Biophysical limits of current debates on degrowth and the knowledge economy

Documento de Trabajo FLACSO Ecuador 2016_04

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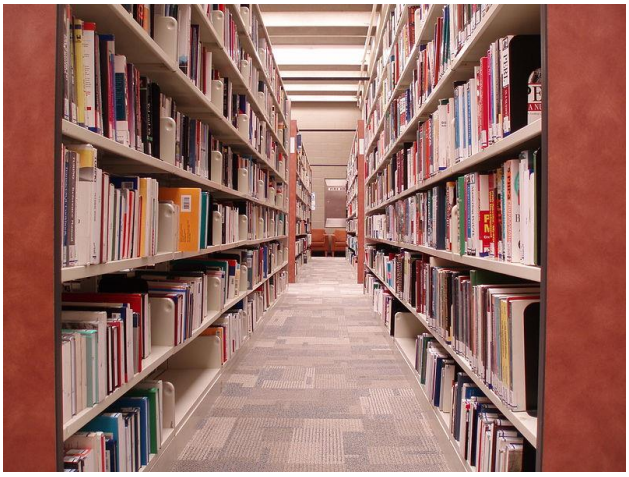

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Abstract

New or revived concepts such as degrowth and the knowledge economy represent a necessary criticism to the conventional view on economic growth, especially in regard to their environmental criticism. Both ideas are related as degrowth needs the application of knowledge in order to be operationalised and both share as a desirable outcome the reduction of working time. However, both concepts also bear common flaws in their criticism, due to the lack of attention in their analysis of the biophysical side of the economic process that has been analysed in approaches such as societal metabolism. The document discusses these weaknesses with the aim of stirring the much needed debate on the limits to growth.

Keywords

Degrowth, knowledge, sustainability, complexity, societal metabolism

JEL Code

O11, O44, P18, Q43, Q57

1. Introduction

The economic crisis the world is experiencing since 2008 and phenomena like peak oil (Campbell & Laherrère, 1998; García-Olivares & Solé, 2015; Hubbert, 1956) have reinforced critical views on conventional economic growth, such as degrowth or the knowledge economy, that revisit old debates on the limits of growth (Daly, 1973; Meadows, Meadows, Randers, & Behrens, 1972).

Both concepts, discussed in more detail in this paper are related, as they suggest that a restructuring of the economic system is needed so that human needs are satisfied while

reducing the environmental impacts associated with growth. The way in which these concepts are being discussed, however, also presents some relevant limitations, some of which are dealt with in this paper. In particular, I find there is a disconnection between scholars working on degrowth and scholars working on biophysical approaches to economic development.

The paper contributes to this debate with a couple of examples, on the one hand it discusses the proposal of reducing working time by degrowth proponents. On the other hand, it discusses the theoretical immaterial character of the knowledge economy. In both cases it presents arguments from the perspective of biophysical and evolutionary economics and complexity analysis which stress the need for a deeper debate based on quantitative analyses of future scenarios to assess their viability and feasibility.

2. Biophysical limits of degrowth

The world is experiencing not only an economic crisis in recent years but also a societal one. This encouraged a group of academicians, under the leadership of Serge Latouche, to re-introduce some ideas from Georgescu-Roegen and André Gorz on the impossibility of infinite growth in a finite world, putting back in the discussion table the concept of degrowth. The interested reader can read in the literature the recent history of the movement in France (Baykan, 2007) and its expansion elsewhere (Muraca, 2013). Degrowth is more a metaphor, which would imply the need that rich countries reduce certain activities, in order to make room for more growth in certain activities in poorer countries. Agreeing with the fact that growth as we know it is not viable in the medium term, proposals coming from degrowth defenders also have some problems when it comes to putting them in practice. These limitations come, in my view, from the lack of attention degrowth scholars have put to discussions occurring within biophysical economics when analysing the economic process. Degrowth also assumes that if we do not implement any measures, economies will keep growing as they have done until now, showing a disconnection with peak oil and supply side constraints literature as mentioned above.

