes through a rigorous ex-ante assessment process can help identifying issues, which may hinder the implementation and the success of certain policies. This overall ex-ante assessment will ultimately serve to identify the most promising policies, which we consider worth further consideration and refinement. To this end, the assessment will take different perspectives in DYNAMIX, both qualitative and quantitative as well as covering different dimensions (e.g. environmental, economic, social, legal, public acceptance).

The economic analysis follows two opposite and complementary approaches, which are respectively qualitative and quantitative in nature. While the results of the quantitative socio-economic assessment will be presented in a forthcoming DYNAMIX report (Deliverable 6.2), the present document contains a series of qualitative assessments of potential economic impacts of the suggested policy mixes.

Economic policy analysis has a long-standing tradition, and it has always gone hand in hand with economic theory since Adam Smith's 1776 *laissez faire* lesson (a non-interventionist prescription no doubt, but still already a way to use economic tools to derive suggestions to policy makers about what do – or refrain from doing – for the benefit of the society). Environmental economics as an independent field of study has more recent origins, and has always been characterised by a strong link with policy. Indeed, the normative perspective (that is, trying to define how the economy should be, and how to get there¹) seems to be prevalent in the works of environmental economics. A number of environmental policy instruments, currently implemented worldwide, are either based on existing tools whose extension to the environmental field have been suggested by economic research (environmental taxes are the example of choice) or have been directly invented by environmental economics. Emission Trading Systems (ETS), for instance, are based on the idea of negotiable permits, first put forward in general terms in 1960 by Coase and further adapted to environmental issues by Crocker (1966), Dales (1968) and Montgomery (1972)(Ellerman 2005).

¹ As opposed to the *positive* approach, which aims at describing and understanding the economy as it is.

Thus, economics is particularly well equipped to assess policies aimed at improving the way we use natural resources. Of course, economics can only assess aspects of any given policy that have an economic dimension, and economics can perform this assessment only according to economic criteria devised within the economic methodology for policy analysis. In particular, economics gauges any given policy that has economic relevance against four criteria: effectiveness, efficiency, equity and feasibility. Chapter 2 of this document is devoted to the illustration of these criteria and to the analysis of their major determinants. In a nutshell, effectiveness has to do with the ability of a given policy to accomplish its goal; efficiency relates to the ability of the policy to minimize the cost for the society of reaching that goal; equity has to do with the distributional consequences of the policy and the fairness with which costs and benefits of the policy are distributed within the society and across generations; feasibility has to do with the chances the policies have to be implemented without being stopped by any technical, legal, social, economic or political obstacle. This last criterion obviously does not exclusively belong to the economic domain but is rather interdisciplinary in nature. Similarly, equity has a strong social connotation and it is highly relevant from a socio-political perspective; however, it does have a strong economic salience insofar as it relates to economically meaningful issues, such as income and wealth distribution, and social welfare.

The three policy mixes under scrutiny are not only relevant for the sustainability of our current and future existence on this planet, but also focus on some fundamental issues that have long been at the core of environmental economics research, or indeed, economics itself. The concern for the looming scarcity of resources dates back to Thomas Malthus (1796) who focused his pessimistic predictions on the overuse of agricultural land and its ability to support a (geometrically) increasing population.

The agricultural sector has also been the cradle of other research ideas in environmental economics, such as, for instance, the regulation of non-point pollution externalities, which focused initially on the regulation of chemical effluents (fertilizers and plant protection products) in agriculture (Pearce and Koundouri 2003). The policy mix for metals and other materials fits naturally in the research field of natural resources economics, and in particular in the economic theory of exhaustible resources, which dates back to Harold Hotelling's work on the optimal extraction path for a finite resource such as metal ore (Hotelling 1931). The overarching policy mix contains environmental tax reforms which, again, are at the core of the normative side of environmental economics. Indeed, the exploration of the pros and cons of market-based instruments as opposed to command-and-control ones, is a crucial area of research for environmental economics since the seminal results by Pigou on correction of negative externalities through taxes (Pigou 1920), and later the analysis by Weitzman (Weitzman 1974) and Baumol and Oates (Baumol and Oates 1988).

In order to underpin the economic analysis with a sound methodological framework, Chapter 2 provides an overview of the theoretical approach applied in Chapter 4. It first shows that any policy exhibits a series of features, which allow ordering it into one of the categories identified by the economic policy analysis. This categorization includes four types of policies:

1. market- based (such as green tax reforms, environmental taxes and subsidies);
2. command-and-control instruments (such as product standards);
3. education and information policies (such as skill enhancement programs and public information campaigns);
4. voluntary (and other) instruments (this latter group is residual and contains those instruments which do not fit into any of the three previous clusters)..

On this basis, we re-classify all DYNAMIX policies into these categories, with the aim of better structuring and guiding their qualitative analysis in Chapter 4. The second section of Chapter 2 illustrates the four criteria used by the economic policy analysis (i.e. effectiveness, efficiency, equity and feasibility) to assess a policy. In this perspective, we understand them as the attributes, which a policy should exhibit in order to be regarded as “promising”. In the same perspective, the chapter also investigates the major determinants of each attribute.

Chapter 3 complements the analysis performed in chapter 4 with the evaluation of the DYNAMIX policy mixes from the points of view of coherence and consistency. To this aim, it first tries to match all DYNAMIX policies with the five key-targets of the Project, as they are defined in Umpfenbach (2013). Then, it evaluates coherence and consistency at the “external” level, which regards the relationship between the policy package in its whole and the key-targets. At the “internal” level, the analysis focuses on the interactions among the individual policies.

Chapter 4 provides the qualitative assessment of each policy instrument in detail according to four economic criteria indicated above. It adopts the policy reclassification proposed in Chapter 2, which entails the four categories of instruments highlighted above. In the final section, we carry out the qualitative assessment of each single policy mix.

Chapter 5 draws upon the results of the previous chapter to derive useful indications about the completeness of the policy mixes, its strengths and some viable directions for improvement, which may include rethinking and reshaping of individual policies, or replacing instruments, which *prima facie* seemed promising. Moreover, Chapter 5 draws on the economic approach to policy analysis to provide some indications about the ideal timing of the proposed policies.

Our concluding remarks are presented in Chapter 6.

2 Methods

This chapter describes the methodology for the qualitative assessment of the DYNAMIX policy package. This includes three policy mixes (PMs): the overarching policy mix (PM-O), the policy mix for land use (PM-LU) and a policy mix for metals and other materials (PM-MOM). Each PM contains a set of instruments (policy instruments), which altogether pursue the general objective of the PM. The policy approach of DYNAMIX is based on policy mixes rather than on individual policies. This is consistent with precise indications of economic policy theory, which are motivated by the complexity of the real world. It is recognized, in fact (see, for example, de Serres et al., 2010) that the environmental externalities originate from a combination of diverse market failures at the same time. For this reason, a policy mix generally appears a more adequate instrument than a single policy instrument². This explains why multifaceted policy instruments tend to prevail in the real world and in the environmental and resource policy in particular (Bennear and Stavins, 2007)³.

The design of each policy mix is based on thorough considerations about which issues are believed to be the most crucial in the relationship between the economy and the environment. These are summarized in the five key-targets described in the deliverable D 1.2 (Umpfenbach, 2013: 1-2) and relate to the use of metals, the level of GHG emissions, the use of land by the agricultural sector and the quality of water. Basically, every PM is built putting together a series of policies which contribute to reach one of these key targets.

In chapter 4, we study the single policy instrument (i.e. policy instrument) and (in section 4.5) the single PM. This analysis is based on the investigation of four assessment parameters, spelled out in section 2.2: effectiveness, efficiency, equity and feasibility. In chapter 3, we study the relationship between the whole DYNAMIX policy package and the key targets of the Project. This analysis is developed at two levels, as indicated in the next chapter. At an external level, it looks at how the whole policy package stands in relation to the five key targets of DYNAMIX. At an internal level, it studies how the individual policies in the three PMs interact with each other. Both levels of analysis use two assessment criteria: coherence and consistency.

The two kinds of analysis are complementary. A complete assessment of a PM includes both the investigation of the four assessment parameters listed above and an evaluation of its coherence and consistency. From a methodological point of view, however, the analysis of chapter 3 does not require specific insights because it is very much linked to the particular policy under investigation, and for its own nature, it is very much based on the analysis of chapter 4. By contrast, the analysis of chapter 4 deserves a deep methodological reflection. This chapter aims at delivering such a reflection.

² See however, Lehmann and Gawel (2013) for a summary of economic critiques regarding the overlapping of climate policy instruments.

³ On this point, see also Jenkins (2014)

The first step in this direction is the observation that policies are very heterogeneous, and differ strongly from one another. This is due to the context in which they are implemented and to the objectives they pursue. However, economic theory allows identifying certain common aspects among policies and on this basis it provides a classification into four well-defined categories, which are given by

1. market-based instruments,
2. regulatory and command-and-control instruments,
3. information-based and educational instruments,
4. voluntary instruments and other instruments.

This categorization is recognized also by policy makers as it emerges from several policy reports by major national and international bodies (e.g. OECD, 2006). Moreover, it is exhaustive in the sense that each and every policy can be ascribed to one of these four groups. The analysis performed in this document is based on this categorization, as it allows a more systematic and efficient assessment of the DYNAMIX policy package. This motivates section 2.1, which is devoted to a reclassification of all DYNAMIX policies into the four types given above.

The major contribution of this chapter is given by section 2.2, which illustrates the four assessment parameters, and describes which factors possibly affect them, and how these act. The qualitative assessment of any policy is based in fact on the investigation of these four attributes and on the evaluation of the role of a reasonable spectrum of forces which may reasonably influence them. The typical outcome of this analysis is a set of indications regarding how promising a policy can be.

2.1 Reclassification of the DYNAMIX policies

This section first provides a brief description of the main features of each policy category given in the previous section, in order to provide the necessary background for the reclassification of the DYNAMIX policies. Then, based on the features of each policy, it assigns them to the proper category.

2.1.1 Market-based instruments

In order to explain the basic mechanism of the market-based instruments, we consider the simplest economic theory, which depicts the economy as a set of private actors which interact with each other in order to achieve a personal objective. Private actors are supposed to be fully rational. The two main types of economic actors are firms and private households (i.e. workers, consumers and savers at the same time). In the standard neoclassical setting, firms are assumed to pursue costs minimization with the final goal of profit maximization while

private actors (households) are assumed to maximize their utility (happiness). All actors interact on markets to reach their objectives. Standard economic theory assumes that these are perfectly competitive and perfectly functioning (i.e. free of any type of distortion as for example information asymmetries).

The logic behind the market-based instruments is that these influence the price levels that the economic actors take into account to make their optimizing decisions. In other words, they are a system of incentives which, under the assumption of rational and economically motivated actors, should lead to changes in purchasing habits. The main market-based instruments have a fiscal nature, i.e. they are taxes and subsidies; however also non-fiscal schemes such as negotiable permits (trading schemes) belong to this category of instruments. Environmental taxes are typically used to reduce the level of harmful activities, as taxation makes them become relatively more expensive. Similarly, in many countries health policies include for example high tax rates on tobacco to discourage consumption. On the other side, subsidies can be used to support production or consumption of products which are considered socially desirable. Although they are very widespread, taxes and subsidies are only a sub-set of market-based instruments, which may indeed take various forms. More complex systems include for example green tax reforms (GTRs) or green fiscal reforms (GFRs). Complex as they can be, these instruments are actually a combination of taxes and subsidies. Another category of instruments is given by trading schemes, which have the basic goal of making trading opportunities available where they did not previously exist. In a simplified framework, these instruments basically involve the government in the role of setting an allowed level of an activity, as in the case of carbon dioxide, and allocating emission permits to emitting subjects. Private actors are then free to trade these permits amongst themselves. This type of instrument allows the government to specify the total level of emissions without imposing limits on individual agents. It can be shown that they are equivalent to either environmental taxes or subsidies depending on the mechanism adopted for the initial allocation of the permits: auctioned permits are equivalent to a tax, grandfathered (freely distributed) permits are equivalent to a subsidy (Baumol and Oates 1988).

Since a market-based policy contains one (or more) fiscal instruments, the identification of this type of policies within the three PMs is quite straightforward. Although its name may not reveal it, the “Circular economy tax trio” is in effect a GTR like the two “Green Fiscal Reforms” in the PM-MOM. All these instruments include in fact a taxation instrument and a full (or partial) reuse of the tax revenues in the economy. Further fiscal instruments include an increase in the value added tax rate on meat products, which is a pure taxation instrument and two subsidy policies (i.e. the reduced VAT for the most environmentally advantageous products and service and the increased spending on research and development). Finally, the EU-wide introduction of feebate schemes for selected products categories combines a tax and a subsidy. Table 1 provides an overview of all market-based policies contained in the DYNAMIX policy package.

PM-O	<ol style="list-style-type: none"> 1. A ‘circular economy tax trio’ 2. EU-wide introduction of feebate schemes for selected products categories 3. Reduced VAT for the most environmentally advantageous products and
------	--

	service
PM-LU	4. Value added tax (VAT) on meat products
PM-MOM	5. Green fiscal reform: internalisation of external environmental costs. 6. Green fiscal reform: materials tax. 7. Increased spending on research and development.

Table 1. Market-based policies in the DYNAMIX policy package.

2.1.2 Regulatory and command-and-control instruments

Regulatory and command-and-control instruments prescribe what is permitted and what is not. Typical instruments in this category are laws, administrative regulations, contracts and agreements. Instruments of this kind do not intervene on prices directly, but have a clear impact on them. Standard economic theory usually considers this type of instruments less efficient than market-based instruments. However, two main strengths characterize regulatory and command-and-control policies. In contrast to fiscal instruments, they allow reaching with precision a given target, while taxation usually allows for an approximation. Since fiscal instruments target prices and act through price elasticities, they turn out to be less efficient in the case that the objective involves a radical use change, as for example in the case of the total ban of a highly toxic substance. Analogously, a regulation may prove more effective when the objective is a quick and fundamental technological change. These are the main reasons for DYNAMIX to include appropriate instruments of this type in the overall package. Table 2 contains the related list.

PM-O	1. Boosting extended producer responsibility
PM-LU	2. Stronger and more effective environmental and climate dimension for EU land management in the CAP. 3. Revised emissions levels in the National Emissions Ceilings Directive (NECD) and additional instruments for better management of the nitrogen cycle on farmland 4. Regulation for Land Use, Land Use Change and Forestry (LULUCF) 5. Strengthened pesticide reduction targets under the Pesticides Directive, and provision of guidance to farmers on integrated pest management
PM-MOM	6. Product standards (requiring, e.g., water piping produced from polymers rather than copper).

Table 2. Command-and-control policies in the DYNAMIX policy package

2.1.3 Information and education policies

Although this document classifies information and education policies under the same category, these two types of interventions have a slightly different objective, and they basically focus on different groups of actors. Information policies usually target a wider public, but act at a more superficial level in the sense that they tackle issues mostly regarding consumption habits. The assumption behind this type of policies is that the public is not sufficiently informed about the full consequences of its everyday consumption choices. In the case of the “Targeted information campaigns on changing diets and on food waste”, the objective of the policy is twofold. On the one hand, it is to increase sensitivity towards health-related and environmental consequences of certain nutritional habits. In this perspective, typical information policies include new and more informative labelling on targeted products. On the other hand, the policy aims at indicating consumers that there is considerable room for reducing food waste with beneficial effects on the environment. The aim of the “Step-by-step restriction of advertising and marketing” is more drastic, as it consists in reducing the opportunities for the public to be informed about the existence of a given (harmful) consumption good or service or even to be persuaded to buy it.

Education policies are usually more related to schooling and pursue a change in habits and behaviours more at the production than at the consumption side. This is the case of the “Skill enhancement programmes”, for example, which target the upper training levels like the academic or the vocational ones. This type of policies is educational in the sense that it aims at modifying as well extending the cultural background and the technical skills of labour forces in order to prepare a fruitful context for broader technological shifts. The DYNAMIX information and education policies are listed in Table 3.

PM-O	1. Skill enhancement programmes 2. Step-by-step restriction of advertising and marketing
PM-LU	3. Targeted information campaigns on changing diets and on food waste
PM-MOM	NO POLICIES

Table 3. Information and education policies in the DYNAMIX policy package

2.1.4 Other/voluntary instruments

Voluntary policies impose no obligation on economic agents and are successful only if individuals freely accept to abide with them. This type of policies usually contains one or more instruments, which belong to one (or more) of the three categories analysed above. In the case of the policy “Enabling shift from consumption to leisure”, for instance, this “could include examination of longer statutory vacation times, dismantling of discrimination of part-time workers, the introduction of flexible wage records and reductions of the fixed cost of labour that currently disfavour part-time posts” (Ekvall et al., 2015: 79). Here, the first two instruments are regulatory in nature while the last one takes the form of a fiscal instrument. A

similar analysis applies to the “Promotion of Payment for Ecosystem Services (PES) programmes” and to the “Development of food redistribution programmes/food donation to reduce food waste”. In these policies, a set of regulatory instruments aims at installing the programme while further market-based or even regulatory instruments are included to foster the policy. In the case of the “Local currencies for labour-based services” and of the “Stimulation of sharing systems”, the voluntary dimension is based on a market-based instrument which aims at creating a new market for a good (the local currency) or a service (the bike renting). Table 4 provides an overview of the DYNAMIX policy instruments belonging to this category.

PM-O	1. Enabling shift from consumption to leisure. 2. Local currencies for labour-based services.
PM-LU	3. Promotion of Payment for Ecosystem Services (PES) programmes. 4. Development of food redistribution programmes/food donation to reduce food waste.
PM-MOM	5. Stimulation of sharing systems

Table 4. Other/voluntary instruments in the DYNAMIX policy package.

2.2 Four relevant attributes to assess each policy

This section describes the four assessment attributes, which guide the qualitative assessment of policies in chapter 4. These are effectiveness, efficiency, equity and feasibility. The adoption of these four parameters for policy assessment is the outcome of a reflection, which is deeply established in the relevant literature. This section first illustrates the main features of each individual parameter. Then, it shows that the four parameters together allow a sufficiently complete assessment of a policy. In the remaining part, it investigates which variables influence the four attributes the most.

While the four parameters are basically autonomous, they also affect one another, as it will emerge further below in this section. For this reason, our analysis deals with each one of them separately but also highlights their mutual interactions. Very often, they are related through trade-offs. A typical example is given by efficiency and equity. A progressive taxation is more fair but less efficient than a lump-sum one, which foresees a taxation of an equal monetary amount for every agent. Another example is given by green tax reforms, which may have regressive effects (and thus a negative impact on equity). Policy makers may decide to mitigate them through appropriate instruments, which however negatively affect efficiency.

The first two parameters in the list (i.e. effectiveness and efficiency) represent rather necessary conditions for a policy. Economic effectiveness, which indicates the capability of a policy to reach a given objective, is clearly a basic condition. Ineffective policies should be simply neglected. Economic efficiency refers to the costs implied by a policy relatively to the

objective it can achieve. A policy which seems promising in achieving a given goal is potentially appealing. However, if it is particularly costly, alternative, cheaper options should be taken into consideration. Ideally, a policy should allow reaching the objective at the lowest possible cost. As to the interdependency between the two attributes, these are indeed strictly related with one another. It is ideally possible to increase the effectiveness of a policy through higher costs, which reverberate on the level of efficiency.

Equity and feasibility are more related to the sphere of the political economy of a policy. In fact, they jointly determine to which extent a given policy is easy to implement. Equity issues regard the effects of the instrument on different categories of economic agents, while the feasibility represents the level of difficulty in introducing and implementing the policy. It may well happen that a seemingly effective and efficient policy does not prove automatically desirable for the economy, or for a part of it, and for this reason it may turn out to be of difficult implementation

Narrowly defined, equity has to do with households' welfare, which in this context are considered heterogeneous from the point of view of their income levels. According to a wider concept, equity may apply also to economic sectors. A given instrument usually affects different actors differently, as in the case of decarbonization policies, which mostly affect the energy intensive sectors. With regard to the relationship between equity and the first two features, we can theoretically imagine that even an effective and efficient policy may be highly unfair. As to the relationship between equity and feasibility, at a first sight, it might seem straightforward that lower equity means lower feasibility. However, this is not always the case. On the one hand in fact, it is quite straightforward to instrument the level of unfairness, which might affect a small group of people and be very high, or conversely, affect many actors while being quite low. On the other hand, another issue relates to the ability of the negatively affected categories to convey their dissent at political level. This ability depends on various aspects as for example the size and the nature of the affected groups. We can conclude that equity strongly influences feasibility, although the relationship among the two is complex and multifaceted. This brief overview shows that equity and feasibility do not necessarily imply that a policy may to be automatically implemented. Feasible as it can be, a policy may be highly ineffective or inefficient. This allows concluding that both necessary and sufficient conditions are required for a policy to be successful.

With regard to the level of measurability of each individual attribute, the first two parameters (effectiveness and efficiency) are in principle instrumentable, as we will argue in the related subsection. More precisely, their measurability is technically possible. However, the quantification of each aspect of effectiveness or efficiency may be quite costly so that its quantification is eventually neglected. For this reason, the assessment of the first two attributes is generally based on the vast literature which includes (theoretical and applied) models and econometric studies. The former type of instruments is used for the ex-ante assessment while the latter category is employed in the ex-post analysis. Very often, due to the relative novelty of the instruments under scrutiny, there may be few ex-post studies and in some cases, also ex-ante analyses can be scarce. From a methodological point of view, the measurability of equity is similar, although a word of caution is in order. A variety of indicators is available to instrument income disparities, which potentially allows measuring the impact of

a given instrument on equity. Since the instrumenting of equity foresees income heterogeneity among agents, providing an ex-ante assessment of equity requires models, which allow for such heterogeneity. This is however challenging in terms of model complexity and this explains why the ex-ante assessment of equity may be often a hard task. Quite differently, ex-post evaluations, which are performed econometrically, are usually more viable.

Feasibility is far less easy to quantify than the first three attributes. This is due to a series of aspects, some of which are typically related to the intrinsic human dimension of any policy, and include, institutional, social and even cultural factors. Perhaps the most relevant studies in the economic literature on feasibility are those which analyse the process behind the introduction of a new policy (in an ex-post perspective). An interesting example is given by Bødker et al. (2015) with regard to the introduction of a fat tax in Denmark in 2011.

2.2.1 Effectiveness

Effectiveness is usually defined in the relevant economic literature, as the capability of a policy to achieve a given target. Such definition is used for example in OECD (1999), as indicated by Clinch et al. (2006). Its qualitative assessment is significantly different from the quantitative one and the two approaches are basically complementary to each another. For a given policy objective, the quantitative evaluation assumes that it is possible to instrument how close to the target the policy allows to get. The closer to the target a policy can get the more effective it is. The assessment of the effectiveness in a precise empirical context requires an applied simulation model, whose result is clearly different from any ex-post econometric valuation. The ex-ante quantification exercise cannot account for all those elements that effectively influence the realization and the action of the policy in the real world. The qualitative assessment aims at highlighting the main aspects, which foster and hamper the effectiveness. Generally speaking, the result of the qualitative assessment does not consist in a numerical indication of the degree of effectiveness of a given policy or in an ordering among different policies. The qualitative assessment focuses on factors which are in any case difficult to be assessed quantitatively, and in this perspective, it is motivated by the limitations of the quantitative evaluation. In fact, the apparent unambiguousness of the quantitative analysis actually hides the presence of a series of issues.

A first problem is related to the “capability of singling out the most appropriate tools relatively to the policy targets” (Sexton et al., 2007). The literature involved in the analysis of the effectiveness agrees that it is intrinsically difficult to design generally effective policies. The quantification of externalities is not straightforward. The data used to instrument them and the methods employed to process this data are numerous and lead to different results. As an example, consider the case of GHG emissions in the agricultural sector at the global level. Depending on the studies, these range from 17% to 32% of total emissions (Bellarby et al. 2008). Another example, provided by several authors (Gustavsson et al., 2011; Godfray et al., 2010; Stuart, 2009; Quested and Johnson, 2009) regards food waste. In this context, authors highlight the existence of several inconsistencies between regional and global data. An interesting overview of the issues related to the capability of data to reflect the effective entity of externalities is given in Dorward (2012).

Another issue is related to the modelling techniques employed in the quantitative evaluation. These are by construction not quite flexible and do not allow to fully capture the complexity of the real world. The strong simplifying assumptions are a necessary evil of the quantitative approach: they allow the operability of computationally complex models, but are bound to affect the results. Conversely, the qualitative approach discusses the impact of these assumptions and allows to qualify the results of the quantitative analysis.

A third source of complexity is the intrinsic heterogeneity in type and intensity of externalities (Lichtenberg et al., 1993) and of the effects of a given policy (Sexton et al., 2007). As far as the heterogeneity of externalities is concerned, an ideally effective policy foresees the application of an instrument, which takes into account all these differences. In the case of pesticides, for example, it is necessary to distinguish among types of effects, which include those on workers (due to their exposure), those on consumers (through pesticide residues on foods) and those on the ecosystems due to drift, runoff, and species interactions. These effects vary because of a number of factors, like, for example the active principle contained, the mode and the quantity in which they are used, the features of the application location (Sexton et al., 2007 and Zilberman and Millock, 1997). All these elements make the design of an effective policy very difficult and suggest that policy makers have to make some choices. In the EU, for example, it was decided to set maximum residue levels in its directives 76/895 (fruit and vegetables) and in 86/362 (cereals). More generally, we can argue that a market-based instrument like a tax might need to be differentiated according to the type of pollutant, its mix with other pollutants, its source, its amount and its timing. Another interesting example relates to the environmental impacts of food waste (Roy et al., 2009). In this case, a major difficulty relates to the assessment of the impacts of individual food products (each variety has differentiated impacts). With regard to the heterogeneity of the effects of a given policy, the case of water use management is illuminating. As observed by Varela-Ortega et al. (1998: 193) “the effects of alternative pricing policies for irrigation water are strongly dependent on regional, structural and institutional conditions and that changing policies produce distinct consequences within the same region and water district”.

Another category of determinants of effectiveness relates to the economic sphere, and follows from the basic fact that any policy intervention is implemented in a context in which a bunch of other policies is already in place. This issue regards the effectiveness but also the efficiency and the feasibility, as it will become evident in the related subsections 2.2.2 and 2.2.4. To our knowledge, the first author to study this topic is Harberger (1971), who argued that “government regulation has become sufficiently pervasive that [...] evaluations of the market effects of the newer regulations must therefore, take account of these prior regulations” (Lichtenberg and Zilberman, 1986: 1140). Bovenberg and Goulder (1996) are among the first authors to study this issue, while Bovenberg and De Mooij (1994) argue that “any new environmental taxes interact with existing taxes that already distorted economic decisions” (Albrecht, 2006: 91) with the effect of undermining both the efficiency and the effectiveness of a given policy. In a slightly different context, Goulder (1995), who provides an overview on the so-called “double dividend”, “comes to the conclusion that for most green tax reforms, negative tax interaction effects are larger than positive revenue-recycling effects, ‘so that, overall, a revenue-neutral carbon tax is likely to involve positive costs in a second-best

setting” (italics in the original, Albrecht, 2006: 91). In the case of agricultural policies, the role of interactions with the existing policy framework is highlighted by Sexton et al., 2007, by Lichtenberg and Zilberman (1986) and Harberger (1971).

The degree of economic integration between the country where the policy is implemented and the rest of the world is another crucial determinant of effectiveness. A major feature of the current world economic system is the intense degree of integration among national markets (globalization). In the case of the EU member countries, integration among them includes the four basic freedoms, which allow the free movement of goods, services, labour and capital. This fosters firms’ possibilities to shift their production plants to another country in view of changes in the regulatory framework in the country of origin. The effectiveness of a given policy depends very much onto the strategy followed by the targeted actors. Ideally two polar-opposite reactions are possible. The targeted actor may modify its behaviour in order to adapt to the new regulation while keeping its level of activity almost unchanged. Alternatively, it may decide to avoid the consequences of the new policy through migration. Here, the link between effectiveness and efficiency is evident because the achievement of the policy objective may be coupled with higher costs due to the squeezing of the economic activity following to the migration of the potentially targeted actors. The case of the introduction of a fat tax on several food articles (butter, milk, cheese, pizza, meat, oil and processed food) in Denmark (October 2011) is a noteworthy example of this behaviour. According to the Danish Tax Ministry, who abolished the tax almost one year later, the tax had encouraged cross border trading with negative employment effects. Danish retailers claimed that many of their customers were taking their business to other countries, such as Sweden and Germany. The role of globalization on policy effectiveness is the object of several papers. Turner et al. (1998) and Murphy (2002) are among the first to highlight that any policy may negatively affect certain sectors, and firms may decide to migrate. Based on this, Bosquet (2000) believes that any environmental reform in a world with mobile capital needs to be coupled by appropriate instruments to prevent targeted firms from leaving the country of origin. This forcibly affects the original policy efficiency. In the literature on energy policies, a similar position is expressed by Chang and Berdiev (2011).

Compliance is a further factor which crucially influences policy effectiveness. Quantitative models for ex-ante analyses usually assume full compliance. However, this plainly contrasts reality. In the case of environmental regulation, various authors (Macho-Stadler and Pérez-Castrillo, 2006; Macho-Stadler, 2008; Shiota, 2008) find that compliance is crucial, as the policy enforcement does affect actual emissions. Cheng and Lai (2012: 431) are convinced that “neglecting enforcement policy or assuming full compliance would lead to inadequate designs of policies”. An important determinant of compliance is the level of complexity of the instrument. The more complex an instrument is, the higher the tendency not to comply with it. In this perspective, a desirable feature of a policy is given by adequate compliance costs for the regulated actors to bear. Otherwise, the tendency will be one of not complying, with negative impacts on effectiveness. Higher compliance may be achieved in various ways. If a policy manages to convey widely recognized values, its social desirability automatically fosters the level of compliance (Hilton, D. et al., 2014). In the same line of argument, the general acceptability of the instrument positively affects compliance.

Compliance is related to monitoring and enforcement. Since Becker (1968), it is well known in the literature that higher penalties can enhance higher compliance. However, this points to an additional trade-off, which regards effectiveness and efficiency. More intense monitoring efforts improve effectiveness, but at the same time increase costs of policy implementation. Monitoring costs cannot be excessively high. Moreover, policy enforcement as well as monitoring activities is potentially subject to institutional constraints. The political effects arising from lobbying need then to be considered. This provides an insight about the links between effectiveness and feasibility.

2.2.2 Efficiency

Efficiency refers to the relationship between the objective that the policy foreseeably allows to reach and the costs that the economy bears due to its introduction. Note that economics in this context does not consider as costs the monetary payments among different categories of actors, but the so called “deadweight losses” that is the resources that are actually lost for good in the process. Every policy is associated with economic benefits for certain categories (minor costs or higher revenues) and with economic costs (minor revenues or higher costs) for others. The costs under scrutiny here consist in a fraction of resources, which the economy loses following to the policy introduction. Consequently, such stock of resources is no longer available for income (GDP) production.

There are various cost categories to consider. An important one is related to the welfare loss caused by the policy. In the economic theory, this loss originates from the fact that an economic policy instrument very often has an impact on one (or more) markets, as it shifts the equilibrium away from the position, which it would theoretically reach autonomously (endogenously), and which would be efficient. In this context, efficiency means that available resources are allocated optimally so that the maximum level of welfare can be reached. In the case of a perfectly competitive market, for instance, in absence of distortions, the introduction of a tax or a ban implies a welfare loss. This loss does not correspond to any benefit for anyone. Both buyers and sellers share it in the sense that resources simply vanish. As mentioned above in this chapter progressive income taxes are inefficient, as they in fact imply a welfare loss. By contrast, a lump sum tax, that is, a tax of the same monetary amount for every agent, is efficient. As we will argue in subsection 2.2.3, however lump sum taxes raise equity concerns as they are not progressive.

In addition to the welfare loss, there are further categories of costs to take account of. The simple act of passing a law, which encompasses for example the introduction of a tax, is different from implementing the new regulation in the real economy. Two categories of costs are related to the latter activity: costs borne by the government (i.e. the regulator), and costs borne by private actors (i.e. regulated subjects). In the first case, costs are mainly administrative. These are for example the labour costs of the civil servants who are responsible for the tax payments. In the case of a regulatory policy, typical costs may be related to monitoring activities. In some cases, these may be very high so that monitoring activities are reduced, with negative effects on the general degree of compliance. Another category of costs is due to enforcing operations, which may not always be covered by the

regulated agents in full. All in all, administrative costs may be quite relevant: “Pigou himself even assumed that in real life administrative costs of externality taxes could outweigh the benefits from externality reduction” (Albrecht, 2006: 93). On the opposite side, private actors bear compliance costs. In the case of a tax, these costs do not include excise payments. Here costs are due to compliance activities. In the case of a regulation, costs may include, for example, the labour costs related to the activities of monitoring the production process and reporting to the public administration.

