Technological Change and Sustainable Development A world of opportunities for the region

Carlota Pérez

Professor of International Development at the London School of Economics (LSE), United Kingdom

Anabel Marín

Researcher at the National Scientific and Technical Research Council (CONICET), the Research Centre for Transformation (CENIT), and the STEPS Centre

The transformation of natural resources from new technologies offers a wealth of opportunities for growth in the region. New information-based intangible services and products are appearing, from smart phone applications and social networking to mass data collecting (big data), the Internet of Things, 3D printing, and robotics. How to generate greater production and trade from the revolution under way, and what policies contribute to an equitable social distribution of progress.

Executive Summary

Taking into account the lessons of history, this article proposes to analyze the opportunities and challenges

for integration, trade, growth, and sustainable development in Latin America in the present historical period. The period of growth dominated by mass production, based primarily on cheap energy for transportation, electricity, and synthetic materials, and the expansion of markets for standardized products, has generated significant tensions between trade, growth, and sustainable development. At present, however, we are leaving behind the logic of mass production and moving at full speed into the information and communications technologies (ICTs) revolution, whose expansion is based on information, telecommunications, and low-cost microelectronics. In this shift many opportunities are opening up for sustainable development. In this article, we discuss these new opportunities and analyze their implications for Latin America. We argue that Latin America can, by using its historical advantage in natural resources (NRs) and the lessons learned during the import substitution period, take advantage of new technological and market opportunities tied to NRs in order to develop technological capabilities, and new activities and products that will be at the center of the new styles of production and lifestyles coming into place. We conclude that these opportunities can be exploited only through significant political and institutional innovations that may accompany the new processes unfolding.

Trade and Sustainability

The literature on trade and integration has been sending out a clear message: international trade promotes economic growth and therefore development. However, sustainable development problems associated with environmental degradation, increasing inequality and, more recently, climate change throw this relationship into doubt. If trade encourages large-scale production of products that require intensive material use (biomass, minerals, fossil fuels and metals) and/or use precarious employment for production, it is not so clear that facilitating trade leads to growth and sustainable development.[1]

In the last few decades there have been clear indications of this tension. Economic growth has been accompanied by a significant increase in the use of resources (80% in the last 30 years), huge pressure on the environment, and growing social inequality. It has been estimated that if growth continues at this pace and in the same manner, to provide the rising population with the current level of consumption of developed countries, by the year 2050 nearly three times the materials will be needed, with serious climate consequences, even if this were possible (Dittrich *et al.*, 2012). This challenge is perceived by some authors (Schneider, 2011) as a conflict between trade, growth and sustainable development, which can only be overcome by reducing consumption, trade and eventually growth.

In this paper, we present a different vision. We take into account the lessons of history to analyze the opportunities and challenges for integration, trade, growth and sustainable development, in the context of the opportunities that technology, institutions and market forces are opening up in this specific period.

Successive changing opportunities

Every half century, the global economy is transformed by a technological revolution (Schumpeter 1939). Every one of these revolutions combines new multipurpose technologies, an infrastructure network that extends and accelerates trade and communications, and a new paradigm of optimal organizational and innovative practice (Pérez, 2002 and 2004). The analysis of the processes of dissemination and assimilation of each wave of technological change enables us to observe a regular sequence: emergence, financial bubble, collapse, recession and golden age, which lasts until the potential is exhausted, creating the conditions for the emergence of the next revolution (Pérez, 2002 and 2004).

1

Source: Pérez (2002 and 2010b).

This vision of history allows us to characterize the present moment as the turning point in the dissemination

of the ICT revolution. Ahead is the possibility of a golden age. The global infrastructure is already in place and we have learned the paradigm (the logic) that guides its maximum exploitation; everything is set to transform all the other industries. It remains, however, as in equivalent periods of previous revolutions, to indicate the direction of innovation to achieve a complete and successful transformation (Mazzucato & Pérez, 2014). The moment offers opportunities for different regions and countries, depending on their previous context and level of development (Pérez, 1985 and 2001), but possibilities of sustainable growth exist for all countries and cannot be wasted. Success in each case depends on identifying opportunities and making the appropriate institutional innovations to take advantage of them.

