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ABSTRACT

This report presents the results of the preparatory work to support the review of the EU Thematic Strategy on the sustainable use of natural resources (Resource Strategy). It focuses on raw materials (metals, minerals, fossils, and biomass), and space/land but excludes energy. It also covers their environmental pressures on the media (air, water and soil). The report highlights the strengths and weaknesses of the implementation of the Resource Strategy; its key actions; strategic leverages (awareness, knowledge, MS initiatives, and policy integration); and achievement of the key objectives of decoupling and observing the threshold of overexploitation.

The recent trends (1970-2007) show that considerable progress has been made on the increase of resource productivity in the EU. Although relative decoupling of material use and economic growth has been achieved in some areas, absolute decoupling is yet to occur. The stable or even decreasing domestic material extraction is balanced by the significant increase of global, physical trade, illustrated by the increasingly reliance of EU consumption on environmental burden shifting. Methodological limitations and data gaps still prevent quantifying the environmental impacts of resource use.

The integration of the key concepts conveyed by the Resource Strategy into post-2005 policies in the EU and MS had a positive but partial influence. There is a variable applicability across types of resources, policies, and sectors. This is partly explained by the different understanding of these concepts, the lack of operational tools, and specific targets. The analysis of initiatives in countries within and beyond EU shows some promising examples, such as market-based instruments. Key factors for a successful implementation of a resource-use-related measure include the setting of clear objectives and targets, a better cooperation between policy makers and sectoral representatives, use of synergies across policies, and integration of local specificities.

The strategy has achieved significant progress in some areas. In particular, the establishment of a Data Centre for Natural Resources and the development of indicators of resource use provide a strong basis for the knowledge base. Policy integration across sectors and stages of the life cycle has been increasingly promoted. The awareness of environmental impacts of resource use and life-cycle thinking has been raised and particularly strengthened by the JRC's work on life-cycle assessment and the establishment of the International Panel on Sustainable Resource Management. Some MS have highly contributed to more sustainable use of resources.

There is still opportunity for improvement. In particular, the establishment of a strong knowledge base allowing environmental impacts and resource use to be linked remains an ambitious challenge. Strong disparities still remain between MS regarding their contribution to more sustainable use of resources. This underlines the importance to set up the High Level Forum in a short term, as was required by the Resource Strategy.

Finally, the study proposes five promising areas for future action: 1) Setting a more precise formulation of the Strategy, with clearer definitions and targets, and the consideration of new policy options; 2) Raising awareness among stakeholders and a closer cooperation between policy makers, researchers, and sectoral representatives; 3) Improving knowledge, in priority research areas, and the establishment of a basket of indicators; 4) Fostering the development of MS initiatives through sharing of leading initiatives, and 5) Fostering policy integration, including input and output of economic processes, and a common framework to deal with Waste, Resource use and Sustainable Consumption and Production.

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EXECUTIVE SUMMARY

The main objective of the Thematic Strategy on the Sustainable Use of Natural Resources (Resource Strategy) is to achieve a more sustainable use of natural resources by reducing the negative environmental impacts generated by the use of natural resources and at the same time ensuring economic growth.

This report assesses the progress achieved towards the Resource Strategy's objectives mainly by evaluating its policy knock-on effects and also the real-world effects.

This report analyses:

- the past, current and future trends in the use of natural resources,
- the influence of the Resource Strategy on the adaptation and development of existing and new policies,
- leading examples of policy initiatives in EU Member States and third-countries, and
- the efforts made for, and main outcomes of, the implementation of the Resource Strategy

The outcome of this study includes the identification of progress towards the achievements of the Resource Strategy's objectives and axes of further improvement. Possible future orientations are also provided to enhance further the implementation of the Resource Strategy.

TRENDS IN RESOURCE USE

Conceptually, it is suggested to define resources as natural assets deliberately extracted and modified by human activity for their utility to create economic value. As such, they can be measured both in physical units (such as tons, joules or hectares), and in monetary terms expressing their economic value. This is a somewhat narrower definition than that employed by the Resource Strategy, but allows for an exhaustive classification of resources into energy resources, material resources, water and land resources, each with sub-classes, for which consistent accounting systems in principle exist.