The overall extent of the administrative and compliance costs depend on the type of economic instrument being used, and the distribution of these costs between the regulator and the regulated may differ widely between fiscal instruments (taxes and subsidies) and trading instruments. In the case of fiscal instruments, the regulated are likely to bear most of the cost, and have little scope to reduce direct compliance costs. However, they enjoy some flexibility to change production processes or to take other steps to minimise the costs of compliance, providing the tax or subsidy rates involved are not changed frequently. In the case of trading mechanisms, the costs involved are likely to be more evenly distributed between the regulator and the regulated.

Usually, an applied simulation model (for ex-ante assessments) can account for the costs related to the welfare loss but not for administrative or compliance costs. For their nature, these are many, diversified and policy-specific. For this reason, it is difficult to include them in a model, which usually provides a very stylized and partial depiction of the real world. This throws light on the difficulties related to a thorough quantification of the level of efficiency of a policy and further motivates the present qualitative analysis.

Another relevant point regarding the quantification of the efficiency has to do with difficulty of fully capturing the benefits of environmental policies. An effective tax may well achieve the target of reducing a given externality. However, standard models usually depict private agents through objective functions (utility and profit) which usually do not account for environmental quality. This constitutes a major asymmetry in the quantitative assessment of the efficiency of a policy, as it indeed acknowledges (some of) its costs but it neglects its main benefits.

Efficiency is strictly linked both to feasibility and effectiveness. If a policy contains a instrument, which is technically difficult to comply with, this increases the probability of non-compliance with the consequence of a lower effectiveness than expected according to any ex-ante quantitative evaluation. At the design stage of a policy, if compliance costs are expected to be high, there will be higher resistance by the targeted subjects against the policy. This was the case in Denmark (Bødker et al., 2015), when the government tried to introduce a fat tax, which was in effect difficult to calculate for targeted firms.

2.2.3 Equity

Equity has to do with how the impact of a given policy affects different categories in the economy. A thorough equity assessment calls for different layers of analysis. Within a national dimension, it is necessary to distinguish between impacts on private actors and impacts on sectors. Considering the specific case of DYNAMIX, which is an EU-wide policy package initiative, it is also necessary to take into account how different countries may be affected by the same policy. Moreover, considering the share of the EU economy in the world economy, also the impacts on non-EU countries may deserve our attention.

A more stringent regulation on material use or on emissions has clearly a strong and unwanted impact on those sectors, which use those inputs more intensively (on this, there is a vast literature, including among others Bosquet, 2000; Standaert, 1992; Danish Finance Ministry, 1995; Norwegian Green Tax Commission, 1996; Harrison and Kristroem, 1997; Vermeend and van der Vaart, 1998). These effects may be mitigated by appropriate compensation instruments, with the main goal of counteracting the negative effects of the installed policies. This principle finds application in the GTRs which, as we will see in chapter 4, include a taxation of an externality and the use of the related fiscal revenues to reduce another type of taxation. The issue of the distribution of impacts among nations is related to this. Clearly, those nations whose economies rely more intensively on the sectors, which are targeted by the policy, will suffer more than others. The nexus between policies formulated at the central level and national consequences is crucial.

A more delicate issue concerns equity among private households, which are by assumption heterogeneous in their income levels. Environmental fiscal policies tend to be regressive. This is based on the idea that the poorest population layers employ most of their income to satisfy primary consumption needs. Taxing such consumption is equivalent to taxing a major fraction of their income. For better-off groups, the same taxation is equivalent to a proportionally lower taxation rate. This is a basic reasoning which may be complemented by several, more specific reflections, which indeed explain why in the relevant literature positions are not so uniform on this point. According to Albrecht (2006), the empirical research on the distributive consequences of environmental taxation is not conclusive. In the case of congestion taxes, Clarke (2012: 16) seems aware of their redistributive effects, but also points out that “(i) tax revenues can be used to compensate losers and that (ii) it is not necessary for every tax in the economy to be progressive in its impact if society seeks to pursue redistributive objectives – what matters is the overall impact of the tax-transfer system not the impact of every specific tax. For example, Paul Howes (Hudson and Johnson, 2011) suggested that reductions in income caused by the need to pay congestion charges may be more important for workers than experiencing congestion itself”. Other authors who contribute to this debate are, for example, Brooks and Sethi (1997), West (2004), West and Williams (2004), Essi and Huhtala (2008).

With regard to policy impacts on non-EU countries, the issue is particularly relevant for that part of the DYNAMIX policy package, which deals with land use and agriculture. It is well known (World Bank 2007) that three quarters of the world’s poorest people depend on

agriculture. It follows immediately that the consequences of the EU policies need careful evaluation as they may have intense impacts on the most vulnerable population layers of the world (on this point, see, for example Swinnen and Squicciarini 2012). In fact, there is risk that some of these instruments add up to global inequality and poverty.

Equity is related to feasibility. According to Thøgersen (1994), the more a policy corresponds to social values, the more acceptable it is. As equity is to a certain extent one of these values, it can be argued that equity positively affects the general feasibility of a policy.

2.2.4 Feasibility

Feasibility is the level of difficulty related to the introduction and the implementation of a policy. This definition implicitly assumes a sufficiently effective and efficient policy. As an instrument of the crucial importance of feasibility, we recall that there is agreement in the literature on the fact that a policy may be highly effective and efficient, but this does not ensure easiness in its implementation. As argued by Carahera and Cowburn (2015), effectiveness and efficiency are necessary but they are not sufficient for a plain implementation. On this point, see also Gago et al. (2013) who provide a wide literature overview supporting active energy policies, but conclude that the main problem is not designing effective and efficient policies but rather to implement them.

Feasibility takes a different shape depending on the policy considered. It is a relevant issue in the case of market-based or regulatory policies, while it may be less crucial for educational, informative or voluntary policies. This does not mean that the implementation of these latter policies is intrinsically viable. In the case of an educational policy, problems may arise once this implies opportunity costs in terms of the abolishment of other educational programmes. A skill enhancing policy could face feasibility problems if it were compulsory. From the point of view of a firm, this might mean additional costs due to the unproductive employment of labour forces. Also in the case of an information policy, this may turn to be unwanted because it simply challenges certain features of specific types of products. Finally, voluntary policies should be in principle easier to implement, unless they undermine the interest of one or more categories. The case of the public bike rental service in Seville is interesting in this sense. According to some anecdotal evidence, in fact the initiative was fiercely opposed by taxi drivers.

A crucial determinant of feasibility is the level of trust between the government and the general public. The type and the quality of communication from the policy-maker side are essential to improve or simply to strengthen the level of trust. Any policy needs to be communicated as plainly as possible. Most importantly, the reason for its introduction must be conveyed very clearly. There might be disagreement regarding the priority level of the issue targeted by the policy but there may be no lacking information around the governmental policy objectives. Environmental taxation instruments (as also those related to public health) are always prone to the risk that their objectives are mismatched with that of revenue collection (Albrecht, 2006). This usually occurs in the case of fuel taxes that “reflect more of an interest

in raising revenue than in reducing fuel use (EEA, 2001)” (Albrecht, 2006: 90). It is necessary that the government keeps environmental or health objectives distinct from budget or broader economic goals (Bødker et al. 2015). In this framework, experts are to play a central role to give credibility to the instrument under discussion. In this vein, an important signal relates to which governmental body is in charge to design the policy. If the instrument has environmental nature, it cannot be uniquely processed by committees or commissions whose activities range uniquely in the fiscal or economic area but appropriate environmental bodies must participate to the process. An already introduced (environmental) tax cannot be adjusted according to budget needs and its design cannot pursue objectives like the minimization of administration costs for firms, as this may impinge its effectiveness and thus its acceptability. In the particular case of a GTR, Dresner et al. (2006) reports that the general public may even mistrust assurances that revenues are used as promised. High transparency in their use becomes then a priority, which may be granted though the set-up of ad-hoc independent bodies with the task of monitoring that revenues are not diverted to other purposes.

According to a quite recent strand of literature (e.g. Thøgersen, 1994; Alesina & Angeletos, 2005; Japhet, 2012), an important aspect of feasibility is the degree of support that a given policy enjoys. If the policy is based on widely shared positions, this helps its implementation. For this reason, communication aspects are crucial. The public must be enabled to understand the reason and the objectives of the policy. Dresner et al. (2006: 902) verify in a case study the importance of this aspect and report that in their interviews with alternate focus groups some “stated that they would not support a instrument they could not understand.” In general, different actors unevenly perceive a given issue or the role of a policy (Karplus, 2011). According to Dresner et al (2006: 938), for example “it is notoriously difficult to get the general public to care about the greenhouse effect because it is an invisible, abstract, large-scale and long-term problem that is the consequence of everyday actions. Careful attention to the way, in which consumers perceive the costs of different policy instruments, is therefore essential, and instrument choice itself may either relax or tighten political economy constraints”.

The role of interest groups is central in the policy making process, and it is well described in Stigler (1971). Persson (2012: 24) argues that “when individuals are affected by political decisions, they have an incentive to try to influence the political outcome”. This is explained by two reasons. On one side, economic actors are self-interested and their preferences depend on their position in the economy (e.g. Frieden and Rogowski, 1996; Milner, 1997; Hiscox, 2001). On the other side, as observed by Resnick et al. (2012), this is due to the intrinsic distributional nature of policies. Costs and benefits are often unevenly distributed across time and among actors. Costs usually come first and benefits come later. Moreover, the degree of probability associated with costs may be higher than the one of benefits. “Green Growth is [indeed] similar to most types of policy reforms that advocate the acceptance of short-term adjustment costs in the expectation of long-term gains.” Resnick et al. (2012: 215)

A second type of redistribution deals with the fact that global benefits may be coupled with a heterogeneous distribution of costs among different categories of actors. This gives origin to conflicts of interest between different groups (Birner et al., 2011; Bellemare and Carnes, 2013; Weersink et al., 1998; Murphy, 2002). According to Agne et al. (1995), groups with

primary importance are policy makers (i.e. the government) and other relevant groups at the national level, like sectorial organizations of firms, other technical service organizations and the public administrators. Each government has its own utility function (Resnick et al., 2012) and this clearly emerges in the case of policies targeting in the agricultural sector. Lopez (2001) for example, finds that political contributions from agriculture are highly effective at generating subsidies.

In some circumstances, the role of interests groups is often, as in the case of the fat tax in Denmark (Caraher and Cowburn 2015). In the field of environmental policy, several authors conclude that lobbying activities can effectively influence the final choice of the environmental instruments (Buchanan and Tullock, 1975; Boyer and Laffont, 1999; Aidt and Dutta, 2004) or they may affect the stringency of the policy (see Oates and Portney, 2001 for a good survey). The food industry for example, systematically opposes regulation by using tactics like filing lawsuits, supplying governments with industry-funded biased research. With regard to the influence of interest groups, Bosso (1987) claims that the pesticide policy in the US has developed on the basis of the interaction among interest groups and their influence on legislation and the political process. The absence of public awareness in the 1950s and 1960s led to a pesticide policy, which was firmly controlled by an "iron triangle" composed of the pesticide industry, the US Department of Agriculture and the Congress agricultural committees. Political disturbance followed by the publication of R. Carsons book "Silent Spring" in 1962 accelerated the development of active environmental pressure groups and directed their efforts towards agriculture. Pesticide policy became a more dynamic process in which numerous interests are considered.

Also consumers constitute an important interest group, although their ability to influence political choices through lobbying is usually lower than for industrial groups. This is consistent with the basic principle that diverse groups are usually differently able to convey their own interests. Some authors (e.g. van de Walle, 2001; Olson, 1965; Srinivasan, 1985) show that the interests of some segments of population are systematically underrepresented in the political system. One reason for these differences is intrinsic to the typology of actors considered. A related factor is the amount of resources available for lobbying. These depend also on the turnover affected by the policy. In the case of pesticide production, for example, this adds up to \$32 billion with more than 5 billion pounds of pesticides applied to crops around the world every year (U.S. EPA 2007). Further elements are the level of concentration of the targeted sector and its input-output relationships to other sectors. The agricultural sector, for instance is extremely concentrated and the inter-sectorial linkages typically spread to other sectors (e.g. chemical production) as outlined by Sexton et al. (2007) and Zekri and Romero (1993).

3 Summary across all policy mixes

This chapter provides a comprehensive analysis across all three DYNAMIX policy mixes, as described in Ekvall et al. (2015) (deliverable D 4.2). The analysis performed in this chapter follows two main lines of reasoning. The former looks at how the entire set of policy instruments stands in relation to the five DYNAMIX key targets listed in Umpfenbach (2013) (deliverable D 1.2). The latter studies the policy mixes looking at how the various policies interact. Both approaches use two basic assessment criteria, namely coherence and consistency (see here also Nesbit et al., 2015). Policy instruments are coherent if one contributes to the achievement of one (or more) key target(s) or one (or more) objective(s) of another policy instrument. Consistency refers to the lack of conflict among policy instruments or between a given policy instrument and one (or more) key target(s). We carry out our analysis of consistency and coherence from a strictly economic perspective.

The output of our analysis will help formulating appropriate proposals for changes to the DYNAMIX policy mixes, with the aim of maximizing coherence and consistency. These proposals will be presented in chapter 5.

3.1 Three policy mixes and five key targets

The first aim of this section is to provide a concise overview of the three policy mixes as they are described in Ekvall et al. (2015). In this framework, for ease of analysis we restructure the policy instruments contained in the three policy mixes according to the primary approach of intervention. The five DYNAMIX 2050 key targets are (see Umpfenbach 2013):

1. Reducing consumption of virgin metals by 80% compared to 2010 (instrumented by RMC in the EU) representing scarcity of metals and environmental impacts caused by extraction, refinement, processing and disposal of metals;
2. Reducing greenhouse gas emissions to 2 tonnes CO₂-equivalent per capita and year (instrumented as footprint to reflect embedded emissions and as EU-internal emissions) representing climate change impacts of greenhouse gas emissions through energy use as well as agricultural and industrial processes;
3. Reducing consumption of arable land to zero net demand of non-EU arable land representing, as a rough approximation, impacts of biomass production on soil quality, water quality and biodiversity;
4. Reducing nitrogen and phosphorus surpluses in the EU at the level best available technique can achieve representing impacts of agricultural production on marine and freshwater quality as well as soil quality;
5. Reducing freshwater use so that no region should experience water scarcity representing impacts of resource use on freshwater availability.

There are three policy mixes (PMs) in DYNAMIX, namely:

1. An Overarching PM (PM-O)
2. A PM for land use (PM-LU)
3. A PM for metals and other materials (PM-MOM)

A closer look at all the policy instruments contained in these three PMs shows that these can be gathered into three main groups, which are indicated in the first column on the left in Table 5 below.

Cluster	Policy instrument	Policy mix
Fostering dematerialization and a Circular economy	1. Circular economy tax trio 2. Boosting extended producer responsibility 3. Skill enhancement programme	PM-O
	4. Green fiscal reform: internalisation of external environmental costs 5. Green fiscal reform: materials tax 6. Increased spending on research and development 7. Product standards	PM-MOM
Reducing land use impacts	1. Stronger and more effective environmental and climate dimension for EU land management in the CAP 2. Promotion of “Payment for Ecosystem Services” programmes 3. Regulation for Land Use, Land Use Change and Forestry 4. Targeted information campaign to influence food behaviour towards: reducing food waste and changing diets 5. Development of food redistribution programmes/food donation 6. Value added tax on meat products	PM-LU
Reducing emissions	1. EU-wide introduction of feebate schemes for selected products categories 2. Reduced VAT for the most environmentally advantageous products and services	PM-O
	3. Revised emissions levels in the National Emissions Ceilings Directive (NECD) and additional instruments for better management of the nitrogen cycle on farmland 4. Strengthened pesticide reduction targets under the Pesticides Directive, and provision of guidance to farmers on integrated pest management	

Table 5. The restructuring of the original PMs into clusters of primary intervention approach

Table 5 shows that the PM-O and the PM-MOM share the same primary intervention approach, which focus on dematerialization and circular economy. The PM-O and the PM-LU also contain policies aiming at a different goal, namely the reduction of emission. For sake of exposition, we will call these groups clusters of primary intervention. By this we want to stress that each policy potentially allows achieving a primary objective (after which its cluster is labelled) but also a series of additional objectives, which may correspond to some other clusters. A very simple example can be taken from the “Circular economy tax trio” policy instrument (cluster 1), which aims at curbing extractive activities, with a side effect in terms of emissions reduction (cluster 3).

The summarising analysis in this chapter leaves out the following policy instruments (which would all fit “Fostering dematerialisation and a Circular Economy”).

1. “Local currencies for labour-based services” (PM-O),
2. “Enabling shift from consumption to leisure” (PM-O),
3. “Step-by-step restriction of advertising and marketing” (PM-O),
4. “Promotion of sharing systems” (PM-MOM).

The reason for this omission lies in the potentially rather negligible effects of these policy instruments. For instance, the “promotion of sharing systems” may overlap with activities in the private sector, which is moving towards sharing systems in several contexts. Hence, an issue of efficiency may arise regarding the public sector intervening in this sector.

Table 5 is intended as a support to the discussion of the correspondence between the DYNAMIX key targets and the overall policy mixes. This is the external line of approach, described in the introduction to this chapter. In the following we review one by one the five key targets and then assess both the external coherence and consistency of the DYNAMIX policy mixes.

The first the key target corresponds to the area of dematerialization and circular economy. The DYNAMIX policy mixes contain several instruments aiming to achieve this objective, all of which are included in the PM-O and in the PM-MOM. In contrast, key targets (3) and (4) are exclusively tackled by the PM-LU. As regards target (5), no single policy mix deals with it directly, but positive impacts can be expected from several policies, in the sense that they may lead to both improvements in freshwater quality thus diminishing risk of scarcity of freshwater of good quality, and to mitigation climate change impacts, thus potentially reducing the risk of quantitative scarcities. As an example, take the supply side policies of the PM-LU. Almost every one of them (possibly except for the LULUCF) to varying extent has an impact on the availability of clean freshwater.

Key target (2) is dealt with in each PM in a similar way to key target (5), because a more dematerialized and circular economy will also help save energy use and GHG emissions.

Based on these considerations we will analyse matching between the DYNAMIX key targets (1) to (4), taking (3) and (4) together, and the policy instruments. On this basis in the next section we will investigate the coherence and the consistency of each single cluster of policies.

3.2 Coherence and Consistency of the three policy mixes with the key targets

Key target (1) foresees a consumption reduction of metals by 80%. This is dealt with by several instruments in the PM-O and in the PM-MOM. We could identify a certain contribution to dematerialization also by PM-LU, e.g. a more efficient use of materials like pesticides and nitrogen, but we believe that this is not actually so relevant in the whole picture. Therefore, we exclude this PM from the analysis of key target (1). With regard to the PM-O, the policy instruments which pursue a reduction in the use of metals are (see Table 5):

1. The circular economy tax trio that foresees a taxation instrument on (metallic and non-metallic) materials' extraction,
2. boosting extended producer responsibility and
3. the skill enhancement programmes.

Both the first and the second policy may have quite immediate effects, once introduced, while the third one has probably only long-term intermediate effects needing coordination with other market-based instruments.

As to the first two policies, we argue that they target all materials and not only metals.

In the PM-MOM, like in the case of the PM-O, there is no single policy which deals only with metals. The two Green Fiscal Reform instruments overlap in the sense that the second one is fully included in the first one. The policy instrument “Increased spending on research and development” may also have some effects but these will materialize in the longer run only. Our conclusion is therefore that in the whole DYNAMIX policy mixes there is no single policy exclusively addressing metals.

A key reason for this lies in the risk of burden shifting. It is in fact very likely that a policy targeting only metals with such a pervasive objective (-80% of consumption) would lead to higher demand for substitute materials and to more research activity aimed at discovering new materials as substitutes to metals. However in order not to indiscriminately tax all materials and hence putting firms in a situation where they are unable to refrain from using the complete set of newly taxed materials, any feasible material taxation must be specified to target a certain selection of materials relevant for dematerialisation.

To key target (2) (i.e. the reduction of GHG emissions to 2 tonnes CO₂-equivalent per capita and year) various policy instruments of all three mixes may potentially contribute, since every economic sector is responsible for a share of GHG emissions and changing less sustainable economic practices will help emitting less GHG and hence help achieving this key target. However, efficiency reasons dictate that policy instruments should focus first on those sectors where reductions can be achieved at the least costs, which by and large are those relying heavily on fossil fuels such as the energy sector and transport. In addition to the contribution from all policy mixes, two specific policy instruments are contained in the PM-O may help achieving this key target in particular:

1. EU-wide introduction of feebate schemes for selected products categories
2. Reduced VAT for the most environmentally advantageous products and services

According to the level of detail in the description of these policy instruments in Ekvall et al. (2015) neither policy targets clear-cut sets of goods; however in different places, they indicate different goods (and services) and emissions which may be targeted by the policy. According to these examples, it seems that the feebate policy is more concerned with material goods while the VAT reduction should be for both goods and services. For the feebate scheme, one focus is on batteries and accumulators, paints, detergents, refrigerators and high-emissions and highly resource use appliances. The VAT reduction instrument could cover products and services for which EU environmental standards (Ecolabel, EU energy label) already exist or could be easily introduced. This would encompass, inter alia, environmentally beneficial works done in the housing sector (renovation, maintenance), some local, labour intensive services and products, virtual books and organic products. Hence, the policy instrument descriptions do not provide exhaustive lists of products and/or services covered. Another issue making this economic impact assessment less straightforward is that the policy instrument descriptions do not clarify which type of emissions are targeted, e.g. the feebate addresses environmental issues such as greenhouse gas emissions, energy consumption and other pollutant emissions. Distinguishing among different types of emissions is needed to ease the analysis of whether these policies are consistent with the key target (2).

With regard to key target (3) (consumption of arable land), achieving zero net demand of non-EU arable land appears difficult to instrument. In the usual meaning, “zero net demand of net arable land” means that the stock of land used by all non-EU countries to produce export goods to the EU has to equal the amount of land used by the EU to produce its exports. This

rewording allows realising that the key target under scrutiny is based on micro-data, which is relatively expensive to collect. The required information is in fact about the quantity of land that every farm devotes to the production to be exported towards a given country. The difficulties in quantifying this key target helps perhaps explaining why the PM-LU, which is clearly the most closely related to this key target, focuses indeed on a quite different objective, i.e. on making the land use in the EU more efficient. From this perspective the policy instruments set out in the PM-LU are much less coherent with key target (3).

A further issue regarding the relationship between this key target and the PM-LU is related to the level of consistency. Since the PM-LU contains a set of policy instruments which altogether pursue a more efficient land use within the EU with the prime effect of higher agricultural prices, today's level of trade integration may lead to a more intensive land use for agriculture in developing countries outside the EU. It is crucial that the policy mix has a clear objective that can be easily communicated to and shared with the public. From this point of view, aiming for more efficient land use within the EU seems much easier to agree upon for the public than aiming to reduce EU land use's impact outside the EU (i.e. key target (3)). This suggests that the objective set out for the PM-LU may be more easily understood, shared and hence potentially achievable than key target (3).

Key target (4) seems to be the only one addressed by a specific policy mix and policy instruments. Although formulated rather vaguely, the PM-LU foresees revised emissions levels in the National Emissions Ceilings Directive (NECD) and additional instruments for a better management of the nitrogen cycle on farmland. Other policy instruments which contribute to this objective are

1. Stronger and more effective environmental and climate dimension for EU land management in the CAP
2. Promotion of "Payment for Ecosystem Services" programmes
3. Regulation for Land Use, Land Use Change and Forestry

Overall, we find that the DYNAMIX policy mixes and the instruments contained therein will contribute towards key targets (1) to (5), although to a varying degree. While coherence between the policy mixes (or rather their potential effects) seems greatest for key target (4) and the PM-LU, coherence seems also good for key targets (2) and (1), to which several instruments of more than one PM contribute. In contrast, key target (3) is only implicitly addressed as the PM-LU's objective is more focused on within EU land use efficiency, which will without a doubt contribute towards zero net land demand of non-EU arable land – but here effects are much harder to estimate. Key target (5) is not explicitly addressed by any of the three policy mixes, but positive effects towards no freshwater scarcity seem likely from several instruments contained in the three mixes.

While we generally find (some level of) consistency among the policy instrument of the three mixes and the key targets, our analysis suggests that better aligning the PM specific objectives with the key targets will improve communication of the policy mixes and hence reduce potential confusion as to the overall direction and potential effects of the whole DYNAMIX policy mixes.

In the following section, we check for consistency between the policies to be implemented and the existing policy framework. In this context, environmentally harmful subsidies become relevant as they might be perceived by the public as a more general inconsistency between the policy mixes on the one side and the general willingness to improve the economy-

environment relationship on the other side. This might disappoint those parts of the public who would be more sympathetic to offer support to the policy mixes proposed by DYNAMIX.

3.3 Consistency and coherence between the policy mixes

This section investigates both the coherence and the consistency between the DYNAMIX policy mixes. Moreover it seeks to assess further aspects which may be relevant for overall success of the policy mixes. We study the relationships among the three PMs and among the instruments contained herein. In performing this analysis we will be referring to the clusters of Table 5.

With regard to the cluster “dematerialization and circular economy”, there are seven policy instruments in the two PMs, which contribute to achieve these objectives (see Table 5). Some of these instruments (namely the “circular economy tax trio”, the “green fiscal reform: internalisation of external environmental costs, the “green fiscal reform: materials tax” and the “increased spending on research and development”) are market-based, while “boosting extended producer responsibility” and “product standards” have a regulatory nature, and the “skill enhancement programmes” is of educational type. The qualitative assessment of the next chapter provides evidence that all these policy instruments are both coherent and consistent among them. While the market-based policy instruments that use taxation and the two regulatory ones may be considered quite autonomous, we believe that those which contain educational and research support instruments need to be implemented jointly with the others in order to fully deploy their potential effectiveness. As shown in Chapter 4, in our view it makes very little sense to direct education and training activities towards material efficiency if this is not relevant to the private sector. Only if material price developments exert pressure on firms to improve their material efficiency will new technologies and processes (from R&D support) and new skills (from education) become very relevant to microeconomic actors. Hence, here coherence between the market-based and the educational instruments is given. However, once materials and metals become relatively more expensive it becomes important to assess the cost efficiency of a policy instrument like the one supporting skill enhancement programmes. In fact such a policy might eventually result in the creation of economically appealing activities which do not need any form of public support any longer – in which case the training and education support could be ceased or re-oriented.

Within the dematerialization and the circular economy cluster there are some potentially negative overlaps between the policy instruments using taxation. Negative consequences may be caused on efficiency because it may lead to overexceeding the reduction effect with the consequence of an even lower production level than the presumed social optimum threshold. There may also be negative effects on equity since environmental taxation in many cases is regressive in nature and more pervasive taxation has more pervasive effects. Finally, from the point of view of feasibility, high taxation levels may be (come) intolerable for some policy addressees (primarily those who are directly targeted by the instrument) and hard to support for others (who may otherwise advocate such instruments). A possible improvement to the whole cluster may derive from – when aiming for implementing the suggested instruments in political reality – merging these three policy instruments into a single one, which should then single out more carefully the materials and metals to target and the level of the respective taxes. It may be helpful to distinguish clearly between materials extracted in

the EU and those which are imported for reasons of border tax adjustments, WTO-laws (see Lucha and Roberts, 2015) and international competitiveness.

Since environmental taxation gains in terms of efficiency and effectiveness if it targets explicitly a given externality, it may be advisable to first identify which are the main externalities related to the materials extraction and use. Secondly the externalities should be quantified as precisely as possible and on this basis they should be taxed. Relevant externalities relate to the extraction stage, the refinement for the first industrial use and final disposal. Therefore, the design of the Circular Economy Tax Trio, taxing virgin material use plus waste incineration and landfilling, seems very promising.

Moreover, also feasibility motives require adequate communication of the instrument. If the tax rate is as coherent as possible with the externality level, which the use of a given material implies, this will help towards its efficient use.

With regard to the PM-LU, we stress the need to improve communication. Although the main target of the PM can be formulated only in qualitative terms as it consists in a better and more efficient land use, we find that this might be further specified with the introduction of appropriate quantitative aspects at the level of the single policies.

4 Summary per policy mix based on instrument assessment

4.1 Market-based policy instruments

In this section we present the results of the qualitative assessment of the market-based instruments of the three policy-mixes, which are defined in Ekvall et al. 2015. The market-based instruments are the following:

Overarching policy mix	a. A 'circular economy tax trio' b. EU-wide introduction of feebate schemes for selected product categories c. Reduced VAT for the most environmentally advantageous products and services
Land policy mix	d. Value added tax (VAT) on meat products
Metals policy mix	e. Green fiscal reform: internalisation of external environmental costs. f. Green fiscal reform: materials tax. g. Increased spending on research and development.

Table 6. The market based policy-instruments in DYNAMIX

Some of these instruments share important similarities and for this reason are strictly interconnected. In particular, the two green fiscal reforms (instrument (e) and instrument (f) in Table 6) are structurally very similar to the "circular economy tax trio" (policy (a)). As we will see when we analyse them in more detail, the latter is indeed a green tax reform (GTR). Similarly, the two instruments, which aim at fostering the use of certain (environmentally friendly) products while discouraging the use of others, also share several features. The reduced VAT (c) is actually a form of subsidy, which corresponds to one of the two elements of the feebate scheme (policy b). From this perspective, it seems reasonable to deal first with the reduced VAT proposal, and then move to feebate schemes which may be seen as an extension of the previous policy.

Based on these considerations, we will deal with the market-based instruments in the following order:

Group 1: Green Tax Reforms

- a. A 'circular economy tax trio'
- b. Green fiscal reform: internalisation of external environmental costs.
- c. Green fiscal reform: materials tax.

Group 2: incentives (disincentives) to selected environmentally friendly (unfriendly) products or activities

- a. Reduced VAT for the most environmentally advantageous products and services
- b. EU-wide introduction of feebate schemes for selected products categories
- c. Increased spending on research and development.

Group 3: Environmental taxes

- a. Value added tax (VAT) on meat products

4.1.1 Group 1: Green Tax Reforms (GTR)

Three instruments among those included in the policy mixes share a similar GTR nature. In the first part of this section, we provide a general assessment of this class of instruments and we highlight a set of aspects, which are common to most GTR. In the second part, we use these insights for the assessment of each one of the three instruments.

A GTR in principle encompasses the combination of two interventions in the economy: on one side, the taxation of an environmental externality; on the other side one or more support instruments in the economy, whose budget derives from the additional revenues obtained through the environmental taxation. The basic idea of a GTR can be traced back to Tullock (1967) who “first mentioned the ‘extra’ fiscal benefits of environmental taxes” (Gago et al. 2013, p. 12). A GTR is based on the simple intuition that the taxation of an externality has intrinsically two advantages: the reduction of the externality (with the consequent environmental improvement) and an additional fiscal tax revenue flow, which can be used to foster the economy. To stress the co-existence of the two possible benefits of a GTR the term “double dividend” has been introduced. The first dividend lies in the reduction of the externality, while the second consists in the benefit for the economy. However, there is a hidden third effect, namely the one due to the indirect economic consequences of the environmental taxation foreseen by the GTR. A GTR has thus one environmental and two economic effects. One of them follows from the environmental policy, the other one from the recycling of the environmental tax revenues. While the environmental effect (the first dividend) is theoretically positive, the sign of the global economic effect is uncertain because it derives from the two economic effects together. If it is positive, it constitutes a second dividend.

With regard to the possible uses of the tax revenues, there are different classifications in the relevant literature (see for example Baranzini et al., 2000). Among these, Gago et al. (2013) choose to analyse GTRs from a chronological point of view and found that there are three generations of GTR. They show how the use of the resources (usually called recycling, hypothecation, or earmarking) has been evolving over time and has become more and more flexible. This means that revenues have been used for a progressively growing set of objectives. The factors which have most influenced the shape of the GTRs are the general macroeconomic development and the reactions of the public. The first generation of GTR

(e.g. Sweden in 1991) foresaw the use of revenues mostly for income tax reduction. However, as the problem of unemployment spread widely across Europe (Bosquet, 2000: 22), revenues have been gradually employed to reduce labour costs in order to foster employment. More recently, revenues have been used to finance various environmental projects and in some circumstances even for fiscal consolidation (see for example the case of Ireland (Convery, 2010) and to a lesser extent of Sweden (Gago et al. 2013)). Since a GTR usually brings about disadvantages for selected production sectors in terms of competitiveness or for some low-income population layers (in distributive terms) an additional use of environmental revenues is to compensate these losses (see for example Baranzini et al. 2000).

As far as the target of the environmental taxation is concerned, Dresner et al. (2006) point out that a GTR is a generic policy instrument that “can be applied to many activities, but the most common among European countries to date has been taxes on carbon emissions or energy use” (ibid., : 896). Today, this type of taxation is quite the rule, while there are only few examples with a different target (see, the landfill tax in UK).

Effectiveness

Effectiveness is the capability of a given instrument to reach its objective(s). This simple definition suggests that the assessment of the effectiveness is very much based on existing studies and, in some cases, on comprehensive surveys which provide some structured overviews. These surveys are for example Bosquet (2000) and (Gago et al. 2013).