We will first look at the nature of the new technological opportunities associated with ICTs and sustainability, as well as the signs that they are being utilized at global level. Then we will look at the context and the possibilities for Latin American countries to initiate a profound change in their development strategies on the basis of these new opportunities, the number of resources, and previously accumulated technological capabilities. Our vision is positive in terms of a strategy of "technologization" of natural resources in the context of green growth and the participation of all the territory and population in the generation of wealth and the healthy enjoyment of this, although we understand that the obstacles are many and varied and are likely to require appropriate institutional innovations. We will briefly touch on them in the conclusion.

Growth in the ICT age

At present we are leaving behind the mass production revolution, also called the Fordist or Automobile revolution, and moving at full speed into the ICT revolution. The Fordist paradigm was based on cheap energy for transportation, electricity and synthetic material, while the current ICT paradigm is based on information, telecommunications and low-cost microelectronics. In what follows we discuss how in this shift many opportunities for sustainable development are opening up.

Changes on the production side

In the first place, the low cost of access to information and telecommunications is expanding the possibilities of generating an infinite number of new information-based intangible services and products, such as countless smart phone applications and social networks, mass data collecting (*big data*), the Internet of Things, 3D printing, robotics, etc. But growing innovation in intangibles isn't only happening in ICTs, but rather these technologies serve to ensure that each industry can make its own transformation, increasing the services component, replacing tangible products with intangible ones and rethinking the whole to take advantage of the new potential. This has been happening in the distribution of film, music, journalism, and books; in medicine, personal services, education, etc. An indication of the magnitude of these changes is the increase in absolute and relative trade in intangibles (Figure 1).

Figure 1: Share of intangibles in total exports *

Selected Countries

9

* Note: Intangibles included: maintenance and repair services, insurance and financial services, charges for the use of intellectual property, telecommunications, computing and information services, and other business services.

Source: Bureau of Economic Analysis, UNCTAD.

Second, as ICTs penetrate other industries, they encourage telecommunications at the expense of commuting, and favor more flexible production models, contributing to savings in energy and materials. Digital controls and design, and computer-assisted production can, among other advantages, reduce energy consumption, the

use of materials, and pollutant emissions. With ICTs, materials can be better understood and redesigned to make them more closely specified to their use, allowing less material per product unit (e.g. graphene, a nanomaterial of a strength almost equivalent to steel, in extremely light, thin sheets). It is also possible to refine processes and logistics, as well as combining disparate technologies, optimizing transport routes and forms, integrating value chains and all kinds of networks to minimize energy use and attain green goals.

The boom in environmental certifications (Box 1) and the growth in successful experiments in the circular economy (Box 2) show an increasing shift in production technologies. The same is true of increased efficiency in the use of resources as evidence of this shift, at least in certain parts of the world (Box 3).

Box 1. The green economy in expansion: increase in environmental certifications

The proliferation of environmental certifications in the world economy is a manifestation of the harnessing of these new opportunities by some companies and institutions. The manufacturing sector, responsible for 35% of electricity usage, 20% of global CO2 emissions and a fourth of the use of resources, has increased ISO 14001 environmental management certifications by over 2000 percent since their launch in 1996, from under 13,000 to over 300,000 certifications per year globally.

Figure A: Growth rate in environmental certifications

1999-2003

10

Source: ISO.

Box 2. The green economy in expansion: experiments in the circular economy

The circular economy proposes to replace the current system of linear "production, consumption and disposal" with a circular one in which resources are not discarded but reused in another process of production or consumption.

The MacArthur Foundation (2014) has estimated that implementation of the opportunities offered by the circular economy on a global scale could generate more than US$1 billion in annual material savings and a US$1 trillion profit for the global economy.

Some of these businesses have been operating for some time.