Empirically, for data availability reasons, **the focus is on materials and land**. Energy resources are not in the scope of the study and accounts for water resource use do not yet yield meaningful aggregate results that could be linked to economic growth in the way addressed by the TS. The same can be said for the environmental impacts of resource use: While comprehensive data on the amounts of resources used and their relation to economic development are presented, no comprehensive account of the impacts of resource use was possible to establish. Whether the environmental impacts per unit of resources used have remained constant, have decreased or were even rising

in the past, cannot be judged on the basis of existing data. The report suggests an alternative ecosystem service based approach to assess environmental impacts of resource use.

Domestic Material Consumption (DMC) in the EU amounted to 8.2 billion tons or 13% of global materials extraction in 2007. Mineral materials account for 79% of this mass, the remainder is renewable biomass. With an average per capita consumption of approximately 16.5 t/cap/yr material use, the EU is more than 65% above the global average. While material use has stabilised at a high level in the EU-15, it is still increasing in the EU-12. Overall, material use in the EU-27 is growing slowly and at a similar pace as population. While the extraction of many materials shows a declining trend, both imports and exports are increasing at high rates. Net imports of material into the EU-27 amount to 1.3 billion tons and have increased by almost 26% in the period 2000 to 2007.

The **increasing dependency on imported materials** warrants caution for the interpretation of material flow indicators. Current material flow accounts only consider direct material flows and neglect upstream material flows associated with the production of traded commodities in the exporting countries. Pilot studies which quantified these upstream flows indicate that for highly industrialised countries the so called Raw Material Equivalents (RME) of imports are three to six times larger than direct import flows and suggest that overall material demand of the EU is higher than the indicator DMC shows.

In combination with high economic growth rates in the past, the slow growth of material use resulted in **considerable growth in overall Resource Productivity (RP)** (measured as DMC or DMI per unit of Gross Domestic Product (GDP)) and, hence, in relative dematerialisation. While the physical economy of the EU has been growing at a slower pace than GDP, absolute decline of material use only occurred during very short periods, always linked to phases of recession or very low economic growth. **Absolute decoupling of material use and economic growth**, as has been observed for Japan since 1990, **has not been achieved in the EU.** At the MS level, different trends can be observed. While most MS show relatively stable DMC and relative dematerialisation, some MS such as Germany and the United Kingdom have reached absolute dematerialisation, even in the long run. Absolute dematerialisation in most cases was a result of deindustrialisation and fading out of material intensive heavy industries or mining activities, a process which can be related to the externalisation of material use and corresponding environmental impacts to third countries. A number of MS have a DMC growing faster than GDP. Typically, these are the MS with a low level of per capita income but high economic growth (e.g. Spain, Estonia, Romania). In these MS, in particular, the development of built infrastructures contributed to the high increase of overall material use.

The EU-27 covers a territory of 4.3 million km², of which roughly 44% is used by agriculture and 36% covered with forests. As in many other industrialised regions, the EU is experiencing a long term trend of decline in agricultural areas. During the last ten years, an annual average of 10,700 km² land was taken out of agriculture production

and was either reforested or developed as urban or infrastructure land. On the other hand, the forest area grew by roughly 7,100 km² per year.

Despite the substantial decline of agricultural area, biomass production from agriculture has been growing for many years. Since the 1980s, growth in harvest from cropland and grassland has slowed down or even stabilised at a high level. While the shift from intensively used agricultural land towards forest land can be interpreted as a release of environmental pressures, land use intensity on agricultural areas has been increasing until the late 1980s. Since then, agricultural inputs like artificial fertilisers and pesticides (in terms of their mass flow) have decreased markedly while yields remained high. This can be interpreted as a certain **overall decoupling of land use intensity from economic development**. Nevertheless, land use intensity is very high in the EU and in many regions Human Appropriation of Net Primary Production (HANPP) is at a very high level, above 40 or 50%.

