DYNAMIX

Decoupling growth from resource use and environmental impacts

The underlying reasons for resource (in)efficiencies

Executive Summary of Deliverable 2.2

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DYNAMIX PROJECT PARTNERS

1 Executive summary

While progress has been made in increasing the economic benefits of resource use in the EU, there is still significant potential to increase resource efficiency and hence to decouple economic development from resource use and environmental degradation. These aims can be achieved by:

1. **Using fewer resources** to fulfil the same needs
2. **Increasing the (socio-economic) value and benefits** from the use of (the same amount of) resources
3. **Reducing the environmental impacts and damage** associated with the use of resources

This report documents the work performed in Work Package 2 (WP2) of the EU funded FP7 project DYNAMIX. The objective of the DYNAMIX project is to identify policy pathways to absolute decoupling of economic growth from resource use and its environmental impacts. This report identifies the main inefficiencies of resource use in the EU and investigates their drivers and underlying causes. This research will serve as a basis for identifying key policy areas to focus on later in the DYNAMIX research project and support the European Commission in the development of policy mixes that will achieve absolute decoupling. A thorough understanding of the drivers and causes of inefficient resource use is vital when designing appropriate and effective policy mixes.

Based on an extensive review of existing literature and data, the main areas of inefficient resource use were identified and analysed using qualitative and quantitative methods. Resource use in the EU was examined from the perspective of individual types of resources such as materials, energy, water, land and ecosystems, but also from a production and consumption perspective, with a particular focus on food, transport and buildings. In both cases a life cycle approach was used following the resources from their extraction to outputs and returns back to the natural environment in the form of waste and emissions to air, water and soil. Material (and substance) flow analysis was used to demonstrate how resources such as iron, cobalt, phosphorus and water are used in the EU or globally.

The drivers of inefficient resource use were examined qualitatively and quantitatively using meta-analysis of literature. Based on this analysis, six broad groups of factors that directly or indirectly influence resource use were identified: behavioural and informational; institutional and organisational; policy and regulatory; economic and demographic; technological and infrastructural; and bio-physical.

1.1 Global and macro-economic overview of inefficiency

A review of the global and macro-economic flows of resources and their uses provided a first indication on which resources are used most inefficiently and where in the life cycle this occurs. The resources that are used the most in the economy are not necessarily the same as those that are used most inefficiently, but the total flow of resources in the economy provide an idea of which types of resource use are most important to improve.

- The EU food system is particularly resource intensive in terms of biomass extracted, freshwater withdrawals, land use, application of fertilizers and wild fish catches. While there is significant potential to improve resource efficiency related to agriculture, fisheries and food production, the greatest potential seems to lie in addressing food consumption: diets, overconsumption and food waste.
- Over 75% of EU's primary energy consumption is based on fossil fuels. Renewables represent about 10% of current energy consumption, but could potentially cover all EU energy demand. In addition to being a finite resource, the burning of fossil fuels is the main source of human induced GHG emissions that lead to climate change. While renewable energy sources could reduce GHG emissions significantly, this involves large investments and might even put a even greater strain on the use of other resources, e.g. land and water to produce bioenergy, critical raw materials to produce photovoltaics and wind turbines. It would be less costly to increase energy efficiency in power generation, buildings, transport and industry, even though this also requires significant investments.
- Compared to other resources, metals are generally the most valued within the economy. Despite being inherently recyclable, they are often sent to landfills at their end-of-life. Besides reducing the demand for metal through better design and longer product lifetimes, closing material loops seems to have the greatest potential for increasing resource efficiency of metals.
- Minerals also have the potential to be more efficiently reused and recycled, however the greatest potential for improving the resource efficiency of construction minerals is through better design and planning of buildings and infrastructure. It also holds the potential for more efficient use of land, energy and water related to buildings and urban areas. Other minerals, phosphorus in particular, are used very inefficiently with losses occurring throughout the life cycle.
- The greatest users of freshwater in the EU are the energy sector (for cooling purposes), the agricultural sector, public water supply and industry. The greatest inefficiencies identified were related to irrigation technologies and practices; leakages in the public supply system and evaporation in (energy production) cooling systems. There is also scope for significant improvements in the water efficiency of water-using products (e.g. toilets, showers, dishwashers, washing machines, etc.) and buildings as well as the potential for reusing wastewater and harvesting rainwater.
- The main inefficiencies identified related to land use is land conversion from natural land to agricultural or built-up land (particularly, urban sprawl and transport infrastructures). Due to large remediation costs, abandoned contaminated sites in particular represent inefficient use of land, which is a finite and scarce resource.
- From a general perspective of resource use, the extraction of all natural resources and the generation of environmentally harmful emissions and waste along all life cycle stages are often the cause to severely degraded ecosystems and their ability to provide the services that the economy is dependent on. In most cases ecosystems provide these benefits in a much more efficient manner than humans are capable of.