The garbage industry in countries such as the United Kingdom is already beginning a serious transition from the old linear model of truck and waste disposal towards a focus on resource management, where the industry acts as a supplier of raw materials and energy for the rest of the economy (SITA, for example, is developing uses for commercial non-recyclable material as fuel in cement kilns; Viridor supplies the Coca-Cola plant with ECO plastics from recycled bottles.)

Some companies have noticed customers' environmental interest and have opened sustainable product lines. One example is Ricoh, a specialist in office solutions, document management services, and printing products, with the Green Line label of products designed and manufactured for recycling or reuse. The line is exported to six European countries, has a better profit margin, and already represents between 10 and 20% of sales.

In China, Trina Solar, one of the world's largest solar panel manufacturers, has begun to develop technologies and standards for recycling photovoltaic modules that are in their final stage of use, in order to reuse glass

and electrical and electronic waste.

Box 3. The green economy in expansion: Improvements in efficiency in the use of resources

The productivity of materials, calculated as the ratio between real GDP and the extraction of materials measured in tons of raw ore or crops, has increased in almost all regions of the world in the last three decades. To a greater extent in European countries and United States, and to a lesser extent in Africa, Oceania and Latin America, the use of materials has also decreased slightly. However, they still have a long way to go, with material productivities significantly lower than those in Europe and United States (US$233, US$502 and US$381 per tonne, respectively).

Figure B: Material productivity of resources

In US$ per tonne

11

Source: SERI/WU Global Material Flows Database.

Source: Sustainable Europe Research Institute – SERI http://seri.at/

Lastly, ICTs favor more decentralized and flexible production and distribution models, making it possible to meet varied and specific needs, with a variety of production and market scales. The resulting hyper-segmentation of markets, activities and technologies (Pérez, 2010a) suggests that instead of the traditional goal of homogeneous large-scale production, companies can find advantages in multiple demand segments, which is also tied to growing lifestyle changes. Figure 2 shows examples of how the markets of all kinds of products and services have been fragmented by specialization and adaptation, from standardized markets to the most differentiated niches. In the lower left corner showing commodities subjected to strong price competition, not only are raw materials shown but also standard manufactured products and more common services such as beach tourism. In contrast, the special materials, organic food, and food adapted to the customer in the upper areas and right-hand column of the Figure, are placed alongside the manufacturing of luxury goods in profitability and price stability.

2
3

Source: Based on Pérez (2010a).

All this favors an economy of diversity with a vast range of possibilities for development models that integrate large majorities in the benefits of growth (see section 4). The rapid growth of niches such as organic food is a manifestation of these new possibilities.

Changes on the demand side

Although there is much promise, what is technologically feasible can only be exploited in a cost-effective manner when it meets a solvent and dynamic demand.

Each technological revolution has led to a radical shift in consumption patterns and ways of life compatible with the range of products molded by new technologies. The changes run very deep, from the mid-nineteenth century Victorian Way of Life to the cosmopolitan style of the Belle Époque and the American Way of Life of the twentieth century To give an idea of the intensity of the changes involved in each of these transitions it is enough to examine the transformation of home life between these two periods (see Figure 3) which not only changed the way of life of the bourgeois and middle-class strata in almost all countries, but also that of

the great majority of workers in the advanced countries.

Figure 3: The emergence of the American Way of Life
From the *Belle Époque* to Fordism

4

Source: Based on Pérez (2009) (OME).

It is worth wondering now whether it will be possible to take advantage of the power of ICTs to create a sustainable global economy with a variety of lifestyles and consumption patterns that are environmentally friendly, that do for most of the whole world what mass production and post-war policies did for most of the advanced western world. The process of change in ways of life with new technologies has always been slow and tends to begin among the classes of higher income and education to then pass down to other classes through imitation and as prices fall. These elites are already adopting a more sustainable way of life and marking the direction of the shift in values (Box 4)

Box 4 : The new values of the elite

- Gourmet food is based on fresh ingredients
- Natural materials are better than synthetic
- Minimalist interior design is a sign of good taste
- Organic fruits and vegetables are healthier
- Multipurpose is better than unifunctional
- Small tends to be better than big (as in ICT products)
- Exercise is a pleasure and important for wellbeing
- Bicycles are chic
- Solar energy is a luxury, as are electric cars
- Working from home is possible and preferable
- The interactivity of Facebook is better than the passivity of watching TV
- Communications, shopping, courses, and entertainment on the internet are better than traditional forms, etc.

