
Wealth creation in developing countries: linking techno-economic-social networks

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Abstract: Some European countries have benefited from programs involving the creation of alliances of techno-socio-economic networks. In developing countries, their competitiveness based on industrial clusters are non-existent because of their poor regional enabling conditions required for assembling complex organisational interactions. To help alleviate this situation, a 'wealth creation based on innovation and enabling technologies' model (WIT) was developed. Within this framework, the economic growth is articulated by a systemic enabling environment, capable of supporting network economies, industrial ecosystems and regional innovation systems, with a purpose: to transform regions with scarce resources, hostile conditions and poor associativity into poles of regional attractiveness and competitive clusters of companies capable of producing high economic value strongly inter-related with the social and environmental capital in their communities. A more recently version of the WIT model, was developed, which adds sustainable wealth creation, called SWIT, which articulates all the stakeholders of the biosphere system of capitals.

Keywords: technology enabling environments; network economy; systemic innovation poles; regional innovation systems; sustainable wealth creation; developing countries.

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1 Introduction

“More and more economies that are purely based on the market will become economies of access... More reciprocity and trust will be required to achieve an effective associativity ... global commerce is becoming increasingly dense and accelerated. No enterprise can compete effectively as an autonomous agent. Competition will occur more and more in the form of clusters.”

– (Rifkin, 2004)

Developing countries (DCs) have been widely diagnosed by a large number of international agencies and organisations, deploying indicators, data, and recommendations that show large discrepancies between developed and undeveloped regions. Most of these stem from the fact that mechanisms that work in industrialised countries are being transferred, without considering local conditions, resources, values, or natural environments (Scheel and Parada, 2008). There are no mechanisms that force the markets, technological processes and public policies to converge effectively under hostile conditions. The competition against transnational conglomerates and large monopolies is based on ancient practices and obsolete business models (Scheel and Parada, 2008). The pyramid’s base (Prahalad, 2004), as well as the social gap, are becoming wider and wider and it is not being handled with effective structures and with the creation of win-win equitable returns among all the participants.

On the basis of several cases observed (Scheel and Pineda, 2011), it seems that the worst problem of DCs is that they are immersed in several historical paradigms, such as: irrational exploitation of their limited resources (natural, physical, knowledge and relational capitals) with minimum value-added practices; adopting, almost by decree obsolete practices, inefficient technologies, ineffective economic models, and/or political models of other countries with purely reductionist and myopic strategies; their inability to associate themselves with large networks of economic value and social interest; distrust, which prevents them from forming capital systems (human, economic, social, public, environmental) in a joint win-win process for everyone; and, perhaps one of the most limiting problems, their inability to practice an unbiased, uncorrupted and transparent rule of law for the protection of property (physical and intellectual), enforcement of contracts, and alignment of industrial public policies with the wellbeing of the community.

In addition, the businessmen, enterprise, and public institution stereotypes are operating autonomously, isolated from the rest of society, destroying the possibility of intra-organisational relations with atomised, reductionist and disjointed goals for any regional plans, and making it impossible to have a long-term common enterprise-industry-region world-class vision (Scheel and Parada, 2008).

Bell and Albu (1999) establish that 25 years of research in countries such as Brazil, Argentina, Mexico, Korea and India have accumulated a large body of understanding, which suggests three broad affirmations. First, analysis of change in a firm’s production technology must encompass a great deal more than just its machinery-embodied technology because technology is a much more complex bundle of knowledge, with much of it embodied in a wide range of different artefacts, people, procedures and organisational arrangements. These embodiments of knowledge include at least the following: product specifications and designs; materials and component specifications and properties; machinery and its range of operating characteristics; operating procedure

and organisational structures needed to integrate these elements into an enormously variable range of different production systems.

Second, there is no sharp distinction between innovation and diffusion. Very few components of production technology are simply acquired and then brought into use according to a standard, which is replicated from previous applications. Even in cases where the introduction of some element of new technology involves a fairly close approximation to such non-creative technology, the interactions with other elements of technology in the production system typically require creative problem-solving and innovative re-configuration of at least some elements in the overall production system.

Third, external sources of technology are not limited to machinery suppliers. Customers, for instance, may be much more important sources of technology, providing not just knowledge about product specifications, but also a wide range of other elements, like operating procedures and knowledge about the properties of materials.

Nevertheless, to provide a clearer framework for this aspect, it is useful to focus on two authors. Rabellotti (1995), who carried out research in the footwear industry in the cities of Leon and Guadalajara, Mexico. She found that their technological performance was very poor, and that this was associated simply with the lack of a domestic capital goods sector. Besides, there was little exploration of why these clustering firms' capabilities to manage the opportunities and threats created by technical changes were so weak. And the other author is Visser (1999), whose research was in the garment manufacturing in Lima, Peru. His analysis dwells on the relationship between productivity performance and static linkage effects. Furthermore, there is a conceptual emphasis on the dynamic functions of the firm, and the dynamic linkage effects of clustering.

After analysing cases from different countries in Latin America, it can be observed that, in essence, great value and differentiation need to be produced in various ways. One option is leveraging the natural resources that can be currently found in regions that are economically less fortunate, and empowering them with an "*accelerated relocation of resources to greater value zones*". Another possibility is transferring the results of expensive research conducted in countries that already have a culture and the infrastructure to implement it, by "*aligning them through innovation cycles*" of greater value; or by generating '*glocalisation*¹ *cycles*' to leverage local production in competition with world-class specifications in global arenas as well as to bring world class products/processes into local markets that have limited regional conditions necessary for their production, but are attainable at local prices (Scheel and Pineda, 2011). This local allocation of the production is becoming a common trend of large corporations, towards a worldwide economic nationalism of the global value chains (Ritzer, 2003).

Based on these premises, the limiting paradigm of historical determinism must vanish, and a new model must be created, made-to-fit the 'regional-local' requirements. From its conceptualisation it should be based on the resources, conditions, processes, relationships and local values prevailing in each region. All that, taken together, can turn the local competing parties into innovative *collaborative poles* with the potential to compete at massive global levels but, at the same time, able to create and share a more equitable social capital and a more sustainable environment.

To reach these levels, scarce resource capabilities, autonomous practices, hostile and low profile conditions and poor associativeness mechanisms, need to be transformed into practices of great value, so that enterprises (the true producers of economic value) can

generate *cycles of increasing value returns* (Arthur, 1990) and *network economies*, ..., forming highly attractive, competitive and productive poles.

Developing this synergy among stakeholders was the main motivation for creating the *WIT model*² (*wealth creation and sharing, based on innovation and enabling technologies*), which aims to achieve sustainable prosperity for regions that have not the proper conditions to attract considerable foreign funds, or for industries that operate under hostile conditions, or enterprises with scarce resources, that are not very productive and work within an isolated scheme of development. The WIT model is based on three pillars: a strong industrial ecosystem infrastructure; a supportive innovation system; and the explosive value generation of network economies. It has been specially designed to foment, strengthen and capitalise associativity relations, currently very weak, among all members of the economic and social systems in developing regions.

