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Growth and Cooperation of Latin American Countries: The Role of Industrial Knowledge.

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A direct comparison of the welfare implications of pure competition between the states of Latin America and the outcome of a cooperative set of actions of these states is not possible. Laboratory experiments in the social sciences are impossible; societies experience just one run through history. Nevertheless, a concise study of the performance of a specific tool of cooperation, namely the Industrial Knowledge Bank (IKB), can be performed. If over time, such a tool attracts more and more countries, which formerly relied on competitive forces only, then an indirect proof of the superiority of cooperation can be assumed. The industrial knowledge is exchanged via specified projects, which form a network in the IKB databank. Then, the evolution of the structure of this network mimics the growth of the actual cooperative industrial projects. This paper provides a brief history and description of this institutional attempt to increase cooperation. It also shows the most relevant bottlenecks met by this project. Further, a clear picture of the state of industrial cooperation across South America is studied in detail through the development of the nodes of this network. We then use two indices typical for welfare increase to compare Latin American countries being part of the cooperation with those not taking part. The visible correlation can be interpreted as a hint of the advantages of cooperation. In conclusion, we provide some possible future scenarios for further industrial development in Latin America based on the study of this Industrial Knowledge Bank.

Keywords: Latin America countries, cooperative set of actions, Industrial Knowledge Bank (IKB).

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INTRODUCTION

There is a long-standing debate in economic theory about the question of the benefits produced by competitive behaviour as compared to cooperative behaviour. This question can be approached on the level of human individuals, on the level of firms, or on the level of whole countries. In this paper we will concentrate on the most aggregated level, on the advantages that cooperation has if countries cooperate. What can be considered to be advantageous on the level of a country? Economists usually distinguish between supply side advantages, e.g. higher productivity of firms, and demand side advantages, e.g. average real wage growth. Macroeconomic models use accounting identities and estimated equations of aggregated firm and household behaviour to link both sides: A typical model would predict that higher productivity in a country will be translated by macroeconomic mechanisms into higher real income levels. For both phenomena well-defined indices exist for all countries in the world. To nail down how cooperation can be operationalized is a trickier task. In everyday business life cooperation and competition are always intermingled in a number of ways. On one hand, an important element of each economic activity always is the amount of knowledge on which this activity can be based.

The more knowledge the larger the success of the activity. The central argument for competition stems from the incentive for (private and secret) knowledge acquisition of an agent, which increases if the difference to the knowledge of the competitor is maximized. On the other hand, there is a well-documented correlation between total amount of knowledge and the momentum of its further increase: More knowledge breeds a larger further increase of knowledge. Thus combining the knowledge of competing agents can make both of them better off. This situation has been rigidly investigated formally by game-theoretic models, while applications on the level of nation states are less frequently found. This paper uses a unique possibility to investigate this question by studying the development of a database for knowledge concerning industrial production techniques that can be used by Latin American countries. The provider of this knowledge is an international organization, UNIDO, which enables us to ignore the otherwise very complicated question of identifying the process of primary knowledge acquisition and agency of a carrying social entity. Of course, this immediate empirical pillar of this paper also determines how far results can be generalized.

As mentioned, for the goals of this paper, namely to provide arguments for the superiority of cooperative behaviour in the area of industrial development, the Industrial Knowledge Bank (IKB) of the United Nations Industrial Development Organization (UNIDO) is a most important empirically available source of evidence. It therefore has to be explained right from the start.

The Industrial Knowledge Bank (IKB).

The IKB of the United Nations Industrial Development Organization (UNIDO) is a platform created to mobilize human resources, knowledge, and expertise in Latin American and Caribbean (LAC) countries [1]. The IKB is also a modern cooperation tool intended to aid in the exchange of knowledge and expertise on industrial and productive development among LAC countries. It is an innovative mechanism of South-South Cooperation [2] created to facilitate the transfer of industrial knowledge, promote development and improve production through the exchange of experts between LAC countries [1].