Faced with this, the crucial question for the countries of Latin America is whether the rationalization of the use of materials and energy and the changes in demand spurred by ICTs threaten their trade opportunities with NRs. We will address this question in the next section.Obviously, the force of the energy-intensive and high waste life model is still great, but air and water contamination problems are forcing change in emerging countries, especially in China. Also in the advanced countries a process is appearing of using ICTs in an environmentalist direction, modifying traditional patterns of consumption (Box 4). All this will increasingly influence patterns of production, especially if policies are adopted that clearly encourage investment in the green economy.

Box 5: Growth in the sharing economy

The sharing economy encompasses various forms and products: house and lodging swaps, loan of utensils and tools, collective shopping, collaborative consumption, shared ownership, shared value, cooperatives, co-creation, recycling, upcycling goods (process of converting disposable materials or trash into products), redistribution, etc.

There is also a shift in the possession of access, not only through collaborative exchanges but also rental systems, users' clubs, etc.

The number of passengers who instead of buying a car choose car sharing has increased over 1000% in the last eight years; the number of passengers who share bicycles (bike sharing) more than 7000%.

One of the icons of the collaborative economy is Airbnb, which makes it possible to rent out one's own home to travelers instead of hotels. It has grown phenomenally, with over 4 million users in just six years. The company doubled its revenue in a year, reaching US$250 million in 2013.

In terms of the threat to traditional jobs and businesses, some of these models of consumption have raised protests and controversy. Society will need to manage conflicts and innovate in respective regulation.[2]

Natural resources as innovative sectors

Opportunities for development are a moving target (Pérez, 2001). Growth or development processes occur when a technological opportunity is combined with market potential and previously acquired skills, in a context of static and dynamic comparative advantages. The combination of these factors occurs differently in different periods and in each region or specific country.

In previous studies (Pérez, 2009; Marín *et al.*., 2015) we have argued that ICTs and globalization represent for Latin America a unique technological opportunity in the current period, together with the exploitation and processing of NRs, combined with a market opportunity in the growth of material and food requirements in emerging countries, especially in Asia. Taking advantages of this situation would not imply "moving away from raw materials," as was the watchword of import substitution, but on the contrary using them as a platform for technologization, industrialization and innovation.

Past arguments about the limits to technology and NRs demand no longer hold water. NRs are becoming knowledge and innovation-intensive.[3]

There are at least three factors driving these areas: first, the growth in market volume is leading to more remote sites and less favorable conditions that require great feats of engineering to extract oil from deep water, irrigate the desert for agriculture, desalinate sea water, etc.

Second, ICTs are providing the conditions for innovation in products and in the productivity of processes, from the use of geopositioning to identifying fishing sites or locating herds, to sophisticated instrumentation for irrigation, sowing, fertilization, etc., to the design of new materials or experimentation with chemical processes through compu-synthesis. Life and material sciences, also using ICTs are producing impressive advances in biotechnology, nanotechnology, water chemistry, green chemistry, etc.

Third, the hyper-segmentation of markets discussed above opens up possibilities for innovation oriented at covering increasingly specific and increasingly demanding needs. This in addition to the growing number of consumers who prefer sustainable products (gourmet, fair trade, organic, etc.) and the likely increase in relevant regulations.

In addition to this leverage effect of innovation in NRs there is the opening-up that new east-west geopolitics

offers the developing world, whose competition for resources makes it possible to negotiate better conditions of technological and learning participation. This can be further leveraged by the new operational logic of global companies and their interest in the use of local capacities, which opens up new possibilities for outsourcing and alliances at the local level (one example is BHP and Codelco's supplier development program in Chile).[4]

Learning accumulated in previous stages can contribute positively to the use of these opportunities.

