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Development and Eco-Efficiency in the Information Society

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Abstrct

I / dematerialization of economies is probably the main characteristic of the IST (Information Society Technology). We explore in this text the benefits of i / dematerialization in the terms of eco-efficiency and / or sustainable development. If the main contribution of IST / ICT (Information and Communication Technology) is demonstrated by the efforts of the economies to increase their intangible capital stocks and to restructure, i / dematerialization is not inherently eco-efficient and / or sustainable, but tends to generate unintended effects as the rebound effects. In relation to the dematerialization of production, we favor the Immaterialization paradigm "as a switch in consumption behaviour from more material to less material".

Keywords: IST, ICT, Eco-Efficiency, Imaterialization, Dematerialization, Development

Introduction

I/Dematerialization probably seems the main economic trajectory of the 21th century. The economies trend seems oriented towards increasing their intangible capital stocks (van Ark and Hulten 2007), however the investments in ICT (*Information and Communication Technology*)) underwent a real boom in the 90's and also in the 2000's. Nowadays we are aware of the fact that the catching-up growth from the 90's and the 2000's of the CEE countries is related to the restructurings generated by the investments in the field of information and communication technology (van Ark and Piatkowski 2004; Apostol, Bălăceanu and Pădurean 2011) and that the sectors which intensively use ICT are placed at the basis of the USA's divergent growth as compared to Europe (O'Mahony and van Ark 2003). At a global level, the vertiginous downfall of prices and the progresses of globalization facilitated the technology transfer towards the emergent economies, and the ICT contribution has almost doubled, from almost a quarter up to a third of the total capital contribution between 1995 and 2000 (Jorgenson and Vu 2009). Anyway, the economists have perceived knowledge and new technologies as being the main answer to the sustainability and development problems (Chichilnisky 1997, 1998; Yamamichi 2011; Qiang et al 2012; Pascu, Nedea, and Milea 2012). They consider the economies which are

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based on increasing the informational and/or intangible capital stocks tend to be less dissipative. The main arguments of economists are probably related to the capacity of immaterial economies' of providing increasing returns; in comparison, conventional economies are much more materialistic, being based on accumulating factors (the technology is incorporated), and these economies are obviously dissipative. The theory of incresing returns provided for the first time the possibility that the economies continue to grow without being obliged to increase their physical capital stocks and/or the energy/resources consumption. The information and communication technology reanimated the interest in development based on generating and using knowledge and/or massive accumulation of intangible capital. For economists, the great hope was that of anticipating the problems generated by development in a sustainable and eco-efficient way (*eco-efficiency*), namely "by the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout its life cycle, to a level at least in line with the Earth's estimated carrying capacity" (Willard and Halder 2003, p.9).

The element that still remains is that related to the dematerializing economies' ability (through increasing the knowledge and/or intangible capital stocks) to encounter the development issues in a sustainable manner. In other words, is the informational society's technology an environmental friendly technology? Do ICT and Internet head off the problems related to development in an eco-efficient and/or sustainable manner? The debates in the last ten years have shown the fact that the substitution of informational products for material products and the downfall of prices are not bare of problems, generating the so called *rebound effects*. The main significance of *rebound effects* is that informational products have the tendency of using the *positive feedback* mechanism in order to generate the loss of eco-efficient gains which are derived from reducing the material consumption and /or the costs. In other words, if ICT and dematerialization reduce the consumption of materials in what regards the production of goods and services, then, on the contrary, the economy has the tendency of becoming unsustainable by means of reducing the costs and/or inherently increasing the consumption (Tulbure 2002; Schauer 2002, 2010). The main challenge of IST (*Information Society Technology*) is to surpass the so-called *rebound effects* in a way that would allow the eco-efficiently increase of gains, not their diminishing.

We are exploring in this text an alternative for sustainable development starting from the advantages of IST and / or the concept of *imaterialization*. In this way, we distinguish between *dematerialization* and *imaterialization* according to Simmons (2002) and Juric and Voegel (2005) in order to indicate the fact that the virtualization of economies has to be correlated with the consumer's values or lifestyle (*a switch in consumption behavior from more material to less material*) in order for the society to benefit from the informational society's eco-efficient gains and / or to become sustainable.