Among the measures proposed to achieve degrowth, the reduction in working time stands out, as it is very attractive. Degrowth would imply an increase in leisure time, it would allow reducing unemployment while maintaining material living standards and reducing environmental impacts (New Economics Foundation, 2010; Research and Degrowth, 2010; Spangenberg, 2010; Victor, 2012). Recent literature on degrowth (Alexander, 2012; Cattaneo & Gavaldà, 2010; D'Alisa, Demaria, & Kallis, 2014; Demaria, Schneider, Sekulova, &

Martinez-Alier, 2013; Huppes & Ishikawa, 2009; Kallis, 2011; Latouche, 2009, 2010; Lietaert, 2010; O'Neill, Dietz, & Jones, 2010; Schneider, Kallis, & Martínez-Alier, 2010) focuses on individual change through voluntary measures and presents degrowth as a social / political movement, in opposition to the analytical perspective used in the past to analyse the scale of the economy (from John Stuart Mill to Herman Daly (Daly, 1973)). In this regard, there are also some authors who discuss degrowth from an energetic and biophysical economics perspective, providing new edges to this much needed debate (Sorman & Giampietro, 2013).

Unfortunately, the argument of the reduction of working time does not hold when a biophysical approach to the economic process is used. As it will be shown, reducing working time is only possible at the expense of consuming more energy and/or reducing the material standard of life. If the proposal is for reducing working time, we need to be prepared to discuss and tackle the trade-offs involved. Only once these have been analysed, informed decision making can take place.

In the eventuality, for example, that working time is reduced without increasing energy consumption, society as a whole will be faced with a reduction in the activities that are performed by agents. Society will not be able to bear the energy (or labour time) cost of certain activities.

There are basically three options to make degrowth a reality:

(1) Voluntary reduction in our levels of consumption (Alexander, 2013);

(2) Efficiency gains in the use of natural resources: applying new technologies / knowledge so that we can produce more value with the same amount of resources, or produce the same with lower amounts of resources; and

(3) Increasing labour productivity: applying new technologies / knowledge so that we can produce more value per hour of work and we can reduce working time.

It is thus very interesting to see how the option of limiting population growth, or at least not promoting its growth, is absent from most of the literature on degrowth (Kerschner, 2010). It would seem only Georgescu-Roegen defended a progressive degrowth of population (Georgescu-Roegen, 1975; Levallois, 2010).

The first of the options mentioned above can be dismissed simply observing historical trends in consumption. Apart from small communities or experiments on transition initiatives and relocalisation (Demaria et al., 2013; Quilley, 2013), most of the

world population shows increasing levels of material consumption over time, usually related to rising income (Haas, Krausmann, Wiedenhofer, & Heinz, 2015; Schaffartzik et al., 2014). Changing this observed pattern is the study area of sustainable consumption (Røpke, 1999, 2009). These trends, however, do not show signs of being reverted in recent years.

The second option will be discussed below when analysing the knowledge economy.

The third of the options is discussed next. Work implies different types of energy use. On the one hand, we have households in charge of *producing* labour time, providing a reason why the energy and material consumption needed by households for the reproduction of the labour force could be considered as the 'energy cost' of labour (Gever, Kaufmann, Skole, & Vorosmarty, 1986). On the other hand, labour time consumes energy directly when work is realised, and indirectly embedded in the machinery that is used.

Standard economic growth theory assumes that technological advance is an exogenous force driven by human knowledge that results in increasing productivity of labour and capital. From a biophysical perspective, however, enhancement of labour productivity is preceded by a higher control by workers of energy, be it indirectly (embedded in machinery) or directly (in the form of fuels and electricity needed to operate them).

This result was already observed by Cottrell in 1955, when he stated that productivity increased hand in hand with increases in per capita available energy consumption (Cottrell, 1955). For some time, within the realm of energy analysis there is evidence that supports this claim. The higher labour productivity of US workers with respect to European was found to be explained by their differential energy consumption per hour of work (Boretsky, 1975). This result was also observed for manufacturing workers in the US (Cleveland, Costanza, Hall, & Kaufmann, 1984). These same authors also showed that when oil price in real terms was lower than real wages (in relative terms), oil happened to substitute labour time and productivity also increased, and vice versa. More recent work analysing the role of energy (or exergy and useful work) for productivity gains has being carried out with the same results by the group lead by Bob Ayres (R. U. Ayres, Ayres, & Warr, 2003; R. U. Ayres & Warr, 2005; R. Ayres & Voudouris, 2014; Warr & Ayres, 2012).

