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Artificial Intelligence and Work

Building a New Employment Paradigm

Robotics
Technology
Job
Task



Humanization
New abilities
Prometea

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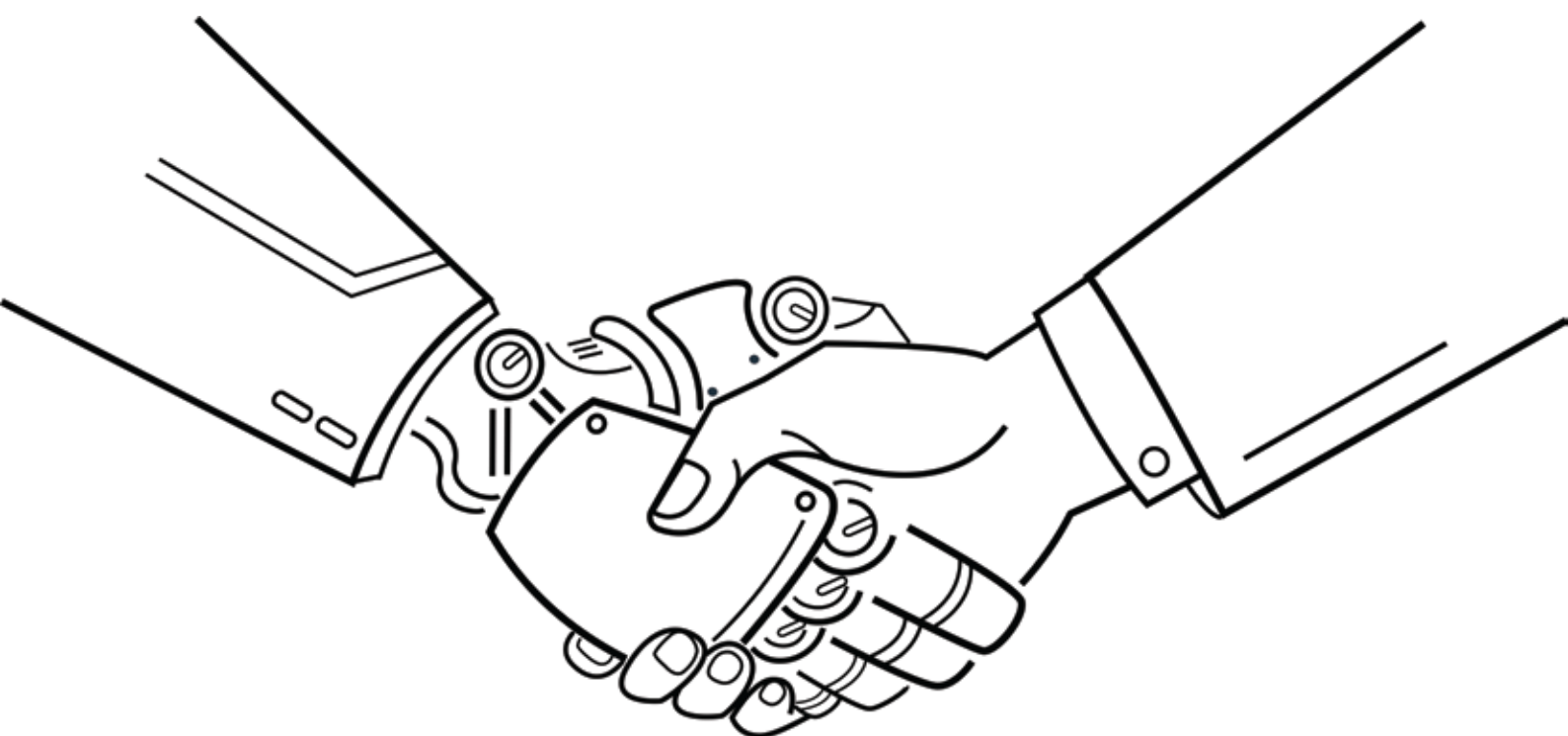
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Foreword

The world of work faces major shifts with the advent of a new set of technologies commonly known as “Artificial intelligence” (AI). Automation is no longer limited to tasks and jobs that require physical strength. With the advent of AI, powerful computers crunch large databases (“Big Data”) to carry out routine tasks in engineering, accounting, journalism, the legal profession, human resource management, medical research or even education. Tasks that would typically be performed by highly trained workers can now be carried out in a fraction of the time by machines and without fatigue or error. By some account, close to half of all jobs could potentially be automated over the foreseeable future thanks to these technological breakthroughs.

No wonder, then, that people are worried whether there are still enough jobs going around in the future for everybody to find a decent work opportunity. Intensive debates started to open up whether new forms of social protection – such as a universal basic income for all – or direct intervention to slow down the introduction of robots and AI-powered machines – the robot tax – would be necessary to soften the impact of these changes. Many national and international bodies, such as the International Labour Organisation, have spent significant effort to support these dialogues, offer analysis and develop business and policy solutions that help strengthen the opportunities that AI offers while mitigating the risks to jobs and earnings it might bring.

The following book is a timely and essential contribution to this global dialogue. It helps focus the attention on one of the major emerging regions of the global economy. Opportunities and challenges that AI represent in Latin America often differ from those in other parts of the world, not least because of differences in sectoral specialisation, demographic dynamics or local tastes of consumers. Businesses and policy makers, therefore, need to find new, innovative approaches to help leverage the benefits that this new technology offers. In this respect, mobilising research and developing applications through the Innovation and Artificial Intelligence Laboratory of the School of Law of the University of Buenos Aires, this book offers novel and significant insights into the potential and limitations of AI in Argentina and the wider region.

The book demonstrates that for a better understanding of the implications of AI on the world of work, it is critical to analyse tasks rather than jobs: Existing jobs might be enriched when tedious and routine tasks are being taken over by machines. Additional jobs and tasks arise as human ingenuity creates new offers, often in relation with social media or in the creative industries. The book also highlights the essential role that both States and companies have to play in preparing the workforce of the future. Educational institutions need to develop into larger eco-systems where young people and those already in the workforce can learn to “co-work” with new AI-based tools and smart machines. The focus need to be brought to adapting and developing their skills and competences throughout their working life, which requires a new approach to education and learning.

Approaches to address these challenges will differ depending on the country context and the institutional capacity of governments, businesses and workers' associations. The International Labour Organisation offers the guiding principles and the necessary technical assistance to help navigate our partners in times of fast technological change and labour market disruption. Thanks to its careful research and analysis, this book offers the right opportunity for dialogue and conveys the fundamental message that only through close collaboration between governments and social partners can we expect to leverage the potential that AI offers for faster productivity growth, higher living standards and decent work. In this spirit, I highly recommend this book for it to receive the wide, global audience that its important messages deserve.



A handwritten signature in blue ink, reading 'Ekkehard Ernst'.

Dr Ekkehard Ernst

Chief of Macroeconomic Policies and Jobs Unit
Research Department
International Labour Organization

In a Few Words...

The most disruptive technology of the Fourth Industrial Revolution we are experiencing is artificial intelligence. For many centuries, human beings have coexisted with machines that replace or improve our physical skills. We are now adapting ourselves to complement or substitute, through an artificial mean, what we used to do with our biological intelligence.

Some alarms turn off and others turn on. As it frequently happens before every technological disruption, the idea that machines will take over our jobs emerges. However, we leave fatalism aside to focus on the analysis of three main tendencies related to the impact of artificial intelligence and robotics in employment.

First. Artificial intelligence will move forward on mechanical and routine tasks, and workers will be reassigned to more creative and productive tasks. Second. Instead of considering automation as a threat, it should be thought as a mean of taking advantage of opportunities and benefits so as to increase the competitiveness in the economies of the countries.

Third. Companies and governments will have to invest in the development of skills for those individuals who are not sufficiently prepared to take advantage of the new job opportunities.

More automation = unemployment? From global statistic studies, asymmetries can be verified. While the increasing automation can reduce employment in some sectors, it increases them in others. Even though it is too hard to establish a linear correlation on aspects with a multicausal nature, the reduction of job positions in specific areas or tasks does not have a global impact, since there is no evidence of an increase in unemployment.

In Latin America, if we see a slow progress on emerging technologies, it is still more difficult to correlate the phenomena with the global unemployment figures. However, in asymmetric development contexts, Latin America can reduce risks, face challenges and enhance the benefits of robotics and artificial intelligence.



New jobs and tasks. When analyzing employment transformation, we can establish four main angles. First: jobs are focused on the use and improvement of technology, such as *drone* pilots or *software* developers. Second: *freelance* jobs that are developed in the collaborative economy, *i.e.* specific jobs that are sporadically done. Third: jobs that arise from social networks as “*influencers*”. Fourth: those related to certain areas or sectors like the so-called “orange-economy”, a concept that is linked to the exponential growth of activities related to creativity, art and entertainment.

The issue is, then, to count with the new skills that both workers of the present and future need to include in their resumes. On the one hand, digital skills, that allow them to face the challenges and to adapt to the demands of digital life. On the other hand, creativity and socio-emotional skills, that are made of creative thinking, the development of emotional intelligence and complex human interactions.

“Working with artificial intelligence makes the research for solutions and its means to be more clear and precise”.

Companies and States play an essential rôle, considering that beyond investing in technology, they should invest in human capital that adapts and can work with robots and intelligent systems. Also, people who want to be suitable for the future jobs, must be prepared to face permanent learning.

Task-based approach.

Lessons learned from the “Prometea’s experience” - the artificial intelligence system created in Argentina. Through research and practical applications done in the Innovation and Artificial Intelligence Laboratory of the School of Law of the University of Buenos Aires and the Public Prosecutor’s Office of the Autonomous City of Buenos Aires, we have noticed a new working paradigm with an approach based on segmentation of tasks, data governance and automation. Working with artificial intelligence makes the research for solutions and its means to be more clear and precise. Prometea’s experience, demonstrates what was proven in previous paragraphs, as in all cases, the working possibilities are broaden. Training algorithms into routine, repetitive and mechanical tasks, gives employees the possibility to be more productive in postponed or complex tasks.



I. Introduction

The asymmetric evolution of the printing press gave us an important and historic lesson for the progress of artificial intelligence¹ (hereinafter, “AI”) and robotics. Although the development of printing and books was exponential from the 16th century, in certain cases they were banned for more than two centuries.

Resisting or rejecting the evolution of these Information and Communications Technologies (hereinafter “ICT”), explained the differences in literacy between the inhabitants of the Old Europe who lived in the Spanish and English colonies in America, and between the inhabitants of the Indian Mongol Empire and the Ming Dynasty in China, who continued to use scribes. By the end of the 17th century, 90% of the English population was literate, although it existed a significant gender gap. During the same period, the Hungary’s female population were mainly illiterate: only 5.5 % were able to read and write².





The asymmetric evolution of printing and books represent the paradoxes that produced the irruption of the emerging ICT: benefits that coexist with bans, resistance and the consolidation or development of new inequalities between people³. The great and deep changes that lead to technical innovations are used to have several sides, luminous as well as obscure. Just as the books and printing facets were essential in the literacy process, the increase of knowledge and the development of societies have also deepened a path that will become each time more exponential with every industrial revolution: create, transform and eliminate tasks, professions and jobs.

The most disruptive technology of the Fourth Industrial Revolution we are experiencing is an ICT: artificial intelligence. AI is accompanied by developments in robotics and other emerging innovations which produce unpublished changes. Machines and algorithms are increasingly more capable to reach and even widely overcome multiple and specific skills that were exclusively done by the brain. These radically transforms the nature of our activities.

For many centuries now, human beings have coexisted with machines that have replaced or improved our physical skills. We are now adapting ourselves to complement or replace, through an artificial mean, what we used to do with our biological intelligence.



II. Some Alarms Turn Off and Others Turn On. International Trends

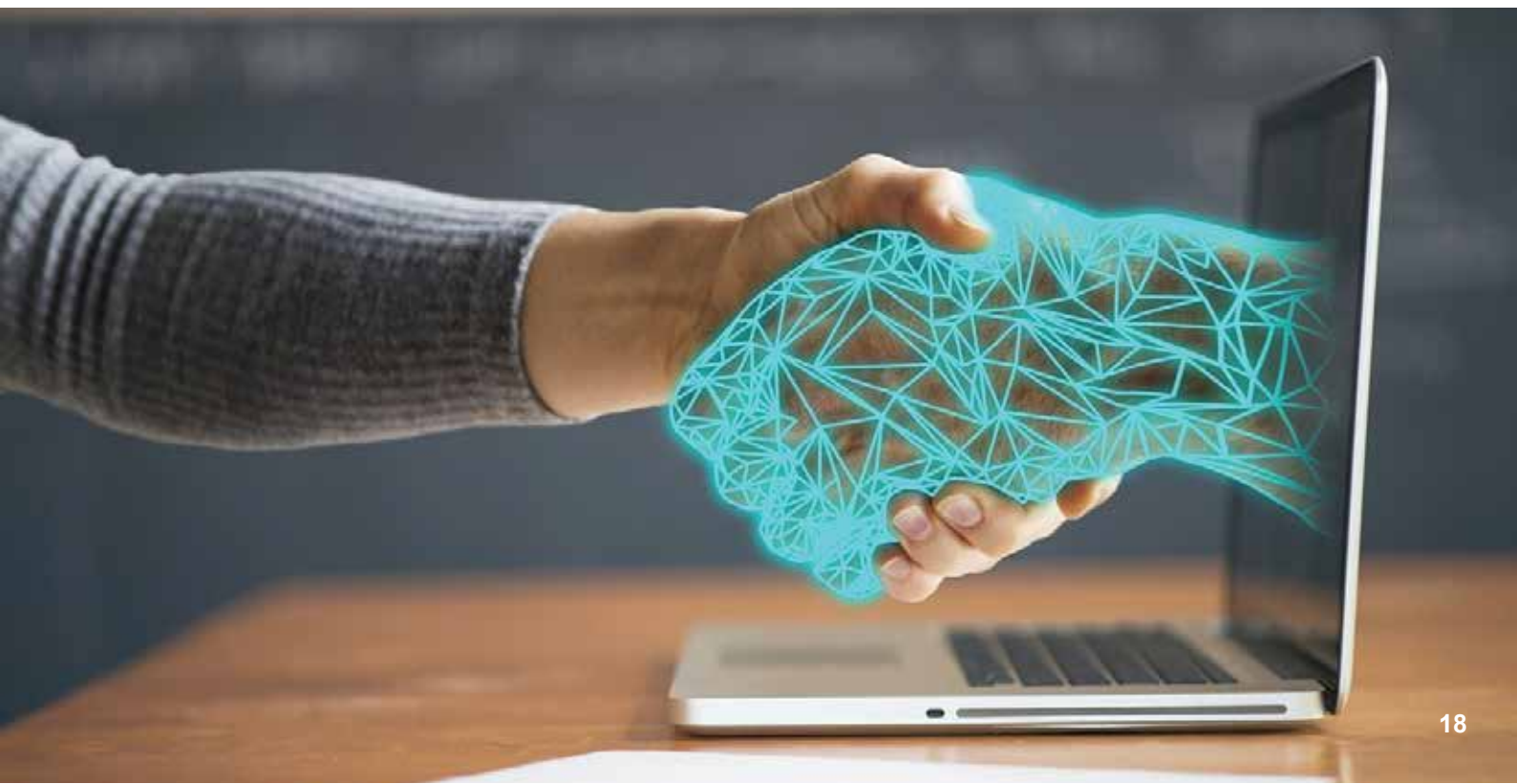
The idea of machines taking away our jobs usually raises before every technological disruption⁴. The Fourth Industrial Revolution is not an exception, although there are some novel aspects. During the first report in this matter published in *La Ley*⁵, we pointed out that the alarms were excessive and that, in general, there was no correlation with automation and global unemployment figures.