Unexpected learning

The model of import substitution industrialization (ISI) in Latin America established a positive-sum game between governments that advocated development, and mature Fordist industries in the North (Pérez, 2010a). As Figure 4 shows, the heart and focus of the effort was assembly under protectionism and subsidies which guaranteed the profits of foreign and local companies, while at the same time catalyzing the economy in general, as a source of job creation at all levels and in mobilizing demand for services and consumption. The resulting levels of training and complexity varied greatly, but the characteristics of ISI strongly marked the productive fabric and culture of the business world throughout the region (Pérez, 1996).

Figure 4: Model of import substitution industrialization in Latin America

5

Source: Based on Pérez (1996 and 2010b).

Given that production was protected and destined for the internal consumption market, there was none of the pressure that Asians experienced in reaching global quality and price. This discouraged learning and technological development in the assembly industries (manufacturing), but their demand mobilized the accumulation of capabilities in the infrastructure services (electricity, telephones, ports, roads, construction) and in the production of various inputs (cement, paper, cardboard, packaging, printing, bottles, cables, etc.) and, in the most advanced countries in the region, a capital goods industry developed, generally oriented at process industries, agriculture, etc. The multiplying learning effect did not occur in the manufacturing and assembly line industries, but rather in the processing industries, while it continued and grew stronger in trade, banking, agribusiness and, especially, in traditional natural resources (NRs), whose income made it possible to finance subsidies to industry, education and health policies and science and technology infrastructure (Pérez, 1996 and 2010a). Some activities required and contributed to creating an educated middle class, with could be used for a well-oriented development process.

In the following periods, in a scenario of increased economic openness, it was the NRs assembly industries that grew the most, favored in many cases by advantages in terms of location and special systems favorable to the development of capacities (Kosakoff, 2000).

It is worth noting the contextual reasons that led to the accumulation of skills and knowledge in the areas associated with the main natural resources of each country. In the first place, the specificity of the local resource forced the development of a certain level of experience and technological capacity in situ (Warhurst, 1994). On the other hand, efforts to develop the capital goods sector or consultancy capacity in engineering found in large NR companies the most likely market. Lastly, "research institutes and universities in the public sector often had more success in establishing agricultural extension services or in obtaining contracts with mining companies in the public sector, than in establishing links with private manufacturing companies, molded by the context of ISI."[5]

In our view, these newly acquired skills, along with learning in the service and processing industries during and after the process of import substitution, are the cornerstones for the leveraging of the current

technological opportunity, in connection with NR endowment.

Institutional Innovations

The question remains of whether environmental policies would reduce the volume of demand affecting producers. The tentative answer is that the pace of expansion of the raw materials markets will depend on the balance of two concurrent processes: the decline in the consumption of materials per product unit, and the full global development that this relative decline makes possible. The incorporation into consumption of the whole developing world, with environmentally sustainable life patterns, could maintain the markets for countries producing food, materials, and energy, on the condition of innovating in response to their changing requirements, and in one clear direction: that of green growth.

Just as carrying out import substitution industrialization required a centralized developmentalist state and a set of regulations and appropriate incentives, at present, when innovation is the essence of strategy, it will take a far more decentralized process that promotes the consensus, with space for creativity and full participation and with technified government institutions capable of leading the convergence process. This means adequate institutional innovations that suit the handling of the new context.

It is a question of starting from the main NRs of each country and strengthening existing capacities, building a network of innovation (Figure 5) around them that includes everything from capital goods, inputs and services, to processing and shipping. The goal would be to raise the training of the whole and to intensify the network in terms of participants, levels and variety of paths in processing downstream (A1, A2 and B1, B2 in Figure 5) and in the forms of collaboration between companies and universities and other knowledge sources.

Figure 5: Promoting an innovation network around natural resources

6

Source: Pérez *et al.*, 2014.