Other studies with the same findings include countries such as Ecuador (Falconí-Benítez, 2001), Spain (Author 2001), China and India (Velasco-Fernández, Ramos-Martín, & Giampietro, 2015) as well as the EU-15 countries (Sorman & Giampietro, 2013).

Based on this evidence, an increase in labour productivity would be preceded by an increase in energy consumption per hour of work, as I hypothesised before. We should also

add here the energy needed to generate, maintain and utilise knowledge, which will be dealt with later on.

In contexts when energy is expensive, as it happened until mid-2015, energy importing countries become poorer in relative terms, as their consumption translates in higher rents being transferred to exporting countries. Therefore, improving labour productivity by increasing energy consumption to reduce working time, may prove more expensive. When energy is expensive, either we end up working more hours or we reduce our material consumption levels.

The assertion that we can work less hours, maintain our material standard of life, while reducing unemployment and environmental impact is an illusion made possible thanks to cheap energy and cheap goods coming from developing countries (mainly from China). It does not hold in a context of expensive energy or in the context of a progressive stalling of the economy of developing countries limiting the option of developed countries to externalise the production of goods.

Thus, in a context of expensive energy, the population is forced to work more hours and not less, plus becoming poorer in relative terms. From an environmental point of view this may have positive implications as pressure upon energy and materials is reduced. However, from a social point of view it is more complicated, as new distributive conflicts may arise upon those bearing the burden of fiscal adjustments, not only at the individual level but between countries. This also leads to new ecological distribution conflicts (Martinez-Alier & O'Connor, 1996), as countries fight to guarantee a continuous supply of natural resources that are key for their economic development, which is translated, for instance, in the much debated issue of land-grabbing (Scheidel, Giampietro, & Ramos-Martin, 2013; Scheidel & Sorman, 2012).

Some literature on degrowth explores different transition paths to achieve a sustainable society, however, the emphasis is solely given to the elements that those paths may include without analysing the viability and feasibility of those scenarios in quantitative terms (Videira, Schneider, Sekulova, & Kallis, 2014). It is regrettable that this much needed discussion of degrowth in biophysical terms (which is inevitable eventually) is not based on a sound economic and biophysical analysis. It appears to be, on the other hand, directed by experts in marketing who, with the use of provocative slogans, are unintentionally helping mask and postpone the debate on what, how and when is to be reduced.

3. The illusion of the (bio-) knowledge economy

Many economies have defended the idea of transiting towards a knowledge (and also bio-knowledge) economy as a strategy to decouple economic growth from natural resource consumption. This approach omits the fact that a knowledge-based economy is not immaterial, as it needs a level of organisation of society and a level of structures (education and health systems, security, justice, etc.) that consume resources *per se*. They can do so because the dirty work has been externalised to the emerging economies of developing countries.

This interpretation of a theoretical dematerialisation of the knowledge economy is accepted in scientific disciplines like ecology or physics, while is under discussion in some social sciences like economics, where the predicament is for economic growth to be based in an infinite resource, knowledge. This is clearly an ideological postulate which instils the idea that economic growth can be infinite provided it is based in the infinite resource knowledge. The problem with this postulate is, simply, that it does not hold. It is true that knowledge is immaterial *per se*. However, the generation, maintenance, systematisation and utilisation of it is not, and requires important quantities of natural resources in terms of infrastructure (schools, universities, libraries, and laboratories) and manpower (professors, researchers, divulgators) that consume natural resources for their own maintenance and operation.

The idea is still, very attractive, a fact explaining that governments from all the political spectrum have supported it unconditionally. Thus, the European Union enacted in March of 2000 the so-called *Lisbon Strategy* (for growth and jobs), where a plan for the European Union was detailed with the goal of transforming the EU into the most competitive economy of the world by year 2010, based on the exploitation of knowledge. The strategy was replaced by the strategy Europe 2020, Europe's growth strategy (European Commission, 2010), in which the concepts of *green economy* and *circular economy* joined knowledge to guarantee economic growth in the EU.