Some years ago, the World Economic Forum predicted that by the year 2020, 5 million job positions will be lost as machines would replace human work. Nowadays, it is considered that half of the main job positions will remain stable until 2022, since the emerging tasks and raising jobs will compensate the decrease in work. In 2016, the International Labour Organization (hereinafter, ILO), warned that in the next decade or two, 80% of the workforce of the Association of Southeast Asian Nations will have approximately 56% of employment at a high risk of displacement due to automation⁶.



The predictions on technological advances and its indirect and unpredictable impact are changing. In essence, we leave fatalism aside to focus on the analysis of three main tendencies related to the impact of artificial intelligence and robotics in employment:

1. jobs, in general, are not at risk in the short term and it is very difficult to predict if they will be in the long term. In addition, most of the investigations that address this issue are focused in labor markets of the United States, Europe and some Asian countries;
2. there are few articles that focus in new jobs and tasks that are emerging, and how they impact on global employment figures;
3. the most compelling challenge is redirected to the following binding objectives: automate to humanize, generate the right conditions for people to reconvert against routine, mechanical, repetitive and unhealthy tasks that will be automated; and lastly, encourage the development of new skills and capabilities that are required by the labor market. Let's see.



First.

Advances on Mechanic and Routine Tasks

During the process of automation and AI systems application, the routine, “codified”, or foreseeable tasks are mainly replaced. In those cases, workers are reassigned as to dedicate themselves to more creative and productive assignments. When certain jobs become redundant due to automation, the generation of new jobs counteracts these losses⁷.

In this sense, the implementation of AI is relevant for routine tasks that exceed the responsiveness of governmental institutions, as its implementation will improve management and will allow operators to dedicate their time to other tasks without affecting the employment.



Second.

Make the Most of Opportunities and Benefits

Instead of considering automation as a threat, many studies rightly focus on its benefits in order to increase competitiveness in the economies of the countries; especially in the emerging and developing ones⁸. Artificial intelligence technologies correctly designed and implemented, can guarantee concrete perspectives to improve the quality of life, allow greater accessibility to services and reduce production costs. Automation provides unprecedented opportunities regarding dangerous and arduous tasks. It helps us make more informed decisions, by rationally managing large amounts of data that would otherwise be difficult to interpret. It even allows us to communicate without knowing the language of our interlocutors, it has the potential to enhance culture, entertainment, transformation and acceleration of bureaucratic procedures⁹.



Third.

Transition and New Skills

We are experiencing great transition scenarios between jobs or tasks that arise, others that are transformed and some that tend to disappear. The “pre-digital” workers will eventually leave the labor market, to let millennials or “native digitals” to naturally incorporate their knowledge in the use of new technologies. This point is where some studies stay focused: on how companies and governments should invest so as to help people to adapt in the best way to changes, since there are no observable efforts to train all employees in new skills. However, at the same time we should focus on the skills development of those who have lost their job and are not sufficiently prepared to make the most of the new job opportunities¹⁰.



III. More Automation = Unemployment?



Approximately, more than 70% of Latin Americans, Europeans and North Americans see AI and/or robotics as a threat to employment¹¹. The perception of unemployment is not a new phenomenon, and is probably based on concrete cases that emphasizes it. For example, Foxconn, the world largest electronic manufacturing company from China, in 2016 has replaced almost 60,000 employees when introducing robots to the process of production for the performance of repetitive tasks. Last year, the Company's President stated that in the next 5 to 10 years, they are planning to replace 80% of their workforce with robots.

A similar phenomenon happens with the e-commerce company, Amazon which in the last years has invested in thousands of robots to deal with mechanical tasks, making human tasks less tedious and physically less demanding (workers no longer carry and stack up boxes). These robotic incorporations can be seen in exact figures: in 2018 Amazon hired 20,000 less workers than in 2017 (from 120,000 to 100,000). However, some analysts consider that the quality of work improves because it allows people to carry out more sophisticated tasks that require more cognitive skills¹².

However, the pessimistic perception and the employment reduction do not affect global numbers. Moreover, paradoxically, countries, that develop more robotics and AI have less unemployment or are more stable.

There are 5 leading countries in robotics: China, Japan, South Korea, United States and Germany. Together they cover 73% of the total volume of global sales. After contrasting the robotics capacity with the unemployment rate of each country we obtained the following outcome:

In China there is a continuous increase on industrial robots, 59% more than in 2017 (137,900) compared to 2016¹³. However, the unemployment rate of 4% is the same as the previous year, and it is estimated to remain stable until 2023¹⁴.

In Japan something similar has happened, the increase of robots on 18% on sales (45,566 units in 2017)¹⁵, has not impacted negatively on employment. Although it is hard to establish correlations with a multi causal origin, it is true that in this country, unemployment is decreasing and it is foreseen as stable until 2023¹⁶. South Korea, although it has not experienced an increase in robotics in 2017, since there was a slight decrease compared to the previous year¹⁷, its unemployment rate was 3.2% and it is estimated to be of 3.1 % by 2023¹⁸.



Let's look at the United States of America's case. In 2017, the country has increased the incorporation of robots by 6% compared to the previous year (33,192 units)¹⁹ and its unemployment rate has dropped. In figures: 9.6% in 2010, passing from 4.4% in 2017 to 3.8% in 2019, estimated to keep stable for 2023²⁰. If we analyze the manufacturing industries, another paradox can be noticed. Since 2010 a path towards automation has started in order to strengthen the industry in the domestic and international markets²¹. However, the number of workers in the automotive sector increased by 230,000 between 2010 and 2015, while 60,000 industrial robots were installed during that period in the same sector²².

A similar phenomenon occurred in Germany. During 2010-2015 the number of jobs in the automotive sector increased from 93,000 to 813,000, while 93,000 robots were incorporated during that period in the same sector²³. In this country, the unemployment rate shows a steady decline for years (from 7.7% in 2009 to 3.2% in 2019) and it is projected practically immobile by 2023²⁴, however, there is an increase in the production of robots and intelligent systems²⁵.

In conclusion, we noticed that there are three phenomenon taking place, which are similar to other periods, even if they occur at another scale, depth and speed.



On the one hand, asymmetries are verified. While the increasing automation can reduce employment in some sectors, in other sectors it increases it as in the case of the automotive industry²⁶.

In these years, a coexistence between three effects will increase: displacement, complementarity and productivity. While in certain cases there will be a direct substitution of jobs and tasks -displacement effect-, there will be a complementary increase related to new machines and other tasks or jobs that arise –complementarity effect-. The productivity effect is linked to a phenomenon related to the demand for lower prices and the general increase in disposable income in the economy, due to a higher productivity.

In general, these effects do not materialize simultaneously, and the standard narrative states that unemployment will initially increase with automation, before falling again when prices and productivity are widely adjusted in the economy, usually at a much later stage²⁷.

Secondly, the reduction of jobs in specific areas or tasks does not have a global impact, since there is no evidence of an increase in unemployment, although it is very difficult to establish a linear correlation on aspects that have a multi-causal origin. However, although Foxconn and Amazon hire fewer people in certain areas, general unemployment rates decline or remain stable (see Annex 1).



Finally, it is almost impossible to certainly know the consequences of a tsunami while it happens. In the 19th century, a manual loom worker could not assume the fact that while its work was extinguishing, others were being created that would lead to more tasks and jobs. In a world where the instantaneous tends to be prioritized, the inability to project the opportunities granted by such technological advances produces a fear scenario linked to apocalyptic scenarios initially raised. The Fourth Industrial Revolution and its emerging technologies involve too many disruptive factors that hinder the establishment of causal correlations with a certain degree of success regarding the direct and indirect effects on employment. Even more, when we go through unprecedented scenarios of creation, transformation and extinction of activities or tasks that require special care in the analysis, to take advantage of the benefits of the phenomenon and not rush to fatalistic conclusions related to risks.



IV. Latin American Perspectives



If we analyze the global unemployment figures, Latin America shows a slight and slow reduction in the rate: 7.8% in 2018 compared to 8.2% in 2017 (World Bank)²⁸. For this year, the ILO has foreseen that it will be of 7.7%²⁹. In this context, our region faces several obstacles in adopting technologies³⁰. It means, in essence, a lack of adequate infrastructure and a lack of strategic framework for modernization at the state level, as well as problems associated with basic needs. In addition, the workforce does not possess the skills or preparation required by the digital world. Consequently, it is more profitable for companies to continue paying low salaries than investing in innovation³¹.

In Latin America, if we see a slow progress on emerging technologies, it is still more difficult to correlate the phenomenon with global figures of unemployment³². Despite the late adoption of technology, it is considered that the risk of automation in employment is of 39% (in a scale of 0% to 100%, being 100% the maximum risk)³³. However, in contexts of asymmetric development, our region can reduce risks, face challenges and boost the benefits that AI and robotics present.

First

On the one hand, it is crucial to promote the inclusion and training of workers who are in a situation of vulnerability, so that the inevitable transition towards ecosystems of greater automation is inclusive³⁴. On the other hand, AI and robotics have the potential to increase the economic growth of the region. The latter is linked to redistribution, increasing efficiency and optimization of multiple tasks, and not so much to the fact that machines replace humans. In this regard, it is essential that in the short and medium term, favorable environments are created so that workers can add value to other existing tasks or develop skills linked to those that are being created³⁵.

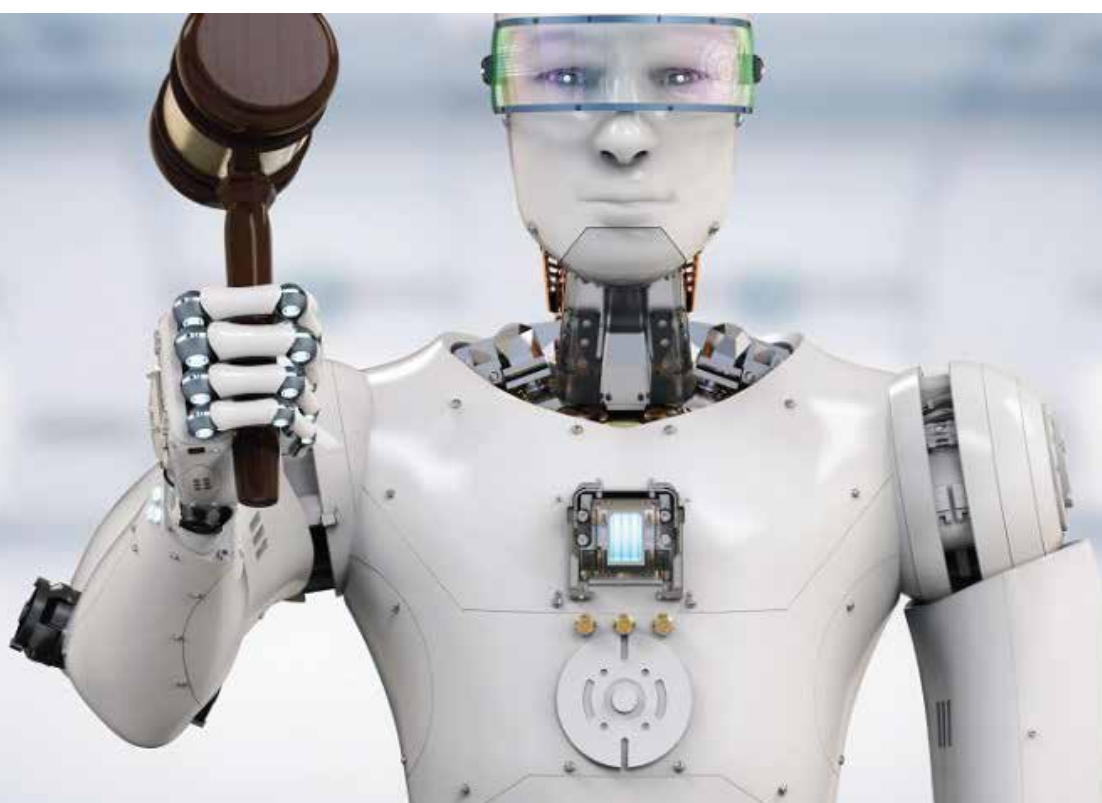
In this sense, social inclusion is determinant in terms of the training that is required. High levels of poverty and underemployment threaten a policy of substitution of labor roles, but this is not a problem that can be attributed to the use of AI, but rather to government management options.