To assess the effectiveness of a GTR, it makes sense to distinguish between the environmental objective (i.e. the first dividend) and the economic objective (i.e. the second dividend). With regard to the environmental dividend, Bosquet (2000) carries out a survey of all studies as of April 2000 and concludes that the environmental dividend is usually positive (according to ex-ante analyses). Gago et al. (2013) survey 699 simulations and find that 95% of the applications confirm the positive effects in terms of reduced emissions. In addition to this series of ex-ante studies there are some ex-post studies, which refer to Sweden (Swedish EPA, 1997) and Norway (Larsen and Nesbakken, 1997), and which confirm the existence of the first dividend.

The second dividend has been analysed both by theoretical and empirical ex-ante studies. Theoretical studies typically find that the conditions necessary for a strong double dividend, i.e. simultaneously positive first and second dividends, are rather restrictive (see e.g. Bovenberg and Goulder, 2002). For this reason, Labandeira et al. (2004) and André et al. (2005) suggest that “it is necessary, therefore, to resort to economic simulation methods” (Labandeira et al., 2004: 291). This is indeed what Bosquet (2000) and Gago et al. (2013) do in their papers.

A first difficulty in assessing the existence of the second dividend is how to define it. A decision is required on which economic variables are to be taken into consideration. The two variables that are usually considered are the level of economic activity (which is instrumented either by the per-capita GDP or by the employment level, according to Okun's Law⁴) and by the welfare level⁵. This is the approach taken by most studies. However it is crucial to note that these two variables are not necessarily directly proportional. It is possible that the effect of the GTR on GDP indicates the presence of the second dividend while the welfare analysis provides opposing evidence. This is clearly an important issue for policy assessment, but, much more importantly, it represents a clear policy dilemma.

There is a strong link between the revenue recycling mode and the existence and size of the second dividend. In fact, it seems that a reduction in labour costs is the best way to exploit the positive effects on the economy, while the reduction in personal income tax level has minor results on overall economic activity. With regard to the effects on employment, Bosquet (2000) concludes that 73% of studies predict a positive effect while stressing the positive role of recycling with cuts in social security contributions (SSC) because all this means lower labour costs. However, an important condition should be fulfilled, i.e. labour markets need to be flexible (Proost and Van Regemorter, 1992; Standaert, 1992; Beaumais and Brechet, 1993; European Commission, 1993; Finnish Environment Ministry, 1994; Bossier and Brechet, 1995; Mors, 1995; Don, 1996; INFRAS and ECOPLAN, 1996; Norwegian Green Tax Commission, 1996; Greenpeace and DIW, 1997; RIW, 1999). As to the effects on GDP, approximately half of the studies reviewed predict positive effects.

All in all, we can conclude that there is quite a widespread agreement in the literature that a GTR is generally effective. Even more interestingly, it seems that the major problem of GTRs is not their effectiveness or their efficiency, but their equity and their political and social feasibility. On this point see in particular Dresner et al., (2006) and Gago et al. (2013), who provide reasons to support energy taxes and even more GTR.

Efficiency

If we think about the principle of a GTR and we assume this to be implemented in an ideal world, we can promptly conclude that this is an efficient instrument. Both aspects of the GTR confer efficiency to the instrument. The taxation of an externality is, from a theoretical perspective, efficient, and the reduction of a distortionary instrument is by assumption efficient as well. In the real world, however, things are more complicated and for the reasons indicated below it is not only difficult to verify whether a instrument is efficient or not, but it is even more difficult to determine an efficiency ranking among different policies. The first problem is that a GTR is introduced in an established economy, in which there are already numerous instruments implemented (both market-based and not). For this reason, a GTR suffers the same problem of any other tax intervention, i.e. the interaction with the situation in place. In a

⁴ According to Okun (1962)'s Law, there is a negative relationship between unemployment and real GDP.

⁵ Some authors call "third dividend" the employment increase while others apply this label to the reduction in local environmental impacts.

second best world, it is well known (Lipsey and Lancaster 1956) that because of these interactions the effect of a given tax might be the opposite of the expected one. Secondly, there are always management costs (e.g. monitoring and collection costs on the government side and compliance costs on the side of private actors) which need to be accounted for. Third, efficiency is seemingly never for free. There is quite a widespread agreement in the relevant literature that environmental taxation tends to be regressive, as will be shown below in this section (see “Equity”). If the environmental (and perhaps regressive) instrument is coupled with an additional instrument which should mitigate an existing distortionary instrument, the general efficiency is expected to increase while regressivity is expected to grow as well. All this would hurt the equity aspect and highlight the clear trade-off between the two dimensions of efficiency and equity.

Equity

The fact that a GTR is revenue-neutral does not exclude possible negative effects on selected sectors or on some population layers. A GTR can typically have regressive effects and undermine the competitiveness of some sectors, for instance for resource intensive sectors.

As to the regressivity of a GTR, Gago et al. (2013) study econometrically the results of 699 simulations obtained from 100 studies and find that more than three quarters of them predict a rise in regressivity. This result is in line with EEA (2011) and Ekins and Speck (2011). Of course the level of regressivity depends on various variables such as the target of the environmental taxation contained in the GTR: some studies find for example that taxing transport is not as regressive as taxing energy for house heating. Böhringer and Müller (2014) take it as given that environmental taxation is regressive and highlight the trade-off between efficiency-related and distributive issues. Their conclusion is that the environmental revenues should be used in pursuit of a range of objectives in order to fine-tune efficiency and distributional issues.

With regard to competitiveness, unless the GTR is not designed to be sector-specific, so that revenues from the extra taxes imposed on a given feed back to that sector only (Dresner et al., 2006), there is risk of adverse effects on selected sectors (the energy-intensive ones, for instance) when distributing revenues to all sectors, for instance as reduced labour cost. In this case, few sectors would lose relatively significantly and most would gain relatively little so that the general (positive) effect maybe is negligible. The literature however is not unanimous on this. OECD (2004), Agnolucci (2011), Speck et al. (2011) find the effects on sectorial competitiveness to be negligible. In the case of Germany, Ludewig et al. (2010) show even the opposite. According to Bosquet (2000), “nationally, empirical evidence suggests that energy-intensive sectors will be the most affected, but [...] labor-intensive sectors will benefit”. (Bosquet 2000: 28),

Another aspect to consider regarding equity is the possible inflationary effect, which ex-ante studies indeed predict (Gago et al. 2013).

Feasibility

The political feasibility of a GTR includes several aspects. On this topic, there is very little relevant literature, and most of it is gathered in a special issue of Energy Policy which reports the results of the PETRAS project (Energy Policy 34, 2006). As pointed out by Clinch et al. (2006), however, “Studies of behavioural responses to environmental taxes are important for future modifications and adjustments of the environmental tax in the country concerned, as well as the tax system in general.” (Clinch et al., 2006, p. 961).

A first aspect, which is as trivial as it is essential for the feasibility of a GTR, is the level of awareness in the public. Only a minority knows about GTRs and even fewer can understand their logic. From this perspective, a first problem is the “implausibility of the policy to the general public” (Clinch et al., 2006: p. 962), which is unable to understand the co-existence of an environmental and an economic objective in the same instrument. This explains why a crucial issue for a GTR is the lack of trust by the public regarding to the re-use of the environmental fiscal revenues. Here there are two issues: on the one hand there is a pure technical aspect, which follows from the fact that fiscal neutrality requires a long term projection of the financial impact of the environmental tax, which should ensure new and stable tax revenues to compensate income tax reductions (on this point, see also Dresner et al., 2006). On the other hand, there is the basic “distrust of the government and politicians in general, distrust of tax policies, and distrust of government intentions regarding ETR” (Dresner et al., 2006: 902).

Clearly, to overcome this problem, high transparency is a prerequisite. At best, the government should declare the revenues’ level and the modes of their re-use with clear illustration of their effects on the economy. This approach might also help convincing people that a double dividend is possible. An additional obstacle seems in fact the general scepticism of the public around the existence of the second dividend.

Another important element influencing the level of trust among the public is the visibility of the first dividend. The public wants to see a positive effect of the related taxation on the environment.

A ‘circular economy tax trio’

Motivation, Nature and objectives of the instrument

This instrument consists in a taxation instrument on (non-metallic) materials’ extraction and on the landfilling or incinerating of waste. Since this instrument foresees that “80 % of the tax revenues are used to reduce labour taxes and charges, and 20% is used for restoration” (Ekvall et al.: 50-51), it is clearly a GTR. The environmental objectives (first dividend) are (see Ekvall et al.: 48):

- (a) reducing raw virgin resources extraction;
- (b) encouraging recycling/making recycling more profitable;
- (c) internalising externalities linked to (1) the extraction/transportation of raw materials (2) landfilling and incineration.

Effectiveness

If the objective of this policy is the reduction of the quantities of virgin materials extracted, it is plausible that a tax on these can be effective to various degrees, depending on the price elasticity of the targeted materials. An issue which may need further consideration is the level of the tax, which seems to be identical for every type of material according to the policy instrument (which indeed quotes one single source in this context, i.e. UEPG (2013)). Another issue is the ambiguity given by the objective of taxing only materials extracted in the EU or also outside the EU. Notice that the second illustration of the objectives (see Ekvall et al.: 48) foresees a taxation of materials extracted both inside and outside the EU. Clearly, if the target is to limit extraction outside the EU, also imports need to be taxed. In fact, taxing only domestic extraction would simply divert EU internal demand to production from outside the EU and the main effect of the instrument would be less extraction within the EU and more extraction outside the EU. On top of these considerations, the relative magnitude of the quantities of materials extracted in the EU in comparison to those extracted outside matters. If the extraction activities within the EU were just a minor fraction of global extraction, a policy taxing the EU extracting activity would be quite a minor instrument.

As for taxation on landfill and incineration, one may also expect this instrument to be effective.

A more complex issue is related to the existence of a double dividend, as it is quite difficult to assess it ex-ante without a simulation model. In the case of the landfill tax in the UK, the subsequent tax shift brought about a decrease in the employers' national insurance contributions by 0.2% (Dresner, S. et al 2006) which seems quite negligible to allow to claim the existence of a positive second dividend.

Efficiency

The problem of taxing virgin materials is linked to the type of distortion which needs to be tackled. If the problem is represented by the externalities arising from the extraction activity, it is sensible to think that this instrument is generally efficient. Of course, the standard considerations apply in the case of efficiency, i.e.:

1. In any case the new tax is going to interact with the existing system;
2. There are management costs which accrue both to the government and to private actors;
3. The quantification of the externality, in order to allow a possibly efficient taxation is in any case an issue.

With regard to the externalities arising from extractive activities, these should exclude those related to the transportation of extracted materials for the simple reason that transport does not pertain to extractive activity and means of transport may differ with different levels of externality. For this reason, it seems quite inefficient to tax materials extraction because

materials will be transported. Of course it makes sense to tax the transport activity per se but this requires due investigation of the issue.

If the reason of taxing resources is related to possible scarcity, doubts on efficiency are quite strong since there is no information or estimates about costs related to the possible future exhaustibility of the resources (this topic will be dealt with below under “Feasibility”).

Equity

As far as equity is concerned, it seems that the most important aspect of this policy instrument is the taxation of extractive activities, in particular considering that one of its consequences may be that “quarries and extraction sites [...] will close as a result of the reduced consumption” (Ekvall et al.: 50) level. If this is one of the effects to expect, we may imagine that the instrument does not appear fair for employees in the extractive sector. For this reason, a part of the revenues from the taxation might be used to support those workers in order to allow their re-introduction on the labour market.

Feasibility

The instrument intervenes on the links between the environment and the economy. The economy takes resources from the environment and transforms them into goods, parts of goods or waste.

As shown by the PETRAS project, an important element of each environmental policy is the awareness of the public regarding its nature and its objectives. In the case of the Circular Tax Trio, the logic behind it is obvious for professionals, but it may be difficult for the public to understand the connection between taxation of natural resources and taxation on landfilling sites and incineration plants. It is also important that the public is conscious of the effective severity of the issue that the policy aims at tackling. With regard to objective (a), there is a need to recognize that the objective of reducing extracted quantities is not a shared one, as there is no agreement among experts regarding the current level of resource availability. This is confirmed by various price forecast studies, which predict that the main materials’ prices will remain either stable or will even fall in the next decade (see for example the latest World Bank commodities price forecast in World Bank, 2015). From the point of view of the public, it might be difficult to explain that extracted quantities need to be reduced without providing sound evidence that resources are getting scarce. As observed by Dresner et al. (2006), the environmental benefits of the policy need to be clearly visible to the public in order to improve public acceptance of the policy. In this context, it may appear quite inconsistent or even offensive to indicate intergenerational equity as a case for such a tax. Thinking about “preserving European resources for future generations” (Ekvall et al.: 49) seems inappropriate while today there are people who are excluded from the use of these resources.

Of course visibility is not sufficient for a policy to be successful. To get an idea of the importance of public acceptance for policy success, one could take the example of the environmental policies which would be needed to counteract climate change. In some cases

these policies have clearly failed to find public support. A first example is the general carbon tax in France in 2009–10, which had to be abandoned after it foundered on a combination of constitutional difficulties and political opposition. Another case is the introduction of a carbon tax in Australia, which has proved to be an immense source of controversy, being introduced in 2011, but withdrawn following the general election of 2013.

With regard to objective (b) - encouraging recycling/making recycling more profitable, the recycling does not appear to achieve anything per se. The public might ask why it is necessary to improve recycling. Recycling is functional to a contraction of landfills and incineration activities. However there is the option of very low emission incineration activities (take the case of the famous Vienna incinerator, which is situated in Spittelau, not far from the city centre). From this perspective, a reduction in recycling is more a consequence than an objective. This is in a sense implied by the instrument description, which states that “The taxes on landfilling/incineration [...] are expected to conduct the shift from disposal and incineration to recycling” (Ekvall et al.: 49).

Objective (c) - internalising externalities, seems much easier to implement. Externalities due to all three types of activities (extraction, landfilling and incineration) seem quite evident and easy to illustrate. A reduction of the number and size of landfilling sites is an easy to instrument objective and also highly visible, and for this reason promptly shared by the public. However, the idea of using some of the revenues obtained from the taxation to maintain biodiversity might seem to the public to be less worth supporting. It might seem in fact that the scale of such an intervention does not reach a threshold which can allow altering the current trend of loss in biodiversity.

Green fiscal reform: internalisation of external environmental costs

Motivation, Nature and objectives of the instrument

The policy targets a wide range of goods and commodities. In particular it aims at taxing:

1. All types of raw materials, both metallic and non-metallic (wood, concrete, sand and gravel)
2. All types of energy resources, which are classified in the following three categories:
 - a. Those used to produce energy commodities, which are then employed in material production
 - b. Those used to produce materials (like plastics)
 - c. All remaining types
3. External costs of water use, which “are probably the least clearly connected to metals” but need to be taxed in any case “partly to form a coherent whole and to safeguard against unknown risks of burden shifting” (Ekvall et al. 2015: 168)
4. All types of emissions from all sectors, in order to avoid any possible burden shifting.

As regards the name of the policy, according to Dresner et al. (2006) and Clinch et al. (2006) it seems more adequate to use the term “tax reform” rather than “fiscal reform” since the latter

term should be used to indicate a general reform of the environmental policy, which includes also the abolition of the harmful subsidies, which here remain untouched.

As for the nature and the objectives of the policy, it seems that this policy is facing general challenges. The first follows from the motivation and the objectives. These can be summarized as follows (see Ekvall et al. 2015: 169-170):

1. increasing material efficiency,
2. reducing the demand for products and services that require metals and other materials
3. increasing recycling.
4. increasing energy and water efficiency
5. reducing pollution
6. creating jobs

Secondly, since the quantification of the external costs is a very complex task, achieving the internalization of 100% of the external costs as proposed by the policy instrument (Ekvall et al. 2015: 167) is most probably unattainable with due accuracy. The determination of the level of taxation to reach the policy objective should nevertheless be performed according to a rigorous methodology and avoid simplistic approximations and generalisations. As local specificities are bound to influence the actual magnitude of the relevant externalities, we recommend that environmental costs are thoroughly assessed at the various locations in which the policy will be implemented in order to fine-tune the tax to be implemented.

It is unclear in which terms and under which conditions water use should be taxed. The level of the tax on water is not specified and the tax base seems also quite unclear.

Finally, no government will easily be persuaded to introduce a instrument that can weaken the competitiveness of its firms. This is confirmed by a number of authors like Bosquet (2000). Even assuming that such a policy was introduced in some MS, firms would promptly move out from these MS to the others in which the policy is not yet implemented. One of the building features of the EU is indeed capital mobility.

Effectiveness

The first aspect we deal with is the first dividend. Considering the incisive nature of the policy, we may expect a positive first dividend. However, from the point of view of firms, the policy aims at taxing a wide range of production factors which are all difficult to substitute using labour. In this perspective, there might be risk that taxing such a wide range of inputs leads to a decrease in GDP rather than dematerialization.

Limited substitutability between the set of taxed materials and labour also influences the assessment of the second dividend. If the environmental instrument has in fact too high an impact on the economy, it may become hard to overcome it with the positive effects related to the tax cut allowed by the environmental taxation. Assessing the existence of the second

dividend is complicated by the lack of specification in the policy description of the portion of resources to be used to cut labour costs.

These considerations suggest that the effectiveness is indeed properly quantified through appropriate simulation models, which allow a comparison of the negative effects of the environmental taxation with the positive effects stemming from the reduction of the distortionary labour taxes.

Efficiency

One major problem regarding efficiency is the overlapping of the distinct taxes foreseen by this policy. According to point (4), all sectors should be taxed on the basis of their overall level of externality, which is linked to emissions. Point (3) of the same objectives' list, however foresees taxation for sectors using water, which however should be already included in the previous instrument, thus leading to a double taxation for sectors using water. A second case of double taxation seems to be the taxation of materials and energy resources, which are to be taxed according to points (1) and (2) above, although they are already taxed according to point (4). The theoretical background behind the quantification of the tax seems quite weak. Various studies are mentioned in the policy instrument and some figures are reported. It seems quite hard however to locate them in a coherent picture. In particular the figure of 35% seems not to have any clear theoretical background or connection with the figures mentioned before.

In the case of water an approximate estimate of the externality, which nevertheless is to be taxed, is yet to be determined. This is a crucial piece of information for both the effectiveness and the feasibility of the instrument, and probably will need a supplement of empirical investigation prior to the actual implementation of the instrument. A possible practical reason for postponing this step is that such externalities might be highly dependent on the location, as water uses and subsequently, water quality and availability vary across locations. Nevertheless this quantification remains of paramount importance.

Equity

Considering the magnitude of the intervention foreseen by the policy, a severe impact in terms of competitiveness and income distribution can be expected. The latter effect follows directly from the general regressivity of the instrument. On the top of that an inflationary wave may be also expected, which would further harm those population layers with fixed income and, more generally, the whole EU economy.

With regard to competitiveness, if we look at the four targets reported above, targets (1) (2) and (3) seem to be quite concentrated from a sectoral point of view, while target (4) affects all sectors. This allows the conclusion that in terms of competitiveness all sectors are affected, but some of them more severely so (these are clearly the energy and the extractive sectors). The asymmetry in the cost sharing might be a reason for considering the option of substituting

this GTR with a series of sector-specific GTRs (see for example, Clinch et al. 2006). This would allow conveying revenues collected in a given sector to the same sector thus mitigating the negative effects in terms of competitiveness.

Feasibility

Like the circular economy tax trio, this policy also seems to be quite difficult to explain to the public, since the main case for it should simply lie in the fact that our economy is using excessive materials quantities. To be able to claim that the current use of resources is excessive, the public should be provided with empirical evidence regarding remaining stocks. In addition, it should be clearly shown that such a policy in the EU would have decisive effects at the world level. If this were not the case, the public might well ask the reasons for such a tremendous effort. For these reasons, the objectives of the policy may need to be reformulated in order to make clear the importance of these instruments for the environment. Otherwise there is risk that the public cannot understand or agree with their logic with the consequence of not supporting such a policy.

The easiest objectives to convey to the public are the last two in the list above: “reducing pollution” and “creating jobs”. However, we should care about one of the findings of the PETRAS project. The simultaneous presence of the two objectives, the environmental improvement and the increase in employment may be so desirable that they may (paradoxically) create suspicions. Public trust is indeed a basic condition for a policy to succeed. For this reason, the government needs to act on an environmental problem whose existence it is easy to perceive. Furthermore, it needs to propose a clear quantification of the problem, and on the basis of such quantification, it can propose a instrument which of course has to be commensurate to the environmental problem.

In the particular case of instruments aiming at dampening the use of energy products or materials, it may be helpful to go for a sector-specific GTR so that the effects of both the taxation and the revenue recycling can be as clear as possible. In the case of a instrument which targets all sectors in the economy, this clearly has macroeconomic effects. Since the environmental taxation in any case occurs at sectoral level, recycling of its revenues should be done at the same level in order to avoid major competitiveness losses across sectors. This would also give the idea that there is major coherence between environmental revenues and outlays for the economy.

Finally, feasibility is in any case higher if the policy instrument is implemented gradually, in order to avoid major inflationary waves.

Green fiscal reform: materials tax

Motivation, Nature and objectives of the instrument

The objective of the policy is to “reduce material use in the EU through reduced production losses, more material-lean products and increased material efficiency in general” (Ekvall et al. 2015: 1). From this perspective, it is akin to the previous one, which in fact proposes to tax “all raw materials, both metallic and non-metallic (wood, concrete sand and gravel)” (Ekvall et al. 2015: 168). The policy under scrutiny here proposes taxation on “all materials that are used in the EU: steel, concrete, paper, polymers, glass, textiles, etc”.⁶

The main issue with this policy is the similarity with the previous one and with the circular economy tax trio, as will become clear when dealing with efficiency and feasibility.

Effectiveness

We begin with assessing the existence of the first dividend. It is recognized in the relevant literature (Ekvall et al. 2015: 50) that resource demand has low price elasticity, in particular with stable technologies (short run) or limited substitution possibilities in the industrial process. For this reason, even a larger increase in final prices (following from taxation) could have only a small quantity effect. This policy could have high private costs (high prices of final goods) with relatively low public gains in terms of environmental quality.

A strategy to increase effectiveness might be to use the resources obtained from the environmental taxation to finance the transition towards new technological paradigms. This would require in any case long time horizons. We can therefore conclude that the effectiveness of this policy is quite low in the short run but can improve in the long run. A necessary condition for this to happen is the adequate financing of such a paradigm shift. It is clear that the use of revenues to foster the first dividend may undermine the existence, or at least reduce the magnitude of the second one. If revenues are not used mostly to abate labour costs, there is a risk that the desired macroeconomic effect does not materialize.

Finally, we need again to mention that it is difficult to predict the effects of this policy without adequate specification of its quantitative aspects.

Efficiency

Efficiency is quite doubtful in the case of this policy because of its strict similarity with the other two policies which have been mentioned above. If we assume that all three policies are

⁶ A minor doubt arises when comparing the two policies because they contain open lists, i.e. lists of items finishing with “etc...” so that it is unclear what they really contain. A part from this disclaimer, it seems reasonable to argue that the two policies are quite similar.

implemented and that each policy foresees a tax which is commensurate to the externality, the final outcome is overtaxation with a triple taxation of the same item or activity. This would draw the externality level well below the social optimum with a rise in inefficiency.

As we have already said, this policy overlaps also to the circular economy tax trio. If we consider all the reasons for increasing the price of resources through taxation, the relevant literature (Eckermann et al., 2012) recognizes that only one of them has an environmental motive. This is the one linked to the reduction of the externalities, which are mostly caused by resources' production (mining activities) and disposal (which entails either landfilling or incineration). If the negative environmental impacts are linked to these two activities, then it would be more efficient to target those activities, but in this perspective this policy overlaps also the "Circular Economy Tax Trio".

Equity

The basic issues of this policy regarding equity relate to the competitiveness effects on those sectors which produce materials and to the distributional issue. Both these aspects are considered in the analysis of the previous two policies.

Feasibility

In presence of two other instruments with a very similar target, the credibility of the implementation of the one under scrutiny becomes rather doubtful. . The co-existence of three very similar instruments does not help to foster public trust in government, if it is read by the public as a signal of the inability of the government to take consistent and efficient action to protect the environment. Coherence in government action is clearly an important aspect to consider in order to build public trust. The proposed policy needs to be consistent with the general picture of the existing instruments regarding materials. The existence of other instruments, with a contradictory rationale, is clearly counterproductive. As an example, consider the case of Sweden in the area of metal production. The Swedish government subsidized in 2010 "the metal mining sector [...] by € 40 million and the metal recycling sector by € 0.6 million" (Johansson et al., 2014: 72).

Other aspects which influence the level of trust in the government regarding this policy relate to the reasons for this policy. Promoting this policy, by arguing that one of the environmental impacts is that "natural resources will be saved for future generations" (Ekvall et al.: 175), appears hardly credible in the light of the many people currently living without having access to these resources. The public may indeed ask why we should care about future generations if we are proving unable to take care about the ones of today. For this reason, the objective of this policy should be rephrased in a more credible way.

It should also be recalled that there is no consensus among experts about how big the problem of scarcity really is, and this is clearly an additional weakness for this policy (Eckermann et al., 2012).

4.1.2 Group 2: incentives (disincentives) to selected environmentally friendly (unfriendly) products or activities

Reduced VAT for the most environmentally advantageous products and services

Motivation, Nature and objectives of the instrument

The rationale of this instrument lies in the fact that there are often two or more variants of the same product or service, which satisfy consumer needs very similarly, but differ from each other for their environmental impact. Usually eco-friendly versions of a given product cost more than the standard version (Dale, 2008; Mintel, 2009) and they are sometimes perceived to have lower performance (Luchs et al., 2010). For this reason consumers may be less inclined to purchase them, because, in general, consumers are not willing to pay price premiums for environmentally friendly products (Mintel, 2010). The main goal of the instrument is therefore to decrease the VAT rate on this type of products to help them gain a larger market share. The policy instrument targets three categories of products/services: those which carry the Ecolabel (http://ec.europa.eu/environment/ecolabel/index_en.htm), those which are graded A+++ according to the EU Energy Label, and a third set of broadly defined products and services related to home insulation. This is a green (or environmental) ad-valorem subsidy (i.e. proportional to the transaction price). This helps identifying the relevant literature to scrutinize for the qualitative assessment of this policy.

In the case of this instrument, effectiveness and efficiency seem to be strictly connected. There are many elements of the instrument, which are likely to weaken both its effectiveness and its efficiency.

Effectiveness

The first issue relates to the objective of this instrument. The goal is to reward those products which have either a more environmentally friendly life cycle (with the Ecolabel) or those which are the most energy efficient. For this reason, the purchase of those products is incentivized. However, the environmentally harmful activity is not their purchase but their production, or their use or their disposal. An instrument, which makes these products cheaper for the final consumer, has a first effect of shifting consumption away from other products. In the case of energy efficient electric appliances, there is a risk that a shift would occur from products which do not use energy (e.g. furniture), towards products which use energy (albeit efficiently), thus increasing net energy use. Similarly, this instrument may cause an over-demand for energy efficient products. It is important to consider that products, such as household electrical appliances, consumer electronics and boilers for domestic heating account only for about 3% of overall consumption, but induce nearly 60% of all energy consumption from households.

A second issue relates to the standards used to distinguish between green and non-green products. The instrument considers the options provided by the Ecolabel and by the EU

Energy Label. However an extensive literature reports that the ecolabels' reliability and informational content have repeatedly been questioned. In a recent study on ecolabels, Van Amstel et al. (2008) conclude that the "main shortcomings of the ecolabels were found in their ambiguity about environmental themes, their failure to assure the buyer about the product's ecological impact [and] the insufficient information about producers' compliance" (Schumacher, 2010: 2202). In general, the quality and reliability of labelling is in dispute (see e.g. Van Amstel et al., 2008) and this is especially true after the recent substantial increase in the number of ecolabels, all with different criteria and stringencies. An important effectiveness factor for the instrument is therefore a rigorous selection of the standards on which to base the rewarding scheme. For those products, which are in any case included in the instrument but for which no standard is mentioned, a word of caution is necessary. It is necessary to give clear guidelines to distinguish unambiguously between the 'green' products and their 'non-green' counterparts. There are several alternative definitions of "green product". According to OECD (2009), green products entail what is achieved to prevent, limit, reduce, or correct harmful environmental impacts on water, air, and soil; they constitute at least one means of resolving problems related to waste, noise, and general detriment to the ecology, and are an avenue for generating beneficial products and services. Haws et al. (2014) define an environmentally friendly product as one with at least one positive environmental attribute. An "environmental attribute" is an attribute that reflects the impact of the product on the environment. Generally speaking, environmental product attributes can be positive (i.e., the product has little to no negative impact on the environment and is considered environmentally friendly) or negative (i.e., the product harms the environment). This definition is consistent with the definition of "ethical attributes" used in past research (Irwin and Naylor, 2009; Luchs et al., 2010; Pelozo et al., 2013). More intuitively, the characteristics of green products are for example, recycling potential, low pollution, and economy in the use of resources.

Among existing market-based instruments, the reduced VAT rate suggested by this instrument does not seem the most adequate instrument for one main reason, i.e. the amount of the incentive is proportional to the product price. Since the price may reflect higher energy efficiency but also the presence of other more desirable aspects, a reduced VAT rate on all products fulfilling energy efficiency criteria might be a subsidy to buy more upmarket versions of A-rated products or larger A-rated products (Copenhagen Economics, 2008). A further problem connected to the proportional nature of the VAT reduction is the so-called mixed-supply issue. If the incentive is a VAT reduction and the transaction includes two products of which only one deserves the VAT reduction, buyer and seller may agree on a lower price for the standard product and a higher price for the efficient article in order to maximize the advantage of the reduced VAT rate.

All these considerations suggest that a specific subsidy (which would consist in a fixed amount per unit bought) might be more useful in order to reach the objective of the instrument. While such a subsidy would solve the previous issues, it would suffer from the following weaknesses, which in any case characterize the reduced VAT rate. For one thing, a possible by-product of such an instrument (be it a specific or an ad-valorem subsidy) could be the so-called rebound effect. Since the most environmentally efficient products become cheaper, a higher fraction of consumer income becomes available for other purchases, and there is risk that these will include less environmental-friendly products. For this reason, the

instrument would need to be complemented by a tax on least efficient products. A second problem, typical of subsidies in general - is the free riding problem. Consumers who would have bought the product in any case receive the subsidy, too. A further issue relates to the speed of introduction of new (and more environmentally friendly) products into the market. A fast turnover of new products implies that the list of products deserving the VAT reduction (or the subsidy) needs to be constantly updated with some products exiting the list. Finally, both the reduced VAT and the specific subsidy share the issue related to the definition of the correct policy objective mentioned above. The point is not subsidizing the purchase of a more efficient product. The goal is reducing energy demand and environmental impact in general. For this reason, a root taxation of the household electricity consumption might be seen as an alternative instrument. Taxation of electricity consumption would help target the instrument to all consumers and not only to those who buy a new product in the aftermath of the introduction of the reduced VAT policy.

An investigation of previous experiences (Czech Republic and Portugal) show that they do not appear to have prompted particularly sizeable effects.

In any case, be the policy a VAT reduction or a specific subsidy, it seems advisable to couple the instrument with an adequate information campaign. There is evidence for the existence of a 'signalling effect' according to which subsidies and fiscal incentives, if properly communicated, tend to have an impact on consumer demand beyond the purely financial advantage they confer. Information around environmental standards is often very badly spread and very often, there is a lot of scepticism around them.

Efficiency

From the efficiency point of view, the literature seems to suggest that a specific subsidy is preferable to a VAT reduction. For both enterprises and tax authorities, a subsidy will have lower compliance costs relative to VAT rate subsidy.

Feasibility

According to Cnossen (2003), differentiated VAT rate structures complicate the taxpayer's accounting system, require additional audit oversight, increase refunds, give rise to various definitional problems, and invite misclassification. He cites a study by Hemming and Kay (1981) showing that in the UK firms with multiple-rate output have double the compliance costs of firms taxed at a single rate. Cnossen also refers to Agha and Haughton (1996), who found that by adding another VAT rate, the compliance rate is reduced by 7 percentage points.

An important element of feasibility regards the consequences of the instrument on public budget. A major factor of feasibility is that the policy has zero effect for public finances. This is an additional argument for a complete VAT reform, which entails higher and lower VAT rates.

Recommendations and open issues

1. The policy may gain effectiveness if reformulated in terms of
 - a. a VAT reform, which includes both subsidies for most environmentally friendly products and taxes for the least ones. This would avoid a potential income effect which would lead to higher consumption of harmful products and services
or
 - b. a specific subsidy
 - c. a instrument targeting energy consumption (e.g. taxation of households energy consumption)
2. In any case, an accurate selection of the standardization mechanism to which the instrument should be linked is necessary,
3. The choice of a specific, uniform percentage for the VAT reduction (such as the 6% rate suggested in Ekvall et al.,) is not supported by the literature.