Recently, growth strategies have incorporated the idea of a *circular economy*, as it has the advantage of including environmental concerns related to economic development. The concept is particularly fashionable in Europe since the communication from the Commission to the European Parliament, the Council, The European Economic and Social Committee and The Committee of the Regions entitled *Closing the loop – An EU action plan for the Circular Economy* was sent on September 25, 2015 (European Commission, 2014). This work by the EU is heavily influenced by the so-called Stiglitz-Sen-Fitoussi report (Stiglitz,

Sen, & Fitoussi, 2009), in which GDP was criticised as an indicator of the progress of a society. The report contributed to the birth of the Commission initiative called *Beyond GDP*[1], in which a set of indicators measuring progress were developed, with the characteristic of being as clear and simple as GDP, but including social and environmental information.

The concept of circular economy is far from new though. China passed *the Circular Economy Promotion Law of the People's Republic of China* on August 29, 2008 (National People's Congress, 2008). This law only officialised existing work being carried out for years through an initiative on sustainable consumption and production, called circular economy. This initiative already accounted for improving resource use (use efficiency) and encouragement of recycling and waste reduction, anticipated the EU in this field.

Both the Chinese and European cases need to be acknowledged for recognising the need of going beyond the linear interpretation of the economic process found in orthodox economics (resources are taken from the environment, transformed into products and services by the use of capital and labour, and consumed). Both cases make explicit that progress and development of societies implies waste generation and a level of the destruction of nature. The response offered is, though, limited, as they are confident that knowledge and technical change will provide solutions, which will materialise in natural resource use efficiency improvements and recycling. As we will see, these measures are far too insufficient in their desired objectives.

The proposal of a circular economy represents just a re-invention of the concept of *sustainable development* first, and the *green economy*, later. Ferguson provides the interested reader with a deep discussion on the issue (Ferguson, 2015). Concepts that were criticised by ecologists, ecological and biophysical economists and other actors because of its lack of ambition and its semantic dilution. Nevertheless, the model being defended by the circular economy proponents is even more ambiguous. The emphasis given to certain type of *technological optimism* is very convenient to the *status quo*, as it prevents us from questioning the development model in which we are immersed, in which a crisis is defined as the lack of growth. In fact, under the illusion of a circular economy, it would seem that growth can continue forever, as we would be recycling waste into resources. In addition, we would have to be increasingly more efficient in the use of resources and would need lower quantities to generate a unit of added value. This all sounds very good at first.

[1] Beyond GDP Initiative, http://ec.europa.eu/environment/beyond_gdp/index_en.html

However, this approach has two fundamental errors, shared by the proposals for (bio-) knowledge economies. The first is that basic laws from physics, such as the Second Law of Thermodynamics are not taken into account. In one of its definitions, the law states that *every single process entails a consumption of energy*. The practical implication of the law is that even the process of recycling entails a loss of resources, because 100% recycling is not possible, and is energy intensive. The second error is not taking into account the Jevons' Paradox (Polimeni, Mayumi, Giampietro, & Alcott, 2008), which alerts us that use efficiency improvements of a natural resource do not always lead to a lower use of that resource, but, on the contrary, may lead to a higher use. A clear example is that of automobiles. Improvements in resource use (miles per gallon) did not imply lower energy use for transportation, but rather an increase in miles. The transport sector, which depends on fossil fuels for more than 90% of energy consumption, is the one where energy demand grows fastest in most of the countries (International Energy Agency, 2015). The interpretation, in terms of knowledge, is that very often new techniques and technologies derived from new knowledge translate into a higher consumption of natural resources, and not lower. Therefore, maintaining ever greater amounts of knowledge depends on the existence of gradients of available energy, while technology is directly energy intensive.

We, then, should not forget that economic growth will always imply a higher use of resources, despite all use efficiency initiatives or all the recycling programmes that are implemented, as will be shown in next section. This is the reason why we should not become enchanted by concepts like the circular economy, that deviate the debate from a true discussion on the need or not of economic growth and its consequences, both social and environmental. In a recent study on the low degree of circularity of the global economy (Haas et al., 2015), the authors state that only 4 Gt/yr of waste materials are recycled out of 62 Gt/yr of processed materials. 44% of overall processed materials are energy and food, which cannot be recycled. Another 43% of processed materials was used as construction material, leaving only small amounts of these suitable for recycling, 6% at the global level.

As reminded by Martínez-Alier, this debate goes back to discussions introduced in the 1970s (Martínez-Alier, 2015). This could be articulated around concepts such as Daly's *steady state* (Daly, 1973) or André Gorz's *degrowth* (Gorz, 1972), or around more recent concepts such as Ecuador's *Sumak Kawsay* or *Good Living*. Even Georgescu-Roegen reminded us in those same years that the purpose of the economic process was the *enjoyment of life* and not production itself (Georgescu-Roegen, 1971).