In contrast to domestic biomass extraction, trade of biomass based products is very dynamic, both imports and exports of biomass are growing rapidly. Overall, the EU is a net importer of biomass products as it imports large amounts of feed and animal products as well as wood and wood-based products. Thus, biomass consumption in the EU affects the land use in third countries. It has been estimated that the net imports of agricultural biomass of the EU-15 in the 1990s were equivalent to 25 to 33 million ha of land. The implementation of the European biofuel strategy (10% share of transport fuels in 2020) will increase biofuel demand from currently 10 to 35 million tonnes of oil equivalent and is likely to further increase EU's draw on global land resources.

Resource (Material) Productivity (RP) in the EU is significantly correlated to income, but rather weakly to competitiveness (such correlation disappears when both income and competitiveness are considered). Thus MS with higher RP may simply benefit a richer economy rather than being more resource efficient.

At the global level, RP is strongly correlated to income. This can be explained by the inelasticity of resource use: the more inelastic a resource, the stronger is the correlation of RP with income. In other words, RP is largely a function of national income and the international income elasticity of the resource. This means that international differences in RP are mainly due to differences in income. Globally, RP is thus not an independent indicator of efficient resource use or sustainability, but rather an indicator of wealth. The challenge of maintaining RP growth equal or above economic growth rates can also be expressed in terms of the income elasticity of resource use. The resource elasticity should drop and eventually become negative at higher incomes (as in an Environmental Kuznets Curve), in contradiction with past evidence and present trends.

From this, one may conclude that **ambitious measures far beyond the usual promotion of technical efficiency need to be pursued in order for reductions or even stabilisation in resource use levels to be achieved**. The goal of increase in resource productivity which are at par or above the economic growth is certainly laudable. However, it constitutes a departure from the business-as-usual of EU economies. So

far, progress has been made on the increasing the RP in the EU, however at a much slower pace in comparison to other economic inputs, such as human capital. Economic growth almost always surpasses growth in resource productivity, leading to a net growth in resource use: the savings caused by increases in resource efficiency contribute to the growth of the economic system through macro-economic rebound effects. In this sense, resource efficiency increases can be seen as economic factors of production, since they contribute to economic growth, a growth which outpaces the progress in efficiency. Future measures will have to be wide-ranging to overcome this phenomenon of market economics.

The review of the existing literature **calculating the environmental impacts of resource use** suggests a lack of data and methodologies. The few aggregate impact indicators that have been constructed (above all the Environmentally Weighted Material Consumption and the Ecological Footprint) are **criticised for a number of methodological weaknesses**. So far no comprehensive impact coefficients per unit resource use have been developed and no quantitative time series data for environmental impacts exists, not even for specific impacts or in specific countries.

To assess the environmental impacts of resource use, instead of evaluating the impact on different media components (air, water, soil etc.), a plausible approach could be to consider the natural environment as a system providing services to human beings. These services can be affected by socio-economic activities (related to resource use), and these negative effects on services provided by the natural environment can be conceptualised as environmental impacts.

This idea would allow linking impacts to the prominent concepts of “ecosystem services” and “earth systems” and might **provide a more systematic approach to environmental impacts and their relation to resource use**.

IMPACT OF THE RESOURCE STRATEGY ON OTHER POLICIES

The Resource Strategy’s strategic goals and approach are embedded in the **key concepts of sustainable use of resources, decoupling, eco-efficiency, and life-cycle thinking**, whose diffusion and implementation it seeks to promote at both EU and MS levels. This part of the study analyses in what way and to what extent the key concepts introduced by the Resource Strategy have been integrated in selected EU and MS policy initiatives adopted after 2005. In this analysis, the Strategy’s **four concepts are considered here as representative of a whole range of related concepts which convey an equivalent meaning or approach**. For this reason a qualitative approach was mainly followed to evaluate the diffusion of the Resource Strategy’s concepts in EU and MS policies. In addition to this qualitative analysis, a quantitative investigation allowed to assess the diffusion of the exact terms and their synonyms.