Some of the main networks in Latin America, taking into account that the institutional networks of scientific and technological knowledge in Latin America and the Caribbean are attractive options to foster the multilateral cooperation in the region are:

1. *Red Iberoamericana de Indicadores de Ciencia y Tecnología*, To promote the development of instruments for measuring and analyzing science and technology in Ibero America, in a framework of international cooperation, in order to achieve a better knowledge of them and its best utilization as instruments for the decision-making process (http://www.ricyt.org/).
2. R*ed de Popularización de Ciencia y Tecnología en América Latina y el Caribe*, It is an interactive network, which brings together centers and programs for the popularization of science and technology. It operates through mechanisms of regional cooperation that favor the exchange, training and use of resources among its members. RedPop was created in November 1990 in Rio de Janeiro, at the request of UNESCO´s Program for Science, Technology and Society (https://www.redpop.org).
3. The Caribbean Diaspora for Science, Technology & Innovation, is an international body of professionals who have an interest in the development of the Caribbean region. CADSTI recognizes that there is a vast talent pool within the larger Diaspora whose skills go untapped by the Caribbean community (https://caribbeanscience.org/cadsti).

The Industrial Knowledge Bank was initially supported by some LAC countries which agreed on the need to establish such an innovative instrument to encourage and enable cooperation between the LAC countries and bring them closer together through the exchange of their own industrial and productive knowledge and potential. The IKB aims to strengthen the local industrial potential in the region and serve as a useful tool to quickly and inexpensively resolve technical problems as they arise. The main purposes of the IKB are a) To facilitate the exchange of solutions among LAC countries by sending experts from top-ranked and renowned institutions to share their knowledge and expertise during a specific period. b) To facilitate experts exchange between LAC countries in real-time and a cost-effective manner. c) To mobilize the existing talent in the region and initiate communication and exchange among communities. d) To generate new business opportunities between the LAC countries Figure 1, Europe and other regions.

To support the regional integration processes and contribute to the identification, formulation, and implementation of regional cooperation activities, we developed an interactive platform to facilitate the exchange of industrial knowledge and expertise between LAC countries: the Industrial Knowledge Bank.

Figure 1. The IKB is an innovative cooperation mechanism that promotes the exchange of knowledge and experience for the industrial and productive development of Latin American and Caribbean countries.

The IKB promotes development through the exchange and application of industrial and commercial best practices. It is based on the principles of solidarity, complementarity, equality, non-conditionality, and respect for national sovereignty [3].

The Industrial Knowledge Bank [1] is the first industrial cooperation network developed for the LAC region that has produced real results among both public and private institutions. With this study, we propose this type of network as a resource to facilitate and boost industrial development between countries, and to emphasize the importance of digitalization as an essential tool for increasing productivity in the LAC region [4].

Historical Evolution of the industrial knowledge.

The industrial knowledge network's first cycle of operations for Latin America started in 2009 and lasted until 2013. During this period, a total number of 53 technical assistances between institutions in Latin America and cooperating entities in Europe and Africa were reached. We present a summary of the annual results. The main actors participating in the construction of the IKB Network for Latin American industries were public and private organizations belonging to the industrial and productive sectors in the LAC region, and industrial and business institutions in Europe and Africa (Equatorial Guinea). All of these organizations participated as knowledge donors. The most important Technical Cooperations (TC) were:

1. **TC:** CONA, Austria and the United Nations Development Project, Barbados/Dominica.
   Theme: Solar drying of fruits and vegetables: transfer of better practices.

Results/Impact: Training program on drying of fruits and vegetables - Female producers of fruits, herbs and medicinal plants from 5 islands manifested their interest in acquiring equipment for solar drying to preserve and process fruits and plants.

2. **TC:** Oficina Nacional de Normalización, Cuba and Ministerio de Minas y Energia, Equatorial Guinea, Africa.
   Theme: International meeting to establish an office of standardization and quality control.

Results/Impact: Creation of the Equatorial Guinean Agency for Industrial Standardization, Metrology and Certification [6].

3. **TC:** Department of Pharmaceutics University of London, United Kingdom, and Instituto Nacional de Tecnología Agropecuaria INTA, Argentina.
   Theme: Nano-technological systems for pharmaceutical, cosmetic and veterinary applications.

Results/Impact: Development of the first nanoscience and nanotechnology symposium focused on health. Implementation at the Laboratory of Drug Targeting Strategies (Nanomedicines), Faculty of Pharmacy and Biochemistry: Presentation and training of 90 students from different provinces in Argentina, Brazil, Uruguay, Chile and Venezuela in the area of nanoscience and nanotechnology [7].

4. **TC:** ECTI, France and Cámara de Comercio de Cusco, Peru.
   Theme: Competitiveness, sustainable management and development of costume and textile SMEs.