EU-wide introduction of feebate schemes for selected products categoriesMotivation, Nature and objectives of the instrument

The instrument is quite similar to the previous one but differs from it for its more normative structure and its focus on the scale of the impact of a given product rather than on its energy efficiency. Consequently, it is not based on thresholds but on standards, and the threshold fixed according to the nature of the product considered. A car with a sufficiently high gasoline consumption rate is taxed according to this instrument while it can be subsidized by the previous instrument if it is more efficient than other car models in its class.

A first advantage of this instrument in comparison to the previous one is its higher efficiency in keeping the environmental aspects distinct from targeting luxury goods for revenues purposes, which are indeed often linked with setting high VAT rates. A second strength of this instrument is that there is a subsidy for the environmentally friendly products (green products) and there is also a tax on dirty (non-green) products. This is important for two reasons: subsidizing green products does not necessarily imply reducing the use of non-green ones. Furthermore, a green subsidy alone can have positive effects but also no effects or even negative effects on environmentally responsible behaviour. As an extreme case, Perino et al. (2014) find that people are less likely to buy various food products (milk, butter, meat and cans of soda) if their price is reduced because of environmental reasons (e.g. a green subsidy) rather than for reasons due to reductions in raw materials' prices.

Effectiveness

The effectiveness of this policy seems quite assured. This claim is based on real cases (consider the example of a feebate scheme on passenger cars in France) and on a number of studies like Hilton et al. (2014) who analyse two non-financial aspects of the bonus-malus fiscal system, namely the role of social values in the effectiveness of a tax (two studies in this direction are Alesina and Angeletos, 2005 and Japhet, 2012) and the risk of decreasing intrinsic motivation to perform environmentally responsible behaviours due to the use of financial incentives (e.g., Deci et al., 1999 and Frey, 1997).

Efficiency

It may be complex and therefore quite costly to manage a fund to collect taxes on non-green products and use them to subsidize the green ones. In particular, it may be quite a difficult task to keep the fund balanced in order to avoid the government to finance the fund itself. It seems that while the French feebate on cars undoubtedly proved to be effective, the same cannot be said regarding its efficiency. The government had in fact to subsidise the fund, with a negative effect on the public deficit. The policy was effective but this happened at a high price. The question would be then about the scale of this success had stricter budgetary constraints applied.

In general, both this instrument and the previous one focus on a quite restricted list of goods and activities. However, if the objective is to reduce the external costs of home energy consumption it would be probably more efficient to tax directly home energy consumption.

Increased spending on research and development

Motivation, Nature and objectives of the instrument

According to Deliverable D4.2 (Ekvall et al. 2015: 178), this instrument “implies continued and strengthened public funding of research and development (R&D) in EU-27 for recycling and material efficiency. The R&D for recycling will include:

- Design for recycling;
- Efficient and consumer-adapted systems for collection, and identification of the role of the public sector in ensuring their provision;
- Technology for dismantling and separation of components and material; and
- Technology for recycling.

The R&D for material efficiency will include, for example:

- improved processes and products;
- new business models; and
- non-material alternatives for safe investments”.

The last item in the list particularly targets gold as a financial investment option, and the opportunity of finding equally reliable alternatives to it.

The policy strives to promote technological progress and knowledge in the EU in the field of recycling and material, in the hope of reducing the use of virgin material and enhancing the competitiveness of the European industry.

The policy targets “primarily research at universities and institutes and R&D in the manufacturing industry” (Ekvall et al. 2015: 179) and it is expected that the results will spill over to “the manufacturing industry, the wholesale and retail sectors, and the waste management” and indirectly to be beneficial for the whole economy.

In terms of the share of R&D for recycling and material efficiency on total public R&D spending, it should double by 2020 and kept constant. “Money for the public funding will be collected as part of the local and national income tax on households. The level of the tax increase will depend on the cost of the sharing systems.” (Ekvall et al. 2015: 179)

What economics can say about this instrument

Ekvall et al. (2015) defines the scope of the instrument, the targeted stakeholders, and the financing method. In particular, we notice that the instrument covers various areas of recycling and source reduction, it is mainly aimed at public spending in R&D and should be financed through a share of income taxes rather than through earmarking environmental taxes. All these features have relevant aspects for the qualitative economic assessment.

The theoretical economic literature on R&D policy for recycling and material efficiency is at best scarce. There are a number of empirical case studies focusing on specific countries, but the theoretical work seems to boil down to Honma and Chang (2010) and Söderholm and Tilton (2012).

Honma and Chang (2010:1), using a game theoretical model of Cournot competition, find that “positive virgin material taxes or positive final disposal taxes discourage firms from engaging in recycling R&D efforts in normal situations, regardless of whether R&D cooperation takes place. Not surprisingly “both non-cooperation and within-group cooperation are inferior from a welfare perspective to industry-wide cooperation. Furthermore, in the case of within-group cooperation, the symmetric division of firms induces the lowest welfare for all ranges of a given spillover parameter” (p.2).

Söderholm and Tilton (2012: 1) argue that “concerns over potential future natural resource scarcities do not represent a strong motive for introducing policies to foster greater material efficiency but that various environmental externalities and information failures in the relevant material markets do. Moreover, in such instances policy makers should opt for policy instruments that target the relevant market failures (e.g., environmental damages) as closely as possible”. This is in line with more general findings on environmental policy and innovation policy highlighted by Popp et al. (2009) and discussed later on in this section.

To get more qualitative insights, we need to take a broader stance and look at the economic literature on environment-friendly innovation. Thus, the remainder of this section draws from the recent literature survey on the linkages between energy, the environment and technical change by Popp, Newell and Jaffe (Popp et al, 2009).

Their focus on energy issues is outside the scope of this report, and it is motivated by substantial attention given to this topic in the literature. However their excellent review of the theoretical and empirical economic studies on the nexus between the environment and technical change is of great relevance for our purpose and highlights the key findings on the environmental innovation policy which are the main focus of this section.

Effectiveness

The approach of environmental economics to policy analysis focuses on the ability of any given policy to help bring the negative externalities of human activities to an optimal level, or, when optimality is not attainable, to minimize the cost of reaching a given target selected exogenously by policymakers. In the short term, this entails driving the regulated agent to select that level of activity that equates the private marginal cost of reducing the externality with the marginal social benefit of such reduction, or in a second best setting, induce the agents to reach the desired target at the lowest possible social cost. In the long run however, technology changes the terms of “the tradeoff between the marginal cost of pollution control and its marginal social benefit” (Popp et al., 2009: 2). “In particular, technology innovations—such as new pollution control equipment, cleaner production methods, or new substitutes for environmentally harmful products—typically reduce the marginal cost of achieving a given unit of pollution reduction. These innovations may also change the shape or the slope of these marginal costs. In most cases, technological change enables a specified level of environmental clean-up to be achieved at lower total cost to society. New innovations also make it possible for a lower total level of pollution to be attained more efficiently than would be expected if the cost of clean-up were higher” (Popp et al., 2009: 3).

In the case of the policy instrument under scrutiny, this general observation translates into the idea that the technological innovation will reduce the marginal cost of recycling one unit of a given product or of the content of targeted materials within a product, that is, it will change the shape of these products’ cost functions. In general the hope is that it will make it easier and cheaper for society to deal with the end-of-life stage of the targeted products and with the recovery of the targeted materials.

A second pillar of the economic analysis of environmental innovation policy is that there is a fundamental analogy between the natural environment and knowledge leading to innovation, in that both have public good features. Both are non-rival (a clean environment and a scientific idea can be enjoyed by many people simultaneously without reducing their usability for further users) and both are in principle non-excludable (without putting in place specific barriers such as fences and, respectively, patents and copyrights, anyone can enjoy an unspoiled natural area or scientific ideas by, respectively, travelling to the natural area and hearing or reading that idea).

The case for innovation policy arises precisely because of this public good feature of knowledge creation, in that “a firm that invests in or implements a new technology typically creates benefits for others while incurring all the costs” as noted by Popp et al, 2009. They

point out however that there is a sharp difference in the way environmental policy and innovation policy intervene in response to the public good nature of their target. Environmental protection typically entails correcting a *negative externality*, i.e. taking steps to reduce environmental damages; innovation policy entails creating the conditions for the optimal deployment of a *positive externality*, i.e. spreading new ideas that can lead innovation and ultimately to the diffusion of better technologies. In the words of Popp et al.: “Pollution creates a negative externality, and so the invisible hand allows too much of it. Technology creates positive externalities, and so the invisible hand produces too little of it. As such, even if policies to correct the environmental externalities are in place, the level of environmental R&D will still be suboptimal. Because they ignore the positive spillovers created by R&D, firms will underinvest in research activity.” (Popp et al., 2009: 3). In other words, in a free market firms will invest in R&D less than is socially desirable and this provides an immediate justification for public support to R&D (Arrow, 1962).

Popp et al. find in the literature other key factors that justify the relevance of environmental innovation policy: uncertainty, dynamic increasing returns, and asymmetric information issues.

The issue of uncertainty is well recognised in proposing this policy in D 4.2: “The effectiveness of research is difficult to predict. Little impact is expected before the year 2030. On the other hand, if the R&D is effective and results in increased recycling and material efficiency in the EU-27, knowledge transfer to other parts of the world will, in the long term, contribute to recycling and material efficiency also in other parts of the world. This will reduce the energy-intensive production of virgin materials and the associated environmental impacts.” (Ekvall et al., 2015: 180).

Uncertainty matters because R&D is a typically uncertain activity, and while standard R&D is motivated by the prospect of future profits, and thus in general financially viable by firms with an ability to plan ahead while facing uncertain future prospect, environmental regulation compounds the problem because “the technologies needed to comply with proposed regulations may evolve in unexpected ways once policy is in place, making it difficult for regulators to anticipate the true costs of compliance” (Popp et al, 2009: 4).

Learning by using, learning by doing and network externalities can add to the positive externality feature of innovation by making an innovation more useful the more widespread it is. This leads in the words of Popp et al., to *dynamic increasing returns*, which imply that “just like the creation of the technology itself, information about the performance of a technology has an important public goods component.” (Popp et al, 2009: 4). This points to a crucial component of policies aimed at fostering technical change. They should not stop at the innovation phase, facilitating R&D activities only, but they should also foster diffusion and mass adoption of the new technology. A brilliant technological innovation sitting idly on the shelves of a lab, is a waste of intellectual effort and of financial resources.

The adoption of a new technology is at risk, among other things, because of asymmetric information, in particular due to principal-agent issues. This is the case when those who should adopt the new technology do not get any immediate advantage from it; thus for instance consumers may not go for new recyclable products or adopt new waste sorting

procedures if they do not get any economic advantage and if there is no effective way to monitor and sanction whether they abide to the new recycling rules or not.

All the above points to the idea that environmental policy and environmental innovation policy should go hand in hand as much as possible. Popp et al. note that there are two main ways in which this interaction can take place, which have to do with the scope of the R&D policies. “Because knowledge market failures apply generally across technologies, policies addressing knowledge market failures may be general, addressing the problem in the economy as a whole, such as patent protection, R&D tax credits, and funding for generic basic research. Such policies focus on the overall rate of innovation – how much innovative activity takes place. In contrast, policies aimed specifically at the environment focus on the direction of innovation. While this includes policies regulating externalities, such as a carbon tax or cap-and-trade system, it also includes environmental and energy policies using more general R&D policy mechanisms with a specific focus on the environment” (Popp et al, 2009: 4).

The overall result of the various studies reviewed by Popp et al., about the effectiveness of environmental and innovation policies in tackling environmental issues, is that R&D policies are important, but it is the combination of the appropriate environmental policy instruments and R&D policies that yields the best results.

In particular, R&D policies alone are quite useless to spur adoption of new technologies, even though it can be effective in creating them. When adopting a combination of a Pigouvian environmental tax and optimal R&D subsidies Popp (2006) shows that more than 95% of welfare gains stem from the tax. Using R&D subsidies brings about only 11% of the welfare gains. Also Fischer and Newell (2008) find that an optimal portfolio of policies achieves emission reductions at significantly lower cost than any single policy. In a long term perspective, Popp et al. note there might be an issue of timing between the two kinds of policies, due to the uncertainty about the future development of social and private costs: “long-term issues [...] raise the question of whether additional policy instruments are needed that (1) enable the government to manipulate expectations of future prices, or (2) perform the initial research necessary to get ground-breaking technologies close to market, thus lowering the cost (and raising political support for) future environmental policy. That is, one can look at this question as whether environmental policy should come first, and be designed in a way to encourage long-run innovation, or whether technology policy needs to accompany or precede environmental policy, so as to lower the costs of implementing environmental cleanup” (Popp et al, 2009: 6).

Popp et al. devote an extensive section of their survey to the choice of policy instruments to induce innovation. The usual result that market-based instruments are in many respects superior to command-and-control instruments holds also in this context. The standard result carries over quite naturally to technology adoption, and we will discuss this issue in the section about product standards. Analogous results are listed in the review by Popp et al., also about inducing firms to perform R&D. However, in this case results are less clear cut, and, bar the seminal work by Magat (1978, 1979), where command-and-control instruments are clearly out-performed by market-based ones, more recent works in general cannot find an unambiguous ranking of policy instruments in view of promoting environmental R&D. Even

within market-based instruments, Popp et al. point to studies according to which some tools might out-perform others, depending on the circumstances: “Carraro and Soubeyran (1996) compare an emission tax and an R&D subsidy, and found that an R&D subsidy is desirable if the output contractions induced by the tax are small or if the government finds output contractions undesirable for other reasons. Addressing the same trade-off, Katsoulacos and Xepapadeas (1996) find that a simultaneous tax on pollution emissions and subsidy to environmental R&D may be better suited to overcoming the joint market failure (negative externality from pollution and positive externality or spillover effects of R&D)” (Popp et al, 2009: 13).

The behaviour of different instruments is sensitive also to the degree of market power held by firms, as shown by Montero (2002) and Innes and Bial (2002). The latter shows that, if oligopolistic firms compete on prices (Bertrand competition), “a successful innovator may prefer stricter environmental standards so as to raise costs for rival firms. An environmental tax that is efficient *ex post* (e.g. after a new innovation is revealed) also provides incentives for overinvestment in R&D, as firms hope to gain profits by being the first to invent an environmental technology that will affect regulatory levels and impose costs on other firms.” (Popp et al., 2009: 13).

Finally, Popp et al devote a subsection to public R&D. Results are limited and mostly about energy R&D, but there are some few useful conclusions:

- “Government R&D can help to compensate for underinvestment by private firms. Unlike firms, the government is in position to consider social returns when making investment decisions” (Popp et al, 2009: 21)
- “Government R&D tends to have different objectives than private R&D. Government support is particularly important for basic R&D, as long-term payoffs, greater uncertainty, and the lack of a finished product at the end all make it difficult for private firms to appropriate the returns of basic R&D. Thus, the nature of government R&D is important” (Popp et al, 2009: 21)
- “Energy patents spawned by government R&D are cited more frequently than other energy patents. This is consistent with the notion that these patents are more basic. More importantly, after passage of the technology transfer acts in the early 1980s, the children of these patents (that is, privately-held patents that cite government patents) are the most frequently cited patents, suggesting that transferring research results from the government to private industry produces valuable research results” Popp et al, 2009: 22).

Overall, the economic view about the effectiveness of public support to R&D is positive. It is however important to deploy it in coordination with other policies that target the right objective on the product market; in general terms the negative externalities should be corrected by the appropriate instruments while R&D works at improving the way this correction can be performed. Thus, policies that promote material efficiency and recycling for the materials targeted by the R&D policy should be a credible and steady feature of these markets, to make sure that there is a sustained incentive to innovate and then that the innovation reaches the market and it is adopted by consumers. Thus the link to a materials tax mentioned in Deliverable D.4.2 is very relevant not only in terms of acceptability of the tax, but also in terms of the overall efficiency of the policy mix.

Feasibility

The policy takes the form of a subsidy financed through income taxes. While the subsidy shares many of the desirable properties of market-based instruments, there are some feasibility concerns that should be considered. These concerns relate to the administrative and budgetary issues of financing the subsidy and making sure that it goes to those most likely to make the best use of it. We can thus envisage two critical stages:

1. Financing
2. Selecting the recipients and deploying the funds.

Financing the subsidies. Resorting to income taxes to finance this subsidy is not uncontroversial and can bring about distortions and acceptance issues in varying degrees, depending on the pre-existing level of fiscal pressure and how the additional tax, if present, is allotted across tax payers. If income taxes are not raised, but the funds are drawn from the existing pool of income revenues, this will imply that either other public expenditure items are crowded out, or that, if compatible with stability rules, public debt is raised to finance the crowded out expenditure items.

In terms of distortions, it is a well-known finding concerning public finance that income taxation is a distortionary way of raising public funds. The reason for this distortion is that income taxation introduces a wedge between the marginal value of labour for the individual on the market and the compensation he/she receives. If taxation is too high this wedge may induce suboptimal provision of labour, and this is particularly relevant for additional taxation. All form of taxation induce some form of distortion, bar lump sum taxes (those imposed on each living human being in the economy irrespective of any other consideration about her/his condition), but some distortions are actually preferable to others and might be beneficial. The distortion induced by Pigouvian taxation in environmental taxes, boils down to correcting an existing distortion (the one between social costs and private costs of the activity generating the externality) and thus is actually welfare improving (see the previous discussion of green tax reforms). In the case of the policy under scrutiny, a preferable course of action would be to earmark taxes on waste or on materials to finance the subsidy. Additional forms of taxation such as income taxes or commodity taxes should be introduced only if the earmarked revenues are not enough to cover the costs of the programme, and their distortionary potential should be carefully evaluated. This is undecided a priori, and should be carried out using a careful empirical assessment. Baylor (2005: 3) provides a review of rankings of tax distortions in general equilibrium models and finds that “the ranking based on results from neo-classical growth models indicates that capital taxes are the most distortionary, followed by labour and then consumption taxes. Tax ranking based on results from endogenous growth models, on the other hand, are more heterogeneous and vary across framework, settings, and ranking criteria.”

Besides efficiency consideration, public acceptability of raising income taxes and/or diverting funds from other important expenditure items is crucial and can determine the feasibility of the instrument. In countries with high fiscal pressure, any proposal of further taxation will most likely encounter strong public opposition. If taxes are not raised it is advisable to cut expenditures by curbing first the least popular items, possibly going first for cuts in inefficiencies and non-necessary costs in the political and administrative systems. Ultimately what will matter is the magnitude of the funds to be raised that will determine the extra burden for the society and hence the acceptability of the policy.

Selecting the recipients and deploying the funds. The policy description prescribes that the R&D support should go to “research at universities and institutes and R&D in the manufacturing industry” (Ekvall et al., 2015:179). This general prescription begs the question of which universities, institutes and firms should receive the funds, how much should each institution receive and when. Presumably, the natural solution is to follow the same allocation rules as the existing research support programs in the EU Member States. Under point i) the policy description specifies that “The greatest impact will probably be at the EU level through Horizon 2020 and future EU research frameworks and in Member States through national research funding. However, regional and municipal funding of R&D would also be affected”. (Ekvall et al., 2015: 179) Taking the Horizon 2020 program as the main paradigm for fund allocation, one can imagine that the mechanism will be based on the quality and credibility of research proposals and on the reputation of the proponents, evaluated independently by renowned experts in the fields of the research calls. While this mechanism has been in place for long enough at the EU level to reach a sufficient level of reliability, there is scope for caution at the Member State level, where there might be some leeway left to escape a fair evaluation process.

The economic issue here is again the one of asymmetric information. Following this line of reasoning, proponents of research projects are the only ones to really know their ability to deliver the research detailed in their proposals, the quality of their scientific staff and of the original methodologies they intend to deploy within the project. The funding institution has only indirect information about this ability, mostly based on the reputation of the proponent.

The selection process should be geared in such a way to force the proponents to signal their true quality, and the fund should be allocated to those in a best position to deliver the desired results.

However, there is a risk that such a selection process, if repeated long enough to produce learning effects, would end up selecting the member of the population of potential providers which has the highest familiarity with the selection rules. It is thus advisable to revise research proposal evaluation criteria periodically, and to envisage, if the amount of funds allows it, different funding programs, with different scope and selection criteria, in order to capture different profiles of research institutions and finance both fundamental and applied R&D.

4.1.3 Group 3: Environmental taxes

Value added tax (VAT) on meat products

Motivation, Nature and objectives of the instrument

Meat production has a relevant environmental impact. Only in terms of GHG emissions, the impact ranges between 10-12% (Friel et al. 2009) and 25-30% (Wirsenius et al. 2011) with FAO (2006) estimating an impact of 18% of total emissions. In comparison to the whole amount of emissions originating from food consumption, meat is the most important (Weidema et al., 2008). At the same time there is a broad consensus around the idea that the role played by meat in diet in Western countries is excessive (e.g. White and Frank, 1994; Key et al. 1999; Nordgren 2012) or even harmful (see for example Frank, 2007 for an

overview on the consequences of excessive meat intake on human health). Considering the amount of resources required to produce meat (White, 2000), it seems sensible to reduce meat consumption and production (Garnett, 2011; Smith and Gregory, 2013; Weidema et al., 2008). This is the objective of the policy under scrutiny, which clearly targets one sector directly, i.e. the meat industry while having an important impact on a number of sectors indirectly. Upstream, the main sector is livestock while downstream, market services are a major actor with restaurants and the retail sector.

The policy under scrutiny proposes an increased VAT on meat, which in most EU countries enjoys a lower rate than the standard one. For its objectives and for its nature, this policy can be classified as a food-tax and a green-tax on food consumption. This remark will guide the qualitative assessment, which is mainly based on the existing relevant literature. The first result of this review is that a “meat tax” has already been discussed theoretically but has never implemented so far. The most similar tax to have been implemented is the Danish fat tax, which, ended up targeting also meat and dairy products (excluding milk).

Effectiveness

As with any green tax, the target of the meat tax should be at the root of the inefficiency to correct, which is the production of meat rather than its consumption, since the former is the really inefficient activity. However there is agreement in the literature around the idea that a tax on the output of the livestock sector is quite “virtually impossible in practice” (Wirsenius et al. 2011) mainly because of high monitoring costs (Nordgren 2012, 578). For this reason, taxing consumption appears to be more effective, also considering that consumption itself has become inefficient (thus it effectively would become a food tax).

The literature on food-related policies is large (Niebylski, M.L. et al., 2015, for example, find 1174 articles with 315 relevant papers) while the literature on green taxes on food consumption is much smaller. The first question regards the potential effectiveness of a meat tax in comparison to other instruments (typically: command-and-control instruments and information campaigns). With regard to the food-related policy nature of this instrument, command and control instruments are economically inefficient and have mainly been used in relation to cases where there is an acute threat to the life and health of citizens (Reich et al. 2011). Information campaigns have been widely used to improve general health, such as to decrease smoking or to increase consumption of fruits and vegetables. However, a large number of authors (e.g. Wirsenius et al., 2011; Nordgren, 2012 and more recently Ripple, 2014) believe that only a instrument like a tax can lead to “strong sustainable consumption”, namely “changes in consumption patterns and reductions in consumption levels in industrialized countries’ (Fuchs and Lorek, 2005). This view is confirmed by various literature reviews, which substantially conclude that food taxes are effective in lowering the intake of unhealthy foods (Thow et al., 2010; Powell et al., 2010). If we consider the instrument as a green tax aiming at reducing GHG emissions from food production, the information campaigns do not seem very effective according to Edjabou and Smed (2013) because the consumption of meat and dairy is deeply rooted in our culture (Olesen, 2010). This allows us to conclude that a price-based instrument seems the most appropriate to reduce GHG

emissions from food consumption. Also other authors (e.g. Anders Nordgren, 2012 and Alcott, 2008) are convinced that without a instrument like a meat tax too few people would make any significant change to their diets within a short space of time.

The market-based instrument however has a major weakness, as indicated by Olesen (2010) and Randall (2014). In general meat demand is quite inelastic and clearly more inelastic than other types of food which have already been targeted by similar policies (salty foodstuff, sugar-rich products...). Additionally, a meat tax can also have unintended effects (Carahera, M. & G. Cowburn (2015) or even adverse substitution effects, i.e. that consumers substitute taxed foods with foods that are equally or even more unhealthy (Nnoaham et al. 2009; Mytton et al., 2007). Since this tax is not targeting dairy products there is a risk that taxing meat moves consumption to dairy products. With regard to elasticity, ruminant meat seems quite elastic (Gallet 2010) and has the largest contribution of greenhouse gases. An option could be to tax only ruminant meat while leaving unchanged the policy on non-ruminant meat.

In general, it seems that the effectiveness of the policy might be improved if it were coupled with adequate information campaigns. This reinforces the view that taxes need to be paralleled by subsidies and other interventions to encourage healthy eating (OECD, 2006). Notably, Nordström and Thunström (2009) show that subsidies in isolation increase the intake of healthy food but also the intake of nutrients that are often overconsumed (fat, saturated fat, sugar, added sugar, salt) due to a dominant (and unwanted) income effect.

Efficiency

In terms of efficiency, OECD (2010)⁷ argues that the combination of instruments has a positive impact also on this aspect: this is because a combination of different instruments increases the population coverage and can therefore exploit synergies between the different instruments. It is also argued that a combination of instruments may be more cost-effective than any standalone policy instrument by itself. In view of the administrative costs of an increased VAT on meat, these seem to be quite low. Since this would not be a fully new tax but an increase in an existing one administrative control costs ought to be rather limited.

Equity

Changes in food prices usually create winners and losers, the latter often among the poor (Anderson et al., 2012). This is also claimed by Randall (2014) while Ripple et al. notes that, “social justice, equity and food access issues need to be carefully considered” (2014, 3). With regard to consequences on equity, the literature shows that there are two main aspects to consider, namely the economic equity and the health equity. The economic equity deals with the intensity of the impact of the tax on the income level of the different consumer groups. To be economically fair, the impact rate of the tax should be either the same for all groups or

⁷ OECD Health Ministerial Meeting, Paris (2010) ‘Health Choices’.

progressive. The health equity deals with the changes in the dietary habits of different consumer groups induced by the instrument.

While the literature on effectiveness is huge, the same does not hold for the equity. The reason is intuitive: the investigation of equity aspects requires more complex models and larger amounts of data than in the case of a single representative consumer. Papers, which study equity issues, are for example Chouinard et al. (2007) and Smed et al. (2007). Most authors (see for example Nnoaham et al., 2009) find that these instruments are regressive. Nordström and Thunström (2011) obtain quite the opposite result in the case of a simulation of a VAT reform and an excise tax reform in Sweden. According to the authors, none of the instruments seems to have any negative effect on economic equity, as they are both progressive. As to health-related equity, the VAT reform has approximately the same effect on all groups (although this result does not emerge sharply from the literature), while the excise tax reform has a negative effect on the poorest. A study by the Danish Academy of Technical Sciences, 2007, reported in Bødker, M. et al. (2015) claims that it is unsure that food taxes have negative effects on health-related equity.

Feasibility

In the case of a food-tax such as the one on meat, interests groups are the food industry and trade associations, consumers and public health advocates. The former two enjoy a strong influence on political decisions through their lobbying activity. Additionally, they use a wide range of instruments to prevent taxation being implemented (Carahera, M. & G. Cowburn, 2015). Several studies show how the food industry uses tactics similar to those used by the tobacco industry to fight policies threatening their business (Wiist, 2010 and Brownell et al. 2009). The latter two are usually weak in tackling the issues of corporate power and providing evidence to maintain policy and political support. In this framework, academic research often seems to report long after the event (Carahera, M. & G. Cowburn, 2015).

With regard to government ideology, it is quite well-known that policymaker's preferences show a bias towards agricultural protection (de Gorter and Swinnen, 2002). This means that a rise in the VAT on meat may see some opposition in government. In the case of the fat tax in Denmark, the inclusion of meat was discouraged as it was considered infeasible for food corporations (Bødker et al. 2015). Also milk was excluded by the policy in Denmark.

Some points for public acceptability are:

1. Given the first objective, the policy belongs to the category of food taxes. This relates to the issue of the justification for public intervention in food consumption (Smed, 2012)
2. Meat consumption is perceived as a instrument of social and economic development (World Watch Institute 2003).
3. Mismatch between health objectives (including single person health and environmental health) and budget objectives

Recommendations:

1. For higher equity (and higher effectiveness as well) tax reductions on vegetables and other healthy food (e.g. fruit, as in Bødker et al. 2015) may be also included. This would also add to the issue of proving that an increase in the VAT on meat is not dictated by public budget needs but is a instrument for healthier diets and living habits.
2. For higher effectiveness, it may be sensible to distinguish between the two types of meat (ruminant and non-ruminant) as they differ both for their environmental impact and for their role in human diet.

4.2 Regulatory and command-and-control instruments

4.2.1 Boosting extended producer responsibility

Motivation, Nature and objectives of the instrument

According to Ekvall et al. (2015: 65), “the Extended Producer Responsibility (EPR) provides incentives to manufacturer for better product design and for setting up more resource efficient business models. The EPR schemes also encourage waste management solutions through the internalisation of the negative effects of waste resulting from end-of-life products”.

The scheme extends producers’ responsibility to the entire lifecycle of a selected range of products (therefore including their take-back, recycling or disposal) to decrease total environmental impact of those products. In particular, “products which are not covered by EU Directives but for which such schemes have effectively been introduced in selected MS will be considered priority products to which such EU-wide schemes should be applied” (Ekvall et al. 2015: 66).

The new Extended Producer Responsibility (EPR) programmes would increase considerably the obligations for the producers since they “would have the full responsibility (including costs) for the disposal of packaging and other materials associated with the product it puts on the market”. The policy “is expected to lead to the integration of the environmental costs associated with the goods throughout their lifecycle into the final market price of the products” Ekvall et al. (2015: 66).

The policy is described to have the following features:

- It will introduce an enhanced producer responsibility scheme (i.e. building on lessons learnt from existing schemes) which would apply to a selected number of products
- It will most likely affect **tyres, graphic paper, medical waste, oils and agricultural films, for which EPR** has already been introduced in at least eight MS of the EU.
- It should be assumed that these products will be covered by an initial expansion of the scope of EU EPR legislation.
- The implementation of EPR schemes would be boosted thanks to the introduction of appropriate standards.

- While collective responsibility schemes may initially be allowed for a transition period, producers' individual responsibility schemes would be preferred over collective responsibility schemes, as these have proven to be more effective in delivering design change.
- “Successful elements of the WEEE [Waste Electrical and Electronic Equipment] directive] would be reproduced and its limitations addressed” (Ekvall et al. 2015).
- Imported goods would also be targeted by these schemes. Exported goods would not be affected.

What economics can say about this instrument

In the environmental economic literature, the concept of Extended Producer Responsibility appears mostly as a label for the adaptation of external costs internalisation to the case of goods that have a limited useful life at the end of which they turn into waste. EPR indicates the determination of policymakers to make sure that producers take responsibility for the fate of the goods they produce, minimising the pollution of the environment resulting from those goods and maximising the recycling of their components and therefore reducing the net demand for resources necessary to production. This can be achieved through a variety of instruments, which are the “real policies” to be put in place in order to realise EPR. OECD (2014: 6) lists the following policy instruments as compatible with the implementation of an EPR scheme:

- **“Product take-back requirements.** Take-back policies require the producer or retailer to collect the product at the post-consumer stage. This objective can be achieved through recycling and collection targets for the product or materials and through incentives for consumers to bring the used product back to the selling point.
- **Economic and market-based instruments.** These include instruments such as deposit-refund schemes, Advanced Disposal Fees (ADF), material taxes, and upstream combination tax/subsidy (UCTS) that incentivize the producer to comply with EPR. [...]
- **Regulations and performance standards** such as minimum recycled content. Standards can be mandatory or applied by industries themselves through voluntary programmes.
- **Accompanying information-based instruments.** These policies aim to support EPR programmes indirectly by raising public awareness. Instruments can include imposing information requirements on producers, such as reporting requirements, labelling of products and components, communicating to consumers about producer responsibility and waste separation, and informing recyclers about the materials used in products.”

In the policy mix description of Ekvall et al. (2015) it transpires that EPR should mainly be implemented using command-and-control instruments such as the one listed above under “Product take-back requirements” and “Regulations and performance standards”, possibly with the support of some information initiatives. Market based tools do not seem to play a main role in the proposed configuration of EPR.

OECD (2014: 6) also notes that “The chosen mix of instruments will be different from one country, region and industry to the other, based upon political priorities, as well as on the social, economic, legal and cultural context. For example, if a government’s priority is to improve waste collection, the objective could be reached through the introduction of an ADF

or mandatory collection targets. By contrast, if the priority is to stimulate eco-design activities, this could more appropriately be stimulated through instruments that target products' characteristics such as minimum recycled content requirements.”

Another apparently trivial but crucial aspect of EPR, pointed out by Walls (2003: 4) is that “when designing EPR policy and programs, policymakers need to precisely specify the environmental objective they are trying to achieve”. This is because the objective of EPR is not univocal per se: EPR may serve to achieve “waste diversion, reduced environmental impacts from production, such as air and water pollution, less use of virgin materials in production, and reduced toxicity of products” Walls (2003: 5).