1.2 The main drivers of resource inefficiency

A variety of factors that influence resource inefficiency were identified through both the qualitative literature review and meta-analysis. These factors affect resource efficiency in various ways, e.g. positive or negative, as well as directly or in combination with other drivers (conjoint or moderator effects).

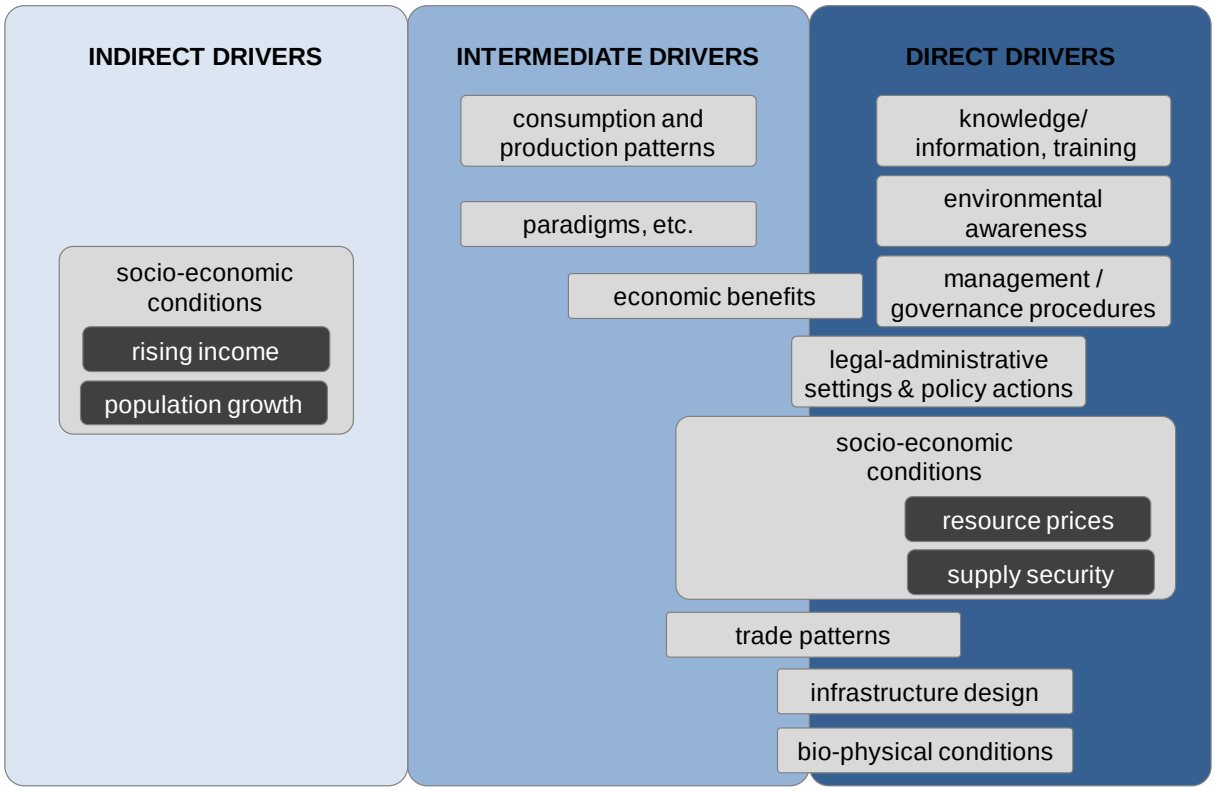
In most of the existing literature on resource efficiency, population growth and rising income (affluence) are identified as two of the main root causes of existing unsustainable patterns of resource use – regardless of the resource type (energy, materials, water, land). However, rising income and population growth are mainly indirect drivers – there are other factors with more direct influence on resource inefficiency. Our analysis points to drivers that constitute part of the complex interplay of factors: in particular consumption and production patterns that translate the increasing affluence of ever more people (emerging middle-class consumers) into lifestyles and habits associated with high resource use. This was observed in relation to areas such as:

- dietary choices (high meat and dairy consumption),
- choice of transport modes and distance travelled (more use of individual transport modes, increasing air travel), and
- housing preferences (larger living spaces per person, increasing number of appliances in use, more efficient heating systems which in the context of the rebound effect might even lead to an increase in excessive energy use).

