THE INTERACTION OF RESOURCE AND LABOUR PRODUCTIVITY

A Scoping Study

Executive Summary

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Introduction

Resource productivity as well as labour and capital productivity are indicators reflecting the development of the economy and the environment. **Resource productivity** refers to the efficiency of using natural resources to produce goods and services within the economy. **Labour productivity** means the quantity of production obtained per unit of labour, which can be expressed by the number of hours worked, the number of employees or the number of employed persons (employees plus other categories). **Capital productivity** measures the level of output (in €) obtained for each Euro invested in manufactured capital.

However, the interrelationships between these indicators in particular and socio-economic and environmental processes in general are highly complex and available expertise, judgement of experts and public awareness are often controversial.

This summary presents the main findings of the scoping study “The interaction of resource and labour productivity”. The aim of this scoping study is to provide an overview on literature findings showing how resource productivity affects both labour productivity and employment as well as an econometric and statistical analysis of the determinants of resource productivity. After a short conceptual explanation of the relationships considered, we outline the historical trends of labour and resource productivity and their main determinants. We analyse the effects of resource productivity on employment and provide some recommendations on how to better integrate resource productivity into economic models and into economic policy making.

Labour and resource productivity as drivers of economic growth

Figure 1 illustrates in broad terms the main driving forces of economic output (measured in terms of gross domestic product (GDP) for the whole economy and in terms of gross value added (GVA) on the sectoral level). It shows that the production factors labour, capital and resource use directly affect economic growth, while the productivities of these production factors influence their relationship with economic output.

**Figure 1.** Illustration of the basic impacts of production factors and productivities on GDP/GVA

*Source: Own illustration.*
The interaction of resource and labour productivity

The arrows from the productivities do not directly point to GDP/GVA, but to the arrow that shows the relationship between economic output and the production factor. “+” indicates positive relationships. It has to be borne in mind that economic output also affects the quantity and quality of the input factors.

In the past, the main strategy to increase labour productivity has been to use scarce and expensive labour more efficiently and therefore to allow for further economic growth and competitiveness. On the one hand, as labour productivity is often related to higher labour intensity and stressful working conditions, a further increase in labour productivity may become problematic in some sectors (e.g. care and education), but is still important for others (e.g. manufacturing) in order to remain competitive. On the other hand, resource productivity has gained importance recently, with the aim of better using scarce resources and subsequently enabling further economic growth.

Figure 2 summarises the main aspects and their relationships with regard to labour and resource productivity.

Figure 2. Labour (productivity) and resources (productivity) as drivers of growth

Source: Own illustration.

Historical trends of labour, capital and resource productivity

Figure 3 shows the development of labour productivity (GDP per hours worked), resource productivity (ratio of GDP and DMC\(^1\)) and capital productivity (GDP over consumption of manufactured capital) in the EU-27.

While labour productivity constantly rose from 2000 until 2007, it slightly decreased during the economic crisis due to a decrease in GDP generation despite an almost constant labour input. While there was a decline in 2010, labour productivity increased again from 2011 onwards. Capital productivity remained almost constant from 2000 until 2007. With the economic crisis, it dropped considerably implying that more or less the same level of annual physical capital consumption generated less GDP. After 2009, it developed constantly, at a lower level than before the crises. Resource productivity improved by 17% between 2000 and 2009. In 2009 material consumption

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\(^1\) Domestic Material Consumption (DMC) measures all materials used within an economic system, excluding indirect flows.
declined significantly during the economic crisis (especially in material-intensive industries) leading to an increase in overall resource productivity. As in the case of labour productivity, resource productivity decreased in 2010, but increased again after this decline.

However, resource productivity expressed as ratio of GDP and DMC does not consider the displacement of dirty industries to other regions of the world. Using instead consumption-based indicators, such as Raw Material Consumption (RMC)\(^2\), the results could be different.

Figure 3. Comparison of resource, labour and capital productivity in the EU-27

How and to what extent does resource productivity contribute to job creation?

Empirical evidence confirms that positive net effects of improved resource productivity on GDP arise, when the benefits of higher productivity levels outweigh the costs of achieving greater efficiency. The production structure and the elasticity of substitution between input factors are important in determining the effects of resource productivity improvements on employment.