In the case of the DYNAMIX policy mix, we can safely state that the main objectives are those most related to reducing resource use related to the products under scrutiny, thus reducing the use of virgin material and in a secondary fashion, reduce the related environmental impacts. However, a well-known traditional result of economic policy analysis is that at least as many policy instruments are needed as policy objectives (Tinbergen, 1967). Thus we would need a specific policy tool for the virgin material use and a specific instrument for the environmental impacts (most probably multiple tools for each of these two main objectives since in general more than one material and one environmental impact is involved in any modern manufacturing activity).

Effectiveness

In what follows we will focus on the role of command-and-control instruments in the economic assessment of environmental policies, but we will also touch upon the merits of market-based tools for reaching efficiently EPR targets. The role of information tools is dealt with in a specific section of this report.

Command-and-control instruments are generally divided into two main categories: technology-based and performance-based. The first ones prescribe how processes and goods must operate or be built. The second ones prescribe a certain threshold in a given endpoint, that must not be surpassed if considered harmful or that should at least be reached if considered positive. EPR can be applied using both sorts of standards, for instance by dictating the amounts of certain components or technologies that must be included in a given product, or by prescribing the minimum percentage of the weight of the products or of some components of the products that should be recycled.

Environmental economics textbooks traditionally devote a large portion of their policy-related contents to the comparison between market-based and command-and-control instruments. The main lesson drawn is that in theory, command-and-control instruments are less efficient than market-based instruments for reaching a given environmental target, because they impose the same target to heterogeneous actors irrespective of their relative ability to attain it. Market-based instruments, on the other hand, minimise the overall cost of reaching a target because they equalise marginal costs across all affected agents, thus implicitly allocating the larger portion of the collective effort to those for which it is easier to exert it. In dynamic terms, the steady implementation of market-based instruments spurs innovation, because it provides incentives for the economic actors to be penalised the least or benefit the most under the conditions given by the instrument. Command-and-control instruments, on the other hand, unless regularly strengthened and updated, only force the agents to do what suffices to abide to current standards, but give no incentive for further improvements.

Market-based and command-and-control instruments have different properties under uncertainty and each category may be preferable under specific circumstances, as highlighted by Weitzman (1974), and Baumol and Oates (1988) and later extended in many other directions by various authors. The general idea is that each type of instrument can be superior to the other in a second best setting, depending on various conditions, such as whether uncertainty relates more to social benefits or to social costs, the shape of the marginal benefits and the marginal cost curves, the characteristics of any tax scheme (linear or nonlinear, fixed or adjustable) and the degree of market power held by the firms affected by the instrument. Overall, however, the merits of market-based instruments seem to outweigh those of command-and control instruments, under most circumstances and assumptions.

Walls (2002) provides a thorough analysis of promising policy options to strengthen EPR, mainly focusing on waste diversion and virgin material use as objectives. She finds (referring to a previous study of hers) that a Pigouvian tax in an ideal world where perfect recycling markets are present could allow optimality to be achieved. Even in a second-best setting, market-based instruments such as UCTS, in which “producers of intermediate goods pay the per-pound tax and collectors of used products receive the per-pound subsidy” are found to be the most cost-effective way to reach a given recycling target. UCTS are particularly promising according to Walls, because they promote both recycling and source reduction. The runner-up is the advance disposal fee, which however encourages only source reduction, followed by far by the recycling subsidy which affects only recycling.

Given the superiority of market-based instruments, it is thus quite clear that the idea that EPR should be improved preferably through the latter undermines the effectiveness of the instrument under scrutiny.

Feasibility

Feasibility issues related to EPR, highlighted in the OECD report, have to do with:

- **Free riding.** Free riding occurs when an economic agent does not perform the action he/she is supposed to according to an existing implicit or explicit agreement, contract or rule to which he/she is bound to abide, and, because of the imperfect knowledge of the other players about the actions of said agent, he/she manages to avoid being penalised for his/her opportunistic behaviour. In the case of EPR, free riding may happen “when some producers do not finance the collection and recycling of their products up to the level required. Free-riding could also refer to non-compliance, for example if producers do not provide accurate data about the quantities of products put on the market” (OECD, 2014: 11). If producers delegate the management of EPR obligation to a collective scheme such as Producer Responsibility Organizations (PRO) the chances of free riding increase “because responsibility is shared and it is easier for producers to circumvent their respective obligations” (OECD, 2014: 11). Free riding has no easy solution. Proposed ways to deal with it involve either taxation⁸

⁸ This option may not be feasible in practice in these exact terms, due to the intrinsic difficulty of identifying free riders and the amount of resources they actually free ride. However it can be approximated by computing the overall costs of waste collection and recycling and then divide it across all firms in the relevant sectors, equally or on the basis of some activity indicator such as yearly turnover. This works quite well with individuals (it might rise some grudging on the ground of

(to expropriate from the firm the financial resources that it does not employ in collection and recycling), stricter regulation, or, conversely, subsidisation, to make the firm indifferent between behaving properly and free-riding. The two latter solutions involve enhanced monitoring to make sure that the firm actually complies. Subsidisation is in line with the traditional solution of the principal-agent problem, which is based on asymmetric information on the part of the principal about the actual effort exerted by an agent and widely discussed in game-theoretical literature (See Mas-Colell et al., 1995, Chapter 13, for a synthesis of this literature). However, subsidisation may run into public acceptability problems if seen as a sort of bribing the producers in order to have to do what ultimately would have been their duty anyway.

- **Enforcement.** This is strictly connected with previous concerns about free riding. Waste treatment and recycling are activities in which illegal or inappropriate practices, such as illegal landfilling and dumping, lack of transparency and traceability, or illegal waste export, are quite easy to implement and difficult to monitor. Therefore regulators should put in place an efficient check system to catch non-compliant firms, along with a credible system of sanctions to reduce or eliminate the incentive to misbehave. This incentive ultimately boils down to the cost difference between compliance and non-compliance. Thus the most direct and efficient solution is to resort to market-based instruments, in particular UCTS, which deals precisely on reducing this margin.
- **Trade and competition issues.** According to OECD (2014), these can entail the product market, the competition among PROs, the competition between PROs and downstream firms such as waste collectors and recycling/recovery providers. In all cases, the concern is that PROs by aggregating the interests of several producers, are able to exert significant market power and therefore distort competition in markets directly or indirectly connected to their activity. Their obvious direct influence is on downstream operators, while the less obvious is on product markets: if PROs manage to significantly reduce operating costs of their members, the latter can lower the price of their products and thus gain market shares at the expense of their competitors. Beside the influence of PROs, the possible heterogeneities of EPR rules across regional and national jurisdictions may yield a relative competitive advantage to some producers.

fairness, but note that we are all implicitly already subjected to such schemes in the case of the provision of public goods such as national defense). It might be more complicated to apply such scheme to firms in a given sector if they are very heterogeneous in size and in their ability to escape taxation by moving abroad.

4.2.2 Stronger and more effective environmental and climate dimension for EU land management in the CAP

Motivation, nature and objectives of the instrument

The rationale behind this instrument lies in eco-inefficiency in farming. Individual farm-level data, collected across Europe using Farm Accounting Data Network or other sources allow for a detailed assessment of the efficiency of farms. Such studies (e.g. Picazo-Tadeo et al., 2011 or Asmild and Hougaard, 2006) show that there is a huge potential for increasing eco-efficiency of farming and for reducing the environmental impact of agriculture without hampering production. However, proper incentives must be provided to assure that farming methods are adequately supported and executed.

Within this instrument, the strengthening of eligibility criteria for support within the CAP is planned – such criteria should apply to specific features of farming, land use and eco-efficiency as well as to soil and water protection instruments. Also, support for semi-natural ecosystems as well as for traditional and eco-friendly farming techniques should be increased and the ecological dimension should be prioritized within the CAP. After 2020, new instruments should be introduced to ensure that farmers use land and soil efficiently. This should be done within the existing budget, by strengthening the eligibility criteria and changing the regulations that cover the allocation of support. Requirements regarding the efficiency, soil, water and climate impacts of farming should be directly incorporated into the CAP framework.

The objectives of this instrument are, by and large, difficult to quantify as they impact on biodiversity, rural landscape and local communities as well as on water quality and soil erosion. However, due to the decrease in fertilizers' use and to the more energy-efficient farming, a 10% reduction of greenhouse gases from agriculture is expected.

Effectiveness

Taking into account the specificity of the European agriculture, several economic effects need consideration while analysing the *Stronger and more effective environmental and climate dimension for EU land management in the CAP*. First, it is widely recognized that organic farming leads to much lower yields than conventional methods (Seufert et al., 2012). Therefore, introducing the proposed instrument will directly lead to decrease farmers' income from selling crops. However, this loss may be compensated with subsidies or other incentives. This may be economically justified, as biodiversity as such also has a great value for society. Sipilainen et al. (2007) show that although organic farming is less efficient when considering traditional efficiency instruments, it becomes efficient if the increase in biodiversity is taken into account. Consequently, while assessing the efficiency of organic and conventional farming, the proper outputs need to be taken into account.

Carefully designed and targeted instruments that benefit from the latest research regarding organic and efficient farming should be neutral for both the CAP budget and farmers' income. Productivity losses should be compensated with direct payments from CAP budget, mitigating the negative impact of productivity losses on long term profitability of farms. However, initial investment and effort is needed both from the farmers' and policy-makers' side.

A first reason for concern is that the reformulated CAP rules may result in temporary exclusions of farmers from CAP support, particularly among those of the older generation who may need more time to adapt to changes. These exclusions may lead to protests as well as additional strains put on social support system in rural areas. However, this effect is only temporary and should be outweighed by numerous benefits resulting from the instrument.

The potential profits for local communities from the policies are numerous. First, greater biodiversity, more semi-natural habitats and organic farming leads to more attractive rural areas characterized by better quality of life. This leads not only to an increase in the number of tourists and a potential shift towards agritourism, which will boost farmers' income, but also, to an increase in attractiveness of rural areas as a place to live. Taking into account the latest technological advances it might be expected that more and more people will move to the rural areas. Deurbanization is already observed in Europe and should escalate in the next decades, but people will move preferably to locations with organic farming, original, semi-natural landscapes and clean areas. Consequently, this instrument can lead to an increase in the price of rural property.

Moreover, more efficient farming will lead to lower losses and lower demand for fertilizers and energy in agriculture, which can slightly slow down economic growth in the short term while the resources are reallocated to other uses from energy and chemical sector, but which can lead both to increased total productivity and to better air and water quality in the long term.

On the other hand, the introduction of instruments that hamper agricultural productivity can lead to increased deforestation as more land is needed to grow the same amount of food. This impact needs to be carefully examined – as Trevawas (2001) points out, environmental costs resulting from organic farming may, in some cases, outweigh benefits. For this reason, support for organic farming should not be granted a priori and forms of support should be designed so as not to lead to adverse effects on environment. However, should the need for increasing food production be limited, including thanks to innovative farming methods and to the instruments aiming at reduction of food waste, potential deforestation might turn out to be a less serious threat. Moreover, the impact of such instruments on land consolidation is difficult to predict – for one thing, organic and traditional farming methods require more direct interactions between farmers and holdings – they are also more labour intensive. For another thing, a decrease in efficiency as well as the need for more up-to-date technologies may foster consolidation, especially in countries where land is quite fragmented.

Efficiency

The goal of the instrument is to improve land management – and CAP seems to be quite a good policy tool, because it can provide financial incentives to farmers who shift towards new farming methods. Such incentives seem to be the most efficient. There are a few examples of instruments that aimed at increase in biodiversity and supporting traditional farming.

Although enhanced support for organic farming was part of the MacSharry reform of the CAP in 1992, the Member States retained significant room for manoeuvre in introducing specific instruments to achieve this goal. Basically, most EU countries introduced specific area payments within their *Rural Development Programmes*. Other policies to increase the popularity of organic farming were those which aimed at promotion and propagation of organic farming – they were also financed within *Rural Development Programmes*. For a comprehensive review of policies introduced in Europe see Sanders et al. (2011)

The efficiency of particular policies targeting organic farming is highly variable and depends on external factors and the specific construction of particular instruments, therefore it is impossible to assess how efficient they are in *strengthening the environmental and climate dimension of CAP*. However, a few lessons need to be remembered while designing specific policies to be introduced within the CAP.

First, there is a high interdependency between the single policy instrument addressing organic farming. Therefore, strengthening the environmental and climate dimension of the CAP should embody not only direct support but also other activities such as promotion and should be rooted in a wider policy context. Introduced packages should comprehensively target the problem and works in all dimensions.

Secondly, the efficiency of instruments that are introduced in different countries is highly dependent on local conditions and there is no *one-size-fits-all* policy package. On the EU level general instruments and some guidance should be introduced, but specific support schemes or promotional activities should be designed and implemented at the national or even regional level. There is a need for the development of local strategies that will contribute to the activities at the EU level but will take into consideration local conditions.

Thirdly, careful monitoring of outcomes is needed. Although the instrumentment of biodiversity or soil quality is extremely difficult, the benefits resulting from particular policies should be clear – without such activities, an assessment of efficiency would be impossible.

Equity

The impact on equality depends on the specific design of the instruments considered. If eligibility criteria to obtain the foreseen support were difficult to fulfil for small family farms, a rise in inequality can be expected within the farms' category. However, as organic farming is to large extent associated with small family holdings, instruments aimed at promoting more natural farming methods should contribute to boosting the earnings of small farms and therefore should lead to a reduction in inequality.

Also, support for biodiversity and semi-natural habitats can increase earnings of rural households through the tourism channel. If more tourists and service workers move to rural areas, farmers can diversify their sources of income, with a consequent fall in inequality. As the instrument is not precisely defined, the overall impact on equality is yet unknown.

Feasibility

Resistance to the instrument would be likely to come from farmers that are quite conservative and reluctant to introduce new farming methods. The other potential group that could protest are large, industrial farms practising intensive farming methods. Also, some difficulties are to be expected and information campaigns and communication will be very challenging for policy makers.

Recommendations and open issues

At the EU-level, a stronger and more effective environmental and climate dimension for EU land management in the CAP means implementation of broad guidelines for Member States. The actions within this instrument should be as broad as possible and cover a few areas:

- First, eligibility criteria for the support should be strengthened to ensure that only farmers who practise environmentally friendly cultivation methods were granted support;
- Secondly, promotional campaigns and educational efforts should be implemented to popularize efficient farming methods among rural households and assure that their incomes would not be negatively affected;
- Within this instrument there is some scope for policy experiments or research that will lead to more environmentally friendly farming without significantly affecting output;
- The particular payment schemes and campaigns that are to be introduced should be tailored to country-specific conditions.

4.2.3 Revised emissions levels in the National Emissions Ceilings Directive (NECD) and additional instruments for better management of the nitrogen cycle on farmland

Motivation, nature and objectives of the instrument

The main aim of the revision of emission levels in the NECD is the reduction of eutrophication and the implementation of instruments for a better management of the nitrogen cycle on farmland. Within this instrument several instruments are to be introduced, including the review of national emission levels within NECD, an increase in public funding to help overcome barriers to environmental action by farmers, and encouragement of better management of the nitrogen cycle on farmland.

The scope of the instrument as defined in D4.2 is very broad and covers a number of policy instruments such as higher fertiliser use efficiency, improved crop and manure management, low-protein animal feeding and improved manure storage. Nevertheless it is mentioned that this instrument should be introduced through more ambitious targets for Member States in the National Emissions Ceilings Directive, while the means to achieve reductions in nitrogen emissions is left to the discretion of different Member States, with possible support from CAP funds. Therefore, we will assess only the broad instrument at the EU level, without digging deeper into instrument details at the state levels.

Effectiveness

The effectiveness of the revision of the NECD is highly dependent on the actual mix of instruments chosen, including other policy mix instruments (e.g. revised CAP and PES). It is likely that some actions would bring cost savings, while others would reduce the profitability of intensive animal production systems (van den Broek, 2007; Schoumans et al., 2011). For instance, Oenema et al. (2009) show that the costs of introducing the three proposed instruments aimed at a reduction of nitrate emissions can equal as much as 25% of the current EU spending on agriculture. However, this is most likely an upper estimate, as these costs depend on specific actions and policy solutions. On the one hand, major investments will be required as farmers with intensive animal production systems will have to improve farm infrastructure and processes. On the other hand some results can be achieved through introduction of better fertilisation planning and management practices, which are virtually

costless (apart from funding needed for education). In this context, detailed cost-benefit analyses will have to be conducted in order to assess a feasible level of emissions.

The economic effects of this instrument are diverse. In a pure, neoclassical framework, all burdens that are imposed on the economy (in that case emission reduction targets) lead to a decrease in productivity, as farmers have to select a combination of inputs that are less efficient in comparison with a situation without any limits. However, taking into account that old and obsolete production practices may persist due to lack of sufficient training and updating of technical know-how, some instruments can, in fact, increase the productivity of the agricultural sector (van den Broek, 2007; Schoumans et al., 2011).

The level of the instrument will have to be set taking into account other policy instruments in the mix, particularly reforms to the CAP and payments for ecosystem services (PES), in order to achieve the best possible synergy effects and to avoid overlaps. Oenema et al. (2009) underline the role of coordination in introducing policies aimed at reducing emissions. Moreover, specific policies will have to be chosen according to the existing nitrate EU policies, as well as other instruments from the mix. As the understanding of the nitrate cycle remains limited, some EU policies limiting nitrate emissions are thought to have synergistic effects, while others are antagonistic.

Efficiency

Research shows that nitrogen losses in Europe are quite high and nitrogen fertilizers could be used more efficiently. According to Hettelingh et al. (2013), the NECD greatly contributed to the reduction in acidification in Europe in the recent decade, but there is still a lot to be done in the area of eutrophication, which is one of the most important environmental problems in Europe and constitutes a serious threat to biodiversity.

On the other hand, it is estimated that controls of agricultural emissions could avert excess nitrogen deposition affecting 200,000 km² of ecosystems, including 90,000 km² of Natura 2000 areas and other protected zones. Oenema et al. (2009) shows that the introduction of similar instruments – balanced fertilization, ammonia emission abatement and low-protein animal feeding - can decrease ammonia emissions by up to 23%, nitrous dioxide by up to 10% and nitrogen leaching losses by up to 35%. However, this comes at a cost to farmers and the EU budget.

Summing up, there is quite a big potential to decrease emissions of nitrates. However, the efficiency of specific instruments is highly dependent on the specific design adopted at the country level. A cost-benefit analysis will have to be conducted in order to assess a feasible level of emissions and win-win solutions should be adopted first.

Feasibility

The lack of a precise list of instruments impedes the assessment of feasibility. Pure restrictions on emissions or fertilizers use may cause some resistance from farmers and agricultural companies as well as protests by the producers of fertilizers. Moreover, it seems that promotional activities which will increase the feasibility of this instrument are not foreseen. However, introduction of new farming methods that will lead to better management of the nitrogen cycle on farmland or grants to farmers for necessary investments financed from the CAP funds seem to be quite feasible. It must be stressed that due to the fragility and

diversity of the agricultural sector across the EU, all instruments should be country -specific, adjusted to the unique country opportunities of reduction in nitrate emissions.

Equity

The impact of revised emission levels in the NECD on inequality is hard to assess without analysing the very specific instruments. On one hand, more stringent regulations could contribute to higher inequality, because greater and more specialized farms could easily adapt to the new regulations and smaller, family-run holdings might be harmed by new regulations. However, with adequate support, and if small farms are entitled to investment subsidies to introduce new farming techniques, the impact on inequality may even be negative.

Recommendations and open issues

As major health improvements may be expected from further limits on nitrate emissions and there is still substantial potential in reduction of nitrate emissions, the instrument is quite an important opportunity to reduce both emissions of nitrates and the resources consumption (such as gas needed to produce fertilizers). However, it must be kept in mind that:

- Coordination is very important – for instance reduction in allowed by NECD emissions should be accompanied by relevant support for more efficient farming methods;
- All instruments should be carefully adjusted to country specific conditions. At the EU level, only coordination and guidance should be provided.

4.2.4 Regulation for Land Use, Land Use Change and Forestry (LULUCF)

Motivation, nature and objectives of the instrument

This instrument is formulated in very general terms, the policy mix is not yet designed and the goal of the instrument is defined as *providing incentives for additional mitigation in the LULUCF sector (land use and forestry)*. The instrument will affect land use through subsidies, land use regulations or offsetting mechanisms, but the precise set of instruments is yet to be defined. The instrument is to be financed either from state budgets or through incentive payments under Common Agricultural Policy (CAP).

Effectiveness

As specific details regarding this instrument are not given, it is quite hard to assess both the effectiveness and the efficiency of its introduction. However, we may assume that this instrument involves some kind of limitation or compensation in the use of land.

The link between land use regulations and greenhouse gas emissions is often much more complicated than it appears at first glance. For instance, Khatun (2012) shows that the absence of tariffs on animal feed together with the CAP regulation led to higher feed imports from Latin America with consequent deforestation and forest degradation in that region. In this vein, new land use regulations in Europe might contribute to the rise in agricultural imports from other countries, leading to deforestation in those areas. Therefore, in addition to

standard instruments impacting land use change and forestry, additional regulations should be introduced to prevent carbon leakage.

The overall impact of land regulations on welfare is yet unknown. In a recent paper, Turner et al. (2014) analyse this problem, and find that a more intensive regulation can decrease the value of land substantially on the edge of cities and only slightly near the city centres. However, they develop a method to split the impact of regulations on land prices into three separate effects: own-lot effect, external effect and land supply effect. The first one is due to the decrease in utility of the parcel stemming from restrictions on development, e.g. a more stringent building code may increase the construction costs or permits may lead to transaction costs. The external effect stems from changing the neighbourhood of a given area. For instance, a regulation banning advertising may increase the property value, because it improves the visual attractiveness of the area. However, the external effect can also be negative as regulations can discourage neighbours from improving their properties and Turner et al. (2014) argue that this is usually the case. The land supply effect is caused by the change in land supply brought about by regulation. This effect is usually positive, as more stringent regulations mean less land available for development. It might be expected that land regulation in LULUCF sector will increase the price of land through both land supply effect and external effect.

Efficiency

There are several ways of affecting LULUCF through policy intervention – the authors of the instruments mention subsidies and land use regulation.

Subsidies can be efficient in changing the development of land and reducing pollution. Although Khanna et al. (2002) claim that the most efficient method of reducing pollution is a pollution tax, restricted payment subsidies or payments yield similar abatement costs, even at fairly high levels of abatement. However, the subsidy approach should be restricted to certain units that are carefully chosen and not granted unconditionally. On the other side of the spectrum, unrestricted subsidies are fairly inefficient reducing the environmental burden, but can boost farmers' income. Consequently, if the goal of policy makers is cost-effective environmental protection, the former instruments should be introduced, but if boosting farmers' income is equally important, the latter policies seem to be a better choice. Furthermore, Ferrero and Simpson (2002) argue that direct subsidies can be more cost efficient than indirect instruments.

The instruments introduced within this instrument should be adjusted to country-specific conditions and goals. First, the broader picture needs to be taken into account to avoid carbon leakage caused by changes in the use of land. Moreover, incentives introduced within this instrument should consider the resulting change in farmers' income. Nevertheless, the efficiency of this instrument depends on the particular nature of the policy instruments to be introduced.

Equity

The impact of this instrument on inequality cannot be determined without more specific information on the particular instruments to be introduced. For instance, regulations on land development may increase the price of property, leading to higher inequality. The restrictions on farming methods may lead to an increase in the cost burden placed on farmers and

decrease their net income. On the other hand, one can easily imagine that conservation payments will lead to higher farm income and contribute to reducing inequality.

Moreover, the potential for mitigation in the LULUCF sector is unevenly distributed between the Member States. Therefore including LULUCF in the EU climate policy without revising the allocated limits would favour some Member States and hurt others. Particular care will have to be taken so that an equitable solution is found.

Feasibility

The feasibility of this instrument is highly dependent on the specific features of the instruments to be introduced, but land use regulation due to its impact on land prices can be a controversial move that will cause protests from land owners. Subsidies and any other type of transfers to farmers should be relatively acceptable from a political point of view, but may still cause protests by either those farmers which are hurt by this policy package or by other groups, which might have to accept a higher tax burden to finance the new instruments.

Recommendations and open issues

The actual usefulness of this instrument depend on details that should be specified on a case-by-case basis, and cannot be properly gauged at the present level of sepcification.

4.2.5 Strengthened pesticide reduction targets under the Pesticides Directive, and provision of guidance to farmers on integrated pest management

Motivation, nature and objectives of the instrument

According to Deliverable D 4.2 “existing Member State National Action Plans under the Sustainable Use Directive could be strengthened; with more demanding requirements in terms of reduced use of pesticides, and improved pest management”.

The instrument under analysis aims at (Ekvall et al., 2015: 136)

- “Strengthen pesticide reduction targets in national pesticide action plans under the Sustainable Use of Pesticides Directive
- Improve pesticide licensing regimes to encourage full implementation of integrated pest management
- Ensure Farm Advisory Services provide all farmers with advice on integrated pest management; and improve the incentives for uptake of integrated pest management, including through links to the policy on a stronger environmental dimension to the CAP.” Moreover it should impose a “Reduction in the use of active substances in pesticides; and improved provision of advice and guidance on integrated pest management”, and

- It may include the “potential for more Member States to introduce fiscal instruments in order to secure a reduction in pesticide use, and to remove VAT exemptions on pesticides”.

In this regard, taxes “would be likely to involve a simple volume tax on active ingredients in pesticides placed on the market, graded according to an environmental impact index. Pesticide taxes are currently in place in Belgium, Denmark, France, Italy, Norway and Sweden. Taxes were in place in the past in Finland, the Netherlands and Switzerland but were abolished. The Denmark pesticide tax has been applied since July 2013 using a Pesticide Load Indicator to grade the tax for each pesticide on the market, so that farmers are taxed according to the environment and health toxicity of pesticides used rather than their nominal value (Withana et al 2013). There is some scope for hypothecation of revenues to deliver improved advice/guidance for land managers in integrated pest management; although in practice receipts are unlikely to be at a sufficiently high level to justify the administrative costs of such an approach”. (Ekvall et al., 2015: 135-136)

What economics can say about this instrument

Since both the quantitative analysis and most of the literature focus on the implementation of this instrument through taxes, our assessment will look mainly at the features of a pesticide tax. However (T. Skevas, Oude Lansink, and Stefanou 2013) provide a comprehensive assessment of exactly the same policy reform addressed here. Their main conclusion is that one single policy tool will not be able to attain a full-fledged strengthening of the Directive, but taxes, regulatory standards and information campaigns should be used together.

Effectiveness

A pesticide tax, in order to have a chance to yield at least partially the desired effects, needs to be specified in a much more detailed way than possible given the usually available information, and, in any case suffers from a number of limitations.

Generally speaking, environmental economics prescribes that the environmental regulation of the use of an input to a productive activity should find the optimal balance between the beneficial aspects of that input and the damages it generates. Since benefits are usually by and large private and damages affect the society at large, the condition to reach overall optimality is that marginal (private) benefits of pesticide use equate marginal (social) costs, which include private production costs and public damages. A Pigouvian tax is the instrument of choice in first best theoretical setting to restore social optimality by inducing the internalization of external costs, i.e. that portion of social costs that are related to the damages and are not taken into account by the producer.

Now in the case of pesticide, it is quite clear that they do produce private benefits, in terms of increased yields and quality of production, and thus ultimately increase profits. They can also generate damages to public health, the private health of the farmers who handle them, to the environment by affecting the survival and the health of non-pest organism not directly targeted by the pesticide. There are also indirect channels of damage generation, for instance, by inducing resistance in the target organisms, which can in turn induce farmers to increase the quantity used beyond the acceptable doses.

The main issue is that these negative effects are not generated by the pesticide per se, but by the quantity of active ingredients that effectively interact with the environment and the biological functions of non-target organisms and of human beings. Thus a simple tax on the value or the quantity of pesticides sold is most likely to be unable to capture the link between pesticide use and its true marginal damages. More precise instruments have been proposed, and the Directive revision itself, as specified D 4.2, mentions an “environmental impact index” by which taxes on active ingredients should be graded. Pearce and Koundouri (2003: 3) note that “the theoretical solution here is to express the tax as an absolute sum per unit of toxicity-weighted ingredient. Determining the toxicity weights is potentially feasible through the use of health-risk coefficients and health or ecological risk coefficients. In practice, capturing the ‘true’ marginal damage from different forms of pesticide and fertilizers is complex due to other factors affecting damage-e.g. ground and weather conditions, ecosystem variation, and so on.”

A detailed discussion of possible metrics on which pesticide taxes could be based, are studied for instance in Archer and Shogren (2001), which compare different kinds of pesticide taxes:

- a flat tax—flat taxes on all herbicides; taxes on each herbicide weighted according to the lifetime health advisory level for that herbicide;
- an “Aquatic tax”, which is weighted, for each herbicide weighted on an aquatic benchmark for that herbicide;
- an “Exposure tax—taxes on each herbicide according to the predicted baseline 1.2 m groundwater chronic exposure value for that herbicide” Archer and Shogren (2001: 230);
- and a “Tillage – exposure tax — taxes for each herbicide and tillage combination weighted according to the predicted baseline 1.2 m groundwater chronic exposure value by tillage for that herbicide” Archer and Shogren (2001: 230).

Each one of these approaches refines the way the tax captures the actual exposure of the environment, and through water use, of humans to the active ingredient of the herbicides under scrutiny. The main conclusion is that “indexed taxes can be an effective and cost-efficient tool to reduce predicted groundwater exposure” Archer and Shogren (2001: 248). They also find that no significant advantage exists to fine tune the index to include herbicide-tillage combinations: “the results are similar regardless of whether we target herbicides alone or we target herbicide–tillage combinations. This occurs because individual herbicides have more effect on groundwater quality than do tillage practices. Finally, we observed that environmental advisory benchmarks alone are not useful to construct effective tax policies.” Also, “no single policy tool dominated the other options for reducing groundwater exposure, surface water acute exposure, and surface water aquatic exposure” Archer and Shogren (2001: 248).

A major issue with pesticide taxes is that their effectiveness crucially depends on the price elasticity of pesticides, and this was empirically found to be remarkably low (Theodoros Skevas, Stefanou, and Lansink 2012, Ivanova, Stoyanova, and Mishev 2012, Pearce and Koundouri 2003). This implies that the main effects of taxes will be a cut in farmers’ incomes, more than proportionately larger than the reduction in pesticide use. Thus, in order to have a chance to reach a significant reduction in pesticide use, taxes should be set at very high levels, most probably too high to be politically acceptable by the affected categories. Thus tax

use should be limited, fine-tuned on the effective impact of the active ingredients as discussed above, and revenues should be earmarked to finance other means of reducing the negative impacts of crop protection products; for instance “the revenues generated by a pesticide tax could be used to sustain investments in the development and dissemination of integrated pest management methods, which could benefit farmers over the long-term” (Schreinemachers and Tipraqsa 2012: 662). Analogously, Pearce and Koundouri (2003: 2) note that “Both Norwegian and Swedish official reviews on the effectiveness of pesticide and fertilizer taxes, reached the conclusion that they will do little to reduce their use, although both also agreed that it is difficult to disentangle tax effects from other instrument effects. This suggests that, [...] the effectiveness of these taxes rests on the uses of the tax revenues. The Danish experience suggests that recycling revenues back into agriculture severely reduces the effectiveness of the tax. Using revenues to further research or encourage changes in farming practice would appear to make more sense”.

Three other reasons for concerns about pesticide taxes are briefly touched upon in a review of current pesticide taxes in Scandinavia (Schou and Streibig 1999). For one thing, the incentives targeted by the tax should be carefully designed and the tax scheme should cover all possible substitutes, otherwise taxation of a specific active ingredient may result in a shift towards another, possibly more harmful one. The scheme should instead promote the reduction in the use of the more toxic ones, and a shift towards the less dangerous ones and towards integrated pest management.

For another thing, distributional concerns are relevant also in this case, if particular crops and/or particular agricultural regions turn out to be more negatively affected by the tax scheme than others. Finally, as any other tax, its implementation will be preceded by a political discussion, which may in principle pre-empt its regulatory potential.

4.2.6 Product standards

Motivation, nature and objectives of the instrument

According to Deliverable D 4.2, this instrument aims at reducing virgin metals use by means of product redesign, longer economic life, and increased reuse, and “entails the development of standards for specific metals products and metals components that regulate the design to, for example:

- Improve the modularity to increase reparability and reuse of components, taking into account impacts on energy efficiency;
- Reduce the unnecessary use of material; and
- Substitute metals for other materials when appropriate, for example shifting from copper water-piping to polymer piping.

The standards could be based on, for example, the best practices from value-chain co-operation in the preceding 10 years.” (Ekvall et al., 2015: 180-181).