Second

According to the Institute for the Integration of Latin America and the Caribbean branch of the Inter-American Development Bank (hereinafter, IDB-INTAL), the impact of AI will be exponential in the Latin American productive force if certain advances that are being implemented in the region are taken into account.

For example, the recognition of images used in precision agriculture for directed fumigation can increase its yield per hectare by 30%; health services can provide medical diagnoses with an accuracy of 96%; the streamlining of the resolution of judicial cases based on predictions with a success rate, on average, of 96%. Regarding this last example, when we promoted the development of the AI system, Prometea, created within the scope of the Public Prosecutor's Office of the Autonomous City of Buenos Aires, we noticed an increase in productivity and efficiency between 300% and 2,400%³⁶ in the opinion making process in Justice, with a better use of existing human resources.



In the field of health, there are prediction and assistance projects such as Entelai PIC (Argentina) which aim is to process clinical studies using AI techniques, so as to provide a comprehensive image together with a report, while suggesting a potential diagnosis to consider. This allows radiologists to quickly identify the most relevant cases. Also, Entelai DOC (Argentina) assists doctors to identify the most relevant³⁷ cases of patients suffering from headaches³⁸.

In Uruguay, GenLives breaks down human DNA to obtain information to diagnose rare diseases³⁹. Unima in Mexico, is an AI system that can quickly detect infectious diseases such as HIV or tuberculosis, with only a drop of blood, a special paper card and a smartphone⁴⁰.



In Peru, a robot named Rover was created, which explores mines in an autonomous way so as to detect gases that are hazardous to human health (methane, carbon dioxide and ammonia) and then sends an alert to miners who are working in the mine⁴¹.

In the agricultural sector there are AI projects that allow the achievement of sustainable development challenges and the protection of the environment, while collaborating with human tasks. One of them is Auravant, a digital platform created in Argentina that allows the agricultural producer to manage and monitor their field remotely through satellite images, with the objective of maximizing yield and reducing costs by capturing the ideal moment of suitability of the ground, while decreasing the environmental impact⁴².

All of these projects show the benefits and the optimization of rights that the application of robotics and intelligent systems bring to human activities. But, at the same time, challenges arise that presuppose having three main aspects clear:

1. what are the new jobs and tasks we are talking about;
2. how it is possible to begin to walk a path of humanization of jobs and, at the same time;
3. how to achieve an increase in productivity and efficiency in many activities from promoting the paradigm of “augmented intelligence”⁴³ or “hybrid intelligence”, also known as “cobotization”.

V. New Jobs and Tasks

Some decades ago, TIME magazine published an article called The Automation Jobless, which stated that the loss of jobs due to automation represented only part of the problem, since the seriousness of the phenomenon was that not enough jobs were created⁴⁴. When analyzing employment transformation, we can establish four main areas:

1. jobs focused on the use and improvement of technology;
2. freelance jobs that develop in the collaborative economy;
3. jobs that arise from social networks;
4. those that are related to the so-called "orange economy", a concept linked to the exponential growth of activities connected to creativity, art and entertainment.



First

Jobs Focused on the Use and Improvement of Technology

Estimations about the future of employment show that until 2022 labor demand will focus on roles such as data analysts and scientists, drone pilot, software & apps developers, e-commerce specialists, AI programmers, experts in process automation, among many others. These jobs are linked to the creation, development and application of robots or intelligent systems. In addition, jobs and tasks that require distinctive human skills from digitalization and digital transformation will increase. Customer service, sales professionals, training and development, specialists in organizational development and innovation managers⁴⁵.



If we take the case of criminal justice, the use of AI substantially increases the possibilities to detect and investigate crimes that were previously unpunished (trace from millions of interactions, cases of child pornography, harassment, among others) and at the same time increase the work of other judicial employees (data curators, data analysts, AI experts) and demand experts who were previously outside the system of Justice.

Finally, in the whole world thousands of AI Startups are developed that work with multidisciplinary teams and can employ ten people directly (engineers, graduates in computer science and other professions that are considered far from technology as linguists or anthropologists. See Annex 2)⁴⁶.



Second

Freelance Work and Gig Economy

The “gig” or collaborative economy, is based on specific works that are carried out sporadically. Flexibility, working online and the decentralization of tasks stand out as its main pillars⁴⁷. Uber driver, community manager, computer security expert or other “freelancers” that can constitute the worker's main income or a complement⁴⁸. For example, around 20-30% of the workforce belong to the *gig economy*⁴⁹ in countries of the European Union and in the United States.

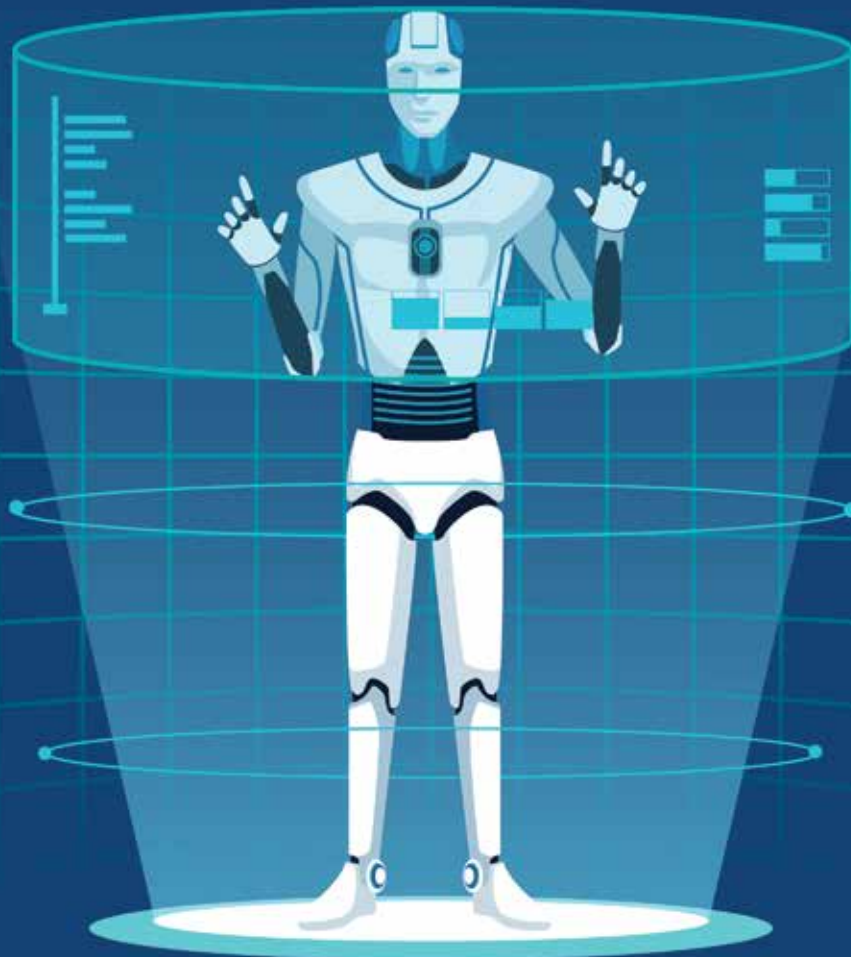
Within the collaborative economy we can also find crowdwork, another way of working that appeared a few years ago and continues to expand. Crowdwork consists of groups of workers who, from different corners of the world, offer companies the possibility of developing projects at any time of the day. As the number of workers is high, tasks are done quickly: for example, large datasets can be processed in a short period of time. These people are only hired for a particular task, with no obligation in the rest of the company, than the one assumed for the project they were hired for⁵⁰.



Third

Jobs on Social Networks

With the explosion of social networks in recent years there are thousands of "*influencers*" around the world. These people use digital platforms such as *YouTube* or *Instagram* to share videos and photos. The number of followers and views can be a source of revenue for advertising. Although we have not found concrete studies that show global figures about this phenomenon, the truth is that many people earn a lot of money. Just to give an example, the young businesswoman Kylie Jenner can gain up to 1 million USD for a post⁵¹. However, social networks are not only for those who take advantage of their benefits, but also constitute a new mean of communication for companies and public entities, which create specific new professions between experts in public communication, psychologists and analysts.



Fourth

Jobs and Tasks of the Orange Economy

The concept of orange economy is linked to two large areas. On the one hand, the goods and services that are generated in art, design, music, fashion, crafts and diverse forms of entertainment. On the other hand, platforms and innovation systems that support creativity associated with esthetics, shape of the goods and services, and the emotional changes that these products generate in consumers. Visual arts, performing arts, crafts, publishing, audiovisual, phonography, interior design, graphic arts, lighting, *software* and video games, advertising and fashion are some of the goods and services that make up this orange economy. In addition, there are creative support activities such as product design, packaging design and *marketing*.

This Fourth Industrial Revolution gives birth to producers and consumers who can now be "prosumers", because they can be both at the same time. Only in Latin America and the Caribbean, the orange economy accounted for 1.9 million jobs in 2015. This is what the economy in Uruguay or Costa Rica generates⁵².



VI. New Skills

Technological advances bring a strong labor demand that is evident. The question is what type of labor and which skills will be demanded. Here we enter the field of new skills that workers of the present need to include in their resumes. Let's review what those essential competences are, how their learning should be approached and what is the role of companies and State.



Digital Skills

Digital skills or what is sometimes called "digital coefficient", are related to a complete set of technical, cognitive and socio-emotional skills that allow people to align with the challenges and the great technological and socio-economic changes that the world is going through, especially linked to an increasingly digital life⁵⁵. The consolidation of these skills is crucial in younger generations, but even more in adults and in vulnerable people. On these groups it is key to develop policies on literacy, assistance, transition ecosystems and transformation of skills, so that they are not left behind.

Creativity and Socio-emotional Skills

Creative thinking, development of emotional intelligence, complex human interactions, and social-emotional skills are the key to the present and future of employment. Although many AI and robotics projects focus on these "more human" areas, the machines are still far from being inserted into activities that are based on these capabilities⁵⁴. It is of fundamental importance to cultivate and develop necessary skills for the interaction between human beings and AI, which will become increasingly complex as these systems are in continuous development, linked to language, gestures, body, emotions and many other expressive dimensions of biological organisms that machines begin to reproduce.

Promotion of Constant Learning

The development of emerging technologies entails a paradigm shift: it is no longer enough for a worker to study a career and at that point finish its formation. Digital, creative and socio-emotional skills shall be constantly developed so as to adapt to the vertiginous and accelerated nature of technological disruptions⁵⁵. It is important to help people understand what AI is, what benefits it can really generate and what risks it entails, in order to allow them to make the best use of the services offered. We must promote a positive and optimistic approach in collective imagination, although this does not imply neglecting or addressing the risks and challenges that may arise.

Invest on Human Capital

In this context of constant demand for new job skills, companies and States play an essential role. In order to increase their efficiency and become inclusive, they must transform substantially. This generates two great challenges that cannot be dissociated: investment in technology and in human capital. Specifically, to alphabetize and create adequate conditions for people to adapt to working with robots and intelligent systems⁵⁶. It is not possible to shift from office worker to drone pilot from one day to another. This is the great challenge for an inclusive transition: to create segmented strategies, according to the types of tasks and profiles, in order to retrain and develop essential skills for new working environments⁵⁷. Here is where the concept of “*cobotization*” appears, a sort of co-working with humans, AI or robots.

If we take what happens in Latin America or Africa as an example, it is clear that one of the main concerns is social inclusion, so that an improvement in the feeding conditions and certain training possibilities would avoid the concrete impossibility of adapting the inhabitants of marginalized neighborhoods to the future workforce. For States, this will be one of the most important challenges. The marginalization of social groups that do not have digital benefits could increase exponentially, if an AI gap is added to the digital gap. This phenomenon may lead to a new source of social and community inequality, deepening even more the borders of isolation and underdevelopment.



Cobotization. Coworking Between People and Machines. Examples of Practical Application

The present work, in general, shows automation as a complement that fosters and strengthens human work. Here the concept of "cobotization" arises, as a convergence between AI systems, robots and workers. As Béliz affirms, the central idea is to create a "workforce with augmented intelligence", in which AI raises the limits of traditional capacities⁵⁸.

On this basis, we believe that the augmented intelligence is based on an inclusive cobotization that is supposed to direct the efforts to establish four great tools that are applied to the larger sectors of human activities: industrial, manufacturing and services. These are:



intelligent assistance;



automation;



**intelligent diagnosis or
detection;**



prediction.

There are several examples of projects that use these approaches or combine them to boost activities. Let's see.

The Da Vinci Surgical System is an ergonomic assistance platform, designed by Intuitive Surgical, which allows the surgeon to remotely and in real time direct the movements of the robot whose four arms have the miniaturized operating instruments. Robotic surgery or computer-assisted surgery allows the surgeon to perform surgical interventions remotely. Through virtual reality, the professional determines the movements that the robot will execute on the patient. The robots that are used for these applications cannot move autonomously and are absolutely dependent⁵⁹.



WISE consists of a platform that automatically detects, recognizes and characterizes geometrically all components of the grapevines plant. It automates the precise elicitation of 3D plants models and correctly segments their components. Its benefit is to allow the optimization of the crop and to calculate the incidence of sunlight they receive⁶⁰.



As an intelligent detection tool, we find the Weeding Robot developed by CIFACIS and CONICET that identifies different weed species in real time and allows the application of different treatments for each type of weed. The mobile platform moves in the field in an autonomous way⁶¹.

Sowing App predicts and determines the optimum sowing period. To do this, it uses AI / machine learning (ML) models that are constructed using historical climatic data, including the daily rainfall recorded at each season and the weather forecast for the region⁶².