The end purpose of the WIT model is to create 'systemic' *poles of innovation and competitiveness*, through leveraging and articulating: cluster-readiness regions, capable of attracting new entrants and empowering their industries, of integrating the key players, of becoming more competitive under global standards, of effectively attracting multiple enterprises that become more and more productive through compatible and high-performance processes that can transform scarce local resources into high-value returns, comparable with the standards of successful regions and, at the same time, be associated with the development of regional social benefits under a sustainable environment.

2 Assembling the WIT model

It seems that world organisations dedicated to regional development, banking institutions, NGOs, and important consulting companies have had the faculty to diagnose the performance of DCs, their transparency, their productivity, whether they are *e-readiness* or not, or if are sustainable or not. However, very few proposals from these organisations are designed to develop programs to improve the low-level performance of these regions. On the contrary, many consultants and financing organisations try to 'transplant' models that have worked in successful economies, with few alterations, to experiment with how they fit into DCs; or through NGOs, they develop programs that continue to subsidise incompetence, bureaucracy and the promotion of comfort areas where enterprises and entire regions have remained in a state of inactivity and low productivity for decades, without accomplishing substantial changes.

The high complexity and dynamism of industrialised economies and their erratic performance³ have greatly influenced countries that are excluded from this high-returns group, and forced them to develop alternative innovative mechanisms, like creating dissipative structures (concept coined by Nobel Laureate Ilya Prigogine), where new conditions and capacities are developed when a critical situation affects the communities and new practices evolve producing higher value levels, even when they are not first-class players. Thus, DCs must develop special strategies and policies for the proper management of their relationships. Such is the case of the digital gap with industrialised countries that is becoming a real *digital development gap* for underdeveloped regions (Scheel and Pineda, 2011). This has forced some of these countries to create totally

different schemes of operation non-existent in industrialised ones. Such is the case of cellular banking in Africa (<http://www.safaricom.co.ke/>).

What is the WIT model?

It is a systemic approach, designed to create the necessary and appropriate conditions to make it possible for industrial sectors and their regions to articulate enabling environments, capable of empowering enterprise core capabilities and industrial drivers, and of aligning all-important relationships to move towards a greater common vision of regional ecosystem prosperity.

The WIT model helps to create poles of innovation and competitiveness (Scheel, 2002), located where an established innovation culture does not exist, or entrepreneurship is not a common practice, or clustering as an associativity practice does not exist, or the proper enabling conditions (technological, human, economic, public or social) are poorly linked. For these cases, the pole can provide an enabling environment where the enterprises can create synergetic cycles of increasing economic returns, and, thus, be able to insert themselves into global value systems and become part of inclusive network economies that promote a win-win situation for the economic engines and social benefits for all the region's participants.

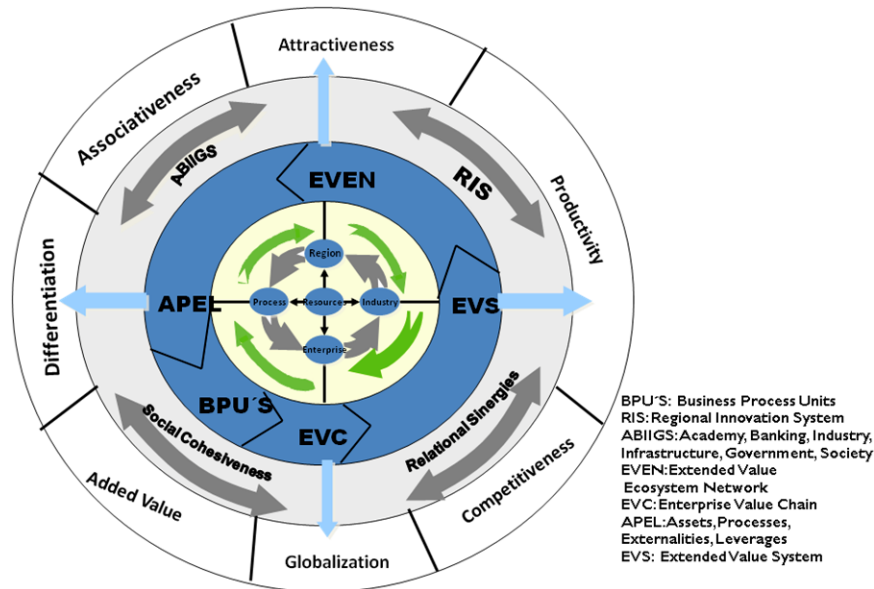
The WIT model is based on solid principles taken from the best practices of successful regions around the world, which have been adapted and combined to generate a mechanism for the creation of great added and differential values for all the participants. The model has been conceptualised to create: systemic (environmental, economic and social) environments; strong, wide network economies; a substantial increasing economic returns mechanism; and all of them articulated under the governance of fine-tuned innovation systems. To achieve this, the WIT model has developed a sequence of four stages:

- 1 Creating the enabling environment of an *industrial ecosystem*.
- 2 Assembling the *network dynamics*.
- 3 Creating the conditions for a *network economy*.
- 4 Linking *innovation* with a *system* of capitals (social, environmental, economic).

2.1 The industrial ecosystem environment

In this first stage, the WIT identifies all the core activities within the region that are the engines of economic development. These are mechanisms that transform resources into value added. They have been designated the PEIR driving units, and start with identifying core processes (P) that transform resources into great added and differential value; enterprises (E) that transform the resources into more value added through the linking of the business process units (BPUs) of their chains with the markets; industries (I) that are formed by linking suppliers, complementary enterprises, and clients of clients, until forming industrial value systems (EVS) that transform relations into more competitive returns; all of this is greatly leveraged by the attractiveness of the conditions and empowerment generated from the relations between the regions' (R) thrust institutions (Figure 1).

Figure 1 The PEIR economic driving units, the value chains developed and their metrics (productivity, competitiveness, attractiveness, etc.) (see online version for colours)



Source: Scheel and Pineda (2011)

There are two other models established by Chertow (2007) that focus on regional development; however, they try to solve the problem in a different way:

2.1.1 Planned inter-enterprises model

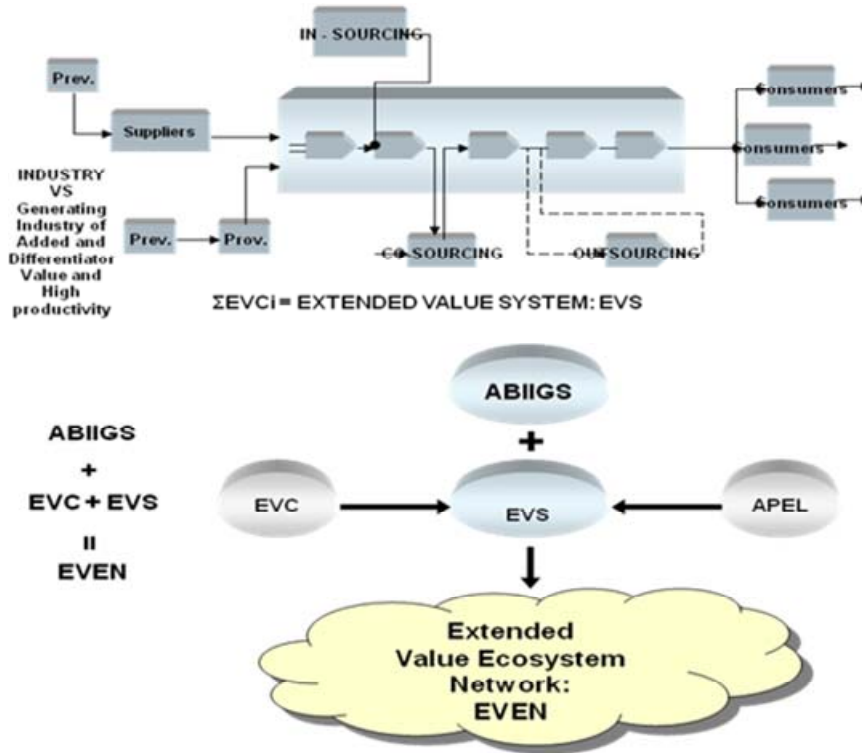
This model includes a conscious effort to identify companies from different industries and locate them together so that they can share resources across and among them. Typical planning for these systems has involved the formation of a stakeholder group of diverse actors to guide the process and the participation of at least one governmental or quasi-governmental agency with some power to encourage regional development among stakeholders.

The main problem of this model is that trying to make the firms invest money to unite their efforts is quite frustrating. In this case, the WIT model tries to empower the companies settled on the region, through an effective network economy (see Scheel, 2010).

2.1.2 Self-organising symbiosis model

It emerges from decisions by private actors motivated to exchange resources to meet goals such as cost reduction, revenue enhancement or business acceleration. The individual initiative to begin resource exchange faces a market test and if the exchanges are successful, more may follow if there is on-going mutual self-interest. In early stages, there is no consciousness by participants of what to share, but can be developed over time. The projects can be strengthened by *post facto* coordination and encouragement.

Figure 2 How the systemic enabling environment is assembled (see online version for colours)



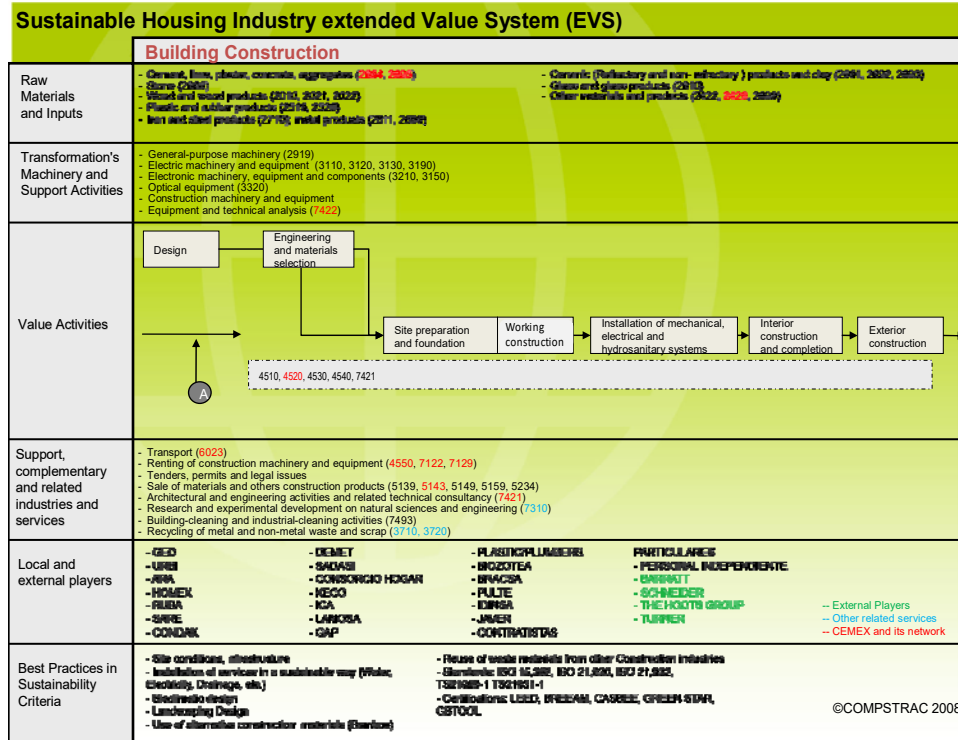
Source: Scheel and Parada (2008)

The main difficulty with this approach for DCs is that it is hard to find a comparable set of self-organising symbiosis projects to examine because, by their very nature, they are not known until there has been some success and an uncovering event occurs. For these cases the WIT model tries to solve this problem by developing the region and allowing the companies in the region to be conscious not only that they are part of the system from the beginning, but also by giving the firms the opportunity to form a more successful critical mass of empowered actors.

Once the driving economic activities are identified within a region, the first step is to articulate the relationships among all the elements sufficient and necessary to assemble a product manufacturing chain (PMC) through an *enabling systemic environment*, capable of articulating value in a viable manner between each one of the parties, until forming a comprehensive extended value system, of great scope, high value and a mean to interlink all actors of sustainability (Figure 2).

This assembling has been applied to multiple cases of clustering of diverse industries in several countries. The most recent ones are in Mexico, for the software industry (Instituto Mexicano para la Competitividad, 2008) and the sustainable housing industry (Scheel and Galeano, 2010); in Bolivia, for the camel fiber industry and the quinoa chain (2008); in Colombia (2004–2008–2009–2010), for the textile, software, health, leather industries [multiple cases for the Chamber of Commerce of Bogota (2005, 2006) and Departamento Nacional de Planeación de Colombia (2007)].

Figure 3 The extended value system deployment of one of the main activities of the sustainable housing industry



Notes: Excerpt from CEMEX sustainable housing industry project 2010, using Compstrac© methodology.

Source: Scheel and Galeano (2010) and Scheel (2003)

Figure 3 shows how the extended value system's sequence of aggregation of components is applied to the *sustainable housing industry*.⁴ Here is an excerpt of one of the activities that the industry develops that shows a deployment of the main activity (construction industry) and its processes, the flows, and all the supporting processes needed to perform the transforming activities. With this deployment, it is possible to establish who to bet on, where the weakest links are, who is the champion with the best performance in the region, and benchmark them against world-class best practices.

This is the basic architecture of the systemic 'enabling environment' capable of deploying all agents, conditions, and inter-process relationships in the industry to coordinate, integrate and articulate all the components and formulate specific clustering strategies.