The standards should be introduced gradually: they will initially cover a few select products or components only, starting with those for which is chapter to reduce material use, switch to

alternate materials or increase the ability to reuse and recycle the product. The instrument should then increase its ambition as “the instrument should be gradually extended to more and more products and include also products where the functionality etc. is affected. In the long-term a product standard might, for example, set a limit to the quantity of material in a passenger car.”(Ekvall et al., 2015: 181).

What economics can say about this instrument

The instrument calls for technological standards for metals or metal products, aimed at reducing their use, maximizing their reuse and fostering substitution with alternate materials when feasible.

The general discussion of the relative merits of command-and-control instruments versus market based instruments has been set out in previous sections of this report and we will limit ourselves to remind the reader that in general, the economic analysis of environmental policy deems environmental standards to be inferior in many respects to market-based instruments such as taxes and tradable permits.

Effectiveness

Here we restrict our focus to technology standards and their possible role in fostering the transition to a socially preferable technological paradigm. In this perspective, Popp et al. (2009: 24) note that the “Incentives to adopt end-of-pipe technologies that only serve to reduce emissions must come from environmental regulation. Therefore, it is not surprising that studies addressing adoption of environmental technologies find that regulations dominate all other firm-specific factors”. In terms of the instrument under scrutiny, if the policy objective is the widespread adoption of a particular technological solution, then it makes sense to prescribe it in terms of specific technological standards. Frondel et al. (2007), find indeed that in the OECD countries, “environmental regulations are more likely to lead to the adoption of end-of pipe techniques”(Popp et al. 2009: 28). However if the real target of the instrument is a more generic environmental endpoint, it would be more effective to specify a set of market-based instruments in terms of that endpoint (e.g. tax per unit of pollution emission) rather than mandating a specific technology. In the case of the instrument under scrutiny it is the first order of motives that seem to prevail, at least when the aim is to improve modularity to increase the reparability and reuse of components, and in a slightly less stark way when the idea is to use other materials instead of metals when appropriate. However, a material tax would serve best the purpose of reducing the unnecessary use of materials.

Feasibility of the instrument

As noted in D. 4.2, “The idea of product standards with an explicit environmental purpose might be more easily accepted if such standards are part of a dynamic policy package that begins with the establishment of EU strategies for dematerialization. This package could also include a green fiscal reform that includes, for example, a materials tax and the removal of environmentally harmful subsidies. Increased R&D on recycling and material efficiency and the establishment of discussion fora might allow for more ambitious product standards, which would make this instrument more effective.” (Ekvall et al., 2015: 181)

Beside this need for coordination within a broader environmental policy reform, we notice that product standards feature the usual feasibility characteristics of all command-and-control

instruments: they are quite simple to design, but require higher monitoring and enforcement effort by the public administration than market-based instruments to ensure compliance. In the case of technological standards, this concern is somewhat eased by, for instance, making the certification of compliance with the standard compulsory in order to access the market for final products. Some residual leeway for non-compliance would remain for exports to non-EU countries in the quite likely case that a global agreement on the standard is not reached, and to a lesser extent, in the case of illegal commercial exchanges of sub-standard products.

Popp et al. (2009) point to a concern raised by the empirical literature about different regulatory treatment of existing producers and new ones. It turns out that command-and-control regulation often imposes stricter standards to newcomers than to incumbents, and such a dual system may worsen the overall environmental impact by unnaturally prolonging the life of dirtier production processes. Thus, while it is probably administratively easier to phase-in new regulations by targeting newcomers first, it is crucial that the same level of stringency is quickly spread to the whole sector targeted by the instrument. In this perspective, it is quite likely that unless adequate steps are taken, Member States would adopt such instruments with different timings and implementation rules. Strict coordination across the EU invoked by the instrument description is indeed very important to achieving the desired results.

4.3 Information and education policies

4.3.1 Skill enhancement programmes

Motivation, nature and objectives of the instrument

The rationale for this instrument is that long-term investments in education should result in behavioural changes that will contribute to increase material efficiency in the future. According to many reports and research papers (e.g. OECD/Cedefop, 2015), a shift towards a more sustainable economy requires specific *green* skills. Both academic curricula and vocational training programmes should adjust to this new requirement.

The challenges faced by many workers in an economy heading towards absolute decoupling would be different to those that they are currently facing. For instance, the development of clean energy sources requires new engineering skills. Therefore, the opening of new university faculties and vocational training programmes is needed to educate specialists in this area, who will be able to build, maintain and further enhance low-carbon energy sources through R&D efforts.

Effectiveness

The motivation behind the introduction of skill enhancement programmes is threefold. First, the aim of these instrument is to reduce the mismatch between skills that will be demanded in a greener labour market and the qualification of workers that are determined by the education system. These skills will be different at all levels – the development of green technologies will require qualified academic staff who will be able to conduct high quality research; enterprises will need professional staff and engineers that are familiar with efficiency improvement technology, and medium level staff trained at servicing new equipment. Therefore the first challenge for Member States is to reform vocational schools and incentivise universities to

rebuild their teaching programmes, in order to allow them to respond successfully to the challenges of a greening labour market.

Secondly, there is substantial scope for public intervention in the area of individual behaviour. A lot of resources could be saved if there was higher and more widespread awareness of energy or material saving practices. Therefore, skill enhancement programmes should embody the development of resource conservation skills in the society. Such education should be provided in primary schools in order to inculcate eco-friendly and energy-efficient habits in the whole society.

Thirdly, to successfully address the issue of mismatch between skills and education in the future labour market, policy makers need to know the exact nature of mismatch. Therefore, research programmes targeting that problem are needed.

The effectiveness of public skill enhancement programmes needs to be carefully examined. According to Ecorys (2010), private enterprises are the main source of both demand and funds to finance *green skills*. Consequently, they should be actively involved in the development of skills enhancement programmes. The role of the state in this area is basically in building strategies and providing coordination for the activities of other actors, as enterprises are in a better position to gauge which sort of skills are needed.

The other area in which the public sector has proved to be successful is in fostering portable skills and lifelong learning. As the private sector knows better which skills are needed and is ready to invest in it, the role of Member States is to enhance cross-cutting skills in resource efficiency. Furthermore, education is needed to popularize the efficient use of energy and to disseminate environmentally friendly behaviour.

As Bowen (2012) points out, there is also significant scope for state intervention in the research sector, as our knowledge about the impact of the transition to a low carbon economy is still quite low, partly because it is a relatively new process and historical data cannot be observed. However, the mismatch between the qualification of workers and the challenges of an even greener labour market may become a serious problem in the future. To address this challenge successfully, economic departments at universities need to take into account the green skills issue in their curricula.

Efficiency

The efficiency of the proposed skill enhancement programmes depends on the capability of governments to eliminate the mismatch between the supply and demand on the labour market, and more generally on how they can influence human behaviour.

Environmental education programmes have been conducted in developed countries since the 1970's. Although there is a consensus that the scope for and possibility of impacting human behaviour is highly dependent on individual characteristics such as personality, attitudes or social norms (see e.g. Hungerford, Volk, 1990), there is still some space for public policy to influence human behaviour. It turns out that educational programmes can affect human behaviour in the long term, and influence attitudes (Orams, 1997). Applying these findings to support energy-efficient behaviours may lead to huge savings in energy and materials. Nevertheless, the overall efficiency of a given campaign depends on the ideas and the specific features of a given programme. There are a lot of examples of good practices that should be used while designing environment awareness and energy efficiency education programmes. Also, there are quite a number of available guidelines on how to design

environmental education programmes – see Monroe, Andrews and Biedenweg (2007) for an example.

There are a few main rules that should be followed while designing an effective environmental education programme. First, it should be carefully tailored to the needs of specific mission of the stakeholder and daily lifestyle of participants. Therefore, the development of skills enhancement programs should be pursued at the local and national level by specific organizations, with the possible involvement of local NGOs. Secondly, a successful skill enhancement programme should involve stakeholders at all stages, from development to evaluation, to ensure the acceptability of the programme and to match the skills that are developed with specific demands. Thirdly, accuracy and balance ensuring the incorporation of different approaches and aspects is needed. Interdisciplinary programmes that encompass different perspectives are much more convincing to participants and therefore more efficient. Moreover, skill enhancement programmes need to be sound and effective in educational sense. Therefore, they need to take into account the newest developments in cognitive learning theory and be designed by skilled teachers, familiar with these developments and tools. Clearly, due to cognitive differences, educational programmes designed for children must be different to those directed to adults. At the same time long term efficiency of the green oriented programmes in education will depend on the overall design of the entire education process – from kindergarten to university. Last, but not least, skill enhancement programmes need to be evaluated using the right tools. Such evaluation will allow for the identification of best practises and prevent deficiencies in the next iterations of these programmes. (Costel, 2015)

Equity

From the economic point of view, the mismatch of skills and demand for labour is positively correlated with inequality. This is straightforward – when adequately qualified workers are in short supply, they can negotiate higher wages. On the other hand, if the supply of skills doesn't fit into the expectations of the employers, the loss on individual and social level is inevitably large. High, long term unemployment or low level of economic activity due to the discouraged, non-employed part of population increase the risk of poverty and social exclusion. All negative individual and social consequences may be expected including poverty, social exclusion, pressure on public finance etc. In this context, comprehensive action to reduce the skills mismatch (including research and policies to prevent skill mismatch on green labour market) should contribute to the reduction of inequality at the aggregate level.

At the same time, educational actions that foster eco-friendly behaviour and habits aiming at saving both energy and materials have no direct impact on inequalities. By incentivising individuals to voluntary re-shape their consumption behaviour they leave the income, wealth or consumption inequalities intact.

Feasibility

The instrument is quite feasible. Moreover, apart from educational action targeted to the society as a whole, it can be, by and large, implemented under the existing instruments and legal systems.

Recommendations and open issues

The main difficulty associated with the introduction of this instrument is the successful identification of green jobs and the potential mismatch between demand and supply on the “green” labour market. Also, the inclusion of green skills into educational curricula and the efficiency of the instrument may depend on Member States and their experience in changing policy and adjusting skill profiles of graduates to labour market challenges.

4.3.2 Step-by-step restriction of advertising and marketing

Motivation, Nature and objectives of the instrument

The aim and motivation for this instrument is to change attitudes in the society and to foster the shift towards resource lighter lifestyles. The authors of the instrument description are aware that the introduction of total restrictions of advertising and marketing would be extremely difficult, hence they propose step-by-step action.

To fully understand the mechanisms and economics underlying this instrument, one needs to clearly define goals and instruments to be used. The aim is to encourage people to shift away from consumption-based lifestyle towards a more environmental friendly way of living. Furthermore, this instrument tackles, as one of the first steps, visual pollution of the city centres. This problem affects all EU countries and the new Member States in particular, where, after the fall of the centrally planned economy, marketing and advertisement flourished enjoying a lack of regulation and comparatively greater freedom than in older EU Member States. Tackling this issue requires country-level landscape regulations and implementation.

Effectiveness

The basic problem with advertising and marketing in a green economy is that such activities increase both material and energy efficiency per EUR. This is the case, because marketing activities lead to an increase in the perceived value of products and people are willing to pay more for the same goods. Luxury cars require only marginally more materials and energy to produce than ordinary cars (or even less because producers can use less material and energy intensive, but more expensive technologies). Therefore, luxury goods are much more material and energy efficient per EUR than their ordinary counterparts. However, it is understandable that step-by-step restrictions of advertising and marketing should contribute to the proposed shift towards less consumerism.

Moreover this instrument will require appropriate marketing activities in order to overcome natural consumer resistance (Raw and Sheth, 1989). It might therefore be challenging to reconcile the restrictions in advertising and marketing foreseen by this instrument with the need to propagate new, “green” products and lifestyles. Educational actions and skill enhancement programs require mass-media and advertising. Therefore, the selection of products and product categories for which advertising and marketing will have to be wisely undertaken – as suggested by the description of the instrument, focusing on luxury goods linked to conspicuous consumption as well as to sugar-rich and fat-rich goods.

Efficiency

The most basic problem with efficiency of marketing and advertising restrictions is the precise definition of what marketing is. For instance, a toy company, together with an international television network, has launched a children's television station. This channel features series giving backstories to the toys sold by the toy company. It is not easy to legally declare such an activity as an advertisement, though it most certainly fulfils this role. Alcohol and cigarette companies have been practicing similar techniques for years. Advertising of certain products can obviously be made more troublesome, but a complete ban in a liberal democracy is certainly impossible.

The most promising part of this instrument is the ban of outdoor advertising in city centres. There are already a lot of examples where such regulations were successfully introduced. The most renowned case is Sao Paulo, the world's fourth largest metropolis, which is free of advertising since 2006. There were a lot of complaints from city businesses and advertising groups, which claimed that a city without "visual pollution" would look like a total concrete jungle. However, in 2011, ten years after the ban was introduced 70% of city inhabitants found it beneficial. In Europe, there are also some examples, like the city of Bergen in Norway.

Summing up, the advertising ban can be efficient, but to a limited extent. Examples of cities without advertising are – up to date – scarce, but they show that such regulations are possible and can be successful in eliminating visual pollution and – at the same time – be accepted by the population. Also, some limits can be introduced to limit or strongly regulate advertising in other media. However, in the presence of modern technologies, of markets where products compete with each other, and of the capacities of advertising companies, a complete ban of advertising cannot be realistically introduced and successfully enacted. Other methods of limiting consumerism and changing attitudes should be sought.

Equity

The impact of an advertising ban on equity is difficult to predict. On one hand, the advertising business that would be severely impacted do provide a lot of service jobs for both less skilled workers and professionals. The disappearance of these jobs can lead to an increase in inequality, but it is most likely that the impact of this instrument on equality should be marginal.

Feasibility

Support for the instrument could be expected from groups campaigning against visual pollution in city centres or child welfare. Actually both conservative and far left groups should agree to limit blatant commercialization of the lives of children and vulnerable members of society. However, the example of advertising ban in the city of São Paulo, as well as other similar regulations in other cities, shows that this resistance can be overcome with benefits for the society as a whole.

Recommendations and open issues

As total advertising ban is not feasible, more specific instruments should be designed and analysed. A city advertising ban is a good starting point for further restrictions of advertising and commercials.

4.3.3 Targeted information campaigns on changing diets and on food waste

Motivation, Nature and objectives of the instrument

According to the instrument description in D 4.2, this instrument is an awareness campaign that aims to

- encourage and achieve reduction in food waste
- change in diets.

The main claim about the chances of success of this instrument is that “the provision of information and advice to consumers will create awareness and foster behaviour change” (Ekvall et al., 2015: 139).

How:

- Information should be tailored to the audience, in terms of media used and contents.
- The campaign should take into account channels to induce the desired behavioural change. Generic provision of information is not enough.
- Should be combined with other policies targeted at enhancing resource efficiency in the food sector.

What economics can say about this instrument

Standard economic theory bases its optimality results on restrictive and somewhat unrealistic assumptions.

By and large we live in a sub-optimal, or in economic lingo, second best world. Two particularly unrealistic conditions for optimality are that all economic activities take place in presence of perfect and complete markets and perfect and complete information. In other words, we should be facing all possible choice options in terms of goods, services, their qualities and attributes, and we all should know all what is to know about them and what we know is true. The consequences of failing to attain these two conditions are manifold but for our practical purposes here, two are particularly relevant. On one hand, the lack of a well-defined market for a resource, such as clean air or water or the environment, may induce people to think that this resource is free, and results in its overuse as a free disposal of the unwanted by- products of our activities. This generates pollution and other environmental problems, which in economics are called negative externalities.

On the other hand, we usually make our economic decisions knowing a limited amount of information about the goods and services we deal with, and about the other agents we interact with. Not only do we usually not know much, but probably what we know is different from what the people we interact with know. Consider a dinner party in your favourite

restaurant. You have chosen that restaurant because during your previous visits you were satisfied with your meal and found the bill reasonable, the service agreeable and the owner is a nice person. But, most probably you are unfamiliar with all the features of the entrees in the menu or the wines on the wine list. Moreover, unless you were on such good terms with the chef as to be allowed to follow all the steps of the preparation of your meal, and you traced down and checked all the stages in the value chain from the farm to your dish, you cannot be sure that what is served is really up to the quality standards claimed in the menu. Most probably it is, because reputation is the cornerstone of this business, but the point is that you know very little beyond what your senses tell you about the quality of your meal; your chef knows a lot more, and possibly he or she in turn might not know all what its providers know about the ingredients have been used for that dish.

In economic terms, our information is imperfect, incomplete, and asymmetric in most occasions, thus any instrument that in principle can improve the information we have can lead to welfare improvements. If these information gaps entail a situation in which negative externalities are present, the case for improving the knowledge of the individuals involved is even stronger, because it can help understand the causes and the extent of the damage suffered and then deploy the correct remediation actions.

Effectiveness

Tietenberg (1998) explores precisely this possible role of information in supplementing environmental policies. Tietenberg argues that the traditional justification for environmental policy due to the Coase Theorem, in which the marginal benefit for the polluter exceeds the marginal damage of the pollutee, can be augmented to allow for a role for information in that it can allow people at risk of being damaged or being damaged unknowingly (e.g. by increasing the chances of future diseases) to realise that they are at risk and to take steps to reduce their damage.

Tietenberg (1998) reviews the literature on the role of information disclosure in environmental policies up to the middle '90s, with a specific focus on the situations in which the general public has limited access to relevant information, but there is no particular asymmetry in the information held by the players. The papers reviewed are empirical studies mostly looking at specific environmental issues in the US, Canada and China. His main conclusions are (Tietenberg 1998: 14):

- The evidence in general suggests that disclosure strategies can ultimately motivate polluters to reduce emissions even in the absence of more traditional regulatory controls.
- “Disclosure strategies may have an efficiency role to play” besides responding to moral motives.
Disclosure strategies may complement traditional strategies or substitute for them, depending upon the circumstances. In some case disclosure strategies may provide interim incentives to control pollution until such time as more traditional regulation can be established (such as in developing countries or in controlling air toxics in the United States).
- “More information is not always better. The amount and type of information conveyed is important. And the incentives faced by the victims of environmental damage in acting on the information are also important”.

- “The literature also raises a cautionary note with respect to the distributional impacts of disclosure strategies. Can it be that in certain circumstances disclosure strategies benefit only the more educated victims? When actions taken by victims have a strong regional component (..), resources may be diverted from less educated (less vocal) regions and toward the more educated regions which complain more”

Verbeke (2005) takes a more specific look at the role of information in the agricultural sector. He argues that the availability of more information is no guarantee of better informed consumers and that “information is likely to be effective only when it addresses specific information needs, and can be processed and used by its target audience” (Verbeke 2005: 348). Moreover, “it cannot be taken for granted that a target audience will pay attention to information intended for it. First, it requires identification and thorough understanding of the target audience’s needs, and second, appropriate management of the information provision so that it optimally addresses particular needs” (Verbeke 2005: 348).

Verbeke (2005) looks more into the details of the inability of standard microeconomic assumptions to account for the consumers’ situation in the food market.

On one hand, he notes that information is particularly incomplete and asymmetric on this market: citing Caswell and Mojduszka (1996) he remarks “that rational decision-making, utility maximisation, systematic interpretation of information and optimal choice are hampered because information in agrifood markets is often imperfect, incomplete, inaccessible, asymmetrically distributed, non-standardised or costly to collect. Hence, potential market failures from information asymmetry arise because consumers face uncertainty regarding the true nature of product attributes, and as a result, make choices that are not well aligned with their preferences (Teisl and Roe, 1998). This risk of market failure holds particularly in situations where product differentiation is low and mainly based on so-called credence attributes (Akerlof, 1970; Darby and Karni, 1973; Blandford and Fulponi, 1999; Grunert et al., 2000). It means that situations prevail in which individuals cannot adequately assess product quality or safety, even after experiencing the good, thus facing uncertainty and having to trust the information provided. [...] In other cases, relevant information may be imperfect, i.e. it may not exist or it may be contradictory, as in the early days of the BSE and dioxin crises where scientists and government held opposing views on the potential health risks“ (Verbeke 2005: 350)

Moreover Verbeke points to another issue which consumers may have with information on this market: relevant information about food quality and safety may be publicly available but not easy to find, to process and to verify, and therefore it might be costly for a consumer to acquire it. “Rational consumers would not knowingly consume unsafe food, though in the absence of credible food quality and safety signals, consumers face uncertainty and incur specific information search costs (Hobbs, 2004)” (Verbeke 2005, p. 350). Verbeke reports that “McCluskey and Swinnen (2004) introduced the ‘rationally ignorant consumer’ hypothesis, indicating that it may be rational for consumers to be imperfectly informed in the specific case of food safety issues. The reason is that the price of information and/or the opportunity cost of processing information are too high compared with the marginal benefits from information, hence constraining information processing willpower” (Verbeke 2005, p. 351).

All in all, Verbeke’s survey shows that “solving market inefficiencies due to information asymmetry can be effective only if consumers are willing to pay attention to the information and process it for subsequent use in their decision making. The latter depends largely on

individual characteristics, which are often situated in the psychological domain” (Verbeke 2005 : 361)

Moreover, “it appears that strategies for reducing information asymmetry through the provision of vast amounts of information to consumers have a limited chance of success, simply because a lot of this information does not target a particular need. Hence, it risks not being attended to and processed by consumers. The particular challenge lies in identifying and effectively reaching market segments. In many cases this is feasible, though it may be problematic when variables such as involvement, personality, motivation or attitudes come into play. A generic approach, involving the provision of massive amounts of information to the general public, stands a real risk of information overload, leading to confusion and lack of interest among the majority of consumers. Hence, over-provision of information in an attempt to solve market inefficiencies caused by imperfect or asymmetrically distributed information may not yield the intended solution to market failures. The implications for information provision, e.g. through generic advertising or labelling, are that the recipient population needs to be well understood, segmented, identified and targeted.” Verbeke concludes that “The assumption that market deficiencies as a result of information asymmetries can be solved simply through providing more and better information seems not to hold when dealing with food consumers facing quality and safety uncertainty. Instead, the management of information from agriculture and the food industry requires that the target population be identified and their specificities be well understood and taken into account so as to make information meaningful, useful and effective” (Verbeke 2005 : 361).

Verbeke’s survey is quite exhaustive and covers a great deal of the issues related to the provision of information in the agrifood sector. Although it contains a section on the issues posed by the information provided directly by firms in this sectors through labelling and advertising, he fails to capture another reason why the provision of correct and unbiased information is important in this sector. This additional rationale goes under the name of deep capture, and while it has a certain conspiracy theory flavour, it has indeed been studied and empirically confirmed in the case of the food sector. Smith and Tesnadi (2013) argue that foods low in nutritional quality may dominate the market due to search costs and, the endogeneity of consumer beliefs. They claim to demonstrate the empirical relevance of the phenomenon—in which firms expend costly effort to influence consumer beliefs by looking at the case of obesity-inducing foods in the US.

Stigler (1971) wrote of the corrupting effect of political interference on industry regulation, a phenomenon now commonly referred to as “regulatory capture.”. What Stigler failed to note, however, was that his logic—that an industry will attempt to influence powerful government institutions that affect its bottom line—applies equally to any institution that holds such power. This larger phenomenon, in which industry attempts to influence not only its regulator, but also (perhaps) politicians, celebrity spokespeople, the media, education, and even academic research—with the aim, ultimately, of influencing the broader public—has been dubbed “deep capture,” and like Stigler’s more limited theory, appears in many cases to have empirical validity (Hanson and Yosifon, 2003; Benforado et al., 2004; Yosifon, 2006). Viewed in the light of modern information theory, the problem of nutritional quality in manufactured foods is in essence an equilibrium selection problem, in which profitability is a function of consumer perceptions and beliefs about nutrition. It is interesting to consider the extent to which the “deep capture” phenomenon might be affecting these beliefs.

4.4 Other/voluntary instruments

4.4.1 Enabling shift from consumption to leisure

Motivation, Nature and objectives of the instrument

The main aim of this instrument is to foster and encourage the shift towards a less carbon-intensive lifestyle with a greater share of leisure in the consumption-leisure mix. As leisure activities are, in general, less materials and energy intensive than consumption, such instruments should theoretically lead to a decrease in both the use of materials and GHG emissions (Druckman et al., 2012).

There are few instruments that might enable reduction in working hours and thus a shift from consumption to leisure. These include regulations to encourage reduced working hours, longer statutory vacation times or weaker discrimination of part time workers. However, the effect on the use of resources is not known – as one needs both time and income generated by working time to consume, there might be a positive correlation between consumption and leisure time. Also, this instrument is based on a vague dichotomy between fast and aggressive consumption and a slow, simplified lifestyle, which is an idea that may not necessarily hold in the real world. Stress and unhealthy lifestyles, especially in the rich world is associated with poverty (see e.g. Mountney, 2012 for a review) – therefore a decrease in income can lead to more and different stress and less satisfaction from leisure. Moreover, as environmentally friendly products are often more expensive, a decrease in working hours may lead to a shift in consumption towards cheaper, imported products produced in countries without any environmental regulations.

Summing up, an involuntary decrease in working hours is most probably not a good solution. Enabling a shift towards leisure should be achieved through voluntary instruments and support of flexible working agreements that will allow for taking longer vacations. Also, part-time working arrangements should be popularized such that they are not associated with lower per-hour wages and not restricted to easy jobs for less qualified workers. Nevertheless, the instrument should be introduced on voluntary basis and rely on extending the possibilities and the flexibility of labour markets instead of more strict, mandatory reduction of working hours and increase in statutory vacation times.

Effectiveness

There are a lot of doubts regarding the effectiveness of this instrument in reducing both materials and energy demand.

First, a shift to more leisure does not necessarily mean a decrease in carbon intensity, as the type of activities matter, as shown by Druckman et al. (2012). Many common ways of enjoying leisure are, in fact, carbon intensive, with travelling as the most striking example. It must be remembered that travelling by plane for leisure activities (vacation, shopping and clubbing trips, etc.), is the most carbon-intensive one and tourism is responsible for almost 5% of world GHG emissions (Plan Bleu, 2010). The increase in tourism resulting from more free time may thus contribute to increase the GHG emissions throughout the world. However, reductions in income associated with reduced working hours may counteract this effect as less (expensive) holiday trips using air transport might be affordable – although low air fares

vs. other means of holiday transportation may still render flights the most economic travel means even under budget reduction.

Also, it is possible that reduced incomes will translate into reduction of non-carbon intensive form of consumption, while carbon-intensive ones (primarily mobility and food) will to a large extent remain intact – much depends on the income elasticities of different products. This yields both opportunities (shift to more sustainable food consumption patterns requiring more time, engaging in non-resource-intensive hobbies) and threats (more free time to travel abroad, which is generally more resource intensive). Nevertheless, the efficiency of this action crucially depends on broader behavioural (regarding consumption patterns), organizational (options for spending leisure time) and technical (less resource-intensive technologies meeting the leisure needs) changes.

Furthermore, the micro-level studies tend to suggest that GDP does not necessarily decrease due to a reduction of the working week, as the marginal product is linear around the 40-hour-per-week mark (although this can depend on the workplace and on the sector of employment), and displays an S-shaped curve. There is also some evidence of productivity gains at the macro level. This may come from additional positive impacts on the productivity of labour (e.g. skills development in free time, rest), but also suggests laying off less productive workers due to unit labour costs increase. Observed decreases in employment levels after reduction of the length of working week (Niemets, 2010) suggest the latter effect.

Moreover, opportunities arising from increased flexibility (Kallis et al 2013) may improve productivity (per hour rather than per person). Once again, it is not straightforward to assess whether this can actually decrease resource use, as this will just transfer time wasted during work hours into leisure time, which can be spent in more resource-intensive way.

In addition, if the number of workers remains constant or increases, and if office spaces or commuting routes will be used in the same way, the resource efficiency will decrease, as the same logistic and office input will be used to support less productive labour (Kallis et al 2013). This will lead to a decrease in the carbon efficiency level of office work and may lead to an increase in both emissions and the use of materials.

Efficiency

The question of the efficiency of such a instrument is the question of how policy can influence behavioural change. The first problem with a voluntary instrument is the fact that some occupations are less compatible with part-time work than others. For example, part-time work would not be probably an option for a management consultant, although periods of intensive work followed by a periods of spare time might occur. For management staff any of these options might not work. Nevertheless as long as policies allow for voluntary decision making, this should not disrupt economic activity. Also, the examples of some European countries (such as France, which reduced the duration of the working week to 35 hours) shows that such initiatives not only contribute to an increase in time devoted to leisure, but also helps to mitigate the impact of economic downturns (see e.g. Kahn, 2012).

Equity

A forced decrease in hours worked with proportional wage decrease will hurt mostly low-earners, while forcing wages to stay the same will reduce employment as some jobs will

become unsustainable, even though redistribution of remuneration from capital to labour may happen in the short run.⁹ That may lead to an increase in inequality.

On the other hand, if the reduction of work time were voluntary, the shift towards leisure may apply to better paid workers and in turn lead to reduced inequalities. However, the overall effect is not clear but the relevant literature suggests that the popularity of part time work can help to reduce inequalities (Zwickl et al., 2015).

Feasibility

Successful examples of countries with flexible labour markets suggest that this instrument is quite feasible and governments should be able to introduce it. However, it must be kept in mind that flexible workplace arrangements have gained bad press in EU countries with large dual labour markets, where jobs are split between those that occupy protected positions in the higher segment of the labour market and a large percentage of workforce that has to rely on temporary agreements. Nevertheless if the reduction of work time is voluntary the possible unequal treatment of the different segments of the labour market is less likely.

Recommendation and open issues

To ensure the effectiveness of this instrument, it should be taken on a voluntary basis that will enable but not force workers to work less and enjoy more leisure. Therefore, this instrument requires it to be made clear that mandatory decreases in working hours and increases in vacation times that will affect incomes are not introduced. This instrument should be implemented in the following way:

- Increase in flexibility of labour markets that will allow willing employers to take longer holidays and work less;
- Empowering part-time working arrangements such that they are not restricted to less remunerative jobs requiring less qualifications.

4.4.2 Local currencies for labour-based services

Motivation, Nature and objectives of the instrument

The proposal entails the distribution of an alternative currency within a restricted community, which could be later traded for labour-based services. Such services include for example, haircuts, cleaning, gardening, hosting cake-baking, vegetable growing and chicken and egg rearing. Such transactions would remain untaxed and the government would recover revenue losses through increases in local and/or national income taxes. The currency is initially distributed within the community and then traded in exchange for local services.

⁹ This will be the case because labour will become relatively scarce what will lead to increase of wages. Also, as the amount of capital per unit of labour will increase, it will become more abundant and cheaper.

Due to the tax exemption for transactions that are performed with such currency, the local services should be more affordable for individuals. Also, the idea of local currencies is mercantilist in nature, aiming to produce gains from a local circulation of currency and support of local exchange of services. This will be possible through changes in relative prices due to the tax exemption for locally traded products.

Effectiveness

Although the instrument could be expected to yield positive results in the realm of community building (Seyfang, 2004), there is little evidence to expect it to improve resource efficiency. Also, the lack of reliable empirical studies on the effects of the instrument is an important issue when examining both the effectiveness and the efficiency of the instrument. Further, it is unclear how the local currency can be exchanged for goods and services and whether it can be exchanged for conventional money. If it cannot, it might be difficult to encourage people to use that currency. If the only incentive for use such an instrument will be tax exemption, it may be prone to speculation and to misuse to avoid taxes. Moreover, it can be very hard to pay with local currencies for services that are not fully based on local resources. If the given area is too small, many of them will rely on external inputs, limiting the usefulness of the currency for the consumers. On the other hand, the larger the area of circulation is, the less local the currency will be.

Moreover, consumption may not actually switch away from goods to local labour-based services. On one hand the proposal postulates making these services more affordable, thus incentivising economic agents to switch consumption, while on the other hand it eliminates this incentive by proposing to finance it with labour income taxes. Furthermore, if it were adopted in the proposed form, which would adjust an individuals' income tax based on their participation in the local currency system, it would eliminate any economic incentive to use it. Furthermore, transaction costs would rise, due to the necessity of searching for businesses and individuals, willing to accept the local currency. This would incentivize individuals to make economic choices based on the acceptance of the local currency rather than on economic or environmental efficiency.

On the other hand, it could be the case that local currencies would influence preferences by improving the visibility of local service delivery. There is however no evidence of a significant magnitude of this effect and thus the actual impact on material efficiency is doubtful. The effect on preferences could be better achieved by directly funding promotion campaigns.

Although local currencies seem attractive and alluring as a vehicle to integrate local communities and promote locally delivered services, their implementation seems quite troublesome. There are some doubts regarding transparency and security of such locally based currencies. Also, there is no evidence that such instruments can be effective in either reduction of material intensity of the economy or shift towards more labour intensive services.

Efficiency

The analysis of the efficiency of locally based currencies reflects the doubts regarding the effectiveness of such a tool. First, no clear incentive exists for people to hold a local currency, which is not a legal tender nor can be used to pay taxes. This is why local currencies around the world tend to be generally short lived. Collom (2005) found that out of 82 identified

attempted local currency systems in the United States since 1991, only 20.7% remained active.