Most of the screened **EU policy initiatives conceived since the adoption of the Resource Strategy use more or less explicitly the four key concepts**. While several policies, such as the EU 2020 Strategy, may contribute significantly to the promotion of a key concept in particular, **much of the potentially relevant legislation only reflects limited uptake of the concepts**. The policy documents screened at the EU level have been grouped into three main categories: transversal EU policies, EU sectoral policies and EU policies targeting resources. Overall, the concept of sustainable use of natural resources appears to be the most widespread and primarily related to achieving growth and enhancing competitiveness, rather than focused on the environmental impacts that arise from the use of resources. In all three screened policy categories, the concept of decoupling is frequent present but rarely considered explicitly. The concept of eco-efficiency is well diffused and most often focused on specific sectors or resources. Overall, in the screened policies the application of life-cycle thinking is less widespread.

The findings of the screening and analysis of selected MS Policies in Spain, Czech Republic, Greece, Ireland, Sweden, Romania, Hungary, and UK suggest that, while the general approach regarding the importance of **achieving a sustainable use of natural resources conveyed by the Resource Strategy is widely reflected, at least in wording, the other three key concepts are overall used heterogeneously**. In general there appears to be commitment to sustainable resource use compared to clearer and potentially measurable objectives as decoupling and prescription of practical implementing steps such as the promotion of eco-efficiency. The concepts of the Resource Strategy are more strongly reflected in the French and the German screened policies.

In addition, a comparative analysis was carried out in the use of the key concepts in Sustainable Development Strategies (SDS) in Romania, Finland and Sweden, which were adopted before and after 2005. Overall, the key concepts of the Resource Strategy have been applied in MS policies, even before its adoption. However, the comparative analysis in the SDS adopted in selected MS before and after the adoption of the Resource Strategy shows that **progress in reference to the concepts has been achieved over time, in particular for the use of the term “decoupling”**.

The adoption and integration of the key concepts in policy initiatives is expected to lead to the adoption of instruments and policies that produce real world effects, mainly by changing behavioural patterns but also in terms of production processes and consumption. The integration of key concepts into policies is also expected to have environmental impacts. However, as it has been explained in the previous section, so far the knowledge of the relationship between resource use and its environmental impacts is insufficient. Similarly the environmental consequences of policies that affect resource use cannot be identified either. Therefore, this section focuses into the economic real world effects that a wider diffusion of the key concepts can be expected to result in.

Specifically, policies aiming to promote more sustainable use have impacts on production costs and incomes at an aggregate level and also foster reallocation of growth among economic sectors, from resource intensive or polluting to more environmentally-friendly sectors. In the short-term these policies might lead to an increase in production costs but in the medium to long-term direct gains from reducing resource intensity of production processes become more apparent. In addition, a more sustainable use of natural resources would underpin the preservation of well functioning ecosystems.

RELEVANT INITIATIVES WITHIN AND BEYOND EU

In the framework of the Resource Strategy, MS were recommended to develop domestic measures and programs to achieve a sustainable use of natural resources. The analysis of the initiatives which have been implemented by MS gives instructive elements of how MS are dealing with the objectives of the Resource Strategy, and how they could improve the management of the issue. Additionally, initiatives developed in countries outside of the EU give elements for future orientations of the EU and MS actions and policies.

In order to build an overview of the actions and policies MS have implemented since the adoption of the Resource Strategy, the MS were formally asked by the Commission to give relevant information on the domestic situation related to the sustainable use of natural resources, i.e. trends of natural resources use and existing resource-use-related initiatives. Based on this information and on complementary information search, an analysis of existing actions and policies in MS was established.

From this analysis, two categories of MS could be distinguished: the first category gathers **MS who have adopted a pro-active approach to manage natural resources**, at least in regard to specific resources, often referring to the key concepts of the Resource Strategy. They have taken initiatives to promote the concepts of the Resource Strategy which go beyond the sheer transposition of EU measures. Among them, only Finland has adopted a National Natural Resource Strategy. The second category consists of **MS who seem to be in a lag phase in the management of the natural resources use**. They don't seem to have developed yet a coherent approach to better understand and govern the resource use at a national level. Existing policies are merely to be interpreted as a transposition of EU measures.