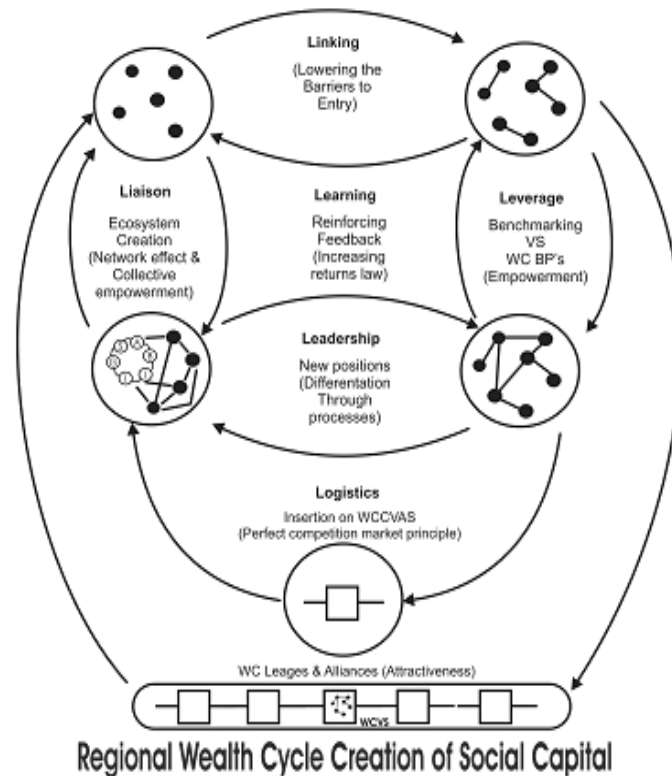
2.2 Network dynamics

Once the systemic architecture has been assembled, the linking between the economic producers and the regional thrust drivers follows, to allow the network to perform with effective dynamics among all relationships.

In countries where the associativeness characteristics are poorly deployed, it is necessary to develop a sophisticated way to link the contents and flows of the chains, relations and systems, of the four economic driving units [processes, enterprises, industries, and regions (PEIR)] with the external supporting drivers to create highly competitive results. To achieve this synergy, a *collective leverage meta-cycle* must be created through the synchronisation of an extensive network of relations: public-private, regional-industrial, industry-enterprise, enterprise-process, enterprise-region, etc. and the effective collaboration of stakeholders, generating a high-value network.

This collective cycle has been developed under what have been coined the seven loops mechanism (Scheel, 2005b), in which the following cycles are performed (Figure 4).

Figure 4 Dynamics of the seven loops



Note: Value network creation and insertion in global systems.

Source: Scheel (2005b)

First, leveraging the enterprises so that they reach high levels of performance and productivity; then connecting (*linking*) these highly productive, efficient enterprises to external industry drivers to form high industrial performance clusters of greater value linking the firms with their complementary and supporting industries.

Subsequently, several chains can be built (PMC); however, they need to be linked (*liaison*) and aligned to their external complementary (ABIIGS) drivers: [*Academy*, research and technological development centres; high-risk Banking instruments and

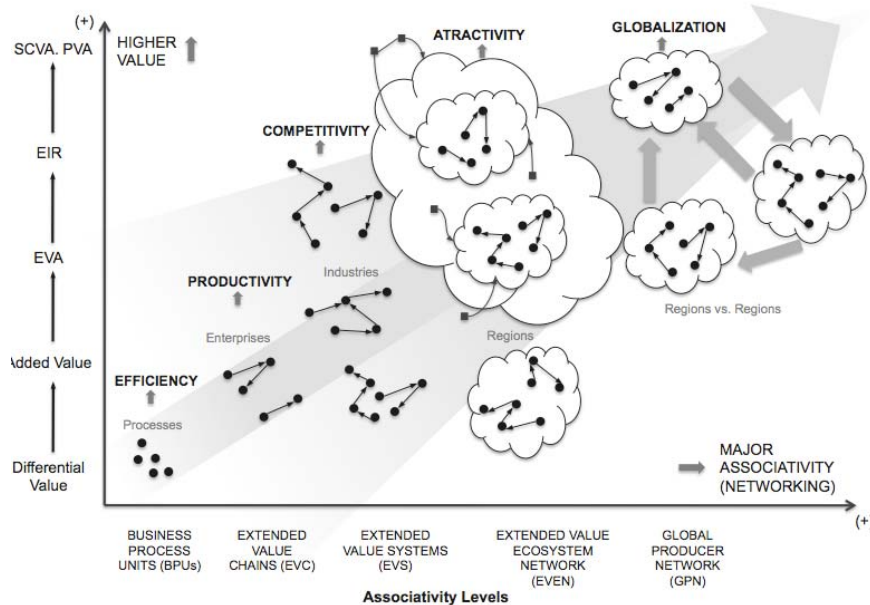
venture capital investors; complementary and support Industries; information and communication technologies (ICTs) and enabling innovation systems and supporting innovation; and *infrastructures*, transport structures, logistics, all aligned and managed by a *governance* that delivers industrial policies, rule of law, supports the attraction of foreign investment and/or technological partners. Finally, all this is reflected in a *social capital* of high value returns and benefits for the quality of life of the region's inhabitants]. All of them form a robust *socio-techno-industrial system* of escalating growing value.

Once this cluster has been assembled, the next stages are used to insert it into extended value systems around the world, reaching leadership under continuous comparison (*benchmarking*) of the industrial system's metrics against the best practices, learning from the gaps and reducing them to a minimum; and, finally, inserting the clusters (through logistics) of enterprises, industries, infrastructures, society, etc. into world-class global value chains (world leagues).

Through this mechanism of cycling empowerment of all agents, it is possible to raise the value performance of local enterprises to global standards, which is a key factor for increasing impact on the regional GDP produced by enterprises in less developed economies (Khanna and Palepu, 2006).

However, the hardest tasks in this activity are determining how to attract companies and driving agents to this new c-environment (*cluster-environment*) and changing the behavioural patterns of the participants, as the benefits of belonging are only obtained when the network is fully assembled and large enough to share the "synergy of the network" among its members. To create this synergy, the entrance barriers must be lowered and the potential participants have to be convinced, one by one, to join the network, under a collaborative protocol.

Figure 5 Assembling the value network cluster (see online version for colours)



Source: Scheel (2005b)

However, lowering the access barriers is not enough. There is also a cultural aspect that must be overcome. For this 'linking', a method described in Scheel (2005b) has been developed. It starts with simple B2B relations, e-market, and e-commerce, and with the promotion of virtual stores, the critical mass (attracting potential) is augmented and subsequently the 'proliferation' of new participants begins. An e-market 'expansion' leading to a 'collaboration between peers', closing the perfect market cycle, follows. That is when the network effect (Arthur, 1996) reaches its peak, and all stakeholders achieve a growing cycle of increasing value returns for everyone, as shown in Figure 5.

In summary, the seven loops dynamics provide a mechanism for the fundamental articulation of the systemic enabling environment over the industrial cluster, which allows a great differentiation and added value for the region to occur. Currently, with this procedure a selected network of participants has been empowered, with the necessary strong relationships, able to create high value returns among all stakeholders.

2.3 The network economy model

The ecosystem structure and its dynamics, however, are not enough. Favourable conditions are needed to enable the increasing returns cycle of a prosperous network economy.