Units of a local currency generally flow to a small number of businesses, which are willing to accept them. Next these businesses are faced with the problem of spending this currency. Even local services, like chauffeuring, vegetable growing or cake baking, require actual material inputs, which eventually cannot be substituted by local services. Papavasiliou (2008) found that over-accumulation may be an important issue of the local currency system, e.g. the restaurant serving ethnic food could not obtain the required ingredients locally. However, this limitation could be overcome should the local currency become more popular in the future. Also, there is a need to establish an uncontroversial method for exchanging the local currency with traditional currency units.

Nevertheless, the positive effects of local currencies are not limited to intensification of local trade but extend beyond that. Papavasiliou (2008) claims that local currency is a laboratory where the participants can test and invent new business and spending concepts, or renegotiate the rules of economic behaviour. Also, the users of the local currency system perceived it as a mechanism that will increase their security and protect local communities in the event of an external economic shock in the mainstream economy.

Additionally, a centralised local currency scheme, such as the one proposed, would require constant supervision as to what can be effectively considered a local service and not a product, i.e. the nature of cake baking may be questioned depending on adopted definitions. This is on top of the usual costs of local currencies connected to the recruitment of dedicated administrators, dealing with redundant acceptance listings and the continuous acquisition of participants (Collom, 2007).

A further difficulty would lie in predicting the scope of the use of a local currency in advance to set the level of income taxes accordingly, as the initial number of system participants would be likely to continue to drop over time. A computerised system would provide real-time data on the number and value of transactions, but corrections in the tax system would necessarily lag. This is primarily a technical problem, the scope of which would depend on the implemented version of the local currency system.

Equity

Presumably, as local currency units could be used in settlements of labour-intensive transactions, it should increase workers' incomes. That should lead to a decrease in inequalities, at least at the local scale. On the other hand, if the owners of capital receive remuneration in exchangeable, "conventional" currency, they will be to some extent privileged over those who will receive "local currency" in exchange for their labour. These conclusions should however be treated with care, as the introduction of local currency may rather lead to the shift of inequality from universal currency to the local currency domain, creating another dimension of inequalities rather than diminishing existing one.

Feasibility

In terms of public support, a local currency scheme should not generate huge protests or opposition, although opinions of different actors may be split. Groups of local service providers would probably be supportive and might be quite vocal. On the other hand economic experts and larger businesses may be sceptical and opposing. Moreover the advantages from shifting

consumption to local labour-based services would appear rather blurry to a general population, while the disadvantages of income tax increases – that are meant to finance the change - would be measurable and real, although most probably not very significant.

Recommendations and open issues

Local currencies would not be likely to gain the continuous support of participants. More importantly, there is no evidence that they would significantly add to resource efficiency and that this positive effect would outweigh their costs. It is unlikely that they can significantly contribute to the resource decoupling within the EU.

4.4.3 Promotion of Payment for Ecosystem Services (PES) programmes.

Motivation, Nature and objectives of the instrument

The idea of payments for ecosystem services (PES) can be summarized as bridging the interests of landowners and outsiders by facilitating voluntary payments from the latter to the farmers in order to incentivize them to refrain from actions that cause excessive environmental externalities (Wunder, 2005). The instrument loosely follows the insights of the seminal paper by Coase (1960), that externality problems are of a reciprocal nature, and thus in some cases it may be efficient for agent A to compensate B from generating a harmful externality, while in others for B to continue the previous activities. Transaction costs may preclude the limitation of externalities through market transactions, thus courts should allocate the right to generate an externality, or not, in a way that minimizes these costs, e.g. the right should be assigned to the party which is willing to pay more.

The proposed instrument postulates that private actors (e.g. water companies, tourist operators, companies seeking to offset carbon footprint) are incentivized to compensate farmers for refraining from activities that adversely affect water quality, biodiversity etc. Incentives would come in the form of 1) fiscal incentives, e.g. tax relief, and 2) various kinds of support, including mediation, control activities or financial guarantees. The financing could come from CAP rural development expenditure, EU research programmes (e.g. FP8), Life+ projects, Structural and Cohesion Funds, as well as Member State specific sources.

The main goal of this instrument is to increase the water quality and limit the environmental impact of agriculture in areas where it is desirable from the social perspective.

Effectiveness

The main feature of this instrument is that payments should be made by private companies (in the water or tourism sector) and government would act only as a facilitator and a guarantor of the deals. Such an approach ensures efficiency, but the impact of the government on scale and scope of intervention is limited.

The notion of Ecosystem Services is a popular one, which describes the benefits provided by nature to the society – namely producing food, maintaining abundant and clean water, regulating the climate and diseases; providing recreational benefits and many others. Such benefits are vast and in an ideal situation, the costs of conservation should be covered by those who benefit the most (the buyers) and should be paid to those who impact the

environmental services (the sellers). In an exemplary case, cited in the description of policy mix, the former are water companies (which however often belong to either state or municipalities) or tourist operators, whereas the latter are farmers. However, one can imagine many other PES schemes with carbon markets, at which companies (buyers) are paying the society (seller) for the allowances to emit (using environmental capacity as the most popular and well known (Cole et al., 2014). Such schemes allow the use of markets to place value on environmental systems and thus maximise the efficiency of their use. efficient (Coase, 1960).

However, in reality this may not be the case. Environmental Services are extremely difficult to value – and although there are some attempts to define the price of biodiversity (see Nijkamp et al., 2008 for a review of available methods), the range of estimates is extremely wide, depending on the country, the overall welfare of the society and on estimation method.

The second problem with valuation of environmental services is the discount rate, which may be lower for current generations than for the next ones. Therefore, the current generation may overexploit the environment (Turner et al., 2003). A wide literature in the climate change area suggests that the social rate of discount adopted for such long term impact assessment related to environment should be lower than for investment projects. Chee (2004) lists many other problems connected with the valuation of environment and biodiversity such as uncertainty and irreversibility. Such problems are central in PES instruments where the price of the environmental services has to be determined.

A further problem with PES is agents' uncertainty and information asymmetry among them. In some cases, the owner (farmer) knows much more about the quality of the ecosystem than the institution that should pay for the environmental services. Moreover, the impact of some activities is unknown in advance (e.g. the impact of the introduction of new species into the ecosystem or the results of switching farming method). Such obstacles may lead to conflicts in how much and when the buyer should pay for the environmental services. A similar issue associated with PES is the issue of free-riding. This is especially relevant in the case of landscape protection. In such a situation, it would be very difficult to force all entities that benefit from new regulations to pay. However, in the case of water pollution and payments for farmers, freeriding may be the rule as third parties would also benefit from cleaner water (e.g. other farmers using fresh water for irrigation) (Cole et al., 2009).

Moreover, the problem of property rights may arise. Environmental services are often provided on land which is not fully owned by private agents, but are leased; or the right to the use of a given area is not permanent. In that case, it might be unclear to whom the payments should be made and how to define the service.

The economic impact will depend on the scale of the programme, e.g. PES could be too low to incentivize farmers away from land development. PES in the United States, where some programmes are successful, while others fail to produce significant effects, illustrates that problem. For instance, New York City and Seattle watershed protection projects and local efforts in Alabama to preserve the gopher tortoise have been successful, while only up to 6% of private forest owners participated in state and federal cost-share programmes (Mercer et al., 2011; Ma et al., 2012). It is likely that local programmes are far more successful than the national ones and such initiatives should be mostly supported.

Efficiency

Although, theoretically PES seem to be very reasonable and efficient forms of protecting the environment, there are some problems with their implementation which were outlined in the previous section. Moreover, the efficiency of PES is to a large extent dependent on the policy design and the value of payments – hence it is quite difficult to assess the efficiency of the instrument as a whole. In general, there are several factors that affect the efficiency of a given PES scheme.

First, the impact of PES schemes and their advantage over traditional, command-and-control instruments is higher when there are heterogeneous costs of improving environment. For instance, if the water utility will pay farmers a given amount for refraining from polluting groundwater, only farmers who can give up fertilizers at low opportunity costs will join the programme. In that case, the effect may be better than the result of an instrument use where each farmer is required to reduce pollution by certain amount. For instance, if benefits from a new wind power plant are greater than environmental benefits resulting from clean landscape, in a PES scheme the socially optimal result will be achieved. To further increase the efficiency of such schemes, the reverse auction for environmental service providers may be organized.

The other factor, which to a large extent influences the efficiency of PES schemes, is related to the transaction costs of implementing and monitoring particular instruments. Although it is quite easy to control and pay when one stakeholder owns a large piece of land that should remain idle to preserve the environmental quality of the area, it may be much more difficult to control thousands of small farms that receive payments for refraining from using fertilizers. Therefore, transaction costs should be taken into account when designing PES schemes. In some cases, the inclusion of transaction costs may wipe out any efficiency benefits stemming from the introduction of the PES scheme instead of command-and-control and completely change the overall balance.

The other way to increase efficiency of PES schemes is cooperation with NGOs and other actors. In many cases, NGOs may be much more efficient in monitoring the compliance than the public administration. Moreover, both knowledge and experience of such organizations may be used to improve the policy design and to increase efficiency. On the other hand, government institutions may increase the credibility of actions taken by NGOs aiming at saving ecosystems and biodiversity (Jack et al., 2008)

Finally, the efficiency of PES schemes depends on how much they contribute to innovation. If the PES scheme is designed such that it encourage farmers to introduce innovations (e.g. replacing fertilizers with alternative farming methods), they may exert long term effects on the environment and hence will be more efficient. Innovations are more likely to occur if payments are tied to marginal improvement in the environmental impacts and when instruments are perceived by stakeholders as permanent (Hahn, Stavins, 1992). This should be also taken into account while designing efficient PES.

Feasibility

As such, PES should be feasible as they provide incentives to mitigate the environmental impact at a quite low cost. However, political feasibility depends on the agents who will bear the costs – if a powerful industry were obliged to pay for environmental services, the instrument may be quite difficult to implement. On the other hand, PES schemes should be much easier to implement due to the fact that they are voluntary and provide incentives for

marginal improvements. Nevertheless, the assessment of feasibility depends on the specific design of the instruments that are to be introduced.

Equity

As the opportunity costs of providing environmental services are the lowest for poor farmers, this instrument may help to alleviate poverty by providing payments for less wealthy agricultural households. Moreover, the payments for environmental services may also contribute to increase in income of rural households. Therefore, it is expected that this instrument will help to reduce income inequality in the rural areas at the small cost of marginally increased inequality in the urban areas.

Recommendations and open issues

PES is a quite promising policy instrument, but it requires refinement and clarification of the particular instruments to implement it. In this case both efficiency and effectiveness is highly dependent on the policy design of particular scheme, the size of payments etc.

4.4.4 Development of food redistribution programmes/food donation to reduce food waste

Motivation, Nature and objectives of the instrument

The main motivation behind food redistribution programmes is the amount of food which is lost each year due to the food waste. In the EU, according to the first pan-European study on food waste conducted in 2010 (BIO, 2010), these losses amounted to 89 million tonnes of food each year which translates into 180 kg per person. The environmental impacts of this waste are also huge – according to FAO in 2005 around 250 km³ of water and 1.4 billion hectares of land was devoted globally to produce wasted food. The carbon footprint of food wastage was estimated at 3.3 Gtonnes of CO₂ equivalent.

Although there are some organizations that collect and redistribute food that would otherwise be wasted, the scale of such actions is quite small in comparison to the amount of food that is lost. In 2013, FareShare, one of the largest food redistribution organization in the UK received and redistributed only 1.5% of the country food surplus (BIO, 2014). In 2013, the European Federation of Food Banks (FEBA) redistributed 402.000 tons of food, which is less than 0.5% of food wasted in Europe. Such organizations are much too small to significantly reduce the amount of food that is wasted and much more coordinated action is needed to significantly reduce the scale of this phenomenon.

The proposal aims to reduce the scale of food waste in Europe by encouraging setting up of food redistribution programmes. Food banks, run by churches, charities, NGOs or government agencies, would receive food in voluntary donations, primarily from retailers and producers, e.g. unsold, harvested or overproduced food.

In general, two problems with the proposed instruments need to be overcome. The first one is the problem of calculating taxes and the impact of food waste on the taxable profits of the company to prevent potential frauds. Moreover, VAT needs to be properly calculated. The

second issue to be resolved is the insufficient efficiency of the redistribution system – it is currently not developed enough to absorb a much greater quantity of food waste.

Effectiveness

The most important condition that needs to be satisfied to reduce food waste is a clear and easy tax system to encourage food producers, shops, restaurants to donate food that would be otherwise wasted. This contrasts to the current situation in many Member States where tax system is either neutral or discriminating for those retailers or producers that try to share they redundant food inventories with the poor. If such a tax system were in place, possibly coupled with an efficient collection system and promotion mechanisms (e.g. special certificates for “responsible food producers”), firms would voluntarily provide food, because this would be more profitable than disposal. In that sense, the proposed instrument could be very effective in reducing the amount of food that is wasted each year. However, a few conditions need to be satisfied.

The first condition is quality and safety assurance of donated food. In the current state of affairs, the liability for losses resulting from consuming donated food that is harmful for beneficiaries can be a serious problem. However, this can be easily resolved if the Good Samaritan Law, which is in place in e.g. Italy, were introduced across the EU. In this legal context, the food bank is identified as the final consumer of the product. The other method of solving that problem is to provide organizations that deal with food redistribution with funds for research and examination of the donated products and hold them liable for potential harm in exchange.

The second condition is a simple and favourable tax law. In the current law system in most European countries, the food donor is currently liable for the VAT on donated items, which makes donations much more difficult and expensive than disposal. However, in many Member States, food donors are not liable for VAT if certain conditions are fulfilled. Also, the value of donated food may be estimated as close to zero, which allows for not paying VAT on donated food, but poses problems for other benefits (e.g. tax credits) that are linked to the value of donations. Nevertheless, the legislation on the tax on donated food is not uniform across Member States and is quite burdensome for donors. Solving this issue as well as the provision of tax incentives¹⁰ is pivotal for the success of food redistribution programmes (BIO, 2014).

The third problem is arranging the logistics so as to transfer food efficiently from companies to beneficiaries in need. The capacity of current organizations and food banks are not sufficient to distribute all food that would otherwise be wasted and there is a room for state intervention in this area. Governments can either support existing organizations and foodbanks or establish new entities that will deal with logistics and transport of excess food. Possible support systems can be based on special support, which will be granted to organizations and food banks on auctions, which will assure the efficiency of the allocation.

Finally, eligibility or some other kind of restricted access might be necessary to ensure donors that their sales will not be adversely impacted, particularly among high-value consumers. Donated food should not compete with products that are marketed and it should be assured

¹⁰ In France and Spain, donors can receive a tax credit on income tax for donated food.

that the food is given to people in clear situations of need. This should be done using national Social Support Systems.

Summing up, a few conditions have to be satisfied in order to assure effective redistribution of food. State intervention should be twofold – on one hand, the state should support donors with tax facilities and credits and on the other hand food banks need to be supported. If the abovementioned conditions are satisfied, food redistribution programmes could be an effective way of reducing food waste.

Efficiency

BIO (2014) deems the financing of transportation and logistics to be one of the key challenges to donation systems. This problem could be minimized if the instrument included the so called “social supermarkets” (SSMs), which are shops selling donated surplus food to means-tested poor at symbolic prices (e.g. on average 33% of the regular price in Austria according to Holweg and Lienbacher (2011)). Such enterprises originated in the late 1990s in Austria and have successfully spread across other Western European countries including France and the UK. Advantages include empowering the poor by providing greater product choice and treating them as customers, utilization of market signals from the clients, more efficient product distribution and generating funds for improved operation, e.g. mobile SSMs in rural Austria (Holweg et al., 2010; Holweg and Lienbacher, 2011; Downing et al., 2014). However, it must be ensured that such SSMs do not pose significant competition to regular retailers.

The other important factor that can influence the efficiency of food redistribution programme is the awareness of donors. There is a need for universal guidance for food producers, restaurants and retailers on what can be donated and how to prepare products for donations. Furthermore, some instruments and certificates should be introduced to identify the most generous donors. Such activities will increase social awareness and encourage donors to give more food (WRAP, 2014).

Nevertheless, the most important recommendation is that food redistribution activities should be coordinated and implemented locally. At the local level, there are no problems with long distance transport, and it is much easier to coordinate the activities of donors and recipients. Moreover, in some cases, there may be local problems or specificities that may be easily resolved at that level.

Equity

The promotion of food redistribution programmes should contribute to a reduction in consumption inequalities, as they provide cheap food to less wealthy families. However, they do not significantly impact income or wealth inequalities that are probably the most visible sources of social exclusion within the society. Therefore one should look at them rather as at the compensation policy than as a part of the long run anti-poverty policy toolbox aimed at removing the causes and not the effects of social exclusion.

Feasibility

Instruments aimed at promotion of food redistribution programmes should be feasible to introduce. The only resistance may come from retailers and producers, who may regard popular and common food redistribution programmes may as competitors.

Recommendations and open issues

At the country level, there are two kinds of actions that need to be introduced to support food redistribution programmes:

- Introduce tax credits and the “Good Samaritan” law, that will allow for easy and simple donations without excessive problems with accounting;
- Support for food banks and organizations that will redistribute the donations to improve their logistics and allow for dealing with greater amount of food.

At the local level promotion activities should be established as well as system of certificates for donors such that they can expose their charitable behaviour to the public.

4.4.5 Stimulation of sharing systems

Motivation, Nature and objectives of the instrument

The aim and motivation of the instrument is to reduce the demand for raw materials (especially metals) by reducing the demand for durable goods such as cars, bicycles and equipment. Taking into consideration the fact that many these items may be rarely used, the demand for them can be successfully satisfied using sharing schemes. Moreover, as public transport in cities is becoming more developed and convenient, the private cars are not as necessary as they used to be in the past.

The motivation behind state intervention in the area of sharing systems lies in market imperfections that should be corrected using legal instruments. For instance, the cost of a single use is highly dependent on the number of users and the amount of time that a given durable tool or equipment is in use. Therefore, if sharing is not popular, the entrepreneur who aims at setting up sharing system has to charge high fees to achieve sufficient returns on investment. Moreover, the question of security is important – a sharing system need to be resistant to frauds or stealing attempts. Currently, this can be done using deposits for borrowed items –however, this system is quite inconvenient for the users. Moreover, if it is not common, the sites where the tools and equipment can be borrowed are quite rare – therefore the overall accessibility of the system depends on the popularity and the number of users.

The instrument aims to establish public sharing systems or support private ones with public funding. Sharing cars, bicycles, tools and agriculture equipment in rural areas reduces the need for individual ownership of these items and therefore the use of materials, particularly metals and polymers. The instrument is to be implemented in the form of one of three options (or a combination thereof), depending on the local and national conditions:

- 1) Local authorities set up a scheme for sharing cars, bicycles, tools, and equipment.
- 2) Local authorities support the setting up of private sharing systems through funding of part of the investment cost.
- 3) National authorities support the private sharing systems:
 - a) through deductions in income tax to consumers for the renting costs, or
 - b) through a differentiation in VAT between goods and services.

Funding would be provided accordingly to the chosen option (or a combination thereof):

- 1) The setup of the sharing system will be fully funded by the municipality. The running of the public sharing system (reinvestments, maintenance, administration, communication, etc.) will be funded in the following way:

- from 2020 to 2030: to 50% through membership fees and to 50% through public funding.
 - from 2030 to 2050 in the scenarios Economic bonanza and Divided we trudge: still 50/50 through membership fees and public funding.
 - from 2030 to 2050 in the Reference scenario and the scenarios Safe globe and Back to nature: 100% through membership fees.
- 2) 25% of investment and reinvestment costs will be covered by public funds in the period 2020 to 2030 to get the system started and growing.
 - 3) Level of support from the national authorities:
 - a) tax deductions will be 50% of renting costs between 2020 and 2030. From 2030 and on, tax deductions will be reduced to 25%.
 - b) the lowest available VAT will be applied on renting services. This level of VAT will vary between Member States.

Effectiveness

The effectiveness of this instrument in reducing environmental pressure is limited, as the amount of material used to produce private cars, bicycles and equipment is quite small in comparison with use in other industries. However, given that market sharing schemes could become more popular beyond given thresholds, public intervention might lead to a substantial reduction in the use of materials. A quite important aspect of the increase in popularity of sharing systems is their impact on society and attitudes – they can to large extent contribute to a reduction in consumerism.

The literature about the impacts of sharing systems on resource use is relatively scarce, as car- and bike-sharing systems were established a few years ago. At best, it provides some insights about how such systems can work and whether they are effective. In recent years, many manufacturing firms have started providing packages for lending or leasing their products instead of selling them. Such business models have become increasingly popular in both business to business and business to customer areas – Fisher et al. (2013) provide some examples related to the chemical industry, the waste disposal sector, and mention the case of Xerox which lends its printers and charges customers per each copy. Such examples show that the lending model can be profitable also for manufacturers. In the B2C area, the most striking example is the Car2Go programme, led by Daimler, in which customers pay for each minute they drive. There are similar programmes in the cleaning business led by *Electrolux* or even in carpeting, where the carpet manufacturer *Interface* invented modular carpets, where only torn tiles are replaced. In many countries, private companies or producers lend various items such as cameras, building and DIY equipment, projectors. These examples show that the sharing economy is developing even without state intervention. Fisher et al. (2013) give a few recommendations regarding public support to *lease firms* – among those are ecological tax reform, reduction of VAT on such services or repair and maintenance sector or public procurement. The other market-based instruments can be landfill and incineration charges. Apart from that, some regulations, such as extended producer responsibility should be introduced.

Given the fact that many manufacturers introduced services that are similar to sharing systems, one may question whether public support to sharing systems is needed. Bellos et al. (2013) develop a model, in which they show that car manufacturers can increase their profits by offering car sharing. However, they also show that while the effect of introducing car

sharing systems on *dematerialization* is unequivocally positive, the impact on fuel consumption and GHG emissions is not clear. The reason is that market sharing schemes may increase the affordability of cars and can lead to more intensive vehicle use in terms of miles travelled. However, Martin and Shaheen (2011) argue, that the negative impact on GHG in households that previously owned their car outweigh the rise in emissions in households that gained access to the cars. Moreover, there are also other benefits from car-sharing systems such as reduction in congestion and the need for parking spaces. Nevertheless, these aspects should be also taken into account and carefully examined while analysing public support for vehicle sharing schemes.

Efficiency

The question of how the government can influence the development of sharing systems is quite important in the context of its efficiency. The introduction of sharing schemes can be profitable even without such support. In this context, a careful examination of the impact of public policies on the use of sharing systems should be conducted before proposing any policy solutions.

Shaheen et al. (2012) surveyed 19 bike sharing systems in North America and found that they are primarily supported by user fees, sponsorships and advertising. As public funding does not appear to play any key role in this case, perhaps it should focus more on improving city infrastructure as argued by Kumar et al. (2012). Likewise it is difficult to anticipate which development barriers will be faced by each sharing system and which sorts of sharing systems will actually emerge. Therefore it might be sensible to consider whether constraining support options to a small number of predefined instruments is the best means of encouraging their development. So far bike sharing systems have been spreading globally without such national frameworks (Parkes et al., 2013). Perhaps it would be best if the choice of a support mechanism were left to particular municipalities, i.e. infrastructure, advertisement space on public property, land grants, land tax breaks etc.

Furthermore, sharing schemes should be contracted out and not run by the authorities directly in order to ensure higher cost-effectiveness, service quality and accountability (Meggison and Netter, 2001; Dovalina, 2006). Such an approach would allow for better allocation of state resources, as firms optimize both the selection of location and equipment.

Another option is to introduce some public support that would lower capital costs of establishing rental schemes for cars, bicycles or equipment. Such instruments will lower entry costs and enable a larger degree of experimentation. However, such kind of support is also susceptible to fraud and there are no such examples in policy practice.

Feasibility

In general, the introduction of sharing schemes should not encounter significant opposition from the general public opinion, however professional groups that will be directly affected by them may be highly sceptical and reluctant to accept the change. While there are not many vested interests likely to be upset by bike sharing, opposition is to be expected in the case of car sharing from taxi corporations and car producers. In a similar way the popularisation of collaborative workspace may hit real estate developers whereas the peer-to-peer renting may be opposed by the hotel industry.

Equity

Since sharing systems give access to mobility at lower prices, this instrument should contribute to reduction in inequalities, at least in the terms of access to services and opportunities. That is especially important in the case of car sharing system, where such scheme may increase the availability of cars especially for poorer families. The impact on income inequalities would be negligible.

Recommendations and open issues

Sharing and rental systems of equipment, buildings and cars are developing even without state support. In this context, two kinds of actions are necessary and possible to support such activities. First, governments should ensure a tax system that supports such initiatives. Secondly, action should be taken to promote borrowing over ownership e.g. education actions and contracting out sharing systems where this is necessary and feasible. Also, public-private partnerships could be an important vehicle that contributes to the development of sharing systems and to the dematerialization of the economy.

4.5 Summary per policy mix

4.5.1 Overarching policy mix

Consistently with the general objectives of DYNAMIX, the overarching policy mix contains a number of instruments which, taken together, pursue three objectives: the dematerialization of the economy, a higher degree of circularity and a general reduction of the emission levels of GHG and other harmful substances. While the rationale of the latter objective is straightforward, as it automatically allows a higher environmental quality, the former two objectives are more intermediate in nature in the sense that they serve to reach a superior goal, which is the reduction of the material footprint of the economy. These two objectives are fundamentally different from each other, and they can be thought of as completely independent from one another. A highly dematerialized economy may not be circular at all, and a circular economy may be tremendously material intensive. However, when it comes to policy making, it is virtually impossible to pursue one of the two objectives separately from the other one. For this reason, it is also clear that they both help in reducing the emissions linked to the extractive activities and to the waste flows from the economy into the environment. In this perspective, they are strictly related to the objective of reducing emission levels.

From a methodological point of view, this sub-section is based on the description of the single policy instruments as given in the deliverable D 4.2 and on the results of their qualitative assessment, which are illustrated in the previous sections of this chapter. The aim of this sub-section is to provide some general insights regarding the policy mix as a whole. To this end, it first groups the policy instruments contained in the package according to which the objective they prominently pursue. After providing this overview, it tackles each single group of policy instruments with the aim of highlighting its major strengths and weaknesses.

On the basis of what we argued in the first paragraph, we group together the instruments which help pursuing higher dematerialization and a more intense circularity of the economy. These are:

1. Circular economy tax trio;
2. Boosting extended producer responsibility;
3. Skill enhancement programme;
4. Local currencies for labour-based services;
5. Enabling shift from consumption to leisure.

In this list, the first instruments fosters the circular economy by imposing higher prices on virgin materials and on landfilling and incineration activities. Appropriate taxation instruments should discourage the extraction of new materials from the earth crust and the disposal of no-longer useful material goods or parts thereof. This should help foster a more circular economy at a first stage and a more dematerialized economy at a second one. The second policy has a similar mixed nature but seems to work in inverted order in the sense that it boosts circularity in a more immediate perspective and it fosters dematerialization in a longer-term perspective. The third policy focuses on material efficiency which is a major channel towards dematerialization.

The remaining two instruments seem less promising in helping achieving any of the three objectives indicated above. The introduction of local currencies should help in shifting consumption from material goods to (less materialized) services, but this is not necessarily straightforward. Considering the types of services encompassed in the instrument, it is rather difficult to imagine that consumers can substitute goods with those services. Moreover, the policy fails to specify whether professional providers of those services might be paid with the local currency. If this were the case, these categories would be tax-exempt, and this would be difficult to accept for the other economic actors, particularly in fiscally constrained times. If these services were to be provided only by private actors as a side line, there would in any case be the problem of professionals who would pose as private actors. The shift from consumption to leisure does not have necessarily an effect on the degree of materialization of the economy and it seems particularly difficult to implement as a instrument. Moreover, if the consumption of goods is the environmentally harmful activity, it seems quite hard to support the idea of reducing another type of activity which does not necessarily damage the environment. Ideally, workaholics might just save and consume zero.

There are two instruments in the policy mix, which mostly focus on emissions' reduction. These are:

1. EU-wide introduction of feebate schemes for selected products categories;
2. Reduced VAT for the most environmentally advantageous products and services.

More precisely, the second one is included in the first whereby this one is also preferable to the other one. For this reason, we find that the VAT reduction is redundant in the whole package and can be dropped.

The two lists above do not include the “Step-by-step restriction of advertising and marketing”. This is due to the difficulty in classifying this instrument because of the unclear formulation of the target. It refers to three types of goods: luxury goods, sugar-rich and fat-rich goods.

Luxury goods are numerous and widely diversified (e.g. wines, fur coats, cars, jewellery items, supercars...) and they do not necessarily imply a materialization issue. Some of them can be related to biodiversity problems. With regard to sugar and fat-rich goods, it seems difficult to include this type of goods under the three major objectives of the policy. For this reason, we believe that the policy should best be rephrased or dropped from the policy mix.

With the whole overview of the policy mix in mind, we can now deal with some major issues regarding each one of the two clusters of instruments, which we identified above. With regard to the first group, we want to deal with an important device to reach dematerialization, which is material efficiency. This is the central objective of the policy instrument proposing a skill enhancement programme. Before further considerations, a word is necessary regarding the construct of material efficiency in standard economic thought. An economy is a set of actors (firms, private households, government), together with their interactions (markets and firms' sectors). The principle of material efficiency may be then referred to an economic actor or to an economic interaction. A basic assumption regarding the functioning of the economy is that each actor maximizes his or her own economic objective (e.g. profits, revenues, markets shares, utility...), and this does not usually include material efficiency. In the case of firms, for example, a major objective is cost minimization, which is equivalent to efficiency maximization. This type of efficiency however, is not material efficiency. It is indeed the overall efficiency of the firm, which is based on the combined use of all production factors together. In this perspective it is conceivable that a firm will even waste materials if this proves to be the cheapest strategy¹¹. From the maximizing behaviour of economic actors, material inefficiency may arise also outside their own sphere of action, i.e. at the level of their interactions. We call this kind of inefficiency "systemic".

This is the basic theoretical framework within which we need to contextualize the skill enhancement programme. From this description, the intrinsic weakness of this policy immediately emerges clearly. This policy seeks in fact to improve the level of material efficiency at the firm level. It is obvious, however that no private firm has any motivation to improve its material efficiency unless this turns into an improvement of the overall firm efficiency. For this reason, no firm will ever take into consideration the advice of any expert in material efficiency unless this materializes into cost cuts. Consider as an example the case of appliances, which are sold with shorter and shorter power cables or plastic bottles which are tinier and tinier. From this point of view the policy needs support from other instruments. The skill enhancement programme becomes economically sensible and effective once materials become so expensive (following the introduction of appropriate market-based instruments like the material tax of the circular economy tax trio) that firms find it convenient to reach a higher level of material efficiency. In such a context the skill enhancement programmes even stop needing to be a public policy because they turn into a profitable private initiative.

As far as systemic material efficiency is concerned, here there are two basic types of interactions to look at: those among firms (which participate to markets with different levels of

¹¹ As an extreme example, recall that in the Seventies in the German city of Leipzig it was cheaper to keep public lights on during the whole day than paying a civil servant to turn them off in the morning and on at evening.

competition) and those between selling firms and buyers (which can be either final consumers or other firms). A typical example of systemic inefficiency is due to the production of goods with low material quality, which very quickly turn into waste. While the skill enhancement programme may be effective in a world with higher materials prices, by helping to boost in-firm material efficiency, it stops being effective at a systemic level. Firms may be ideally highly material-efficient but at the systemic level this turns into a low level of environmental sustainability. This opens up a series of issues which are difficult to instrument. It is hard to choose between a low material-intense product with a short life and a similar article with higher material intensity and a longer life. In this sense, the EPR seems to provide a first answer to this issue and in this perspective it can be seen as a complement to the skill enhancement programme. The EPR aims at material efficiency in the sense of reducing waste and for this reason is consistent with the circular economy tax trio. The drawback of the EPR however is that it is too costly to extend to be extended to a wider set of categories of goods. An option could be to set standards on the optimal level of (de) materialization but this looks far from straightforward to put in practice.

As to the feasibility of the first cluster of instruments, we believe that their objective ought to be slightly rephrased and conveyed to the public in a different way. The objective is neither dematerialization nor a higher circularity of the economy per se, but the reduction of waste flows from the economy into the environment. This is an issue which may easily find the support of the public as its damaging consequences are highly observable, the consequences are shown in the media, and targets in this area of intervention are easily quantifiable. By contrast, if we consider an objective concerning virgin material flows from the environment to the economy, it seems likely to be ineffective –in terms of building public support - to claim that the objective is to preserve resources for future generations. There is no agreement in the scientific community about the effective magnitude of the existing materials' stocks. The idea of rapid exhaustibility of resources seems difficult to substantiate given the updated raw materials price forecasts, which show constant or even declining trends. In the event of impending scarcity, prices should display an increasing, possibly accelerating, trend. Secondly, there is the argument that concerns about exhaustion of resources are to do with intergenerational equity (more a social and economic issue rather than an environmental one). However, one may object that the issue of resources exhaustibility should be considered objectively against the expected opportunities provided by ongoing technological progress, which may potentially help to overcome the problem. In any case, the implementation of a policy today in the interest of future generation is strikingly at odds with the great inequality issues present today within the generations currently alive. For these reasons, we find that the general objective of the entire policy mix might need to be appropriately reformulated in order to strengthen the probability of success of the whole package.