Interactions in the innovation system (Lundvall, 2010) should be directed towards improving the export profile in three main directions:

1. Move forward in traditional processing downstream, adding new sustainable directions;
2. Move upstream to capital goods and services appropriate to the new directions and towards special (biotechnological, chemical or natural) inputs; and
3. Innovate in specialized products for demanding markets, whether industrial or food inputs, adapted to the requirements of a productive world aimed at sustainability and consumers increasingly aware of the importance of a healthy lifestyle and diet (from cosmetics and medicines to organic and gourmet foods.)

The process would incorporate traditional, domestic, or foreign companies connected with a set of new high technology firms capable of raising the value of the export profile of the former and also going their own way (see Figure 6).

Figure 6
High-tech local services networks for technological modernization of the export profile of natural resources

7

Source: Pérez, Marín, Navas Alemán (2014).

In Latin America there are more and more examples of companies that are already headed in this direction, some working for the agricultural sector, others for mining and others for agribusiness.[6]

A socially inclusive model

We understand however that since the process industries such as metallurgy, chemistry and agribusiness do not employ as much labor as the manufacturing or assembly industries, it is important to develop a two-pronged strategy that combines the global specialization effort, in a range of technologies around selected natural resources in each country, with the generation of wealth in every corner of the territory by taking advantage of the hyper-segmentation of the markets to target local, national, and global niches (Pérez, 2010a and Figure 7).

This model implies the stimulus to the entrepreneurial attitude of the entire population and their participation in consensus-building processes, including workers and residents of towns where NRs activities are organized, handing the affected groups fairly, inclusively and with compensation.[7] This level of responsibility and transparency in the exercise of power is facilitated by the opening-up and technical means provided by ICTs.

Box 6 : Sustainable local ventures

The Coopsol Cooperative, located in the province of Santiago del Estero (one of the poorest regions of Argentina) specializes in the production of organic and conventional monofloral and multifloral honey.

In particular, its sales are concentrated in exports and only a small fraction of output is destined for the domestic market. Thanks to its differentiated products (due to their organic origin and the diversity of the flora of the producing region) the Cooperative has been able to place products in several countries, concentrating its sales in Germany and United States.

The expansion of organic production in the cooperative has been of great relevance in starting to replace the conventional (more toxic) production method and being able to access (through international quality certifications) the new European and American organic market. The cooperative has generated a very positive social impact: through a partnership of more than 150 rural families in Santiago, it provides decent employment in the region; it has trained rural workers who have begun to produce honey using new organic techniques. It has also certified fair trade, which ensures that the partner families have control over the entire value chain and profit-sharing from honey income.

See: Marín & Vila Seoane (2012).

The right organization

In this study we have questioned doubts about the possibility of “green” growth and we have argued for the new innovative potential of natural resources as a result of the ICT revolution, and their capacity for being diverted toward trade and sustainable development. Based on this, we have also seen the window of opportunity exploitable by Latin America by innovating around its varied natural resource endowments in a socially inclusive model. We have also argued that the lessons learned during the ISI in NR activities, in their suppliers, and in the processing industries, can serve as a support base to take advantage of this opportunity.

Historical experience suggests that the successful utilization of technological opportunities depends on organization and appropriate policies to achieve convergent actions between government, businesses and society (Pérez, 2002). In this case, given that innovation is key, it is not possible to impose the direction from above, but neither can the market alone establish a common course. It will also be necessary to innovate in mechanisms to achieve consensus and to incorporate the whole of society into the strategy. It will require a

great educational effort, in formal education and within each company and each governmental institution, at local and national level. To achieve both it will be necessary to take full advantage of the power of communication and participation that ICTs provide.

Once the information revolution is installed one can assume that future revolutions will be based on it and that government, companies and society will depend on the proper handling of knowledge. The transformation of the public sector will not be easy, but only by doing this can full advantage be taken of this opportunity and those to come.

Notas

[1] See (Gallagher, 2009; Lottici et al., 2013; Copeland & Gulati, 2003; Wilk, 2005; van Beers & van den Bergh, 2000).