Advantages And Disadvantages Of IST (*Information Society Technology*)

IST/ICT is generally associated with the productivity boom especially in the services sector, with developments in what regards infrastructure and workforce/work quality, with catching-ups

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leaps in emergent economies during the 90's and the 2000's (van Ark and Piatkowski 2004; Apostol, Balaceanu and Padurean 2011; Apostol 2011). A quasi-common description is that "The revolutionary potential of new ICTs lies in their capacities to instantaneously connect vast networks of individuals and organizations across great geographic distances at very little cost. As such, ICTs have been key enablers of globalization, facilitating world-wide flows of information, capital, ideas, people and products. They have transformed business, markets and organizations, revolutionized learning and knowledge-sharing, empowered citizens and communities, and created significant economic growth in many countries. ICTs have amplified brain power in much the same way that the 19th century industrial revolution amplified muscle power." (Essentials 2001, p.2).

Other studies highlight the ICT's development potential in developing countries. Yamamichi (2011) considers that ICT provides the information easier and faster, creates informational exchanges and networks, generates transparency and efficiency in processes, transforms life and contributes to the decentralization of the decisions. For example, if social networks and telecommunications played an crucial part in the revolutions in Tunis and Egypt and they represent a channel through which the under-privileged groups can express themselves, the "social media can be an effective tool to make a contribution to social development by achieving inclusive institutions, cohesive societies, and accountable institutions, with which it had been difficult for people to be equipped when social media was not widely available" (p.11). Similarly, Qiang et al (2012) argues that mobile telecommunications creates economic growth opportunities, social empowerment and local innovations in developing countries. In his opinion, "one of the areas with the greatest potential impact is in the contribution that mobile applications can make to agricultural and rural development (ARD), by providing access to information, markets, and services to millions of rural inhabitants. For both agricultural supply and demand, mobile phones can reduce waste, make delivery more efficient, and forge closer links between farmers and consumers".

A lot more comprehensively, Weillard and Halder (2003) take into consideration the approach of the informational society and sustainable development *insights* and identify six different scenarios in what regard the approach of this issue. Some emphasize on the development, others on i / dematerialization, some on the advantages of applying the IST, others rather on the disadvantages. The isolation and / or the unrelated evolution of development, environmental sustainability, IST etc. at the level of objectives, policies and / or vocabulary (and methodologies) is probably the main source of problems and disadvantages.

We are mainly interested in the main dis / advantages of i / dematerialization of IST (Information Society Technology) and consumer's lifestyle. Among the advantages of economy dematerialization we identify in terms of eco-efficiency the reduction of paper consumption (with major CO_2 decreases), the savings in the services area, such as the implementation of *online banking*, the substitution and increase of the efficiency of transportation by means of introducing the so-called telework or Internet-delivery of media products, a high efficiency in the fields of industry and constructions which can mean savings, only by what e-commerce and business to business transactions imply, and finally the increasing efficiency of planning the

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production, by taking the offer chain from the Internet and reducing inventories; it lowers overproduction, unnecessary capital costs, transactions based on paper and delivery errors, and it determines a bigger output with a lower energy consumption (Weillard and Halder 2003, pp.11-12).

On the contrary, disadvantages are directly related to the rebound effects and lifestyle's impact or the socio-cultural values. Schauer (2002, 2010) and Willard and Halder (2003) mentions two types of effects directly relevant to the IST unintended effects: *primary rebound effects* and *secondary rebound effects*. They both describe economy's failure of separating the GDP's increase from the consumption and unsustainable production processes. Therefore, if rebound effects mainly mean the unsustainable growth derived from the process of reducing the costs, then primary rebound effects indicate the negative impact of IST/ICT over both the precious metals deposits (in what regards the components' part) and the ecosystem that results after their throwing-away (electronic waste). Thus, the fast global expansion of consumption and ICT use can easily become unsustainable. For example, if consumption growth has as effect reducing the ecological footprint from 2.3 hectares at 1.9 hectares per person, it requires instead an increase in the use of ICT exceeding the limit for achieving eco-efficiency (Willard and Halder 2003). Secondary rebound effects mean that the decrease of costs and the eco-efficiency gains which are derived from expanding IST have unintended consequences: the decrease of the costs derived from dematerialization generates at the level of economy a series of savings that are perceived as a growth of products, services and/or energy consumption, obviously as a decrease of gains in what regards the eco-efficiency (Simmons 2002; Willard and Halder 2003, p.15; Tulbure 2002; Hoorens et al 2004, p.37, 61).