This sub-section has devoted only little attention to the second group of instruments, which aim at reducing the emission levels. This is due to the fact the overall assessment of the cluster practically coincides with the assessment of one of the two policies, namely the EU-wide introduction of feebate schemes for selected products categories. This policy is in fact far more preferable to the other ones, which in principle could be dropped. Although we believe the feebate policy to be worth consideration, we feel that it actually belongs more to a

policy mix focused on materials. For this reason, we would suggest including this instrument into the Metals policy mix, as it may be seen as complementary to the “Green fiscal reform: internalisation of external environmental costs”.

4.5.2 Metal and materials policy mix

This policy mix, as described in deliverable D. 4.2, encompasses four major policy instruments and five supporting ones. The major instruments include tax reforms, support programs, and product standards. The supporting instruments include fiscal reforms (again), information instruments, a political strategy and a voluntary program. Thus the policy mix covers almost the whole spectrum of possible policy instruments with varying levels of details in the specific prescriptions of each instrument.

This broad range of tools is a mixed blessing. On one hand, it reduces the risk of leaving out any possibly relevant aspect of implementing resource efficiency in this sector, including known synergies among policy tools. Thus, at least at a first glance, the policy mix appears to be comprehensive. On the other hand, the risk of repetitions and overlaps is quite high, and this casts serious doubts on the overall efficiency and effectiveness of the policy mix.

An important source of concern is indeed on the presence of two very similar tax reforms in this package. Although the wording of their respective policy instruments points to different objectives and different implementation procedures, the material tax and the environmental tax on metals(part of the green fiscal reform: internalisation of external environmental costs) are bound to work in a very similar way, as they will both affect the flows of metal used in the EU. As pointed out in the economic assessment of the material tax, this overlap is bound to disrupt the efficiency of both; in particular by overshooting the correction of the negative externalities that the environmental tax should foster. The recommendation is therefore is to integrate these two instruments, starting from the environmental one, as it is likely to be the least distortionary one of the two, and adding those elements related to the trade of metals which were included in the material tax.

An important precondition for any green tax reform to work is the removal of as many as possible conflicting incentives and distortions in the fiscal system. Thus the removal of harmful subsidies, a support instrument in this policy mix, is particularly welcome and should be explored more thoroughly. Although their direct economic weight might be small, at sectorial/local level they might be important, and their removal may cause distributional concerns as for example in the case of some mining districts which depended on public support for their survival.

On the other hand, taxes are highly relevant for the successful implementation of two other main policy instruments, namely enhanced EPR and support to R&D. As mentioned in the specific assessment for EPR, this is rather a class of policy tools rather than a well-defined policy instrument, and fiscal instruments are found in the literature to be those that yield the best results for the implementation of EPR, (although a tax alone is not enough). However, since the policy configuration for EPR actually foreseen appears to rely on a combination of product take-back requirements, product standards and information, the material/environmental tax might be overlap with and potentially interfere with this instrument, if not properly designed.

In case of R&D support, a sustained material/environmental tax regime is crucial for establishing the correct dynamic incentives for private innovation, hence the motive for keeping investing in new technologies even after the phasing out of public support.

Product standards, on the other hand, are usually seen as an alternative rather than a complement to environmental taxation, simply because if the standard is clearly specified and technically feasible, the desired target is achieved by definition for the products that satisfy that standard, and there is no need to provide any further monetary stimulus to achieve that target. Of course, this depends upon the coverage of the standard across the products available on the market being regulated. If the standard initially applies to new generation products, taxing the use (if feasible) or the purchase of old ones can speed up scrapping the latter and switching to the new ones. Thus some care should be applied in gearing the role of taxes and standards, for instance by exempting from the tax the products that already abide to the desired standards. A potential conflict arises also with EPR policies, but only insofar they already include product standards, as they are often envisaged as a component of such policies. If EPR in the policy mix is limited to a take back requirement coupled with an information campaign, then product standards can be seen as complementing the regulatory framework (the command-and-control side) of this policy mix.

Information-related instruments are usually regarded as useful complements of any policy mix, but never as sufficient to achieve the policy goals. This holds also in the case of the metals policy mix under scrutiny, where they are correctly envisaged as support instruments. They can prove helpful in increasing the feasibility of the policy mix through their potential of enhancing public understanding and therefore, public acceptance. Clear and reliable information will be particularly useful for the implementation of instruments that imply a cost clearly perceivable by consumers such as environmental taxes, or a switch in their usual consumption patterns, such as the adoption of a new waste disposal procedure or the switch to a new product standard.

Overall the policy mix should be fine-tuned to trace clearly the boundaries of the spheres of action of the various tools included in the mix, to avoid wasteful overlapping. The two tax instruments should be integrated in a single one, and designed in such a way to promote the adoption of innovative materials, products and procedures, which should be actively supported and possibly financed with the revenues of the integrated tax. The effectiveness and feasibility of the policy mix would be significantly enhanced by the removal of pre-existing misplaced subsidies and by the deployment of appropriate information campaigns.

4.5.3 Land policy mix

The land policy mix consists of 9 instruments, which makes it the broadest policy mix. It consists of various interventions at each stage of the food production and consumption process, starting from instruments that are addressed directly to farmers (such as a revised CAP, a revised NECD, the promotion of Payment for Ecosystem Services, the regulation for

LULUCF and the pesticide reduction targets), through policies aimed at changing diets (campaigns and VAT on meat products), up to the reduction of food waste on the other side of the spectrum (food redistribution programmes and food waste information campaigns). In the economic assessment of the land policy mix, we will follow the logic of the intervention at each stage of the food chain.

Efficiency

To assess the efficiency of the policy mix as a whole, it is necessary to consider how the policies introduced would impact on relative prices, starting from the price of land, through the prices of fertilizers and agriculture outputs and ending with the prices of different kinds of food. In general, the increase in price of a given production factor or consumption good will lead to higher efficiency in its use.

The impact of the assessed policies on the price of land is as yet unknown and depends on the specific shape of land use regulations. If such regulations decrease the supply of arable land, its price could increase. If the supply of arable land remains constant, the price of land should decrease, as the development opportunities are limited. Such causality is expected due to the fact that the price of a production factor (such as land) should equal marginal productivity. The limitations on possible use (e.g. a ban on certain activities) will change the marginal productivity as the potentially most profitable business will be banned. However, the policy mix assumes that land in environmentally and landscape attractive areas will be protected. The price of such land will be on the one hand negatively affected by LULUCF policies, but on the other payments for the ecosystem schemes should contribute to increase in its price. Nevertheless, the overall effect of these policies on the land price is not clear and probably will be different depending on location, country etc.

The land policy mix policies will negatively affect the supply of land to intensive agricultural production. Moreover, there will be a strong policy impulse to reduce the intensity of the use of land (pesticides and new targets in NECD), which will lead to two effects – an increase in mechanization and in labor intensity (as the relative price of other agricultural production factors – land and fertilizers - will increase) and an increase in the price of agriculture output. This might even lead to a dietary switch – as food will be more expensive, the income effect can push people towards cheaper products (such as crops).¹² However, the substitution effect will depend on relative prices – as there are no policies targeted on seafood and fish, the consumption of these should increase. Also, if meat prices increase by less than crops prices (which is possible, if e.g. animals are fed by imported feeds), a switch towards meat products may initially occur. However, this will be counteracted by the higher VAT rates on meat in most EU countries. Overall, we find that both implicit and explicit price signals generated by the policy mix are generally consistent and may be expected to generate incentives to decrease the land use and pollution intensity of the European agriculture.

Higher prices of food (and meat in particular) together with the proposed information campaigns should lead to dietary changes towards fish, seafood and crops. Moreover, higher

¹² However, this depends on elasticities and is not necessary the case. If the income elasticity for meat is low and for crops is high, the share of meat in diet can increase. However, as Michalek and Keyzer (1992) suggest, these elasticities are rather similar.

food prices (which will include environmental costs after introduction of the policy mix) will create incentives to save food and avoid waste. However, the relatively low price elasticity of foodstuffs may limit the impact of these price signals on food consumption. The policy mix addresses this issue: food redistribution and information campaigns regarding healthy food choices and waste reductions may contribute to increased awareness of the importance of dietary choices among the Europeans. The mix of price signals and awareness-raising policy instruments is an efficient approach and contributes to overall efficiency and effectiveness of the proposed set of policies.

The policy mix is generally consistent and there are no conflicts between its different elements. If it were introduced, it would result in increased costs of extensive farming and higher food prices, which will better reflect resource scarcity and environmental impacts associated with its production. Supported by information instruments, these price signals might lead to a broader adoption of sustainable agricultural practices, more sustainable food consumption structure and reduction of food waste.

Effectiveness

The proposed policy mix is broad and contains numerous policies which provide explicit price signals and command-and-control instruments across the whole lifecycle of food products. It is a relatively complex policy mix, with numerous overlaps between the policies' impacts, and challenges related to determining the right balance between different policy instruments (in order to ensure that implicit and explicit price signals are consistent and reflect the overall priorities of the land policy mix).

The first group of policies focused on land use changes is consistent, targeting different aspects of land use. Policies aiming at reducing the use of chemicals are also sufficient – there are both instruments which will limit the use of nitrogen fertilizers and pesticides. There are also a few instruments that will impact on the land use and landscape and one general recommendation – strengthening the environmental and climate dimension of CAP - that will be implemented at the EU level. Other policies such as LULUCF or payment for environmental services are to be introduced more locally. Therefore, the set of policies that will change land use seem to be sufficient, covering all dimensions.

At the next stage, there are instruments aiming at changing dietary habits. Promotional campaigns are supported by change in relative prices induced by increase in VAT on meat. As these instruments will interfere, synergy effects from simultaneous change in prices and promotional campaigns on dietary habits may be expected. It must be noted that, contrary to policies that will affect land use, most instruments targeting dietary changes will be implemented at the national and at the EU level.

The last set of policies aims at reducing food waste and includes monetary support for food banks and information campaigns for both donors and recipients. Such actions will be introduced both locally and at the EU level and should suffice to ensure a substantial reduction of food waste in Europe.

As such, this policy mix should be assessed as sufficient to reach the goal, so the assessment of effectiveness is positive.

Feasibility

The most important outcome of the land policy mix is probably an increase in relative prices of food and other agriculture outputs. Therefore, the policy mix may encounter resistance from three groups of stakeholders including:

- Farmers, whose income may be affected by regulations on pesticides and fertilizers as well as land use;
- Food companies that will be affected the increase in their main input prices. Also the VAT increase on meat will negatively affect the demand for their products and the suggested food redistribution programs can challenge their business;
- Consumers, who will have to pay higher prices for food.

Although the protests of farmers and food corporations will be mostly heard, as these groups are well organized, the most important issue to be solved is to ensure that the poorest consumers are not negatively affected by the expected increase in food prices. The policy mix as a whole should be assessed as feasible for introduction, but with some caveats - farmers should be compensated for losses resulting from the change in prices of land and poor consumers should not be negatively affected by increase in the price of food.

Equity

Although each policy within the policy mix introduced separately should not increase inequalities significantly, the main outcome of the proposed policy mix is an increase in food prices. The poorest households spend the highest share of their income on food. Therefore, they will be most affected by the policy mix, even though the assistance from food banks is directed mostly to them.¹³ Consequently, the policy mix as a whole may contribute to the increase in income inequalities as real incomes of the poorest will fall relatively more than the rest of the society. To prevent that from happening, other instruments that will counteract this effect such as a decrease in the VAT rate on crops or more intensive social assistance for those most affected, should be implemented.

Recommendations and open issues

The policy mix as such appears to be consistent and sufficient. However, a few elements should be added to counteract negative effects of the policy mix on farmers' income and inequalities. Therefore, a few additional issues need to be resolved:

- First, the negative impact of the increase in food prices should not increase social inequalities. Therefore, some additional policies, such as a VAT decrease on crops or higher social protection should be considered;
- The second deficiency of the policy mix is a lack of instruments that will compensate farmers for the losses associated with limitations on the farming methods. Although, from a purely theoretical point of view such compensation may be inefficient (because

¹³ Although it may be argued that the policies are aiming and reduction of food waste, the share of food waste that is now at disposal of food bank is very low and there is a large room for improvement. Therefore, even if the amount of wasted food will decrease, the expansion of food banks system should lead to increase in the size of help that is provided by the food banks.

farmers create externalities and they should pay for it), it may be necessary in order to increase the feasibility and acceptability of the policy mix. This is especially relevant due to the organization and “soft power” of farmers, which often do not refrain from visible and loud protests that are often burdensome for society. Since in some countries many farmers are not well situated in terms of income, and a lack of such instruments could contribute to an increase in inequalities, some conditional support for poorer individuals is desirable. However, it should be limited to the poorest individuals and financed via social protection system;

- An increase in the prices of meat and crops will contribute to a dietary switch towards fish and seafood. As European seas are already overexploited, some additional instruments to prevent these resources from depletion should be introduced;
- The issue of “environmental impact leakage” is missing in policy mix considerations. Regulations that will increase the price of European food will certainly lead to higher demand for imported agriculture products. This may exert pressure on global food prices, leading to a reduction in the access to food in poorest countries. It may also lead to intensification of agriculture production in Latin America and Asia, leading to deforestation and increase in the use of fertilizers and pesticides. Such leakage should be prevented e.g. with border tax adjustments.

5 Pointers for revision: refining policy mixes and (adding) instruments

5.1 Introduction

This chapter briefly illustrates the main strengths and weaknesses of the policy mixes as defined in deliverable D.4.2 (Ekvall et al., 2015), drawing upon the analysis of the previous two chapters. We will point to the best ideas contained in the policy mixes that should be preserved and enhanced, as well as to the less promising elements that are likely to be superfluous redundant or, in some cases, even detrimental. Again, we will be implicitly guided in our analysis by the economic categories of effectiveness, efficiency, equity and feasibility. Moreover, this chapter will look also at the crucial issue of the timing of the instruments of the policy mix (sequencing).

5.2 Needed corrections in the policy mixes

As outlined in the previous chapters, according to prevailing economic literature we assessed some of the proposed policy instruments to be irrelevant, inefficient, excessively costly, unfair on some social groups, or not well received by the public. Fortunately in our assessment we hardly came across policies which are notoriously faulty *per se*, because they have been proven to be ineffective in the literature or because their unintended collateral consequences can be so detrimental to cancel the benefits: this indeed a rather exceptional occurrence among the policies we analysed. More frequently, but still fortunately rarely, the concerns are expressed in relative terms :We identified a small number of policy instruments, which due to the design chosen and detailed works only to a certain extent and where therefore alternative policy instruments could be considered that seem promising to work better in the respective context. The joint implementation of policy instruments can bring about additional concerns, for instance through trade-offs and unintended negative side-effects of one policy instrument on others such as countervailing effects that neutralise each other or overlapping effects that lead to overshooting the original policy goal, turning individually good ideas into a jointly questionable one.

Where the description of the policy instrument was lacking sufficient economically relevant information, we could not draw definite conclusions regarding its assessment. This is the case, for instance, when a policy instrument is qualitatively well defined, but leaves some key parameters not quantified, whose level may be crucial to determine whether the policy instrument will be reducing social welfare or improving it - pretty much in the same way the right dosage of a medicine can cure an ailment, while the wrong dosage can be either ineffective if too low or poisonous if excessive¹⁴. In some cases this uncertainty cannot be solved within a qualitative assessment, and needs to be solved by resorting to a quantitative assessment and further assumptions detailing needed instrument parameters.

¹⁴ See, for example, our brief discussion of a subset of agricultural policies further on. The issues raised by pesticide regulation fit particularly well in this kind of reasons of concern.

Based on the discussions in chapter 4, we regrettably suggest dropping some of the unconventional and innovative policy instruments, such as the local currencies, the shift from consumption to leisure, the restriction of advertising and marketing (all part of the overarching policy mix) and the promotion of sharing systems (materials policy mix).

As regards the sharing systems, we point out an apparent paradox. As a matter of fact, our analysis finds the conceptualised support for sharing systems not to be needing public support any longer, as the business models related to sharing systems seem to be very successful and self-sustaining. Public support in this case could lead to an inefficient allocation of public funds that could be spent more effectively on other initiatives lacking the funds to take off.

Another couple of policies need substantial restructuring. As regards the environmental tax and the material tax, our analysis indicates a high potential to be effective and efficient, but finds potential pitfalls in the way they are designed. For instance, there could be possible negative interactions of a new tax with the tax system already in place, monitoring and enforcement costs could be significant, and the intrinsic regressivity of environmental taxes also in these cases has the potential to fuel resistance and cause distributional conflicts. Moreover, the material tax and the green tax reform are likely to interfere with each other, if implemented together. In this case, the main issue is the substantial overlap among their targets, which may result in overcorrecting the targeted externalities if they were implemented contemporaneously with the consequence of undermining the efficiency of both instruments. This does not imply, however that the green tax reforms should be dropped from any DYNAMIX policy package suggestion, but rather that the two instruments are suggested to be merged, in order to avoid over-taxation and to ensure a rigorous quantification of a tax level to be applied. The two tax instruments under scrutiny should further be harmonized with the circular economy tax trio and the feebate scheme (both part of the overarching policy mix), to ensure a realistic and efficient cumulated effect on any material directly or indirectly targeted.

For land-use related policies we found the need to make the specifications more precise in order to allow a correct evaluation of their potential impacts, e.g. for the revised NECD, the promotion of ecosystem services and the policies on pesticide use. These policies are not necessarily detrimental to the economy, but need to be more fine-grained in their specifications. In the case of the promotion of ecosystem services and of pesticide regulation, it is in the very nature of the object of the policy, to be complex and multi-faceted, and thus policy success or failure depends largely on the fine technical details.

5.3 Most promising policies

The proposed policy mixes contain a number of promising policies that – if appropriately implemented – promise relevant improvements in social welfare (in the economic sense of aggregate instrument of the well-being of the individuals in a society). There is however no silver bullet; these best policies appear to work better if implemented jointly with other policy instruments; often this joint implementation is a prerequisite for effectiveness of individual instruments.

The support instruments with the highest ratio between resulting benefits and implementation costs are those aiming at improving the level of information held by relevant stakeholders; and the removal of distortionary subsidies. Note that improving information is only as a necessary, but not a sufficient condition to bring about the intended benefits of the policy mix,

and need to be coupled with more incisive policies. Similarly, removing distortionary subsidies only paves the way for other policies targeted to bring about the intended changes. Both work because they bring the real world market conditions closer to the theoretically optimal ones, by removing constraints and distortions that hamper the correct functioning of the economy. Information policies tackle lack of relevant information preventing economic actors to make their choices based on a correct knowledge of the implications of their decisions. Removing distortionary subsidies tackles the abundance of incorrect incentives that prompt economic actors to take socially detrimental decisions.

In a sense, also the revision of the Common Agricultural policy belongs to this group of beneficial policies, because it has the potential to remove a hurdle of distortionary interventions into the European agricultural market often motivated by political rather than economic reasons.

An important example of synergy among policies is the one that links environmental R&D support policies with (correctly formulated) market-based instruments. The latter indeed make the adoption of new, cleaner technologies economically more attractive in the short run, thus accelerating the diffusion of environmental friendly innovation, and justifying the funds invested in costly research programs. An analogous synergy exists between R&D support policies and product standards, but only when a radical technology shift is considered so beneficial for the society that mandatory adoption appears justified. A further synergy can be found between R&D support policies and skill enhancement programmes, as they provide the necessary skills to those supposed to develop or interact with new technologies on a professional basis, thus lead to a greater receptiveness of new ideas, technologies and practices in professional environments and therefore contribute to diffusing new knowledge in the innovation process, leading to a self-reinforcing creative loop. To exploit this potential, however, skilling programmes need to be fine-tuned to regional or local labour market, sectoral skill needs and the education system in order to match the actual demand for specific skilled (environmental) jobs in that region.

5.4 Timing

A crucial aspect for the effectiveness of any policy mix is making sure that its components are deployed at the right moment, in the right combination or sequence and adapted to the specific situational context at time of deployment. Time is thus a further criterion according to which policies can be grouped together.

The first ones to be deployed are those supposed to smooth out the working of a whole policy mix, by creating favourable pre-conditions for the implementation of other policies yet to come. This group includes policies with a typical support role, such as information-related policies (information campaigns on diets and food waste, skill enhancement programs) and those that clear the ground from political or administrative obstacles, such as the removal of harmful subsidies and the revision of the Common agricultural policy. Such actions should start as soon as possible, speeding up the presumably lengthy political process needed to tackle the opposition by those holding long-standing vested interests created by the policies to be scrapped.

Obviously, the policies aimed at creating the best possible playing field need to stay in force over the long-term to create policy stability and maintain their function to create enabling framework conditions. Thus policy makers should make sure that harmful subsidies will not be

reintroduced at a later stage, that revisions of the CAP will be preserved and protected from further intrusions of political requests from interest groups likely to promote the reintroduction of distortionary instruments, and that the public awareness and understanding about resource efficiency will be kept high and up-to-date, hence needing long-term, but adapted implementation of these policies.

Keeping a permanent favourable policy environment stresses the benefits of synergies and hence indicates a need for simultaneous implementation of synergetic policy instruments. Thus, for instance, R&D policies should go hand in hand with market-based instruments that foster the adoption of innovative technologies and procedures, while simultaneously increasing the acceptability of taxes by earmarking the resulting revenues to a socially highly regarded purpose, such as the promotion of scientific and technological knowledge, or to mitigating instruments for the sector(s) hit by the tax in the first place. Therefore, R&D support policies (due both to its beneficial effect on the acceptability and tax reforms and to the long time horizon of the creative process) should be implemented first, together with or soon followed by information based instruments and removal of political or administrative obstacles. Environmental tax reforms and new taxes should then follow, to take advantage of the hopefully more favourable environment that the previous policies have created, in order to ease opposition in the political debate that precedes the implementation of tax reforms and to take advantage of potential synergies.

Agricultural policies that may benefit from the clearer policy environment brought about by the CAP reform should be introduced within a reasonable respite after the implementation of the said reform, to let its effect consolidate. Thus, the revised emissions levels in the National Emissions Ceilings Directive (NECD) and the additional instruments for better management of the nitrogen cycle on farmland, the Regulation for Land Use, Land Use Change and Forestry, the promotion of Payment for Ecosystem Services (PES) and the revised pesticide regulations should follow some years after the revision of the CAP. Within the materials policy mix, product standards should come after R&D support policies, as they are a typical tool to foster the adoption of innovations that require some time to be generated and to reach the pre-market stage in the creative process spurred by R&D support policies.

Another important consideration regarding the timing of policy implementation refers to the distribution of the efforts required to the targeted agents over time. The usual approach is gradual in nature, building momentum year after year (starting lightly and then increasing efforts) but it can also be the case that in some instances, shock treatments could prove more effective. Market-based policies are typically introduced gradually (as in the tax reforms described in Ekvall et al., 2015) in order to increase acceptability in case of taxes or to reduce the financial stress on public funds in case of subsidies. Even when an abrupt introduction is necessary, a cautious approach could envisage the use of limited pre-implementation trials by means of pilots in selected local jurisdictions, for instance prescribing specific standards in a few case study areas to test the uptake of the changes by the local consumers, before implementing at the national level.

6 Concluding Remarks

Bringing today's European Union on a path of absolute decoupling of economic growth from resource use is an ambitious and complex task. The DYNAMIX project puts forward some policy mix suggestions that have a potential to contribute to reach such goal. The actual extent of this potential is obviously unknown, but this does not prevent a test of the proposed policy mixes for their strengths and weaknesses against the desirability criteria singled out by the most relevant disciplines. This motivates this report, which illustrates the findings of the qualitative analysis performed within Working Package 5 using the toolbox of economic theory.

This toolbox is described in detail in Chapter 2 that starts with some brief theoretical background for the practice of adopting policy mixes rather than single policies as instruments of policy intervention. Then, it highlights the two types of analyses performed in this report, and it illustrates the methodology adopted to perform the both. One of them is contained in Chapter 4, and it is based on the four features (effectiveness, efficiency, equity and feasibility), which a policy may (or not) exhibit according to the standard theory of economic policy. Chapter 2 provides the reader with some insights regarding which factors affect these four attributes. The other type of analysis (see Chapter 3) pivots on the two constructs of coherence and consistency, and examines how the whole policy package stands in relation to the five key targets of DYNAMIX and how the individual policies in the three PMs interact with each other.

The methodological background of Chapter 2 should enable a deeper understanding of the results of our qualitative analysis contained in Chapters 3 and 4. Chapter 3 took a more general approach in the sense that it explored how the whole DYNAMIX policy package and each individual instrument stand against the five key-targets described in the Deliverable D 1.2 (Umpfenbach, 2013: 1-2). Following a top-down approach, Chapter 4 analyzes each policy mix in detail (i.e. at the individual policy level) in order to identify both the most and the least promising policies, and to provide an overall assessment of each policy mix. Equipped with the results of the two types of analysis of Chapters 3 and 4, Chapter 5 illustrates the main strengths and weaknesses of the policy mixes. From a methodological point of view, it points to the best ideas contained in the policy mixes that should be preserved and enhanced, as well as to the less promising elements that are likely to be superfluous redundant or, in some cases, even detrimental. Moreover, the chapter looks at the crucial issue of the timing of the instruments of the policy mix (sequencing). Lessons Learnt

During this process we learnt some valuable lessons.

Lesson 1: Mixing is important. This is actually one of the old-timers in the economic policy analysis, which can be tracked back to Tietenberg's principle of one policy instrument for each policy target. The decoupling policy agenda clearly includes a bunch of targets, which spell out the overall objectives in the many economic sectors and for the many parts of the society which potentially affect for the overall goal. The only hope to advance towards such goal is to ensure that the adopted policy mixes are capable of taking care of the various aspect of this complexity and of building on of the known synergies and complementarities the policies they build on. This recommendation is by and large well taken into the proposed policy mixes. In our assessment, we point to policy instruments such as information policies

and the removal of distortionary subsidies which, while being not sufficient on their own to achieve absolute decoupling, do pave the way for more decisive policies by providing a smoother and clearer underlying market conditions. We also find worth of consideration those synergies (which are well-known in the economic literature) that appear to be implied by the policy mixes, such as, for instance, the one between R&D support policies and market-based instruments. However, there is a limit to the number of policies to be included in a mix.

Lesson 2: Choose ingredients carefully. Indeed, as it is obvious to any tolerably skilled cook, the secret of a tasty recipe lays not only in the quality of its ingredients, but also in the balance among them. There is no guarantee that adding together two delicious preparations will result in an equally or more delicious dish. Analogously, two perfectly reasonable and promising policy ideas, if implemented jointly may lead to undesirable outcomes. In particular, it is important to be parsimonious in deploying policy instruments of the same kind on the same target or on similar or closely connected targets, even when the instrument of choice is regarded as one of the best on the menu. The risk is to simply overshoot the target due to an excessive application of the same sort of policy lever on the same group of economic agents. In the policy mixes proposed in Deliverable 4.2, this risk is clearly present for the market-based instruments, in particular for the taxes, which have metals as one of their targeted sectors or as their sole one. A comprehensive rationalization and integration of these taxes would solve this issue. On the other hand, complementarities and synergies are crucially important (see Lesson 1), which means that certain policies *must* be deployed jointly. In a nutshell, lesson 2 can be formulated as follow: To bake bread one needs mixing together flour, water and yeast in the right proportions.

Lesson 3: The devil is in the details. The right proportions are important. As an extra generous pinch of salt can spoil the house's specialty, implementing a theoretically sensible policy mix without carefully dosing the intensity of the policy instruments can lead to disaster. There is thus a need to fine-tune taxes, subsidies and standards to values tailored on the environmental and economic reality to which they are applied. In general, the right "numbers" are unknown a priori, thus they must be sought through careful empirical analyses and possibly pilot implementation of the policies in selected locales. Another level of detail not to overlook is the provision of an effective compliance monitoring system, coupled with effective enforcement powers to ensure that the implementation of the intended policy instruments occurs as intended by policy makers. Oftentimes this level of policymaking is given for granted in theoretical policy analysis, but policy makers cannot realistically rely solely upon the goodwill of the agents they have jurisdiction upon. A transparent and efficient monitoring system coupled with clear rules for the retribution of non-compliant behavior is crucial for the effectiveness of the policies. The existence of a working system for monitoring and enforcement may also contribute to ingraining into the society's mentality the idea that abiding to the new instruments is intrinsically right, with the effect of widening the "baseline" compliance level. To achieve this, educational and information policies are undoubtedly very effective (Muehlbacher, Kirchler, and Schwarzenberger 2011), although these vary across different national cultures (Cummings et al. 2005).

6.1 The bigger picture

Within the economic domain, it would be quite important to frame this assessment within the overall policy situation and outlook for the EU. An exhaustive assessment would be a substantial task and lies outside the scope of this report. However, at least a few considerations can be attempted.

On one side, sustainability considerations are increasingly included in the policymaking of the EU. Just at the time when this report is being finalized, the EU-“Commission adopted an ambitious new Circular Economy Package to stimulate Europe's transition towards a circular economy which will boost global competitiveness, foster sustainable economic growth and generate new jobs” (http://europa.eu/rapid/press-release_IP-15-6203_en.htm). This shows the awareness of the EU policymaking process for the issues tackled in this deliverable and more generally by the DYNAMIX Project. Of course, all this sounds extremely appealing.

On the other side, however there are apparently enormous countervailing forces that may seriously hamper these efforts. One boils down to the different attitudes of Member States, and the long standing issue of EU leadership. Another one regards the degree of awareness and the willingness to act for an improved level of sustainability in the other major economies of the world (USA, Japan and China in particular). The “EU Action Plan for the Circular Economy” (ibid.) needs to be contextualized in a global perspective. A central question in this regard, is whether the EU can globally play a decisive role towards a more dematerialized and circular economy or, rather may just serve as a good example for the other countries. This would be however a *déjà-vu* on the international scene (see the case of the reduction of GHG emissions), the costs and benefits of which need to be carefully examined. A third reason for skepticism regarding the effective honesty of the announced EU-projects for the circular economy comes from the contrast of the spirit of such initiatives with other branches of the EU policymaking, which plainly clash with these ones. Consider for example the current negotiations for the TTIP (Transatlantic Trade and Investment Partnership), which most importantly foresees the so-called ISDS (Investor-to-State Dispute Settlement) mechanism. This mechanism grants two kinds of rights to a foreign investor (i.e. a private firm). On the one side it is allowed to challenge a law, a regulation, a judicial or administrative ruling or any other government decision. On the procedural side, the foreign investor has the option of skipping domestic courts, administrative procedures and all the processes that domestic private actors use and suing the host-country government before a panel of private “arbitrators” (who have the power to make decisions in cases, but are not democratically elected or appointed, and they are not subject to stringent conflict of interest rules). Clearly, the effect of such a provision cannot be anything but a serious limitation of the ability of national governments to regulate. Once such an ISDS mechanism has been in force, it seems quite hard to believe that a project like the “EU Action Plan for the Circular Economy” can find any way forward.

6.2 Beyond this report

The economic assessment carried out in this chapter is obviously an expression of a specific perspective, and its coverage is limited to the economic domain. Outside economics, different disciplines may reach different and possibly contrasting conclusions than the ones drawn in the present report. This is quite likely considering that different criteria are relevant in different disciplines. Equity and feasibility are for instance two constructs about which sociology and

political sciences have produced a hoard of very relevant results. For this reason, it is necessary to frame possibly contrasting conclusions within the EU policy perspective, to highlight the potential for reaching a common view and, using the surviving discrepancies to qualify and enrich the overall conclusions. While, By definition it is outside the scope of this report to discuss other approaches, Deliverable 5.5 has the task of collecting, distilling and reconciling the main messages from the various qualitative assessment performed in Work Package 5.

This is not be the end of the story, however. Whenever reliable modelling tools are available, the results of qualitative assessments are the natural complement to those of quantitative assessments. DYNAMIX Work Package 6, running in parallel to Work Package 5, deals precisely with such assessments, using both environmental modeling and economic modelling tools. In particular, computable economic models are usually not equipped to deal with a number of issues that have been studied in this report, such as particularly complex behavioral aspects, asymmetric information issues, or the intricacy of bureaucracies. On the other hand, they are well equipped to quantify numerically policies whose chances of success hinge on the attainability of the appropriate values of key quantifiable variables and parameters. In this perspective, the undecidedness we lamented above with regard to the qualitative assessment of some policies, which could work or not depending on their actual level, could be actually resolved by the quantitative analyses performed in Work Package 6. Formulating the ultimate policy recommendations in Work Package 8 will need to draw wisely from both perspectives in order to provide a comprehensive and balanced synthesis of the DYNAMIX policy message.

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