Various examples show that in the past several businesses have managed to increase resource productivity with positive side effects on net employment, although the results vary according to different activities and sectors. Explanations can be found in varying eco-innovation opportunities of branches, different reactions to the implementation of policy measures and structural differences in production and energy processes.\(^3\) There are also several recently developed scenario analyses\(^4\) that indicate that improved resource productivity can considerably contribute to employment generation and thus lead to benefits for the EU economy.

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\(^2\) RMC comprises imports expressed or converted into their raw material equivalents (RME), i.e. into equivalents of domestic extractions that have been induced in the rest of the world to produce the respective good.

\(^3\) But there are also several barriers that have hindered stronger resource efficiency increases, such as the lack of access to finance, information deficits, gaps in knowledge, sharing and dissemination of best practices as well as non-utilized innovation potentials. Also the failure to internalise environmental costs has impeded gains in resource productivity (EIO, 2012).

\(^4\) E.g. carried out in the projects POLFREE (www.polfree.eu), NEUJOBS (www.neujobs.eu) or WWWforEurope (www.foreurope.eu).
Policy implications and recommendations

The evaluation of employment effects of an improved resource productivity presents a considerable challenge. There is a wide range of different analyses that incorporate many aspects on various levels, such as firms, sectors and the economy as a whole as well as for individual countries, the European and the global level. Analysis of short and long term effects as well as ex post and ex ante assessments have been undertaken. Based on the literature review and the empirical work, a number of insights emerged, from which some important policy lessons regarding the interlinkages and better integration of resource productivity on the one hand and economic growth and employment on the other hand can be derived:

- There is a strong link between resource productivity and employment. High levels of employment are usually accompanied by high levels of resource productivity.

- “Well designed” policies aiming at increasing resource productivity can have a positive impact on employment. In brief, socioeconomic factors must be considered when creating policies which aim at increasing resource efficiency, since there is a relationship between the two factors. Resource (efficiency) policy may be designed as one part of an integrated economy policy framework and comprise an appropriate mix of policy instruments, including regulatory, economic and voluntary instruments.

- However, potentials, costs and benefits will have to be evaluated from the very beginning. Even if the overall conclusion is that employment impacts may be positive, job losses within and shifts between certain sectors may occur and have to be considered. Thus, a compensation of the losers may have to be part of the agenda.

- Shifts on the sector or firm level might also lead to transitional costs and indirect effects. These include substitution and income effects that depend on changes in relative prices of resources and wages as well as on the crowding out of investment. The main question is whether the net (economy-wide) impact as opposed to the gross (firm or sector level) impact of environmental policies will be positive.

- The empirical analysis that was part of this study reveals that R&D expenditure has a highly positive impact on resource productivity, thus the promotion of resource-efficient production patterns is useful for improving resource productivity. This can be achieved through research and technological advancement as well as appropriate economic and policy guidance.

- According to the empirical analysis, sustainable energy consumption is another determining factor for resource productivity. Higher energy consumption influences resource productivity to a greater extent in countries that are more dependent on conventional energies than in those that use a higher share of renewable energy. Alternative energy schemes which lead to less fossil fuels consumption, in general contribute to higher resource productivity and may have positive effects on the labour market. A relevant policy could be to incentivise private and public sectors in using more efficient technologies to reduce the consumption of fossil fuels.

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5 In order to better understand the system dynamics of raw material use beyond the analysis of productivity indicators, this study also applied a regression analysis to identify the major drivers for resource use and to assess as well the interactions between such drivers over time and across countries.
Limitations and further research needs

In recent years, decision makers asked for establishing RMC as the lead indicator for the EU resource efficiency strategy. Since RMC/RME-based estimates at the country level are challenging, calculating RME of product flows at sectoral levels for all EU Member States would be rather difficult. However, examining resource productivity at the sectoral level is of great importance as each sector shows different material use patterns.

In addition, there is a lack of adequately measuring the quality of labour inputs, accounting for skills, gender, education and employment status of the workers.

Another way forward would be the development of a more comprehensive econometric analysis that allows a better understanding of the relationship between potential drivers such as R&D and energy demand. Extensive sector-by-sector analysis would provide additional insights. Furthermore, accommodating or systematically examining more potential drivers will have to be an integral aspect of future econometric analysis.

Relevant issues that require further investigation include job creation, especially the question of which kinds of jobs will be created and lost with all structural changes towards increased resource productivity, the effects of changes in the international trade relations and the shares of labour and capital costs embodied in material costs.

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