To some businessmen, creation of wealth means producing more with less, growing each quarter more than the previous one, competing with high-risk aggressive scenarios through powerful financial mechanisms, competing with new business models supported by large investments of well-structured digital enabling technologies and well financed entrepreneurs and entrepreneurial ventures in a culture of highly efficient associativity to foster successful businesses.

In emerging and DCs the situation is quite different, due to a lack of most of the regional supporting-enabling structures and of minimum favourable conditions. These countries must unlearn what they have acquired and change the paradigm to start building nearly from zero (and often from an adverse position) each one of the industrial and clustering conditions required in a specific industrial sector to be internationally competitive.

2.3.1 Creating the enabling environments

If the regions do not have the proper *enabling conditions* (Scheel, 2005a, 2005b), they must be created prior to any attempt to build an effective cluster. After a diagnosis of the industrial conditions, the WIT model generates the necessary and sufficient conditions for the network environment to achieve high-value performance at the three levels of regional development (enterprise, industry and region):

At a regional level, the following driving conditions are required to support the industries in developing their competitiveness⁵ in an agile, quick and effective manner (extracted from several cases reported in Scheel, 2005b; UNIDO, 2004).

A *region* must provide:

- Physical infrastructure (including ICTs, financial tools, etc.).
- Regional electronic readiness.
- Regional c-readiness (cluster-readiness).

- Attraction of foreign direct investment (FDI) in the region.
- Special human resource skills.
- Natural vocation of established mature industries.
- Investment in research, development and public and private innovation.
- Foreign investment for patent royalties, licenses, designs, etc., generated domestically.
- The governance of a well-structured regional innovation system, includes coordinating clustering, knowledge management, innovation management, all under a proper rule of law for all stakeholders.

If properly managed, these conditions can make the region attractive enough for its industries, to achieve an *empowered environment* capable of producing:

- High and growing manufacturing value added (MVA) per capita produced by the region.
- Notable margins of manufacturing included in high tech exports.
- Insuperable added value services (e.g., outsourcing).
- Major participation by high and medium technologies in MVA generation.
- Major volume of exports of products manufactured with medium and high technologies.
- A better competitive position for the country in the Global Competitiveness Index (Schwab, 2016).
- Better positioning in the global e-readiness Index.

At the industrial sector level, certain conditions pertaining to the critical factors determining a successful industry must be present. These conditions support better productivity and the positioning of the enterprise in the industrial sector in the region.

Conditions that *regions* must provide to support the 'clustering' of companies and supporting activities in the region include: ⁶

- Favourable domestic market conditions.
- Highly qualified human capital requirements (education development programs and technological innovation programs for entrepreneurs).
- Promotion and investment programs in research, innovation and transfer.
- Financial instruments (new venture capital, etc.) for risk capital physical infrastructure conditions (transportation systems, ports, telecommunication lines, bandwidth facilities, etc.).
- Clear rules of competition and domestic and foreign rivalry.
- Infrastructure for new industrial business models infrastructure (such as cluster structures, innovation systems, etc.).

- Incubation parks for technology and knowledge-based start-ups.
- Intelligence services, of vigilance and prospective, for new technological advances and their trends.
- Synergies with the target industry's complementary and supporting industries.
- General restrictions and limitations affecting the industrial sector.
- Rule of law.
- Government enabling programs (such as national industrial policy programs and national/regional innovation systems (RIS) at the three government levels.

Once the region has created most of these conditions in support of industry and companies, the sector targeted can be well ranked in *competitiveness* in terms of:

- Increase in size and quality of the extended value system EVS (system of enterprises-complementary-suppliers-clients-services, B2B networks, etc.).
- Increase in quality of connectivity between target and related industries (industry-to-industry, complementary and support intra-industrial networks).
- Emergence of new financial mechanisms for new venture capital.
- Emergence of robust electronic payment systems (fast, private, safe and reliable).
- Increase in efficiency and quality of logistics chains (delivery response times).
- Increase in efficiency of the entire product mobility chain.
- Improvement and growth of efficient access systems for customers to network to network liaisons.
- Emergence of new e-government systems that are transparent, safe, reliable and enablers of efficient bureaucratic processes.
- Increase in the number of well-synchronised networks of customers, citizens and public administration communities.

As can be observed, most of the indicators measure the connectivity capacity, industrial policy, innovation and quality of the networks, so that inter and intra-industry relationships can be developed to support entrepreneurial productivity activities.

Finally, at the *entrepreneurial* level of start-ups creation, there are certain conditions that must be developed for the business community so it can be the generator of added, differential values. The activities that the enterprises must master include:

- high price elasticity processes
- fast time-to-market mechanisms
- differentiation niche-producing mechanisms
- highly specialised processes
- generic procedures of low production/manufacturing costs
- customer support systems/processes for the prediction of customer demand

- processes for linking resources to the supply chain (e-procurement)
- logistics chains/effective distribution
- inventory systems (just-in-time systems: JIT)
- flexible manufacturing/service processes (built to order (BTO), lean manufacturing, M2M, B2B, industry 4.0, etc.)
- procedures focused on new forms of working (teleworking)
- processes that allow international market coverage (telemarketing)
- metamediaries (i.e., outsourcers who provide a unique point of contact between a client community and a community of supplier e-markets)
- new e-business models (such as BTO, JIT, etc.).

Once the enterprises are accelerated and leveraged by their industries and regions, they are able to obtain better productivity measurements, such as:

- high rates of return (high efficiency, high quality, etc.)
- high productivity, profit performances
- high hard-to-match margins
- highly differentiated niches of great economic value added (EVA)
- emerging niches (in non-existent segments)
- personalised mass customised products at competitive prices
- low cost, high quality products
- shared processes with great mobility and wide reach, anywhere in the world
- zero-time delivery (instantaneous interactivity)
- high-speed response (to market changes)
- robust reputation and well-known brand
- effective processes towards world-class standards
- fast growth
- well-defined market segments with agile, broad, fast and optimum coverage.

At this point, the economic cycle is closed, between enterprise-industry and regional development.

It is clear that companies perform better when regions deliver the proper conditions working in collaborative harmony for all components of the industrial sectors (UNIDO, 2002) (this is the case of the automotive sector in Mexico, in the top 10 worldwide, where most auto-parts companies are part of well-tuned global value chains (GVCs) and are well supported by highly recognised and world-class positioned suppliers). Their supply chains are more effective, the logistics processes become globally competitive, the quality of the national industry receives more recognition, the industry in general

becomes more competitive and the regions (in this case, several regions in the North – the states of Coahuila and Nuevo Leon, and in central Mexico – Toluca, Puebla and Aguascalientes, with strong brands like GM, Ford, VW, Nissan, Chrysler). They attract more anchor companies and more foreign investment; more specialised human talent is produced by the universities and technological institutions. New start-ups emerge as well as new venture capital organisations, owing to new value opportunities, like nano-materials, fuel-cells batteries, bio technology, etc. This is a vibrant win-win industrial sector where all companies and driver agents are part of a well-established industrial ecosystem.