This defence of the knowledge, bio-knowledge or circular economy is not exclusive to the European Union or China. Some economies in Latin America, like Ecuador, strongly defend a knowledge-based economy in order to transition out of an extractivist economy, as President Rafael Correa, an economist, has stated several times. In the words of the Science Minister of Ecuador (Ramírez, 2014) (my translation):

> The core of the endogenous strategy of wealth generation is to convert the main comparative advantage and value source Ecuador has, from its natural and cultural biodiversity, into socioeconomic value through its contemplation (ecotourism) and the transformation of this information into knowledge and industrial goods and services (e.g. agroecology, biomedicine, bioinformatics, bionanoengineering, bioenergy, biochemistry, among others) to satisfy basic needs, guarantee rights and strengthen the capacities of each territory.

At times, it appears that the defence of these models support their immateriality, which is not true as the abundant evidence shows. Higher income levels associated to economic growth always imply higher energy and material consumption levels (Haas et al., 2015; Schaffartzik et al., 2014; Stern, 2004; Velasco-Fernández et al., 2015).

The current economic, energy and environmental crisis have questioned the very concept of economic growth and its metrics such as GDP. However, the responses we have analysed here share some deep weaknesses that need to be debated. On the one hand, degrowth proposals do not detail how to maintain the current standard of living with less resource use, or which changes in those living standards are needed. On the other hand, those who defend a knowledge-based or a circular economy omit the fact that the generation, maintenance and use of knowledge are resource intensive and need development levels that are usually preceded by high level of consumption of energy and materials, as we will discuss in the following section.

4. Discussion: Accounting for evolution and complex systems

Authors like anthropologist Joseph Tainter show how human societies, when evolving, become more complex in their organisation (Tainter, 1988). This increased complexity is not only reflected in a larger number of individuals and the heterogeneity of social roles (e.g. types of jobs), but also in an increased interconnectedness between them. This characteristics requires the rise of new organisational structures, which explains the appearance of governments, armies, police force, public administration, etc. These new

actors are no longer in charge of obtaining material resources for the functioning of society (food, energy and materials), but are purely dissipative structures, which consume resources extracted and processed by other compartments of society. The sustainability of a society depends on a balance between those agents obtaining natural resources, or hypercyclic, and those agents in charge of maintaining control and knowledge within a society, or dissipative (Ulanowicz, 1986). The new structures demand increasing quantities of resources, a reason why Tainter warns us that evolution and sustainability of a human system will always require more resources.

No doubt this statement questions the predominant predicament based on technological optimism, but is also shared by a number of researchers working on sustainability from disciplines such as physics, ecology, biology, biophysical economics or hierarchy theory (Ahl & Allen, 1996; Allen & Starr, 1982; Georgescu-Roegen, 1971; Lotka, 1956; Maturana & Varela, 1980; Murphy & Hall, 2011; Nicolis & Prigogine, 1977; Odum, 1971; Prigogine & Stengers, 1984; Varela, Maturana, & Uribe, 1974). The increase in organisational structures implies that the overhead of maintaining those structures increases as well. That is, only the maintenance of all the structures requires a growing share of all natural resources used by a society. At the same time, evolution, or the increased complexity of a society, result in a greater development of knowledge. The consequence is that developing knowledge and using it effectively in economic terms needs a society to have achieved a particular level of development, with a concrete set of organisational structures. This means that a knowledge-based economy can never be immaterial, but rather, needs a level of development of structures and human capabilities that are only possible on top of the existing ones, by consuming more natural resources.

In my opinion, the confusion regarding development models based on the generation of knowledge is not by chance. Capitalism needs to re-invent concepts continuously in order to justify continuous economic growth in a finite world. This is what happens in regard to the environment, where we have seen how the concept of *sustainable development* mutate into *green economy* and the most recent the *circular economy* promoted by China and the EU. This belief in a particular kind of *technological optimism* is very convenient for maintaining the *status quo*, as stated earlier, it prevents from questioning the current economic model, in which a crisis is defined as the lack of growth. In fact, under the illusion of the circular economy, it would seem that growth can continue forever, since we are recycling wastes into new resources. Unfortunately, reality does not correspond to this interpretation since, despite being increasingly more efficient in the use of resources to

produce economic value, the world keeps increasing consumption over time (Haas et al., 2015; Schaffartzik et al., 2014), bringing us all closer to what is call the peak of everything and the end of growth (García-Olivares & Solé, 2015).