In the case of Justice and public entities, Prometea has shown surprising results to optimize rights and increase efficiency. This system combines automation, assistance, intelligent detection, prediction and its ability to also integrate *blockchain* solutions⁶³. For example, in the Constitutional Court of Colombia, one of the most influential judicial bodies in the region, Prometea was trained to read, analyze, and detect priority cases in health care matters, to be treated by the Court.

This Court receives around 2,700 actions of tutela per day from more than 4,000 judges throughout the Colombian territory. 1,400 of them deal with the right to health care. After two months of work with a training set of 2,000 health care cases, Prometea was able to select 32 priority cases in 2 minutes⁶⁴. This would take a human being 96 working days. In this way, AI detects patterns that would be almost impossible to recognize, such as a list of more than 2,000 rare diseases, to increase the knowledge and avoid biases when dealing with cases where people want judicial protection because they suffer from health problems.



If we observe these kind of projects, it is evident that the combination of human workforce and AI systems or robots, under an inclusive approach, produces the phenomenon we have called "automation that humanizes". The reduction of biases, mistakes and time that makes activities more efficient, allows redirecting biological cognitive abilities to more sophisticated tasks, or that require empathy and creativity. For example, it is estimated that by the year 2030 digital workers will dedicate two hours less per week to routine tasks which can be automated, being able to focus on more complex activities. It is also predicted that about three quarters of the impact of automation on employment will occur within a single job position⁶⁵.



VII. Task-based Approach. Lessons Learned From the “Prometea’s Experience”

The perspective under which we analyze the present of employment is from the distinction between jobs and the series of tasks that form them, and not as an indivisible and compact set.

As the vast majority of tasks cannot be completely automated, it is very useful to do the following: on the one hand, classify the tasks into three large segments: automatable, semi-automatable and non-automatable. On the other hand, it is very helpful to analyze how human capacity can be increased, based on intelligent assistance, intelligent diagnosis and prediction. This can be measured by doing prospective exercises through different AI available techniques (expert systems, machine learning, among others).



When a worker has an AI system such as Prometea, which in a few seconds detects and compares prices of the latest purchases in the public sector, it increases its capacity to improve the efficiency of public spending. If a doctor has a well-trained virtual assistant (conversational agent combined with an expert system), it can complete the digital medical record more efficiently.

We insist on separating jobs and tasks, because in the short term there are few occupations that can be completely automated with the existing technologies. However, when those tasks are automated work profiles must be transformed⁶⁶.



Let's illustrate this frame of work vs. tasks with examples from the public sector (Justice and Public Administration), based on a research carried out by the Innovation and Artificial Intelligence Laboratory of the School of Law of the University of Buenos Aires and the Public Prosecutor's Office of the City of Buenos Aires⁶⁷. First, we segmented tasks in the Deputy Attorney General Prosecutor's Office in the Contentious Administrative and Tax Matters. We detected that of 169 activities that are carried out, 54 can be completely automatated, whereas there are 74 tasks that cannot be and 41 that can only be partially.



ACTIVITY	Automatable	Non-automatable	Semi-automatable	Total
Legal - Systematization	16	26	13	55
Legal - Ruling	1	5	6	12
Legal - AI	1	8	3	12
Planning and management	9	7	3	19
Administrative - Ruling	14	-	-	14
Training and promotion	13	28	16	57
Total as for Automation Grade	54	74	41	169

Of the 86 activities that require complex skills such as critical thinking and problem solving, only 11 are fully automatable, 28 semi-automatable and 47 non-automatable. However in routine and repetitive activities that demand methodicity and practicality, the vast majority is fully automated: 37 from 46.



SKILL REQUIRED	Automatable	Non-automatable	Semi-automatable	Total
Critical Thinking and Problem Solving	11	47	28	86
Method and Practicality	37	6	3	46
Communication and Effective Relations	3	18	3	24
Presentation and Promotion	2	3	5	10
Precision and Organization	1	-	2	3
Total as for Automation Grade	54	74	41	169

Finally, when we analyzed the complexity of the activities that are done in the Public Prosecutor's Office, we detected that 54 require a low level of complexity and therefore the automatable portion is substantial: 40, compared to 11 that are non-automatable and 3 that can be partly automated. In contrast, of 70 activities of high complexity that are carried out only 2 are automatable, compared to 44 that cannot be automated and 24 that are semi-automatable.



TASK COMPLEXITY	Automatable	Non-automatable	Semi-automatable	Total
Low	40	11	3	54
Medium	12	19	14	45
High	2	44	24	70
Total as for Automation Grade	54	74	41	169

Second, we focused on the General Office of Acquisitions and Security and Emergency Contracts of the Ministry of Justice and Security of the City of Buenos Aires. Thanks to the joint work with this Office, we detected that of 617 activities that are carried out, 338 are completely automatable, compared to 205 that cannot be automated and 74 that can only be partly.



ACTIVITY	Automatable	Non-automatable	Semi-automatable	Total
Administrative	313	74	29	416
Legal	11	105	43	159
Management	14	26	2	42
Total as for Automation Grade	338	205	74	617

We noted that of those tasks that require complex skills, such as detecting applicable regulations and critical thinking, only 2 are automatable, compared to 111 that are not, and 12 semi-automatable. However, in activities that require methodicity and practicality, we find routine, mechanical or standardized activities. Here, the stage is practically divided into thirds: 61 automatable, 51 non-automatable and 60 semi-automatable.



SKILL REQUIRED	Automatable	Non-automatable	Semi-automatable	Total
ICT Use	264	24	2	290
Method and Practicality	61	51	60	172
Knowing Regulations and Critical Thinking	2	111	12	125
Communication and Effective Relations	11	19	0	30
Total as for Automation Grade	338	205	74	617

Finally, if we analyze the level of complexity of the activities that are carried out, the automatable occupy a significant percentage when complexity is low. Of 388, 289 are automatable, compared to 68 that are non-automatable and 31 semi-automatable. As it occurs in Justice, in this body of the Public Administration few activities can be fully automated when it comes to high complexity tasks. Of 153, only 16 are automatable, compared to 125 that are non-automatable and 12 semi-automatable.

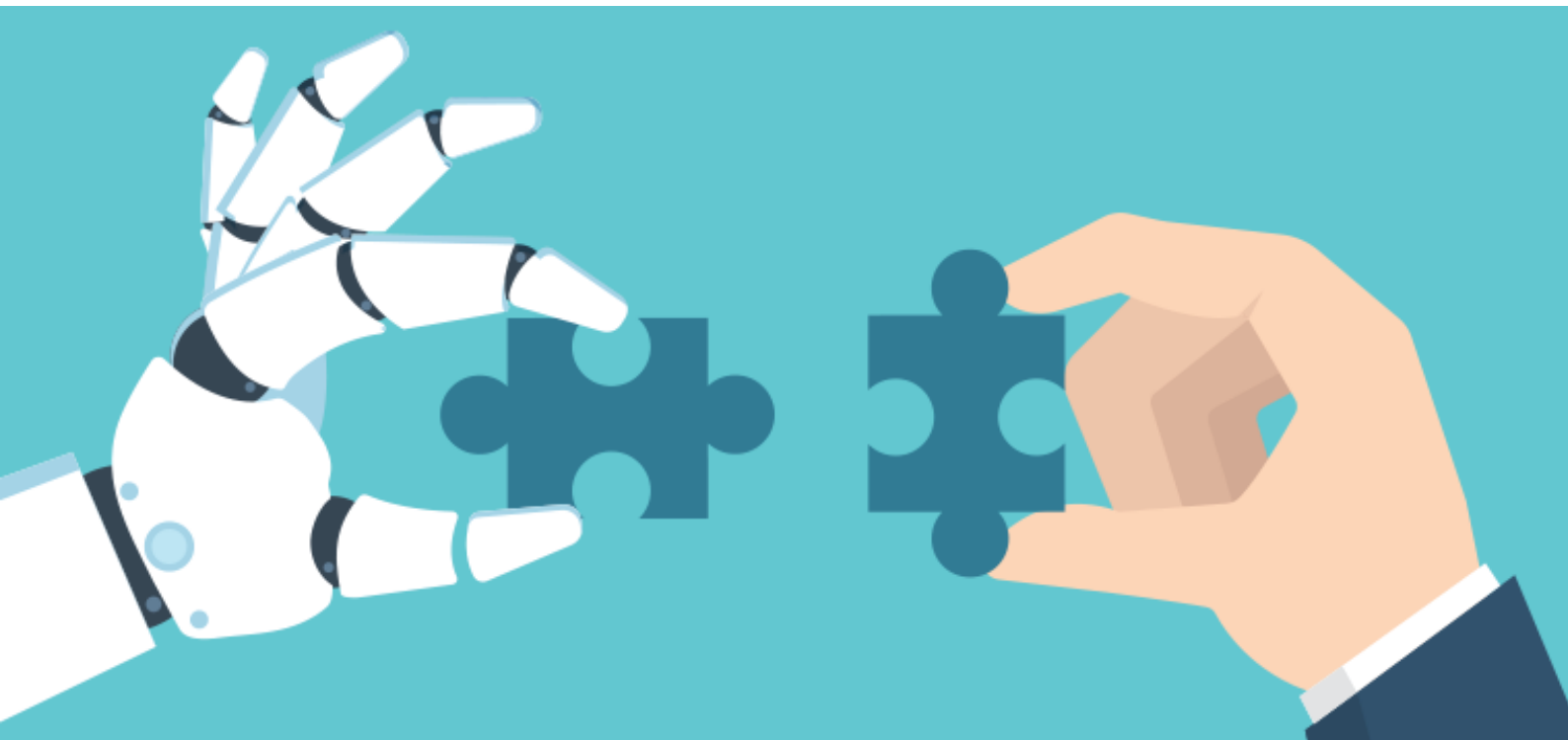


TASK COMPLEXITY	Automatable	Non-automatable	Semi-automatable	Total
Low	289	68	31	388
Medium	33	12	31	76
High	16	125	12	153
Total as for Automation Grade	338	205	74	617

In both public organizations, with Prometea we have advanced on automatable tasks, starting to generate documents in an intelligent way and by developing an intelligent assistant of price comparison. The lessons learned in these and other organizations are similar.

AI As a Challenge for Workers

On the one hand, the present work involves learning concepts and logics linked to intelligent systems that replace tasks, complement others and create new ones. On the other hand, people have to unlearn many techniques, forms and approaches that they have acquired to develop within the "industrial" paradigm, based on a succession of linear steps to reach a certain result. Finally, the incorporation of AI in organizations requires learning a new labor paradigm: teaching machines the "history" of our activities and the objectives to be achieved. With human experts, multidisciplinary teams and AI programmers, productivity and efficiency is increased and the cobotization and augmented intelligence formats are installed.



Data Governance.

“Afforesting” Decisions to Optimize Work

Adopting the automation of tasks approach is linked to applying an adequate "data governance". At this point, it is key to use a basic technique which was developed many years ago: “Decision Trees” (See Annex 3)⁶⁸. Afforesting human decisions implies substantial advantages. Among others, redundant steps and phases that increase the private or public bureaucracy emerge⁶⁹. In other words, decision trees are useful for identifying unnecessary tasks or those that increase inefficiency. We will analyze an example from the Netflix film released in 2018, “Black Mirror: Bandersnatch”.

From the AI LAB we used this example to work on people’s digital literacy⁷⁰. This movie uses a format in which the viewer, with its remote control or its mobile device, chooses what the main character should do. The viewer is not aware of the possible outcomes. Consequently, at different times, the film gives the user two options, from which the user has to select one and thus, the film will lead to different endings. One of the first decisions that must be taken is the following: if the main character shall accept a job offer in the videogame’s company *Tuckersoft*.



The film offers 9 different endings. If one takes all the possible decisions it offers and makes a "decision tree" on all of them, then there are 290 decisions that can be made and the film could last more than 5 hours. If we simplify the tree, and only focus on the decisions that lead us to 9 possible endings, then we should only make 14 decisions. De-bureaucratizing this movie through data governance, and the afforestation of decisions determines that there is no need to make 276 decisions that, in short, will lead to the same 9 possible endings.