[2] See http://www.thepeoplewhoshare.com/blog/what-is-the-sharing-economy/#sthash.CVWRUASj.dpuf.

[3] See Pérez (2009), Marín et al. (2015), Andersen (2012), Dantas (2011), Lizuka & Katz (2010), Morris, et al. (2012), Kaplinsky et al. (2012), Marín & Stubrin (2015), Figuereido (2010).

[4] See: http://desarrolloproveedores.cl/etiquetas/bhp-billiton/.

[5] Pérez (1996, p. 361).

[6] See the case studies for the Trazur, Aguamarina, Beraca Sabará, Bioceres, and Teleios in this issue.

[7] See Newell, 2015, for a description of cases.

Bibliografía

Andersen, A. D. 2012. “Towards a new approach to natural resources and development: the role of learning, innovation and linkage dynamics,” in: *International Journal of Technological Learning, Innovation and Development,* 5(3):291-324.

Benavente, J. M. & Goya, D. 2012. “Project: Opening Up Natural Resource-Based Industries for Innovation: Exploring New Pathways for Development in Latin America. Case Study: Aguamarina.” September.

Copeland, B.R. & Gulati, S. 2003. “Trade and the Environment in Developing Economies.” Initiative for Policy Dialogue Working Paper Series.

Dantas, E. 2011. “The evolution of the knowledge accumulation function in the formation of the Brazilian biofuels innovations system,” in: *International Journal of Technology and Globalisation,* 5(3):327-340.

Dittrich, M.; Giljum, S.; Lutter, S.; & Polzin, C. 2012. *Green Economies around the World? Implications of Resource Use for Development and the Environment*. Vienna: Sustainable Europe Research Institute (SERI).

Figueiredo, P. N. 2010. “Discontinuous innovation capability accumulation in latecomer natural resource-

processing firms," in: *Technological Forecasting and Social Change,* 77(7):1090-1108.

Gallagher, K. P. 2009. "Economic globalization and the environment," in: *Annual Review of Environment and Resources*, *34*, pp. 279-304.

Galvão, A.; Juruá, M.; & Esteves, L. 2011. "Project: Opening up Natural Resource-Based Industries for Innovation: Exploring New Pathways for Development in Latin America. Sectorial Report: The Amazon Region and the use of its biodiversity." June.

Kaplinsky, R.; Farooki, M.; Alcorta, L.; & Rodousakis, N. (Eds.). 2012. *Promoting Industrial Diversification in Resource Intensive Economies: The Experiences of Sub-Saharan Africa and Central Asia Regions*. Vienna: UNIDO.

Kosakoff, B. 2000. *El desempeño industrial argentino más allá de la sustitución de importaciones*, Buenos Aires: ECLAC.

Lizuka, M. & Katz, J. M. 2010. "Natural resource industries, 'tragedy of the commons' and the case of Chilean salmon farming." UNU-MERIT, Maastricht Economic and Social Research and Training Centre on Innovation and Technology.

Lottici, M. V.; Galperín, C.; & Hoppstock, J. 2013. "El 'proteccionismo comercial verde': un análisis de tres nuevas cuestiones que afectan a los países en desarrollo," in: *Revista Argentina de Economía Internacional*, 1:39-64. February.

Lundvall, B. Å. (Ed.). 2010. *National systems of innovation: Toward a theory of innovation and interactive learning,* Vol. 2. Anthem Press.

MacArthur Foundation. 2014. *Towards the Circular Economy*, Web Report. Ellen MacArthur Foundation.

Marín, A.; Navas-Aleman, L.; & Pérez, C. 2015. "Natural Resource Industries as a Platform for the Development of Knowledge Intensive Industries:, in: *Tijdschrift Voor Economische en Sociale Geografie.*

Marín, A. & Stubrin, L. 2015. "Oportunidades y desafíos para convertirse en un innovador mundial en Recursos Naturales (RN). El caso de las empresas de semillas en Argentina." Working Paper CENIT. Buenos Aires.