Immaterialization And Dematerialization : Rebound Effects

The main problem of economy's virtualization/dematerialization is the so-called rebound effects. ICT/IST increases the eco-efficient gains when the materials consumption decreases in the process of producing goods and services, but it generates rebound effects when the costs' decrease makes available savings which stimulates the overall growth in consumption (i / material). The main challenge is to see whether the benefits of IST virtualization can provide eco-efficiency gains that can be stored, developed and / or expanded with the global expansion of IST. Two paradigms are proposed: the Dematerialization paradigm and the Immaterialization model. Tulbure (2002), Schauer (2002, 2010) and Simmons (2002) argue for the Dematerialization model difficulties. Tulbure (2002) argues that the use of ICT does not ensure *per se* environmental sustainability. The argument is that the rebound effect is directly dependent on the behavior of each IT applications user.

In other words, the e-worker has the advantage of less often travel to work, but this advantage can be easily diminished by the larger distances which the e-worker have to cross (the e-working specifically facilitates the distance work). However, the results seem to support this position, for example if the e-working decreases the net energy consumption in the first and the most relevant scenario, the decrease in the total number of kilometers covered is constant;

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the results are similar for CO_2 emissions: if the consumption of total energy is constant, CO_2 emissions do not decrease, but remain constant; calculations include Germany.

Schauer (2002) found that the assumption of the dematerialisation of economy (or *the substitution*) has not been adequately referred and thinks that it functions as a Pandora's box; in any case is not a win-win solution, which provides also economic growth and employment and ecological benefits at the same time. For him, there are *primary / secondary rebound effects*, and they relate directly to the eco-efficiency of the information society in both resource consumption (component side), electronic waste disposal, etc., and the changes they induce in the consumer lifestyle on the line of increased consumption of resources and energy. The main argument is that if dematerialization hypothesis (*substitution hypothesis*) is plausible when promises to virtualizes different products and material services, for example to replace physical conferences with virtual conferences, the paper document with the electronic format etc (*Cyberworld Scenario*), it's possible that the eco-efficient effects to be canceled by the fact that ICT has a positive feedback on the level of industrial production (*addition hypotesis*), stimulating what he calls our endless hunger for new products.

The positive feedback from industry and the *consumer eco-schizophrenia*, a concept which he introduce to emphasize the role of lifestyle in the eco-efficiency equation of virtualization, which allows Schauer to see how consumers can remain in overwhelming proportions unaffected by the environmental conclusions they accept, seem to open a real Pandora's box. Schauer (2002, 2010) also argue that the efforts to reduce the energy and resources consumption could give rise to what he called *democratic brake* (the resistance of population affected by the measures to reduce consumption of energy and raw materials) or that the information society infrastructure investments can generate what he calls *Internet refusers*, a category of people who may refuse to move to a digital world and its advantages due to high infrastructure costs. That would force Europe to develop different infrastructures (double infrastructure).

Instead, Simmons (2002) argues for introducing a difference between the Immaterialization paradigm and the Dematerialization perspective, even if Immaterialization was understood as a kind of dematerialization (Hoorens et al 2004, p.62). The difference is that Dematerialization includes the virtualization of the production, while Immaterialization involves the immaterialization of the consumption behavior.

Dematerialization makes from the gains in eco-efficiency and rebound effects (Rebound Effects D) a substitution effect (price substitution effect), i.e. the amount of products and services with intangible content increases in the economy, emphasizing the increase of consumption of energy and raw materials involved in the production of specific IST products and services, while Immaterialization emphasizes rather on consumer decisions or lifestyle and appears as a“switch in consumption behaviour from more material to less material”; Rebound Effects I are in this case an income effect, not substitution effect: Immaterialization indicate that overlapping the Dematerialisation of economies with a lifestyle not enough immaterial reduce gains in eco-efficiency by increasing the consumption of goods and services with high material content.