The process of making decisions that reflect tasks allows us to identify binary rules and paths. If we take a look at the decision tree from the 290 decisions, we can notice the different options which were proposed and the 9 possible endings of the movie. Also, there are two types: i) convenient decisions; ii) inconvenient decisions, and within the latter, we can distinguish between irrelevant and those that generate a significant increase in the "film's bureaucracy". Let's see.



convenient decisions



inconvenient decisions

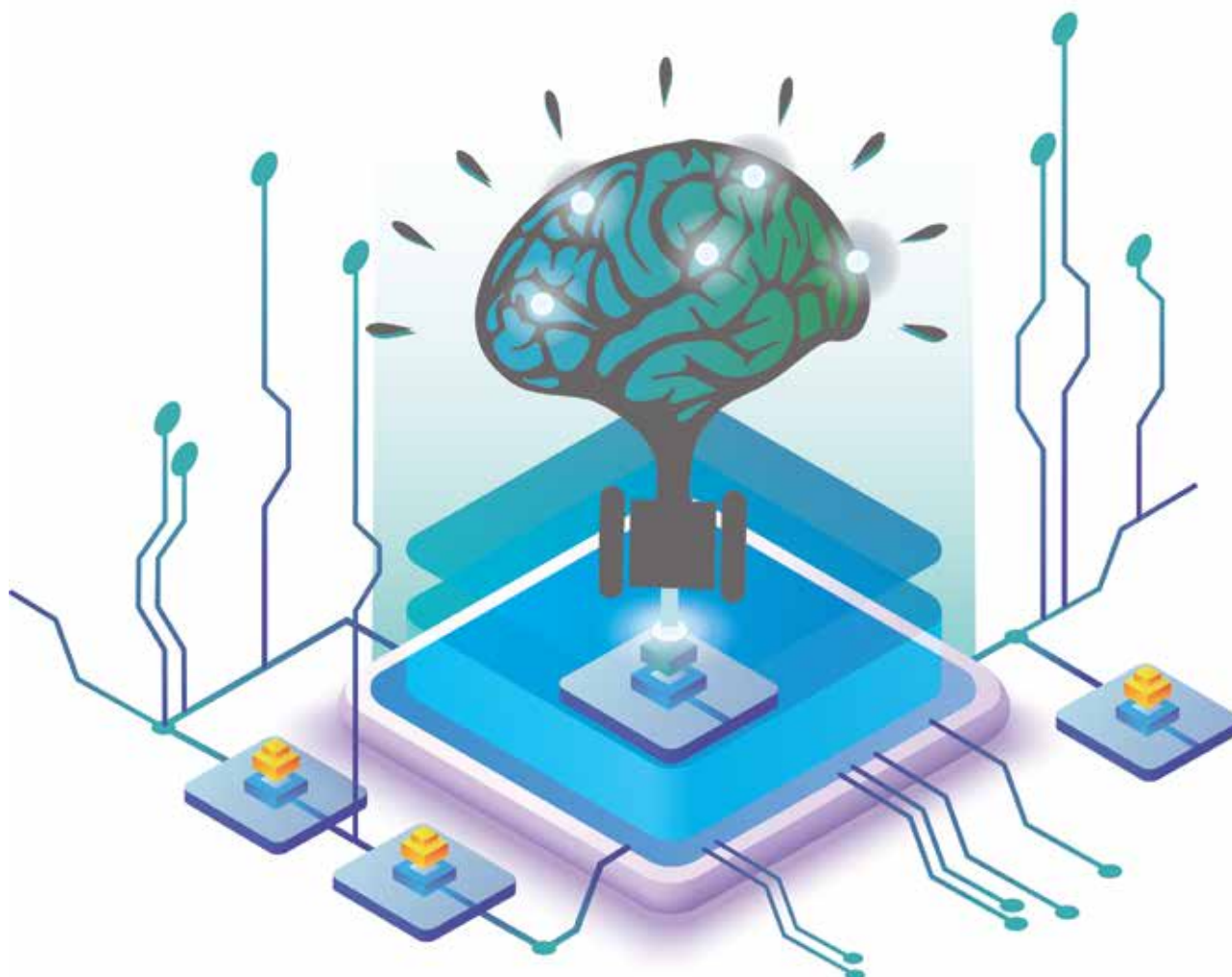
The convenient decisions are those that are strictly necessary to reach one of the endings. If the main character chooses to "face the therapist" the film will have a different ending than if he chooses to "jump out of the window". Inconvenient decisions are those that do not provide different solutions and, in some cases, generate an additional workload: when the main character must choose between eating *Kellogg's* or *Quaker cereals*, or when he must decide between "smash the computer" or "hit the desk." Only by afforesting the film we can accurately identify the convenience, irrelevance and inconvenience that generate additional workload.

For example, if the main character chooses to "smash the computer", we should go backwards to the immediately previous decision, according to the movie chronology. Between irrelevant and inconvenient, the paradigm of the "inefficient bureaucracy" of the Netflix movie is built.



If we apply the Black Mirror "Bandersnatch" example to a company or institution, we detect that public and private organizations have an important portion of automated, mechanical and routine tasks, and we often perform irrelevant or inconvenient tasks. If we want to de-bureaucratize and humanize organizations through AI techniques, it is key that certain groups of tasks are afforested under this approach. In other words, in order to transform the printing or digital bureaucracy into an intelligent bureaucracy, small decisions that are reflected in copying and pasting texts, numbers, and opening digital windows to give standardized answers or simple solutions that are thought once and then, repeated hundreds or thousands of times, must be reduced or eliminated⁷¹.

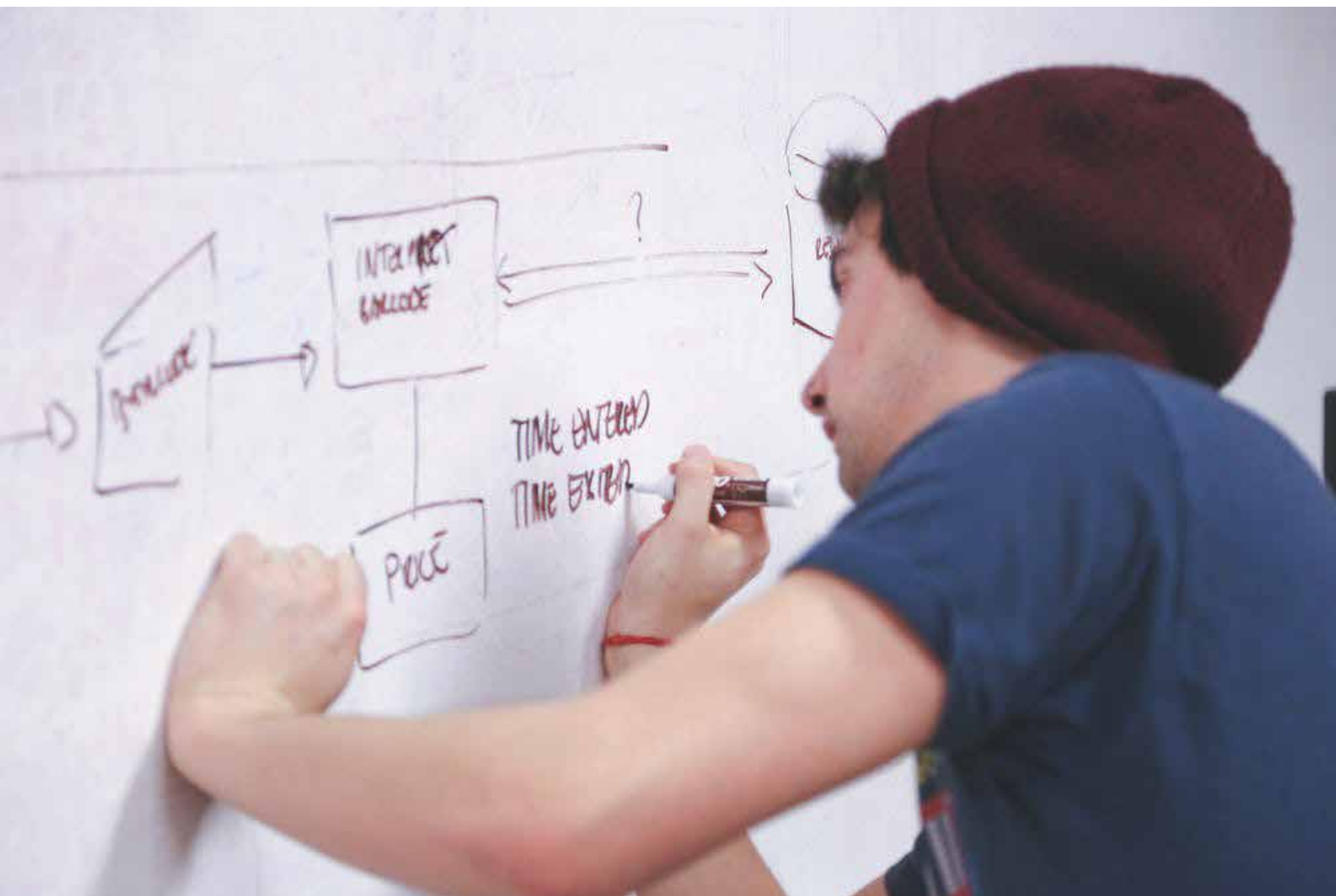
For example, in a purchasing and contracting process of the Ministry of Justice and Security of the Autonomous City of Buenos Aires, drafting a document requires 247 clicks, opening 39 windows and copying and pasting more than 20 data. In the legal aspect, an executive lawsuit proceeding of a Court of the Province of Buenos Aires requires 49 clicks, opening 23 windows and copying and pasting 12 data.



Migrating towards a paradigm of intelligent bureaucracy in organizations begins by doing a similar task to the one we did to de-bureaucratize the film. The tasks and steps that make up the activity are analyzed, a decision tree is made and then we think on how a system like Prometea will quickly lead us to different endings, which amount to documents, reports, judgments, communications or diagnoses.

For example, the 247 clicks and 39 displayed windows are replaced by 14 questions. Once answered, Prometea selects and elaborates the document. In addition, the task of copying and pasting data disappears. The paradigm of intelligent de-bureaucratization works with the slogan that the data is entered or obtained once, so that the machine can "transport" it intelligently, as many times as necessary, within the same document or in later ones. The reduction of time in the preparation of the document is amazing: 120 minutes vs. 1 minute.





Other examples were noticed in the First Instance Courts on Contentious Administrative Matters of the provinces of Neuquén and Corrientes. In the first case, a decision tree was made regarding the instance authorization resolution. When answering a maximum of 5 questions, Prometea selects the right document among 11 pre-loaded models, which cover all possible combinations or paths. In the Court of Corrientes, the tree deals with the first procedural decision in a certain action of protection. In this case, apart from selecting a model, Prometea does a documentation control, in which the user must answer YES or NO according to whether it has the documentation requested by the system.

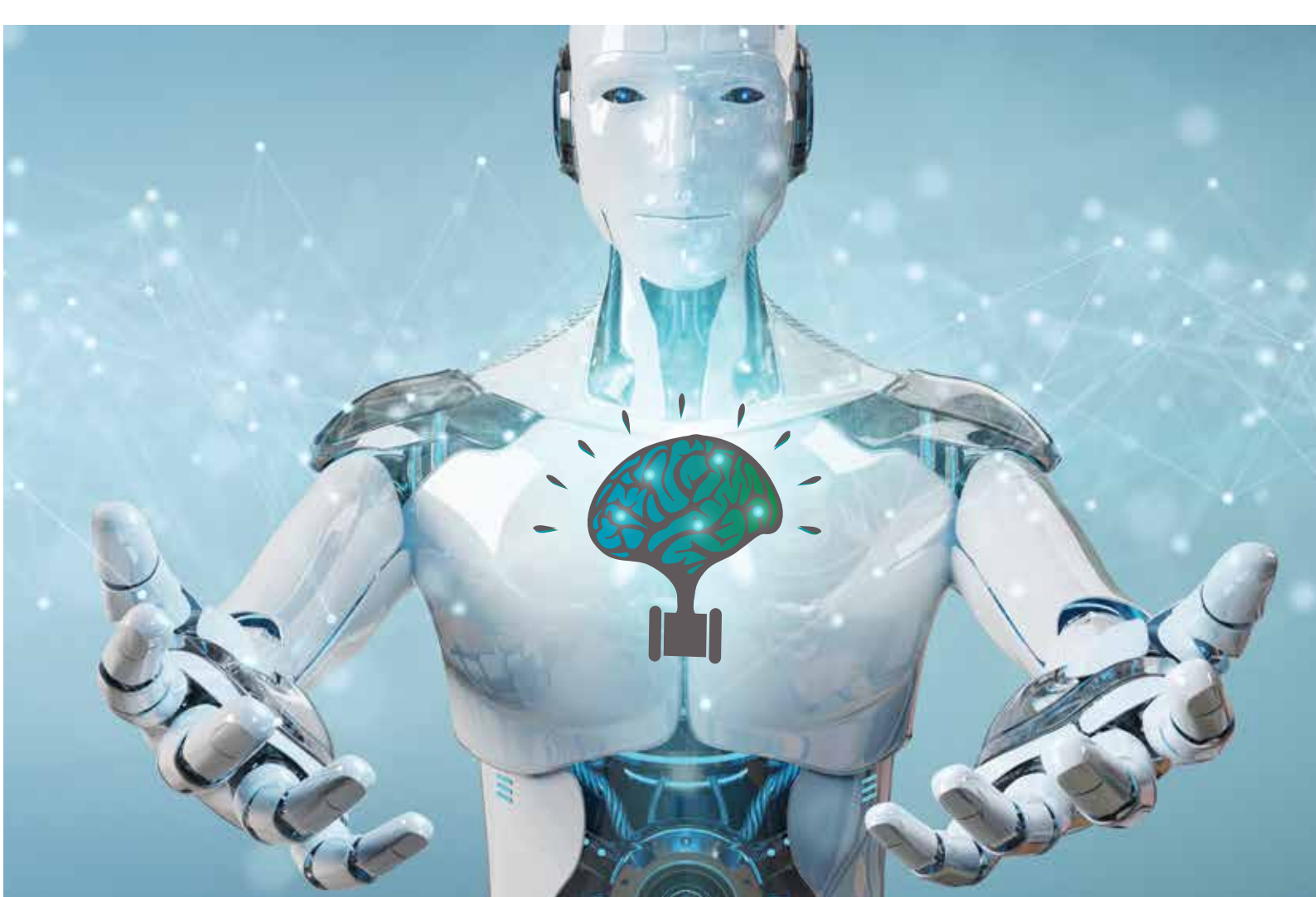
In this way, with only 4 questions, the system chooses the correct provision among 16 possible procedural decisions (See Annex 3.3 - Decision Trees in the Judiciary). These are the outcomes: the Court of Neuquén spends 8 minutes to choose and prepare a document, while in the Court of Corrientes it takes 5 minutes. With Prometea, these tasks are done in 45 and 35 seconds, which represents an increase in efficiency of 967% and 757% respectively.

Complexity and greater possibilities. Working with AI makes searching for solutions and its means to be more clear and precise. Prometea's experience demonstrates what was mentioned in the Cobotization section, as in all cases working possibilities are broaden. Training algorithms into routine, repetitive and mechanical tasks, give employees the possibility to be more productive in postponed or complex tasks.

As an example, in the General Prosecutor's Office, the research work on various topics was deepened and digital booklets that have been widely distributed were done. Among others, Systematization on AI and Robotics⁷² and Complex Litigation in the Americas⁷³. At the same time, many of the employees of the Prosecutor's Office were trained to acquire digital and programming skills.