Among the 830 screened initiatives, some of them were considered as “best practices”. The Finish Natural Resource Strategy was retained since it is an interesting initiative of building a national framework for resource use. Lessons learnt from the Resource Efficiency Action Plan under development in Austria could be taken into account for future implementations of programs or roadmaps. The Consumption Tax and the Carbon Tax implemented respectively in Denmark and in Sweden are market-based instruments which have successfully contributed to reduce the consumption of fossil fuels. The Organised Waste Market in Portugal is relevant to be studied since it aims to

bring together producers and material consumers. In addition, specific standards for biomass, currently under development in the Netherlands, are an innovative initiative to ensure a sustainable production of biomass. In Estonia, laws governing mineral extraction are interesting examples of policies in the field of land use. The French initiative on Raw Material Accounting is also relevant to present the initiative of Germany which is one of the rare attempts at the EU level to set quantitative targets regarding resource use. Various elements of these initiatives were studied in-depth, considering the context of implementation, aims, implementation modalities, and achievements. The potential of diffusing a policy initiative to other MS or expanding it to the EU level, and the barriers which may be encountered and addressed early on at the stage of policy design were also assessed.

MS have access to **different natures of initiatives as action leverages to achieve the objectives of the Resource Strategy** such as strategies, programs, roadmaps and market-based instruments. They **cover natural resources in general, or focus on a specific resource or group of resources**. MS also target **specific stages of the life cycle** of resources, specific economic agents or specific sectors.

The **key factors to ensure a successful implementation** of an initiative include defining clear objectives and targets, using project management tools and methods, implementing stakeholder consultation, establishing information and cooperation between policy makers and other sector representatives, implementing additional and supportive measures and taking into account and fully implementing the existing initiatives inside the MS or in other MS. As for the transferability of an existing initiative, the key factor for a successful transfer is to assess the local characteristics.

Outside the EU, some countries confronted early with particular challenges with regard to the use of specific resources have gained experience in the use of different methods and have by now established mature approaches to manage these resources. The **United States and Australia have established tools and instruments to achieve a more sustainable use of a specific resource, while Japan and China focus on the management of raw materials in general**. The latter adopted approaches which place at their heart the concept of Circular Economy societies based on reduced consumption of natural resources. Their analysis provides useful information on the relevance of these potential courses of action for the EU or MS.

Australia **achieved a more sustainable management of its water resources through the introduction of water trading which results in great water savings**. First developed within each Australian state, the initiative is being promoted at the interstate level. Then, while the Water Framework Directive requires that MS set out and implement specific measures and incentives in order to foster water savings from 2010, the Australian experience could potentially provide the EU with useful **guidance for the implementation of market based tools, and in particular trading schemes**, to achieve more sustainable resource use. The analysis of the water trading scheme points out **a number of important principles** to be retained in the European context, such as clear roles and responsibilities of stakeholders, agreed standards for measuring

water commodities and improvements in water metering and accounting. Another relevant feature is the adequate combination of water trading with mandatory water restrictions. Then, based on the lessons learnt from the Australian experience, the EU might develop a market-based instrument implemented at a regional level even if monitored at MS and EU levels, and combined with other adequate measures. For the most efficient implementation of water trading, the EU might have an interest in identifying the MS candidates in order to optimise benefits.

Since the 1970s, **Japan has developed a coherent and holistic vision regarding material cycle management**, supported and strengthened by the implementation and large diffusion of the concept of a Sound Material Cycle society. The in-depth integration of the life-cycle approach into a national strategic framework appears to be one of the key reasons of the successful material policy in Japan. The concept of life cycle and the related emerging material flows are still considered as tools rather than as a consistent strategy in the EU. The EU could therefore greatly benefit from learning from the Japanese experience, by observing the reasons for success and the difficulties encountered. A number of features of the Japanese approach, which calls for a better integration of waste and resource policies, could be successfully implemented in the field of material management in the EU.