On the other hand, with the application of the above diagnostic tool, it is possible to detect if a region (in which there is a desire to establish a selected industry), meets or does not meet most of these conditions. If it does not meet them, there is little chance for this region to become competitive in international arenas. The gaps must be addressed, and strategies and policies for *enabling environments* for a specific industry must be created.

The following is a brief sample of how the WIT model has been applied to identify regional conditions so that a selected Latin American region can start a world-class cluster of the software industry (Scheel and Gomez, 2007). For instance, in the region of northern Mexico, some gaps were identified that were resolved before any attempt to operate a competitive software cluster (by the end of 2010 most of them were covered); they had to:

- a Create e-readiness (connectivity among SMEs, etc.) infrastructure.
- b Implement financial instruments for supporting new enterprises (new venture) with high-risk requirements.
- c Create a legal regulatory framework (rule of law) of protection of intellectual property, private investment and policies against piracy.
- d Develop a competitive, efficient system of industrial intelligence that can be shared by all the networked organisations.
- e Create mechanisms for the incubation of local software developing enterprises, capable of reaching world-class levels of competitiveness.
- f Generate new business (e.g., e-business) models based on e-structures.
- g Develop new career plans and specialised human resources plans, as well as technology-based enterprise /entrepreneur programs for the young technologist.
- h Develop a regional innovation system, to enable mechanisms for the development of innovation, technology transfer, enterprise incubation, standardisation and efficient process administration, etc. (all activities belonging to the innovation chain of the industry).
- i Create a centre for the efficient diffusion, support, assistance and use of information and telecommunication technologies in entrepreneurial, public and rural developments.
- j Create an institute for certification and better practices of the industry.
- k Redesign public and private-support institutions to establish strong and better-quality relationships (networking) among all the stakeholders.

1 Support regional e-government (to improve more efficient bureaucratic issues).

Most of these practices assume a new commitment to associativity and trust among government, academy, complementary industries and financial institutions to reach the goal of providing a proper systemic enabling environment that supports the enterprises, making it possible for them to learn, innovate, and move toward world-class competitiveness levels.

At this point, when all three levels (companies, industries, regions) have created the proper conditions (e-readiness, c-readiness) necessary and sufficient for the emerging of enabling *ecosystem environments*, the potential clusters of enterprises, with a common goal to create a pole of competitiveness for the industry, for a specific region, become empowered.

2.3.2 Creating a value increasing returns cycle

Once the industrial enabling ecosystem has been built, it is then necessary to create the cluster's dynamics for working in a synchronous manner, where all the stakeholders can operate within a 'cycle of valuable increasing returns' to generate sustainable wealth in time and space (anywhere in the globe where this value is generated more efficiently, ...it is a question of managing the resource allocation efficiently...), in such a way that it can be distributed equitably.

Where does the wealth creation cycle begin?

It begins precisely with the fundamental value-creating units, the processes (within the enterprises' business units) which transform basic resources into added value, through a linking of linear BPU's, enterprise value chains (EVC), EVS and, finally, closing the chains into circular extended value networks (EVEN), with all the required stakeholders included, even residues and waste chains, as shown in Figure 5.

Once this valuable network has been assembled, it must be transformed into an economic (value) cycle of valuable increasing returns, where all members win. The WIT model accomplishes this cycle by combining the following principles (extracted from economic theory and the theory of systems):

- Lowering barriers for new entrants (so that new entrants can be added to the network easily).
- Increasing the *value network effect* (creating more value for each member of the network as more members are added to it).
- Creating a strong inclusive *industrial ecosystem environment* (that contains a community of firms along with its infrastructure and its industrial value, and social, environmental and natural resources).
- Allowing *perfect competition markets* (when all participants of the network grow at the same pace, without monopolies, and with equal sharing for all).
- Creating a *vector of differentiation* (empowering companies with high differentiation against competitors, in perfect competition markets).
- And a last step, where a synergy produces an *increasing returns cycle* (Arthur, 1996), (inserting the extensive network of stakeholders into an economic and social value increasing returns cycle). At this point, a sustainable behaviour is attained

converting the WIT framework into a sustainable WIT approach where a zero-residues approach is implemented.

Following this mechanism, the WIT model has created a synergy among enterprises and supporting institutions so that together they are able to:

- Transform effective, innovative processes into new business models, capable of attaining global positions. A good case has been the software development industry in the state of Nuevo Leon (Instituto Mexicano para la Competitividad, 2008).
- Support competitive industrial sectors, as well as create high-performance, inter-linked industries. An example is the shoe industry in Colombia (Departamento Nacional de Planeación de Colombia, 2007).
- Support well-equipped attractive regions and the attraction of new venture capital (e.g., FDI, anchor enterprises, technological partners, etc.) and foreign business opportunities. They are regions that are cluster-ready and capable of supporting high economic and social value networks. A good case would be the effort that Medellin, Colombia has done to connect different industries supported by a well-tuned regional innovation system called Ruta N; or the case of Curitiba in Brazil with the auto parts industry supplying the competitive Brazilian auto industry; or the cluster of electronics and software of Guadalajara Mexico that is doing a tremendous effort to become a world class smart city (Scheel and Pineda, 2015).

Under the new *enabling environment* supporting this techno-economic-social assembling, special dynamics are created and leveraged by economies strongly based on knowledge and networks (Scheel and Gomez, 2007), that can create synergy among all the participants. This results in a value increasing returns cycle capable of transforming scarce resources under hostile conditions into an inclusive, well-related network that generates notable economic returns and robust value. This is one of the great differentiations of the WIT model, a systemic approach engaged with the economic increasing returns cycle.

2.4 Creating a regional innovation system of capitals

The enabling environments and their insertion into valuable increasing returns cycles provided by the WIT need an effective, equitable governance of resources allocation, connectivity, enterprise integration, the industrial extended value systems and the regional value networks with the sustainable social, environment and human capital of the region.

This is not an easy task. Besides the entrepreneurial and industrial factors, there are human, cultural, organisational and environmental factors with valid interests that must be articulated in order to have a holistic system of capitals. The complexity of the relationships is extremely high and uncertain; and the WIT model must be able to capitalise on this, using the innovation system approach. According to Lundvall (2010), an innovation system is “comprised of elements and relations which interact in the production, diffusion and use of new and economic useful knowledge”.