All the above mentioned drivers appear to be directly affected – or at least indirectly influenced – by either resource efficiency fostering or impeding legal frameworks, administrative settings and political actions. The meta-analysis showed that legal-administrative settings and political actions and legal/political frameworks/actions were most often mentioned of among the drivers identified. While the focus of the study was on factors affecting resource inefficiency, several factors were identified that contribute to improving resource efficiency. The most commonly mentioned are environmental concerns (mainly in relation to water pollution), resource prices, and supply insecurity. While it can be discussed whether environmental concerns as such are sufficiently powerful drivers for more efficient resource use, resource prices and supply insecurity were shown to be considered powerful drivers that case studies demonstrated to have already led to improvements in resource efficiency. Both have direct economic impacts on business, trade and competitiveness.

In an attempt to classify drivers according to the way they influence the improvement of resource efficiency, the following figure (based on the effect type allocation) of indirect, intermediate and direct drivers was created.

Figure 1 Conceptualisation of indirect, intermediate and direct drivers for improving resource efficiency

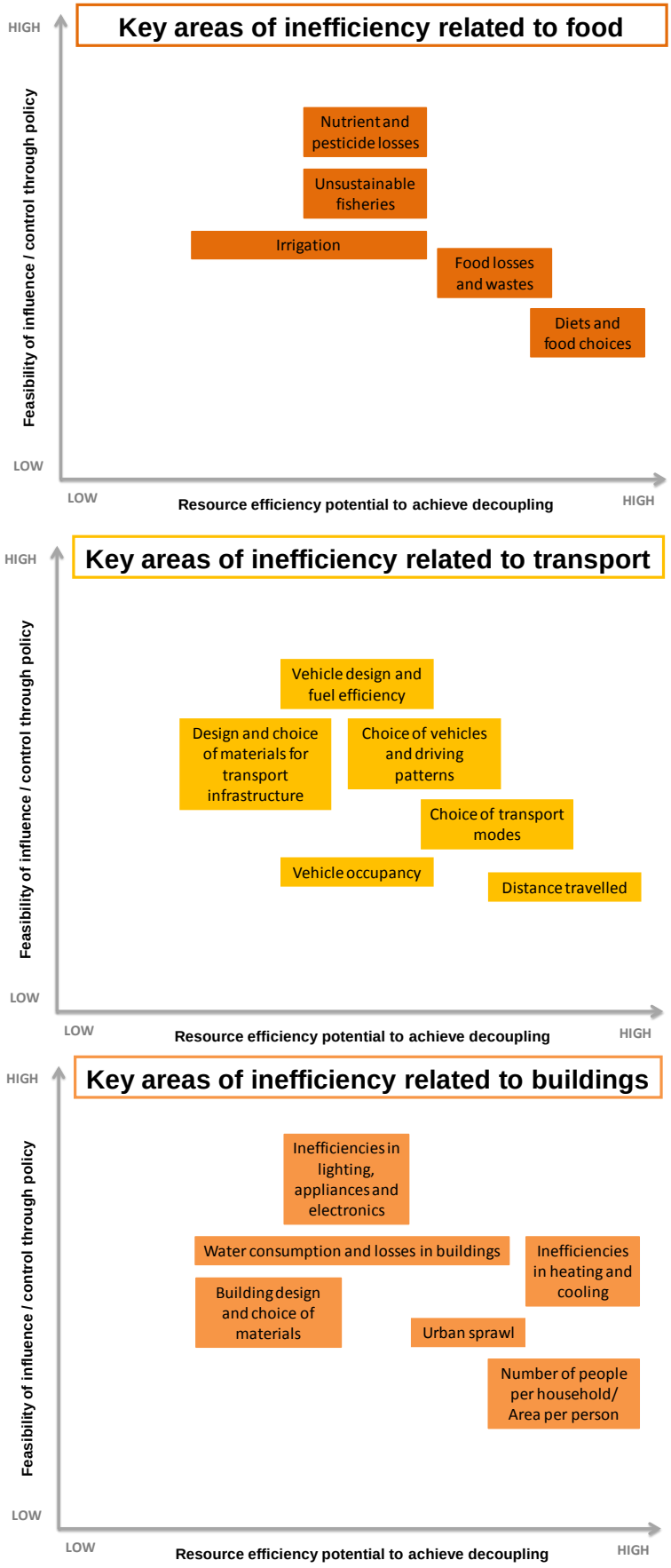


1.3 The key areas to address to achieve absolute decoupling

The review and analysis of resource inefficiency uncovered areas which could potentially be addressed by policy intervention to achieve absolute decoupling in the EU by 2050. Besides some general aspects of EU production and consumption patterns, the key areas of resource inefficiency were related to food, transport and buildings. These represent the areas that contribute the most to environmental pressures in the EU.

Figure 2 presents the areas with significant potential to improve resource efficiency and possibly achieve absolute decoupling. The areas identified in this study are ranked according to two dimensions: in relation to the potential for resource efficiency improvement, and in relation to the feasibility or ease for EU policy to influence resource efficiency improvements (Bringezu and Bleischwitz 2009). The ranking and comparison of key areas of inefficiency are based on the authors' opinion and not on thorough assessments.