Results/Impact: Formulation of financial controls. Participation in a training program for the Chamber of Commerce of Cusco, Peru on competitiveness, sustainable management and development of costume and textile SMEs [8].

5. **TC:** Design Innovation (BTS, 2019), Italy and Instituto Nacional de Tecnología Industrial (INTI), Argentina.
   Theme: Analysis of the productive history, design of strategies to increase value and local productive quality.

Results/Impact: Better understanding of evaluation. Recommendation of design and innovation strategies and organization of the Congress of Design in Cordoba, Argentina [9].

6. **TC:** Instituto Nacional de Tecnología Industrial INTA, Argentina and Centro Paraguayo de Productividad y Calidad CEPROCAL, Paraguay.

Theme: Product diversification of banana candy, fruit pulps, and juices. Training in processing, development of new products.

Results/Impact: Training in hygienic handling of food preservation, canning, and candy-manufacturing. Training and introduction to the design of candy-making plants and practice in the production of jams [10].

7. **TC:** Servicio Nacional de Aprendizaje (SENA), Colombia and Ministerio de Agricultura, Ganadería, Acuacultura y Pesca (MAGAP), Ecuador.

Theme: Design of ovens for improved production of sugar "panela granulada".

Results/Impact: Design of a pilot project for the development of new profitable and sustainable technologies in the sugar sector in the Parishes of Pacto and Gualea in Ecuador's Pichincha Province [11].

Materials and methods

The Three Components of the Industrial Knowledge Bank are shown in Figure 2.

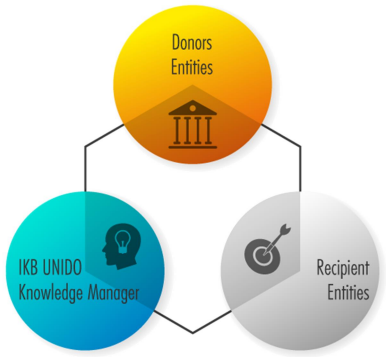

Figure 2. Components of the IKB.

- (a) Donor Entities: lend experts to provide technical assistance in LAC countries at no cost for up to one week.
- (b) Recipient Entities: reimburse the local costs incurred by experts during the cooperation (namely transport, accommodation and food).
- (c) IKB UNIDO: Knowledge Manager: assesses the supply and demand of technical assistance and covers experts' international travel fares; oversees follow-up activities after the technical cooperation and provides UNIDO services when necessary; updates the database with all IKB offers and demands.

The Operating Mechanism

Parties interested in participating in the Industrial Knowledge Bank as donor or recipient entities must send their application/offer of technical assistance to UNIDO. Once received, the UNIDO IKB verifies the experts' qualifications and facilitates the knowledge by unifying the demand with the supply. UNIDO, through the IKB, coordinates the logistics of technical assistance and supervises its implementation. After finishing the mission, the expert presents a final report and evaluates the performance of technical assistance. At the same time, the entity receiving the knowledge evaluates the contributions of the expert and the quality of the assistance received. The UNIDO IKB analyzes the results based on the reports and presents its recommendations to the two parties of the cooperation. Future projects and technical assistance can be built upon these recommendations. The UNIDO IKB disseminates the results across interested parties such as the Latin American and Caribbean Group (GRULAC) in Vienna, Austria. The technical assistance provided through the IKB and the experts of the donor institutions is documented through a series of reports filled out by the participating experts.

Realization process of a technical cooperation

This part of the research is divided into four central parts explained below.

1. Identification of supply/demand: Every country names an IKB focal point, i.e. a state agency in charge of the identification of technical assistance supply/demand.
2. Coordination of the assistance: The IKB verifies the qualifications of the experts and facilitates knowledge, bringing together supply and demand.
3. Final reports and evaluation: Once the technical assistance is completed, the expert presents a final report, and the IKB evaluates the logistics and the quality of the service. The party receiving knowledge evaluates the expert's performance and the quality of the technical assistance.
4. Analysis and dissemination of the results: Based on the reports received, the parties of the cooperation are provided with specific recommendations. Usually after successful cooperations, new projects related to intra-regional development have emerged.

The IKB disseminates the results of all cooperations by its website and the IKB platform, as well as to the Group of Latin American and Caribbean States, GRULAC [5].