In conclusion, one of the great advantages of the AI system Prometea, is the ease and versatility to produce results in the existing processes. This is key, as it does not require a great reengineering work compared to other AI systems. The spirit and interaction of Prometea with multiple and diverse organizations, allows to capitalize learning costs, as well as to guide the initial efforts to obtain concrete and fast results, and to facilitate simple tasks into complex labor systems, with very little investment in human capital. These will certainly allow tasks to become more efficient, while the first steps to seek an inclusive and sustainable cobotization are taken.



VIII. Conclusions

If the latest industrial revolutions have created more job positions than the ones that were eliminated, are there any reasons to think that this one will be different? Although we do not certainly know, the trend seems to be the same in the short term. This Fourth Industrial Revolution is unprecedented for several reasons: the most disruptive is given by the appearance of machines that replace or improve what we do with our brain. Even though it is very difficult to predict the effects of an emerging technology tsunami that transforms us like never before, we must seize the opportunity to enhance its benefits, reduce risks and face the challenges instead of making fatalistic predictions.

An increase of AI and robotics does not impact on global unemployment figures. The technological unemployment that Keynes⁷⁴ foresaw seems to be far away, if we consider the logic of disruptive innovations. Our experience with Prometea during these years, encourages us to deactivate some alarms. In the public sector, we do not foresee specific risks regarding the wave of automation that will rise in the upcoming years.

On the contrary, it is necessary to take advantage of AI and robotics potential, while it is key to literate, accompany this transition so that workers can acquire new skills and generate fertile ecosystems where vulnerable people and certain social groups are not left behind⁷⁵. In the private sector, it is essential for companies to place human capital as an asset, instead of exclusively orienting their objectives to produce more and better, at the expense of human work.

The market is increasingly demanding prepared workforce, with digital and creative skills, that can adapt to technological changes. This adaptation is key, since today's capabilities will probably be obsolete in a few years⁷⁶. For all these reasons, it is very important that governments and companies become aware of this phenomenon, so as to take measures and provide solutions for the sustainable development of human work.

In Latin America, the current worries surrounding work are linked to high unemployment rates, instability and precariousness. Although debates and conflicts about worker's conditions are being raised against digital platforms based on AI (Rappi, Uber, etc.), the fact is that concern on how to carry out the phenomenon of "inclusive cobotization" and the paradigm of "augmented intelligence" does not seem to be on the agenda.

From an optimistic perspective, this represents an advantage since we have the possibility to foresee negative effects that technology may have on employment and thus, take the appropriate measures so that when the time comes, the workforce is not afraid of its displacement. From another perspective, the late incorporation of technology in the region implies that the benefits obtained through optimization, simplification and maximization of the organizations' objectives and activities will not be obtained on a large scale.

Although Latin America is not characterized by its technological advances, robots and humans working together represent the image of a present that is gradually taking shape in the region. Prometea is an example of the beginning of this transformation. The joint work between robots and humans should not be understood in a sequential way, in which one of the parties finishes its work and then the other party begins, as it happens in a production line. It is necessary to work under the concept of interdependence and transdisciplinarity⁷⁷.

In this transdisciplinary context, it is important not only to have experts in specific technical disciplines such as machine learning and data science, but also transversal professions as psychologists, anthropologists, sociologists and humanists, who can enhance the interaction between AI and its users. In addition, they can understand how AI can be used in different areas of daily life to improve their conditions and at the same time, establish significant interconnections between disciplines so that new generations of designers create systems of technological excellence, which generate a tangible increment in economic, cultural, social and psychological well-being⁷⁸.

Human intelligence is key to segment tasks, data governance, afforestation of decisions and labeling information patterns that are essential for AI to boost work through automation, intelligent assistance, intelligent diagnosis and prediction. Machine intelligence allows obtaining outcomes that in many cases would be impossible for humans. There are AI systems, as Prometea, which provide automation services in not a very invasive way, and allow a primary phenomenon of cobotization in complex organizations, without having to wait for a total turnover of the workforce. And even more, when people focus on more human tasks, while AI systems cover simpler, routine, dangerous or unhealthy tasks.

We strive for the augmented intelligence paradigm to begin to flourish. Although there are multiple risks and challenges to address, AI is a great opportunity to humanize jobs, improve sustainable development and optimize people's rights.

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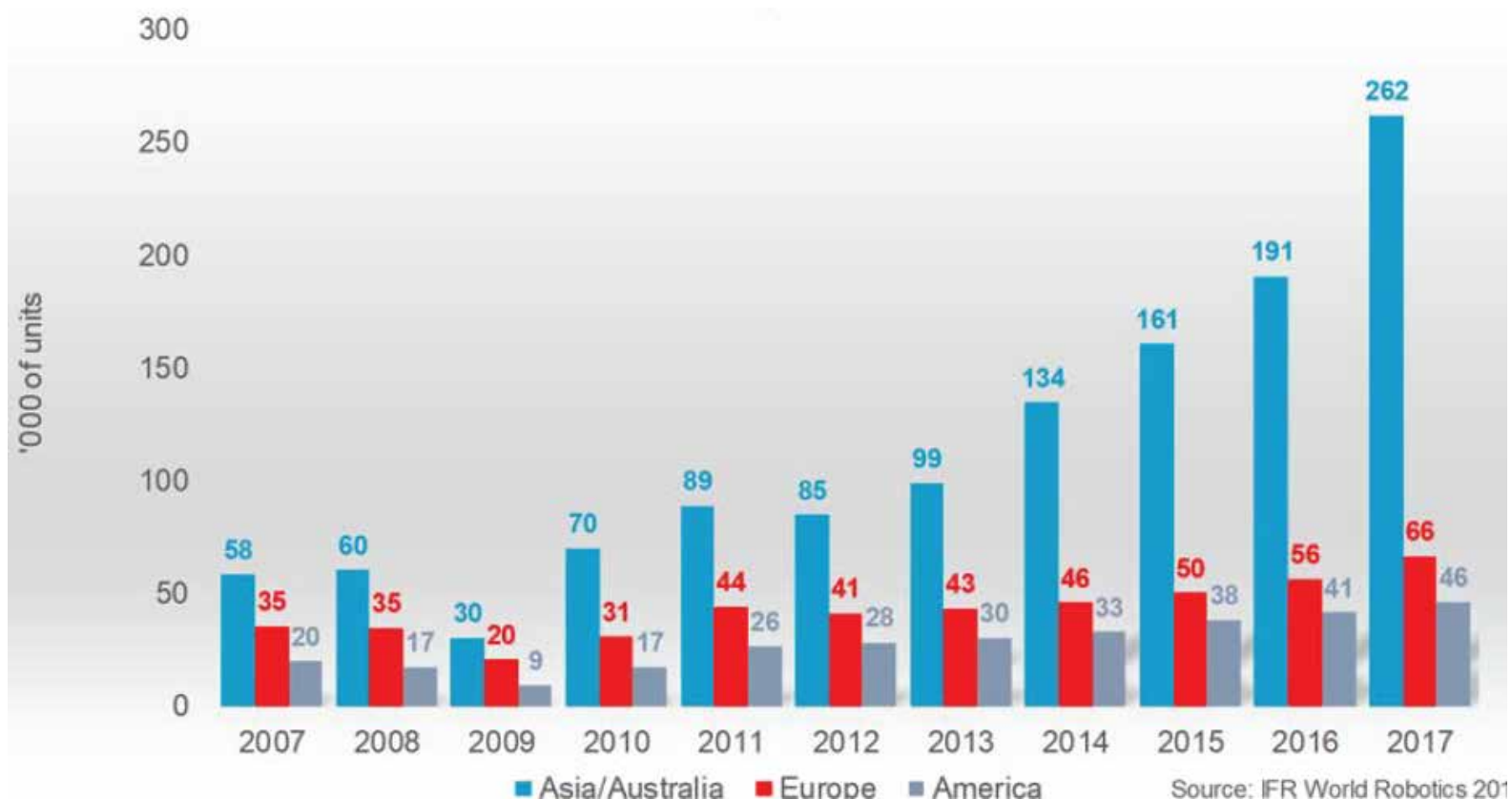
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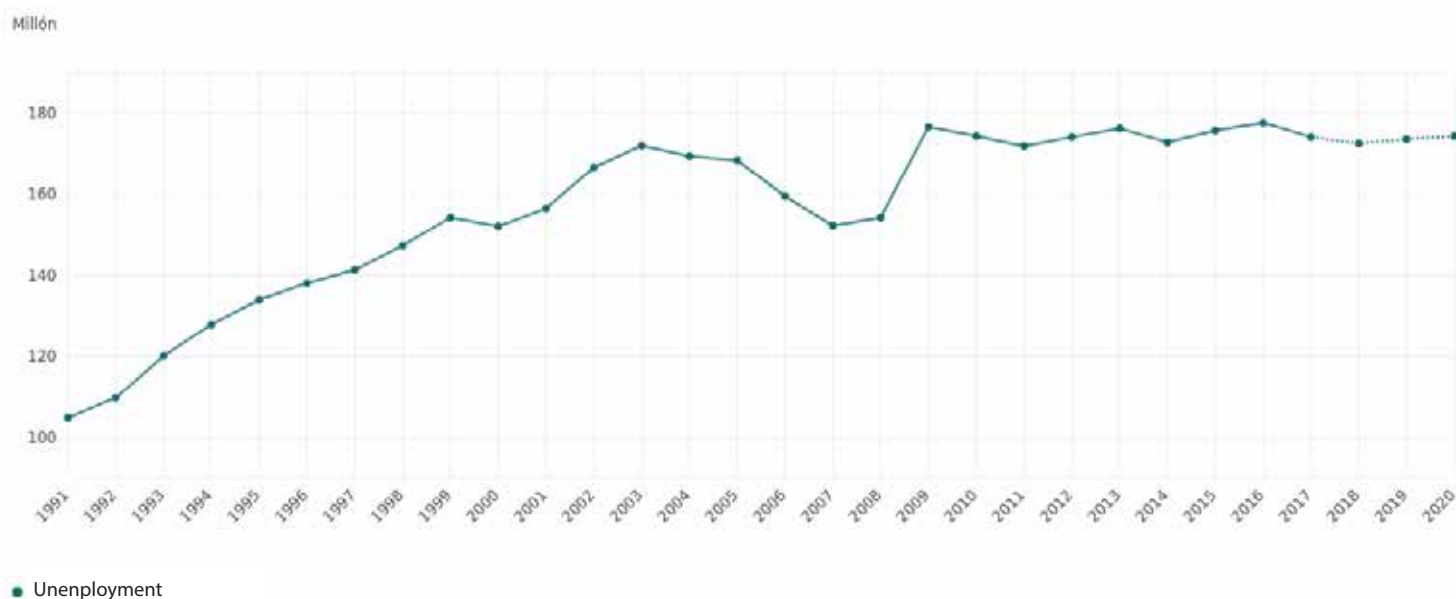
X. Annexes