Figure 2 A preliminary assessment of key areas of inefficiency in relation to potential for decoupling and policy intervention



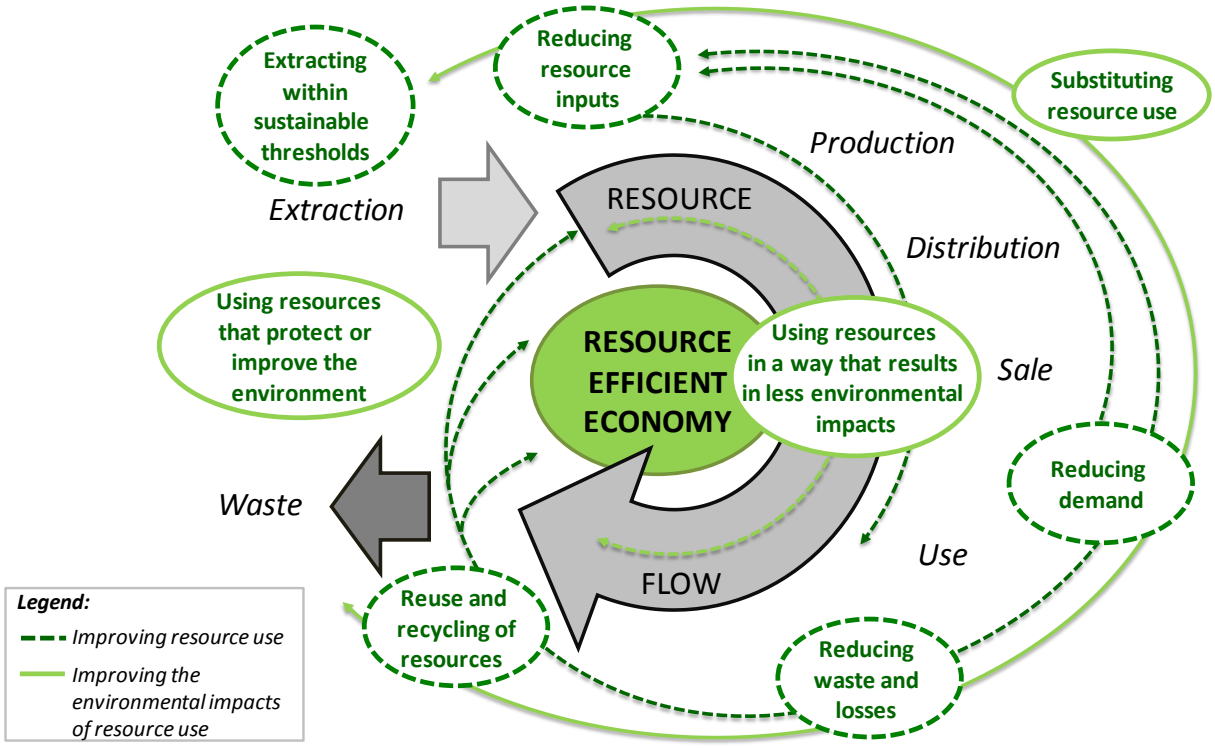
1.4 Approaches to improving resource efficiency

The review and analysis of inefficient resource use showed that there are many different approaches to improving resource efficiency, e.g. reducing waste and losses, reducing demand (e.g. resource sufficiency), sustainable raw material extraction, substituting resources with others that cause less harm to the environment, reuse and recycling, etc. One of the most common strategies to improving resource efficiency is to reduce waste and losses. This can contribute to other resource efficiency strategies upstream in the life cycle of resource use such as reducing the overall demand for resources, reducing the need for resource inputs and ultimately leading to a more sustainable level of natural resource extraction. The reuse and recycling of resources can also reduce the need for virgin resources by closing material loops and reducing the demand for resources.

A set of resource efficiency strategies focus more on reducing the environmental impacts associated with resource use rather than the amounts of resources used. These are substituting specific resources with other types of resources that are less harmful to the environment (e.g. using wood instead of metal), using resources in a way that results in less environmental damage (e.g. applying fertilisers only in certain times of the year) and using resources that actually protect or improve the environment (e.g. establishing green areas to reduce heat islands in urban areas).

The following figure summarises the main strategies to improving resource efficiency.

Figure 3 The identified main strategies to improve resource efficiency



Overall, the findings from the literature review and the meta-analysis contribute to an improved and more comprehensive picture of relevant drivers affecting resource inefficiency. This will serve as a guide for the other work packages of the DYNAMIX project, which aims is to identify policy pathways to absolute decoupling of economic growth from resource use and its environmental impacts.