China's Circular Economy promotion law is a comprehensive, thoroughly integrated, environmental strategy. Based on a visually strong and intuitive concept (the Circular Economy), it could be of importance in establishing a more strongly interlinked approach to resource and waste management in the EU. The approach adopted by the Chinese Government should be of particular interest to policy-makers in EU as it tries to address the issue of increased shortages in a number of resources worldwide, by building on the approach and experience gathered in Japan.

PROGRESS ACHIEVED BY THE RESOURCE STRATEGY

The progress made on the implementation of the actions promoted by the TS seems to be positive. First, the Data Centre and the International Panel have been established and successfully running. One can therefore expect further promising outcomes in the upcoming years in terms of knowledge sharing, as well as production and dissemination of policy-relevant information related to resource use and global environmental impacts. In addition, considerable steps forward have also been achieved in the **development of material flow indicators and life-cycle based indicators**. The achievements in the field of indicators must however be balanced since **further progress needs to be accomplished in the establishment of a basket of indicators, in particular as regards the measure of hidden flows and burden-shifting**. In addition, limitations are encountered to measure the environmental impacts of resource use, despite the considerable efforts granted.

Within the Resource Strategy, several strategic leverages were pointed out to be activated. The assessment concludes on a mitigated balance.

Several communication channels have supported successfully the dissemination of information related to resource use. The outcome is an increasingly awareness on the resource-use related issues among various targets, such as policy makers, scientific community, businesses and civil society.

The improvement of the understanding of the Resource Strategy's concepts is another strategic leverage to activate in order to move towards the achievement of the Strategy's objectives. The assessment reveals a general progress carried out on the understanding of the concepts based on the development of tools and indicators, but points out differences between concepts. Precisely, there is still an insufficient understanding of the notion of "resources" and there is not a common understanding of environmental impacts. Moreover, the **diffusion of the Resource Strategy's key concepts** into EU and MS policies **is effective but incomplete**, with a **variable application across resources and policies**. Besides, the observance of disparities among countries moderates the general progress. Another interesting outcome is that the understanding of the notion of resource, of the related environmental impacts of resource use and the key concepts promoted by the Resource Strategy comes up against conceptual and methodological difficulties. It is illustrated by the absence of measurable objectives related to the concepts. These difficulties are today pointed out as limiting factors to the concrete implementation of the Resource Strategy.

Despite the difficulties, the Resource Strategy had a **positive influence** on both existing and new policies, at the EU and MS levels. It is likely to bring an even more significant contribution to the integration of the ideas of sustainable use of resources and decoupling through the powerful **policy-knock effects** of the affected policies. Given the number of previous and parallel initiatives at the EU level, that somehow convey the same concepts of the Resource Strategy, the establishment of a straightforward and direct link between the present and future trends of resource use and the specific impact of the Resource Strategy is more than unlikely. However, in several areas such as waste management, rural development or transversal strategies, EU and MS recent initiatives are shown to be clearly in line with the Resource Strategy's objectives. This in itself is a **significant achievement of this Strategy** which provides, together **with a prior-to-2006 pool of policies, an overall guidance** related to resource use at the EU and MS levels.

At the MS level, the Resource Strategy has mostly **strengthened existing policies** and **supported new ones**. It has rarely encouraged the development of new and innovative policies except in countries that waited for EU support to further develop legislative frameworks related to resource use. However, many initiatives have been deployed since the adoption of the Resource Strategy, such as instruments to monitor resource use. This makes this strategic document a **catalyst of the development of new initiatives** that aim to raise awareness among the public and the stakeholders, and to support the decisions of policy-makers.

The promoted policy integration by the Resource Strategy through a life-cycle approach has resulted in an important dissemination, and on the deployment of

isolated policy initiatives which integrate life-cycle thinking. Among these particular initiatives, no global approach has been adopted or promoted yet at the economic or political EU level.