Annex 1: Robotics and Unemployment

1. Annual shipment of industrial robots per region

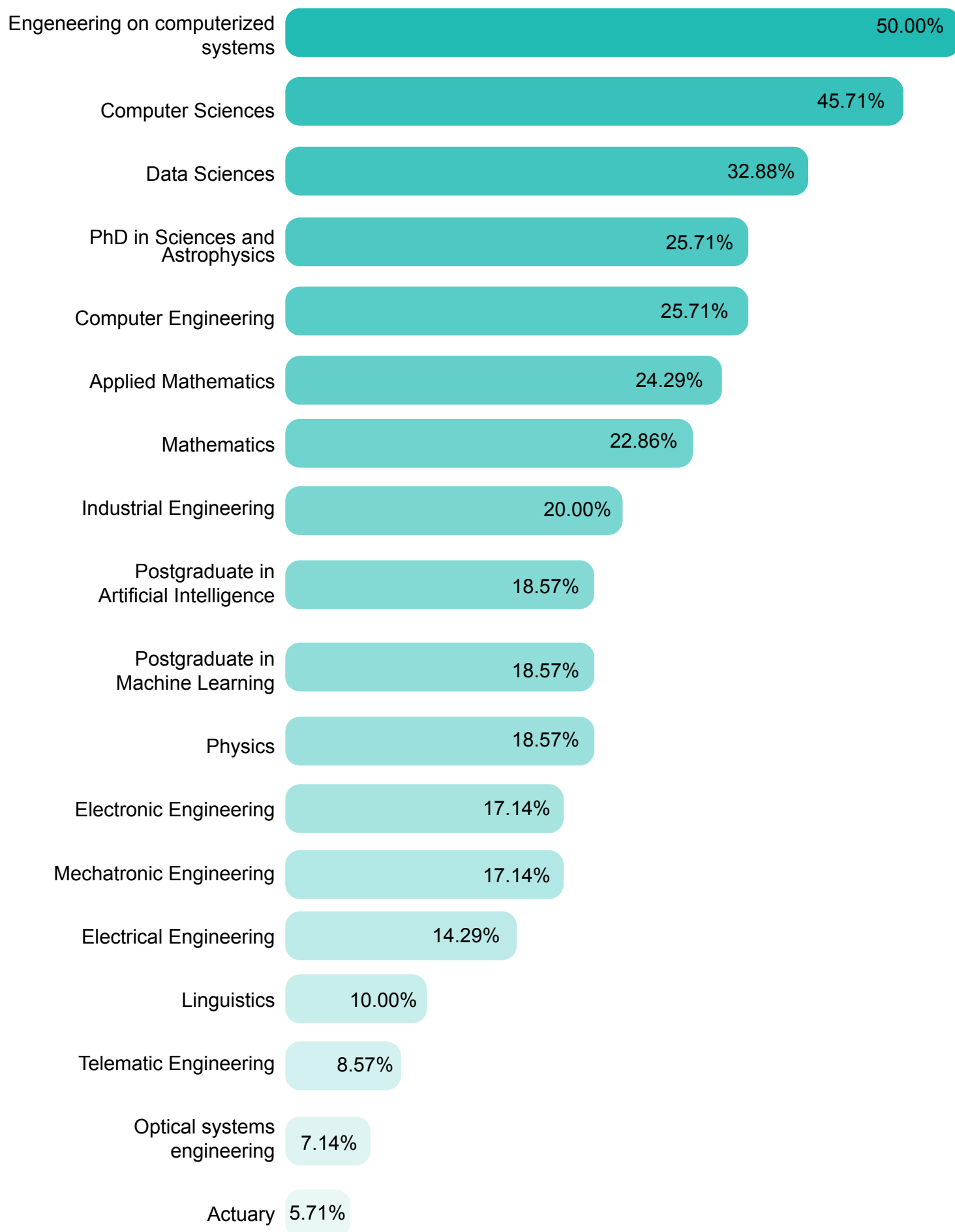


2. Worldwide unemployment 1991-2020



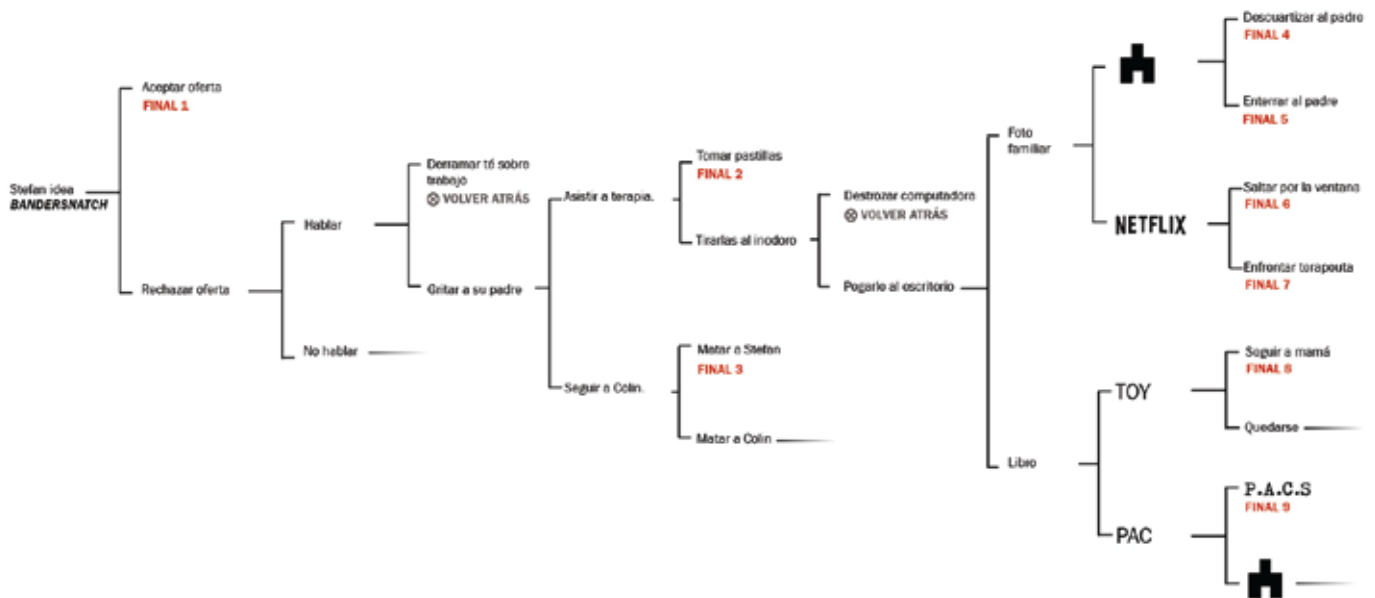
This dataset includes actual and imputed data of 1991-2018 as well as 2019-20 projections.
The data may differ with the information provided nationally. Source: International Labour Office. Assessments modeled by ILO. (ilo.org/wesodata)

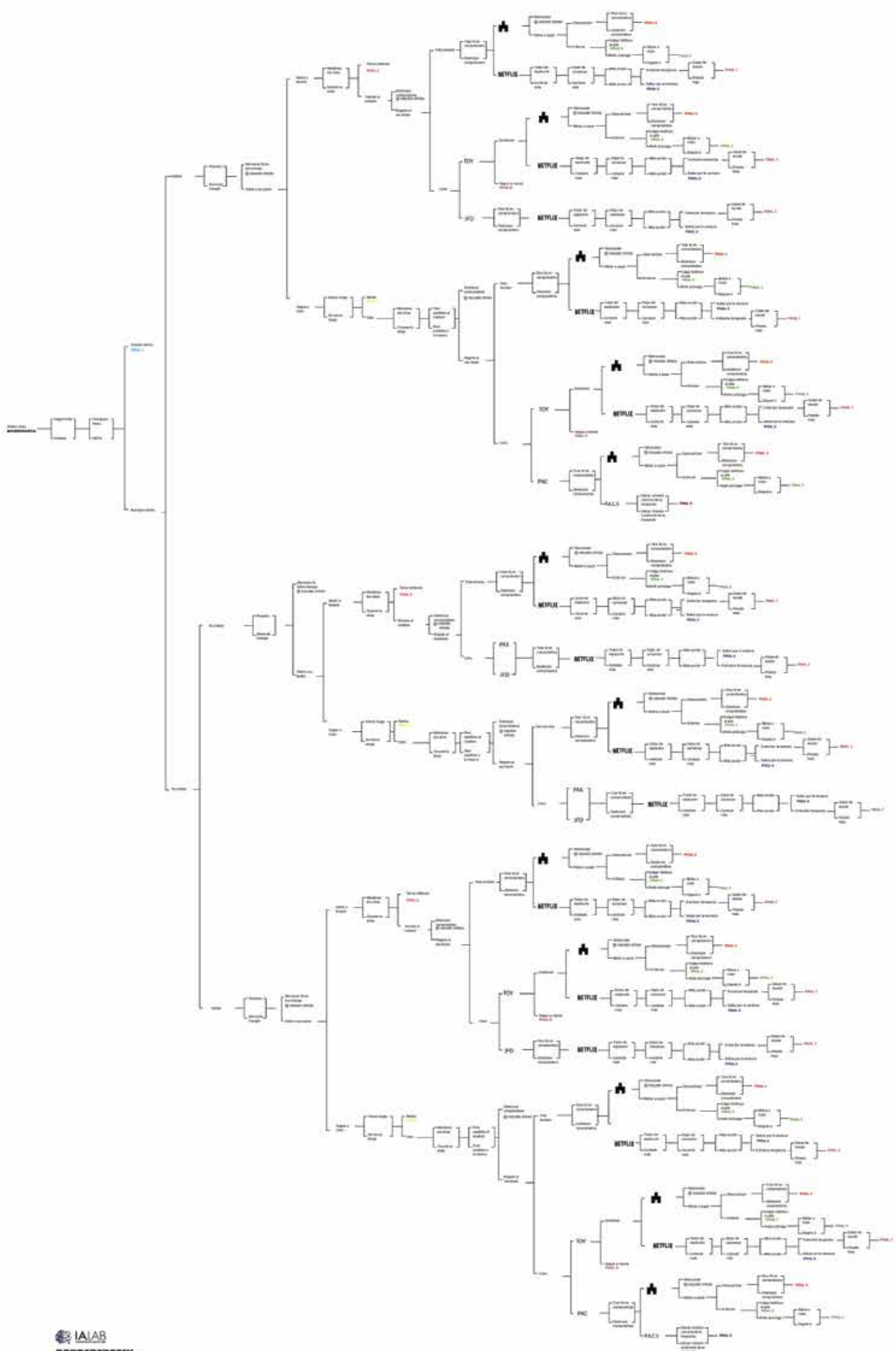
Annex 2: Professionals at AI Startups Ranking



Annex 3: Decision Trees - Map of Activity and Data

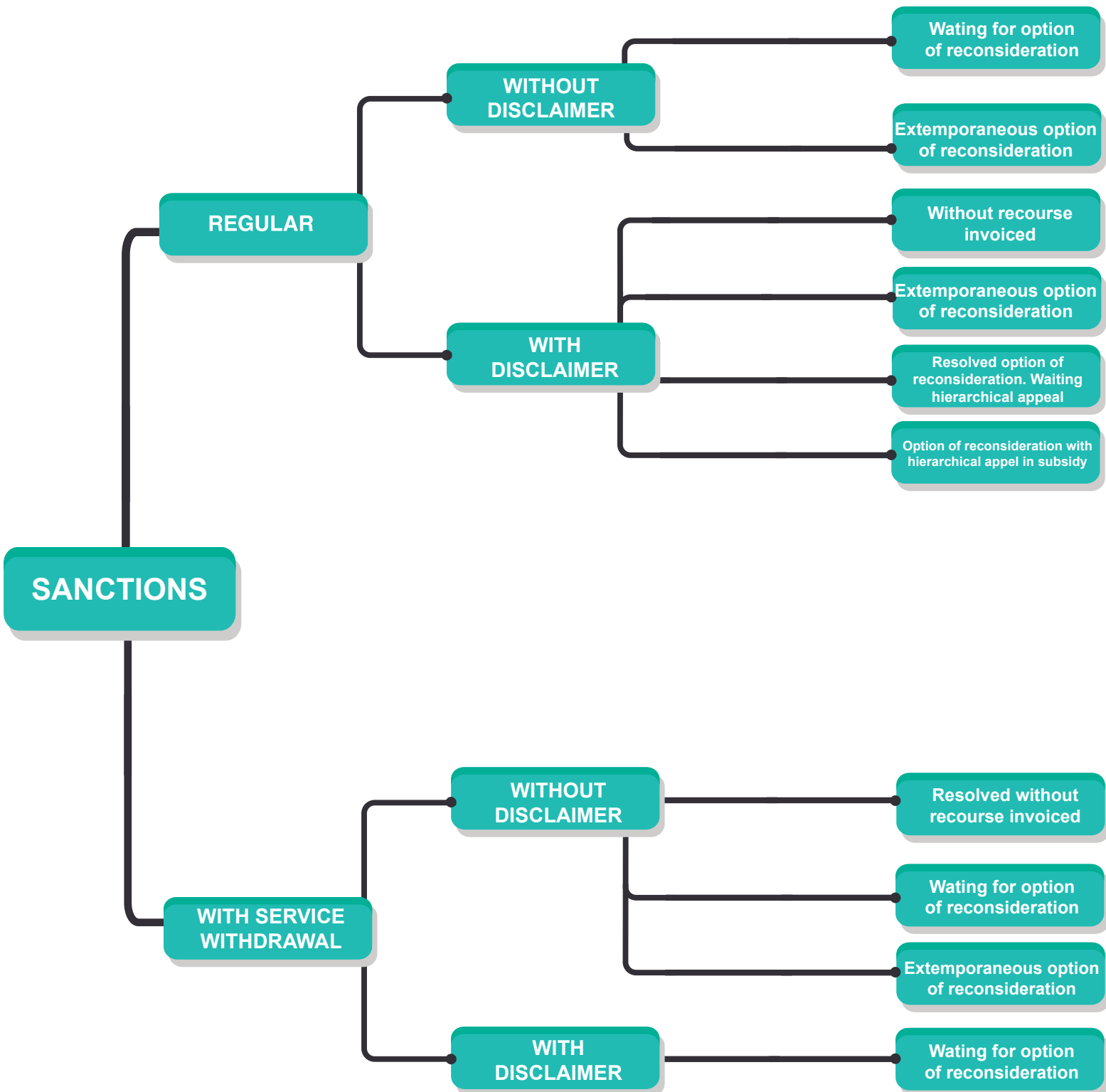
1. “Black Mirror: Bandersnatch” Movie Decision Trees





2. Public Administration Decision Trees

a. Sanctions to Transport Companies - Public Services Regulator Agency - Cordoba Province



b. Procurement and Contracting Process - General Office of Acquisitions and Contracting of Security and Emergencies of the Ministry of Justice and Security - Autonomous City of Buenos Aires