_____ & Van Zwanenberg, P. 2014. "Developing capabilities in the seed industry: which direction to follow?" SPRU Working Paper Series, SWPS 2014-12. June.

Marín, A. & Vila Seoane, M. 2012. "Project: Opening up Natural Resource-Based industries for Innovation: Exploring new pathways for development in Latin America. Case Study: Cooperative COOPSOL Ltda." October.

Mazzucato, M. & Pérez, C. 2014. *Innovation as Growth Policy: the challenge for Europe*. Working Paper No. 2014-13. SPRU-Science and Technology Policy Research, University of Sussex.

Morris, M.; Kaplinsky, R.; & Kaplan, D. 2012. "'One thing leads to another' – Commodities, linkages and industrial development," in: *Resources Policy, 37*(4):408-416.

Newell, P. 2015. "The Politics of Green Transformations in Capitalism," in: Scoones, I.; Leach M.; & Newell, P. (eds.) *The Politics of Green Transformations*. Oxford: Routledge/Earthscan.

Pérez, C. 1985. "Microelectronics, Long Waves and Technical Change: New Perspectives for Developing

Countries," in: *World Development,* 13(3):441-463.

_____. 1996. "La modernización industrial en América Latina y la herencia de la sustitución de importaciones," in: *Comercio Exterior*, 46(5): 347-363. May.

_____

_____. 2002. *Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages*. Cheltenham: Edward Elgar.

_____. 2004. *Revoluciones Tecnológicas y Capital Financiero: La Dinámica de las Burbujas Financieras y las Épocas de Bonanza*. Mexico: Siglo XXI.

_____. 2009. "Long-run economic transformation after the crisis: Technology, globalisation and the environment," in: *OME Annual Report 2009-2010.* ACC1Ó, Government of Catalonia. pp. 79-88.

_____

_____. 2010b. "Technological revolutions and techno-economic paradigms," in: *Cambridge Journal of Economics,* 34(1):185-202.

_____. 2011 "Hacia la PYME latinoamericana del futuro: Dinamismo Tecnológico e Inclusión Social," in: Leone, A. (Ed.). *Compendio Conmemorativo del 35 Aniversario del SELA.* Caracas.

_____; Marín, A.; & Navas-Aleman, L. 2014. "El posible rol dinámico de las redes basadas en recursos naturales para las estrategias de desarrollo en América Latina," in: Dutrénit, G. y Sutz, J. (Eds.). *Sistemas de Innovación para el Crecimiento Incluyente: La Experiencia Latinoamericana*. México: Foro Consultivo Científico y Tecnológico. pp. 347-377.

Rodrik, D. 2004. "Industrial Policy for the Twenty-First Century." CEPR Discussion Paper No. 4767.

Schneider, F.; Martinez-Alier, J.; & Kallis, G. 2011. "Sustainable degrowth," in: *Journal of Industrial Ecology*, *15*(5):654-656.

Schumpeter, J. A. 1939. *Business Cycles*. Philadelphia: Porcupine Press.

United Nations Environment Program (UNEP). 2013. *Green Economy and Trade – Trends, Challenges and Opportunities*.

van Beers, C. V. & van den Bergh, J. C. 2000. "The Impact of Environmental Policy on Foreign Trade: Tobey revisited with a Bilateral Flow Model." Tinbergen Institute Discussion Paper 00-069/3.

Warhurst, A.

Wilk, D. 2005. "Comercio y medio ambiente en América Latina y el Caribe: prioridades y retos." Paper commissioned by the Environment Network of the Regional Policy Dialogue for the IV Hemispheric Meeting celebrated July 19, 2005. IDB. December.

See more about **New-New Integration**

- Current Issue
- Previous Issues
- Contact Us
-

- Es
- Download PDF

×

Contact us

Full Name
Email
Comments
Send
×

Search

Type here Search
Search
×

×

Videos

- Journal **#40**
- Sections
- Front Page
- Prologue
- Structural Transformation
- Magnetic Trade
- Complementary Economies