Given the complexity of measuring the environmental impacts of resource use and the recentness of the Resource Strategy, its real-world effects are difficult to estimate. Insight on the overall past and current trends, as well as projections of resource use can however be provided. Trends show that **relative decoupling between material use and economic growth has been achieved in the EU for both materials and energy**. However, **absolute decoupling has not occurred** since resource productivity has not improved fast enough to surpass the growth in GDP. Whether a relative decoupling of environmental impacts from economic growth has taken place cannot be judged on the basis of the existing evidence. In order to achieve an absolute decoupling, that is reductions of resource use, ambitious measures far beyond the usual promotion of technical efficiency need to be pursued.

Although the Resource Strategy shows **significant progress in some areas**, such as the development of indicators to monitor resource use, which confirms the EU and some MS active contribution to the achievement of the objectives, there are many areas of improvement and many efforts remain to be done. The assessment of the Strategy's achievements reveals **several factors which limit the concrete implementation of the Resource Strategy**. These are likely to hinder the thorough integration into policies and concrete measures of the key concepts. They especially include an unsatisfactory blend of different categories of resources (raw materials, environmental media and land), a limited understanding of the functional interdependencies that exist between different resources and a lack of systematic accounting for the environmental impacts within and beyond the EU. The absence of targets and concrete timelines, the insufficient definition of responsibilities and the specificity of national conditions (socio-economic, political and environmental factors) are also identified as potential barriers. **If these issues are already tackled, there are still areas of improvement.**

FUTURE ORIENTATIONS

Several policy options are identified in order to enhance the implementation of the Resource Strategy and to accelerate the achievement of its objectives.

First, fostering the implementation of the Resource Strategy could be achieved through a better understanding of its scope. This could be obtained through a **narrower definition of the notion of resources**, closer to the economic aspects while including the issues of scarcity and pressure, as well as the **notion of “environmental impacts”**. The latter could entail a new conceptualisation of environmental impacts by establishing their link with socioeconomic activities, and earth system/ecosystem services. In addition to these clarifications, **setting quantitative targets** on resource productivity, such as Austria and Germany did, would provide concrete guidance for EU and MS policy-makers to reach the Resource Strategy's objectives.

The formulation and design of new resource-related policies have to be considered to optimise the management of certain categories of resources, in particular in the fields of materials and space/land. A separate materials strategy that would **distinguish the materials from other types of natural resources**, while encompassing the **environmental impacts** of the use of the former on the latter, could be an interesting option for more sustainable use of resources. It would allow practical measures to be designed, targeting the specific issues and challenges encountered by the uses of materials. In particular, it could feed the debate about the necessity and the way to define specific strategies or methodologies for biotic and abiotic materials. Similarly, a separate policy on land use could be a **significant asset for a better integration of the different, and sometimes competitive, types of resource use**.

In addition to policy formulation and design, **more effective dissemination methods and closer cooperation between stakeholders** would help support the achievement of the Resource Strategy's objectives, by involving several actors from the general public to policy makers and researchers in the field.

The development of a **better knowledge base** within the already established Data Centre today appears as a priority. Practical steps could already be taken. A major one is the acceleration of specific resource-use-related research areas, such as the research into the functional interrelations between the use of different resources to identify strategic (combined) resource use reduction potentials. The promotion of existing operational indicators (DE, DMI, DMC) would also allow quantitative targets to be set up and shared at the MS and EU levels. This basket of indicators could be progressively complemented by further developed indicators of environmental impacts (for example, via a slight extension of the classical Ehrlich IPAT formula). Meanwhile, several promising ways of better linking indicators of resource use and economic impacts could be explored and progressively implemented.

Another promising area of action deals with the guidance and support given to MS to foster the implementation of national initiatives. The **clarification of the stakeholders' responsibilities** and the **introduction of concrete objectives and timelines** would help MS to pilot policy initiatives. The **identification, the promotion and the sharing of leading examples and best-practices** could help MS assimilate the Resource Strategy's objectives and develop tailor-made initiatives.

Finally, further policy integration is a key factor of the successful implementation of the Resource Strategy. The study calls for **expanding the existing cross-cutting integration** across sectoral policies and Directorate Generals, while promoting a life-cycle approach. A **common framework dealing with Waste, Resource use, and Sustainable Consumption and Production** would allow taking advantage of their synergies.