DISCUSSION

The IKB is a successful project that worked between Latin America, European countries such as Austria, Spain, Italy, United Kingdom, and Equatorial Guinea, Africa. From this successful experience and taking into account the importance of cooperation between middle income countries and developed countries, it could be seen that there was a mutual benefit. To facilitate the exchange of solutions amoung LAC countries by sending experts from top and re-know institutions to share knowledge and expertise for a short-term, therewith, facilitate the exchange of experts between LAC countries in real time and in a cost-effective, mobility the existing talent of human resources in the region and initiate communication and exchange among them and generate new business opportunities between the LAC countries, Europe and other regions.

The results show that the country with the highest participation in the network was Argentina (15 cooperations). Historically, Argentina has been a leader in South-South Cooperation with over 20 years of experience in enabling the development and implementation of bilateral and triangular international technical cooperation projects through which Argentinian government experts work together with experts from cooperating countries to facilitate the exchange, adaptation, and implementation of public policies to support inclusive development, democratic governability and scientific-technological progress [12].

The participation of the other countries was highly variable. High participation: Ecuador, Paraguay, Colombia, Peru and Spain (7 to 10 cooperations). Medium participation: Bolivia, Brazil, Costa Rica, Cuba, Mexico, Venezuela, Chile, France and Nicaragua (3 to 5 cooperations). Low participation: Guatemala, Suriname and Trinidad $\&$ Tobago (2 cooperations). Participation in one cooperation: Barbados, Dominica, El Salvador, Honduras, Jamaica, Member Caribbean States. The fact that Argentina, Ecuador, Colombia, and Paraguay participated more than others in this network can be partly attributed to political, economic, governmental and institutional factors in each country such as the level of development, trade and cooperation agreements. We can confirm that although only 63 experts were mobilized, the newly trained population consisted of approximately 400 people in the LAC region and 15 people in Equatorial Guinea. It is equivalent to 6,5 trained people per expert, which shows the success of knowledge transfer by each country's expert.

The countries which received the highest amount of experts were Argentina, Ecuador, Peru and Paraguay. Argentina was a particular case since it provided experts to LAC countries but only received experts from European countries. Peru only received experts, but we hope that in the future it also become a donating country. Some European countries donated very little knowledge relative to other participants. One could conclude that this fact was due to language barriers, which also would explain why Spain was the country with more donated experts. It is clear that although the experts returned to their original countries, the knowledge they shared remained in the receiving countries where the technical assistance took place. These results demonstrated that the goal of the IKB network was fulfilled, acting as a platform for stimulating the exchange of knowledge on industrial and productive development in the LAC region.

Industrial policies change the market's incentives in order to foster a specific sector or activity (be it industrial, agricultural, or service). The IKB network serves as an important tool for supporting industrial policies intended to bolster and strengthen institutional capacity, diversification, production structures, and innovation among Latin American and Caribbean countries. The database is useful to all institutions in the industrial and productive sectors of the LAC region, public and private organizations, small and medium scale enterprises, universities, technological centres and research centres. In total, 87 institutions from LAC, Europe, and Africa participated in the IKB network.

We can conclude that the IKB network, by facilitating the exchange of knowledge, acts as an innovative tool that allows the governments of the LAC region to achieve their development goals, such as a) Encouraging structural change and economic and productive growth in their countries. b) Creating strategies for technological transformation and linking the economic and productive sectors (both public and private) in Latin America, Europe, and Africa. c) Supporting innovation and sustainable development and improving ties to the global economy [13].

According to the results and associated data of technical cooperation carried out through the IKB, we can conclude that the countries with the greatest benefit were Argentina, Ecuador, Colombia, Costa Rica and Mexico because they direct part of their national budget towards cooperation agreements with other countries, through their International Cooperation Agencies or Ministries of External Relations, were the ones that gained the most knowledge with respect to Central American countries such as Honduras, Guatemala. The advantages of cooperation agreements between developing countries include the low costs associated with the transfer of knowledge, the ease of coordination due to geographical and cultural proximity, as well as the fact of sharing the same language [14]. This indicates that the governments of the Latin American region have begun to consider cooperation as an important element of their external politics and that they are aware of the synergies it can generate.

Nevertheless, the goal to support cooperation in the field of industrial development remains an important fundamental task for welfare enhancement. This paper provides a modest justification for this issue.

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