To reach a synergy among all the ecosystem’s stakeholders, the WIT adds the dynamics of interaction that have been used to structure the techno-economic-social environment, the RIS (Cooke, 2003). The RIS is designed to manage the collaboration,

synchronisation and coordination of the different local organisations, agents and all the player relationships, aligned in a common goal: *the creation of wealth and its equitable sharing in a sustainable approach.*

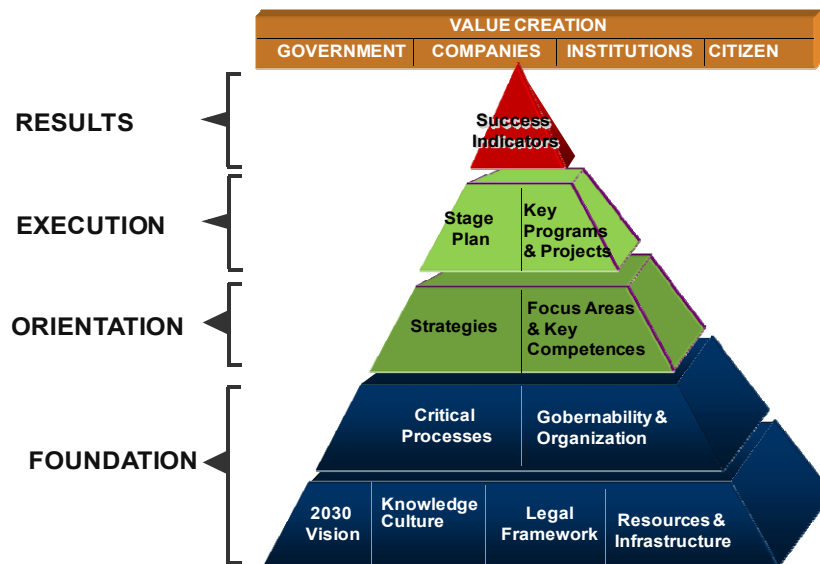
At the regional level, the *attractiveness – prosperity* relationship is achieved when the RIS allows the creation of the necessary conditions so that all the stakeholders, such as, specialised human resources, industrial policy instruments, financial instruments, intellectual property mechanisms, government funds, and complementary and support industries can integrate a well synchronised governance.

The RIS is a part-virtual, part-physical, part-ecological network; it is a knowledge-cluster that permits the administration, coordination and governance necessary to provide the quality links (linkages) that make it possible for the stakeholders to create great *value-added* results for all (Héraud and Levy, 2005).

This is precisely where information and communication enabling technologies are applied, so that the network that is formed can grow, lowering its barriers so that more stakeholders and clients enter and enhance the network, and increase the value returns for all.

Through the performance of the RIS, the WIT’s dynamics maintains a strong structure that will link in an agile, effective and viable manner, the industrial sector (MicroSMEs, anchor enterprises, commerce chambers, etc.) with academy (research and development through research centres, researchers and developers’ networks, tailored-to-fit university programs, etc.), with government sectors (municipal, state, national), with centres for the transfer, promotion and commercialisation of innovation (entrepreneur support legal services, enterprise incubators, business accelerators, copyright offices, industrial parks), with service centres (think-tanks, intelligence systems, enterprise clustering systems, new venture capital services), etc.

Figure 6 The strategic plan of the city of Monterrey, Mexico, designed to establish an innovation system to support the creation of economic, social and environmental value (see online version for colours)



Source: Scheel and Parada (2008)

A sample of how a RIS is being developed in an emerging country can be found in the project ‘Monterrey Ciudad Internacional del Conocimiento’ (Monterrey, International Knowledge City) developed in Monterrey, Mexico (Scheel and Parada, 2008).

In this city several conditions are being leveraged (2005–2010) before a working innovation system can be aligned to the federal strategies for economic growth, social development and ecological resilience. Some of the activities required to support the development of this project are shown below. They were proposed and are under the governance of the I2T2 (the state of Nuevo Leon’s Institute of Innovation and Technology Transfer) for their implementation. Figure 6, shows how these activities will be developed in a 25-year framework.

Briefly, the strategies formulated by the administration of the I2T2 were as follows:

- rebuild the educational agenda, its contents and methods
- incorporate specialists and technologists in industry and increase R&D
- increase the number of research centres and researchers
- strengthen the urban infrastructure
- strengthen the cultural offering
- leverage postgraduate degrees and research in local universities
- support the incubation and creation of new businesses based on innovation and technology
- expand international cooperation
- create industrial and research parks.

As can be observed from this case and from many others in industrialised countries, the RIS structure is fundamental for the good performance of the wealth creation model because it provides the key factors for the success of such regional development projects. A similar case was implemented by one of the authors in Medellin, Colombia during 2010, using the same approach to create the science, technology and innovation master plan, as well as the regional innovation system platform for the city, as part of the Ruta N Project (<http://www.rutanmedellin.org>). This project was established to position the city as a well-recognised attractor of FDI, and international anchor companies, as well as to empower several technology-based clusters (software, energy, health; currently other clusters have been added (from 2014) such as automotive parts, and biotechnology) and new startups with innovative business models.

From these cases and several more from the literature (Scheel and Parada, 2008) we can summarise that for a region to be capable of supporting a competitive industrial system, it must rely on a *regional innovation system*, which must provide: an equally balanced *governance*; a proven capacity for the *incubation* of new start-ups; a flexible *financing* tool supporting new venture capital; a *resource allocation management* mechanism, so that resources may be identified and inserted into well *synchronised networks*, and it must be equipped with a strong *knowledge management* platform, able to provide all the required intelligence services for enterprises, industries and regions to become part of a strongly related network of high increasing returns value.

3 Integrating the parts of the WIT model

The WIT model is formed through the convergence of three supporting vectors: the assembling of network economies, the creation of dynamic industrial ecosystems, and the integration and governance of effective RIS (Figure 7).

The unique purpose is the creation of a *systemic regional enabling environment* with the capacity to leverage and transform resources and regional conditions into clusters of high performance producers of economic and social wealth, shared among all stakeholders of a given region.

During the validation of the model, we learned several lessons from companies, regional governments, industrial chambers and federations, research centres, and incubators; it can be concluded that beyond all the theories and the economic models, we would say that the key success factor for most models of regional development, “*is the capability of the region to develop a holistic space and a dynamic systemic thinking approach capable of creating high value returns for all members, simultaneously and with an equal sharing of wealth for all participants of the community*”.

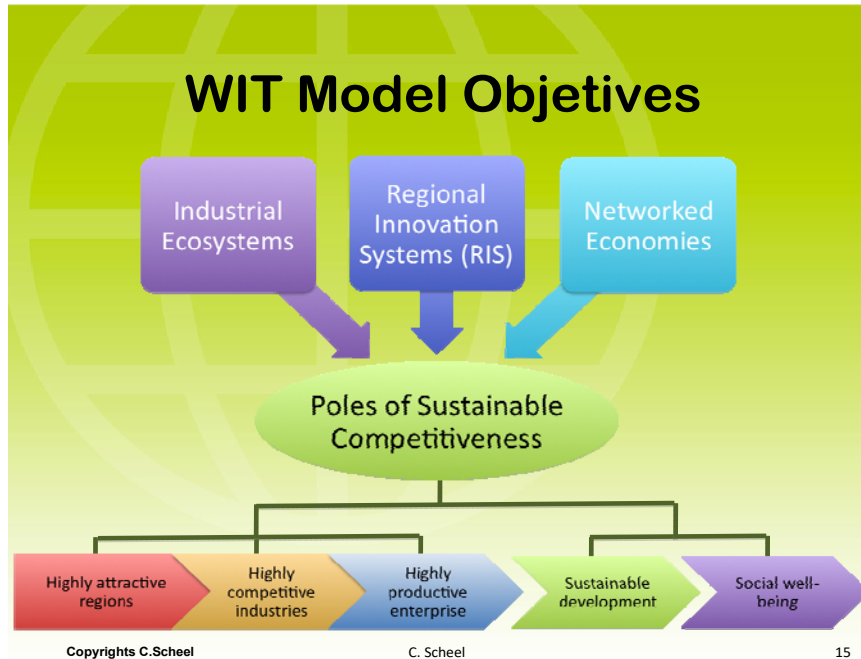
During the last few years we have added to the WIT explicitly the sustainable component, because linear models cannot subsist if there is not a circular mechanism to close the chains toward a functional sustainable growth. The SWIT’s systemic approach provides the conditions for the interaction of procedures at three levels of complexity (Scheel, 2016).