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Thus, the lifestyle or the patterns of consumption are in the heart of Immaterialization understood as a "switch in behavior from more material consumption to less material." For Simmons, “consumption patterns arise from the values and preferences of individuals. IST-pull addresses the issue of preferences. There is a well-evidenced case that 'long-term value change results from generational replacement'. It seems reasonable to deduce, therefore, that long-term lifestyle change will exhibit the same characteristic dependence on generational succession” (p.6); the developments in law and environmental marketing could be stimulating on the direction of consumer values and preferences (Radulescu et al 2009).

There is also a problem Simmons sees here, namely that the benefits of Immaterialization are not irreversible (post-immaterialization effects), that can be reversed by the selection mechanism, which is included in the nature of Rebound I - “the effect of that dematerialization occurring subsequently to the immaterialization switch”.

However, Simmons believes that Immaterialization challenges the neoclassical paradigm of *homo economicus* especially for the error to treat the consumer behavior “on the basis of cost and direct functional preferences alone”, not as a matter of lifestyle. For him, “The choice to opt for immaterialisation is about lifestyle: such issues as upbringing of children; quality of life (as opposed to standard of living); and place in society weigh more heavily than cost issues. Immaterialisation may produce a cost saving: or it may not. It is *the pattern* of consumption that is changed, not necessarily or systematically its *cost*, nor (except very indirectly) its *function*” (p.6-7); nor at the level of investment the rational behavior is not entirely privileged, he intersecting fields including sociology, statistics and psychology (Mionel 2012). Obviously, Simmons (2002) can be found here with the sociological theories of *the habitus* (Pierre Bourdieu) and of symbolic / emotional consumerism (Jean Baudrillard, Gilles Lipovetsky).

Similarly, Jurik and Vogel (2005) argue that the term Immaterialization is designed to minimize the use of resources at the level of current lifestyles. However, this means a) drastic changes in the consumer behavior and b) requires the development of new methodological models: a) Kurik and Vogel found that the Immaterialization is perfectly plausible when substitute the consumption of material goods to the consumption of intangibles.

For them, the main advantage of Immaterialization is that the demand for intangible assets can grow almost infinitely without becoming dissipative (although involves a material basis, just like a concert hall with acoustics and orchestra instruments that are required for the consumption of a classical concert and that can be used several times in a row - Vienna Philharmonic Orchestra instruments for example has a history of 200 years), while the demand for material goods may decrease, see the experiment that tests the consumption immaterial options to 20-25% of the households of Vienna: mineral water consumption in non-returnable bottles versus a specific sport, Nordic walking, and / or shiatsu, exercise of alternative medicine: for 100 euros spent on non-returnable bottles, Nordic walking and / or shiatsu decrease with 30kg the material waste for same amount; b) Kuric and Vogel argue that the introduction of a time budget per consumer (ie duration of a service divided into functional units like *one person hour of utilized service*) resolve the difficulty of measuring for example the recreational activities, ie

service performance = *number of consumers* x *apllied time budget*. Innovation is applied by comparing the beer consumption in the restaurant and the theater visits (2003-4). Without going into details, the results were correlated with production material bases for and showed that "spending time by drinking beer is a better choice for Resource Conservation than going to the theater" (p. 276).

Conclusion

I / dematerialization of economies is probably the main characteristic of the IST (Information Society Technology). We explore in this text the benefits of i / dematerialization in the terms of eco-efficiency and / or sustainable development. If the main contribution of IST / ICT (Information and Communication Technology) is demonstrated by the efforts of the economies to increase their intangible capital stocks and to restructure, i / dematerialization is not inherently eco-efficient and / or sustainable, but tends to generate unintended effects as the rebound effects. In relation to the dematerialization of production, we favor the Imaterialization paradigm “as a switch in consumption behaviour from more material to less material”.

Juric and Vogel (2005) excellently express this: “One integral element of the debate is to shift consumers’ demands from material-based to resource-saving patterns of consumption. The roadmap of immaterialization implies the substitution of material products by adequate non-material services and promotes immaterial needs instead of material wants, thus advancing social change to achieve sustainability” (p.267). The IST promises in the terms of eco-efficiency and sustainable development are directly dependent on extending the benefits of IST / ICT along with changing the consumption patterns on the direction of Imaterialization.

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