Something similar seems to be happening with regard to considering knowledge as a driver of economic development. If we follow the Second Law of Thermodynamics we will understand that *every process entails the consumption of energy*. This also applies in the case of knowledge. It is not by chance that the strongest economies in terms of knowledge, the US, Germany, Japan and more recently South Korea and China, are those with the highest levels of consumption of energy and materials, and include some of the most advanced industrial sectors globally.

We should, then, not forget that economic growth will always imply a larger level of resource use, despite all the efficiency measures or waste recycling programmes that are implemented. This is the reason why the debate should focus on the need of growth. What kind of growth and from whom? As Nicholas Georgescu-Roegen reminded us, the purpose of the economic process should be the *enjoyment of life* and not a particular figure for GDP growth. This is the same idea behind new concepts such as *Sumak Kawsay* or Good Living in countries like Ecuador.

5. Conclusions: a quantitative debate on what, how and at which cost to degrow is needed

Some conclusions can be drawn from the discussions in this paper:

(1) Economic growth *always* implies a greater use of natural resources and energy.

(2) Economic development (and not growth) that is oriented to the satisfaction of needs, the exercise of rights and, in sum, to what Georgescu-Roegen called the *enjoyment of life,* needs to be prioritised, taking into account that, unfortunately, will also imply the use of resources and the subsequent environmental impacts that will need to be tackled.

(3) Circular economy in its current definition and its variants are not solutions, rather they should be considered as *decoys* to avoid a serious discussion of the predicament of sustainability. Waste recycling and resource use efficiency have always been present in societies, one way or another. However, the burden of our

current levels of consumption, driven in part by population, but also by or high levels of material consumption, make these strategies alone not suitable solutions.

(4) It is not clear that knowledge that is relevant for improving quality of life leads to economic growth. For instance, improvements in medical treatments that imply the disappearance of illnesses, clearly improve quality of life, but also reduce what Hirsch called *defensive expenditures* (Hirsch, 1976), and therefore GDP.

The implications in terms of public policy are the following:

(1) A discussion on the *levels of growth* is needed at international level, as suggested by degrowth proponents. However, the discussion should not only be on which are the necessary improvements to maintain our current consumption levels with lower impacts, or to calculate how much the North needs to degrow to open room for further growth in the South, but rather needs to be open to discussions which reconsider our consumption levels, perhaps in line with Max-Neef's human-scale development, with his distinction between needs and satisfiers (Max-Neef, 1991).

(2) A debate on *new metrics* is also needed, to overcome the obsession for GDP growth. Here the use of indicators oriented to measuring quality of life and resource use is crucial.

(3) The debate needs to be oriented towards *prioritising* natural resource consumption. Some uses may be expanded while others need to be restricted or directly forbidden. This will face fierce opposition by the dominant liberal approach in economics. The new metrics defended above could play a key role in this exercise of prioritising uses.

(4) *Planning* is needed more than ever, precisely because of the internal trade-offs and contradictions of development models (Alexander, 2012). Prospective planning may help in prioritising resource use if we are to work for systemic changes that guarantee sustainability. But planning requires good understanding of the nature of the problems, something currently missing.

(5) This prioritisation of resource use will bring new ecological distribution conflicts that *need to be managed*. There will be more conflicts between winners and

losers. This debate will need to answer some questions such as why? Who? And how much to grow? And above all, at which cost?

The debate remains open and valid. It is time for risk decisions that allow us to break with dynamics that only perpetuate the *status quo* of elites in power, with clear social and environmental impacts. It needs to correspond with academia and the public sector to offer solutions that need to be discussed and which come to an understanding with society as a whole. Finally, this debate, though, needs to address which activities are to be reduced, how to make it possible and who is going to bear the costs. This requires that the community of scholars working on degrowth and the knowledge economy to share the arena with those from biophysical approaches to economic development in order to quantify some of the scenarios that have been brought to discussion in recent years.

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