- a *Product-residues level*: The circularisation of linear product chains; based on a zero-value residue industrial ecology system (ZRIES) approach, designed to re-evaluate and transform residues and waste resulting from the production linear chains into closed-loop chains of multiple processes.
- b *Clusters level*: The regional circular value eco-system (CVES); has been designed to articulate the synergies of the cluster of multiple ZRIES businesses within a region, with a common goal for all inhabitants of a region to create self-sustainable benefits for the communities.
- c *Regional level*: The third level is the sustainable regional sharing value system (SVS); capable of providing the necessary conditions (resources, technologies, policies, infrastructure, etc.), the resource allocation management, and an inclusive governance for assembling a sustainable system of capitals of great impact on the social, the environmental and the economic activities of a region.

As established by SWIT, sustainability focused on recovering the essential core elements of the planet-air, water, soil and energy – is ultimately dependent on the systemic articulation of *resources, relationships, conditions* and the *governability* of a region, as well as on the appropriate *technologies* used to transform, link and manage the resources and stakeholders in a valuable system of capitals.

Without this systemic approach to complex situation of sustainable wealth creation for regions with scarce resources, hostile conditions and disarticulated associativity, it is impossible to generate any industrial strategy, social program, or public policy for a sustainable regional growth.

Figure 7 The final objectives of the WIT model: the creation of poles of innovation and sustainable competitiveness (see online version for colours)



Source: Scheel (2005a)

4 Conclusions

The era of competing with isolated enterprises, with industries constrained by reductionist industrial policies or myopic regions are long gone from today's modern competitive contexts.

The WIT model tries to break with the old paradigms of using innovation and information technologies only to support enterprises in their managerial practices and to improve their productive activity autonomously. It has been designed to brake these paradigms in such a way that conventional enterprises of typical industrial sectors that operate in an uncoordinated, isolated manner, producing low added value and operating under hostile productivity, competitiveness and attractiveness conditions, can enter economic cycles of increasing returns and share the benefits of global value chains economies equitably among all the region's stakeholders.

The WIT model empowers the regions, makes them attractive, and prepares them electronically through the modern application of information technologies. It articulates the formation of clusters of new enterprises with supporting institutions. It is able to re-design public institutions and research-transfer-incubation centres, as well as closing the cycle with all the external drivers required to produce a *systemic enabling environment*, sufficient and necessary to create viable *poles of innovation and competitiveness* that are effective and of great impact on the regions' economic and social development.

During the last few years several modules of the WIT model (network economies, innovation systems, and ecosystems environments) have been applied to complex cases, and have achieved relevant results. They have been applied in cases of cluster assembling, articulation and governance of regional players for the formation of poles of competitiveness in Bolivia, Colombia [multiple cases for the Chamber of Commerce of Bogota (2005, 2006) and The National Planning Agency of Bogota], Ecuador (Corporation Las Camaras, Guayaquil, BID), Mexico (Mexican Institute for Competitiveness) and New Zealand (competitive NZ). Other applications include: cases of redesigning conventional enterprises into networked-enterprises to be inserted into global network economies in Mexico; cases of design and development of RIS and clusters in Mexico, Colombia and the Republic of Armenia (USAID and WB); innovation networks for researchers in Latin American countries (Red CLARA and BID); and strategies for reversing the 'digital development divide' existing in several DCs, like Guatemala, where a plan was designed to align the national agendas of competitiveness with information technology strategies (BID, PNUD).

Although the WIT model has produced partial results, there are still many issues without clear answers that must be resolved. Does the WIT model create sustainable, permanent wealth for DCs or just solve some passing economic development problems? Does it have a real social impact? Is it capable of completing a virtuous techno-socio-economic cycle? Does it generate sustainable regional strategies?

Given these questions, in mid-2009 the creation of the sustainable WIT (SWIT) model started, inserting the economic cycle into a sustainable framework, taking into consideration the ecological footprint of the production value chains, the zero-residues industrial ecology systems, and the life cycle assessment Impact for the *residues and wastes value chains*, as well as the social impact of innovation. For this approach, a circular economy scheme was considered, as well as industrial ecology concepts, in order to design sustainable regions that can be economically viable, socially equitable and environmentally resilient.

Maybe the most important message derived from this work is the identification of a disruptive paradigm, capable of changing the style and mentality isolation of Latin American entrepreneurs, and the short-sightedness of government decision-makers with regard to supporting the creation of a new *systemic* approach. This approach centres on networked-enterprises inserted into highly competitive cluster-oriented structures, generators of high value added and differentiation, under sustainable equilibrium, and creators of great benefits for the Latin America region.

This is the new challenge for regional development experts, entrepreneurs, policy-makers, urban planners, technologists and environmentalists: the *redesign of the old limiting paradigms for the economic and social development of developing regions*, given their scarce resources, their hostile conditions, poor associativeness, and their cultural historic determinism.

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Notes

- 1 Glocalization: global positioning and local competitiveness simultaneously (Scheel and Parada, 2008). Glocalization can be defined as the interpenetration of the global and the local, resulting in unique outcomes in different geographic areas.
- 2 *wit*:...the ability to make smart and vigorous contributions in a sharp and spectacular manner... the ability to perceive incongruent relationships and express them in a surprising and accurate manner...Webster Dictionary
- 3 Several economic debacles occurred that may support this statement that affected worldwide economies and financial systems (2009), such as the Greek, Ireland and Spain cases.
 Greek <http://www.guardian.co.uk/business/2010/feb/10/greece-financial-crisis-strike>.
 Ireland <http://www.guardian.co.uk/world/blog/2009/feb/13/ireland>.
 Spain <http://www.latindailyfinancialnews.com/index.php/en/finance/world/6329-spain-financial-crisis.html>.

- 4 This case has been developed with funding by CEMEX (Mexico) and EGADE Business School, Tecnológico de Monterrey (Project, 2009, 2010).
- 5 Competitiveness can be measured using the competitive position marks of the country in the Global Competitiveness Index of the Global Competitiveness Report 2016 metrics (Schwab, 2016).
- 6 c-readiness metrics can be associated with several parametres of the Global Competitiveness Report 2010 (Schwab, 2010), all included in Scheel (2005b).