QUESTION N° 1

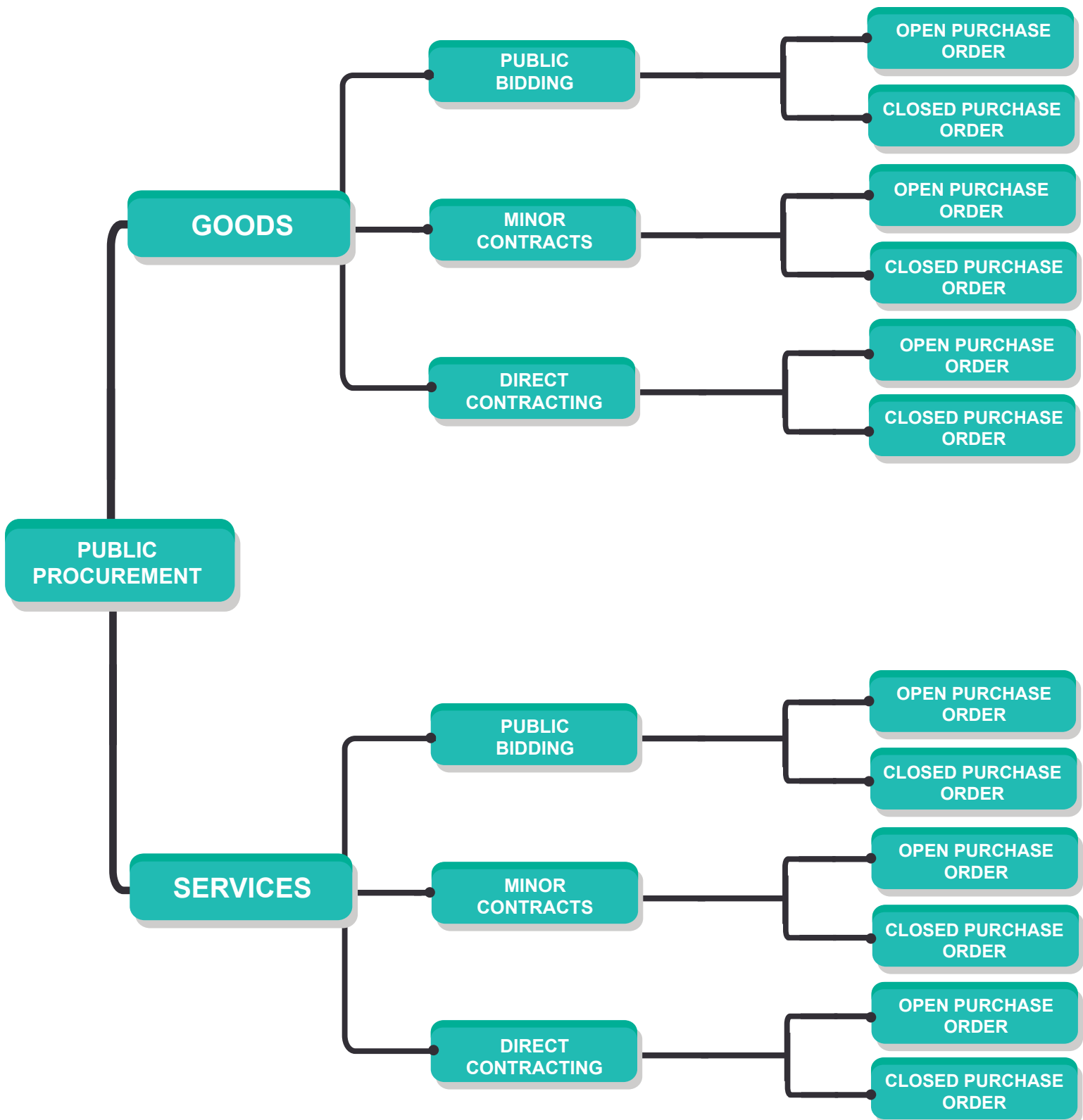
WHAT IS THE OBJECT?

QUESTION N° 2

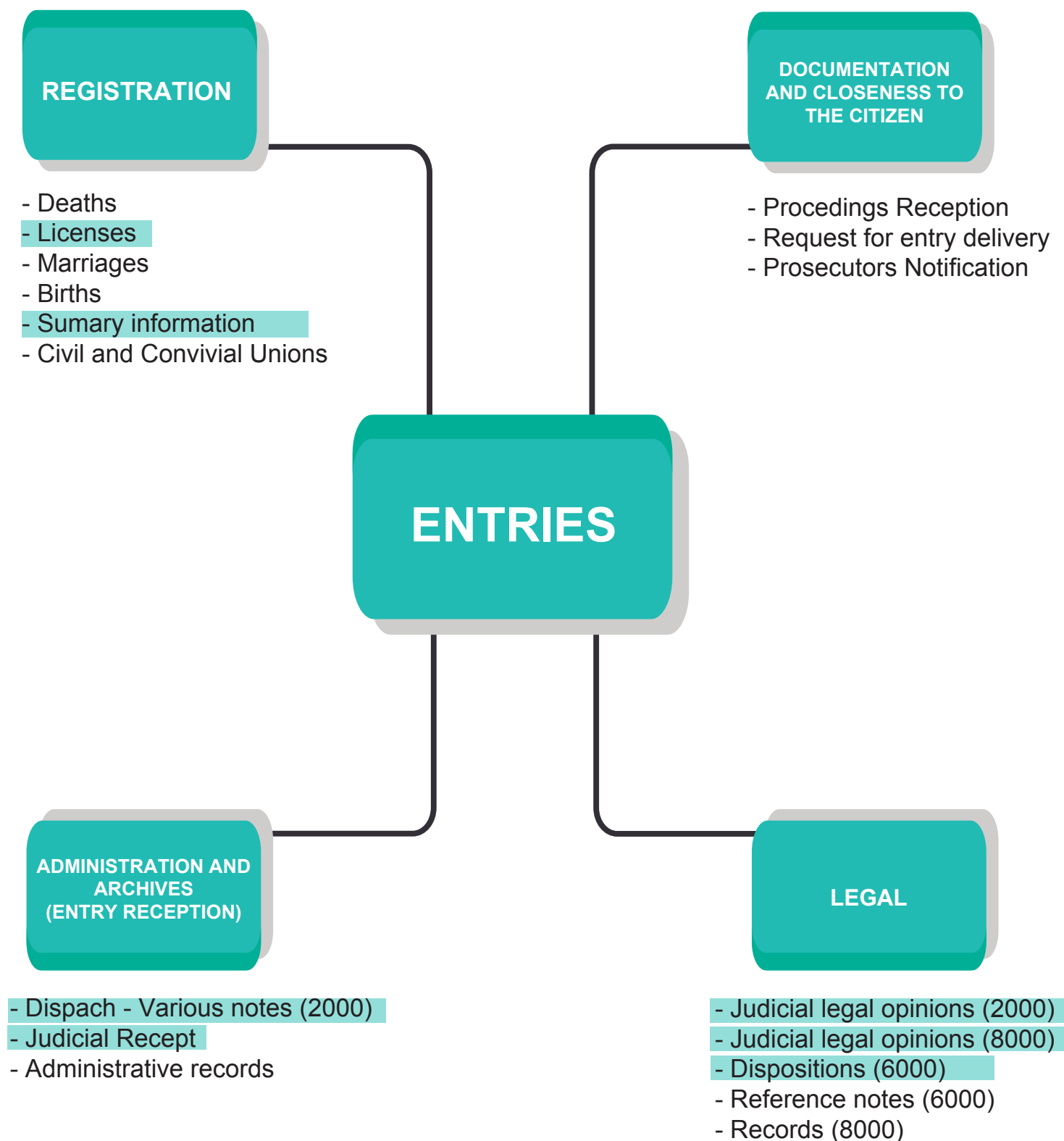
WHAT IS THE TYPE OF PROCEEDING?

QUESTION N° 3

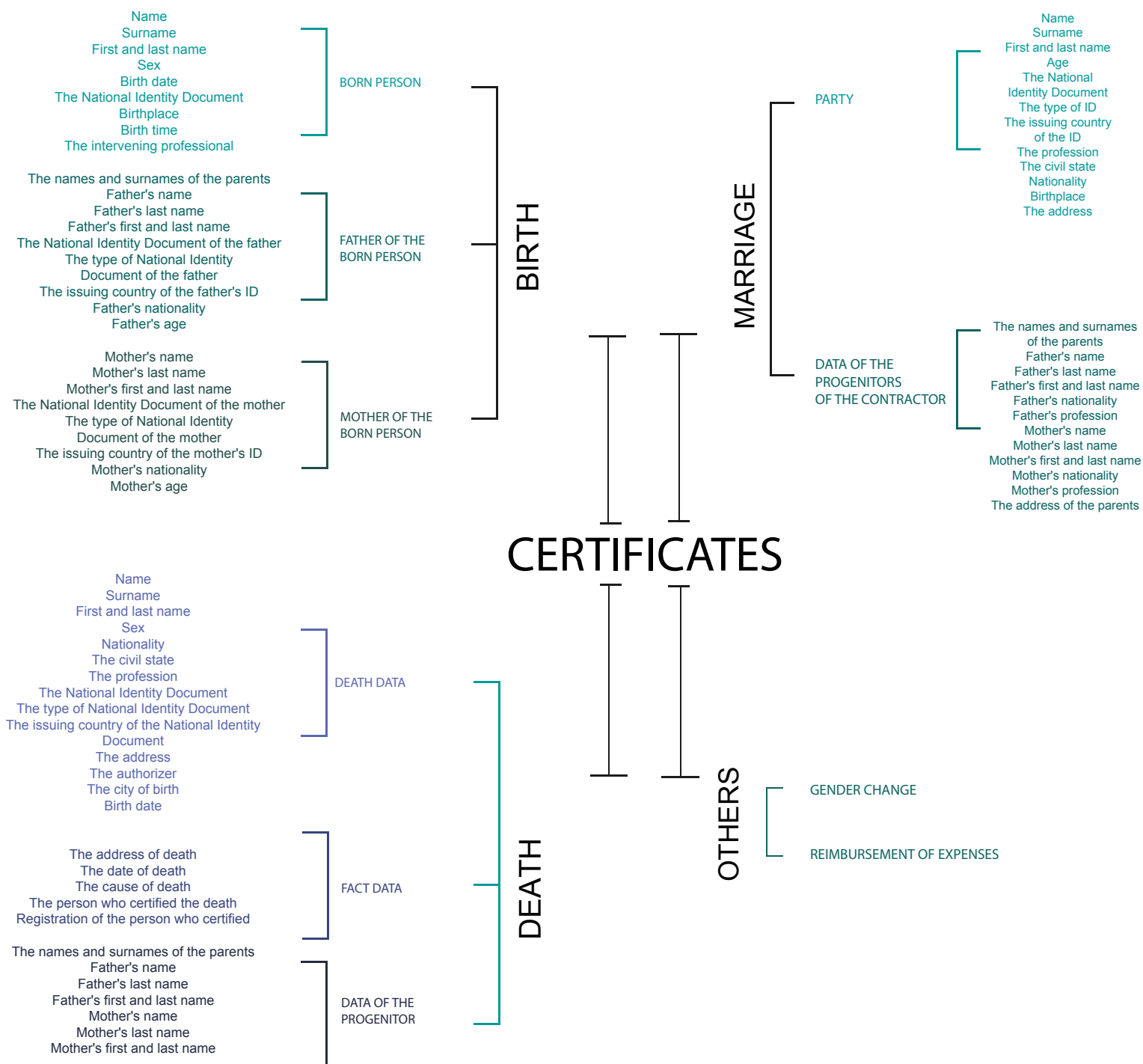
WHAT IS THE TYPE OF MODALITY?



c. Activity Map and Certificate Data Map - Civil Registry Autonomous City of Buenos Aires

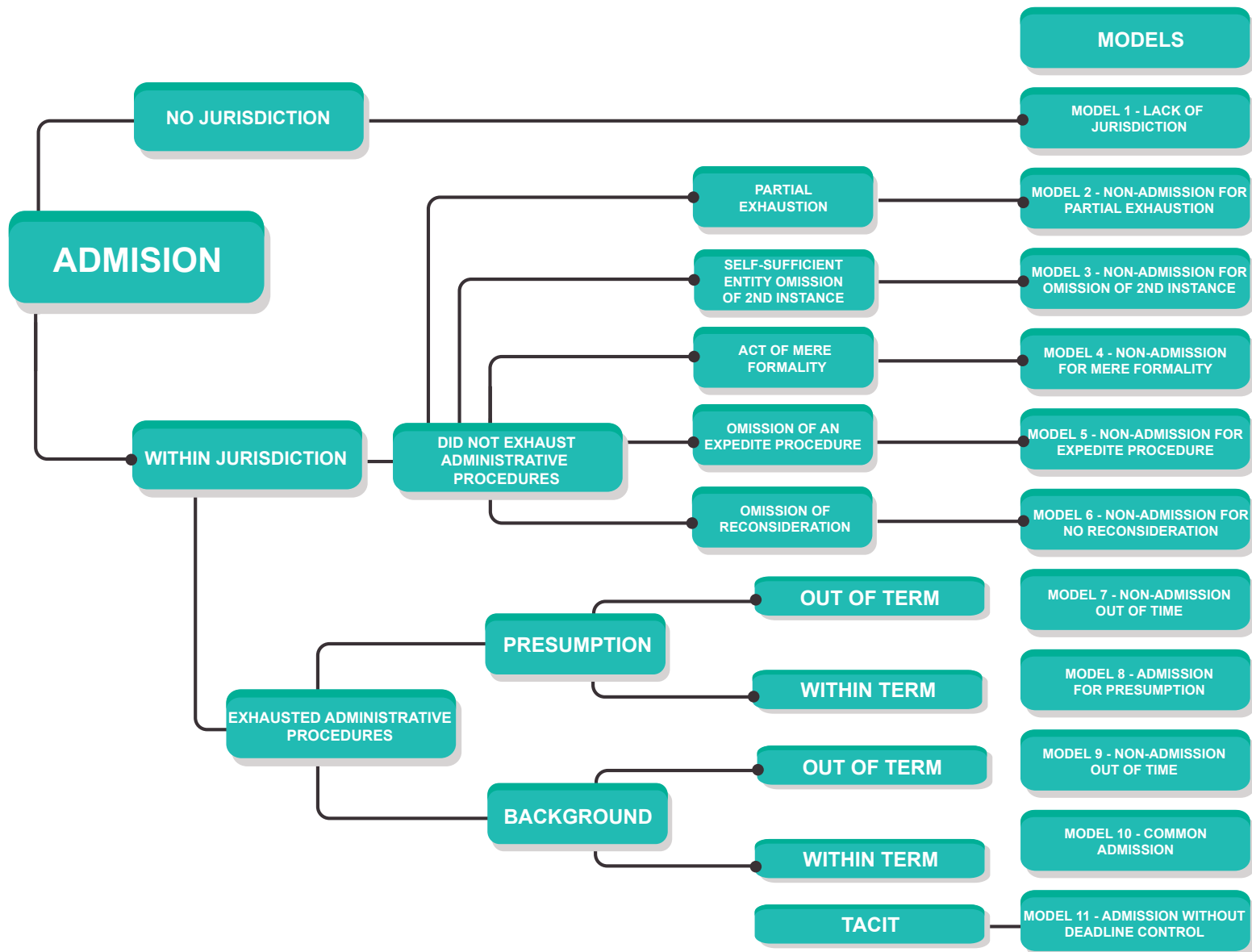


REGISTRATION OF CIVIL STATUS AND CAPACITY OF PEOPLE

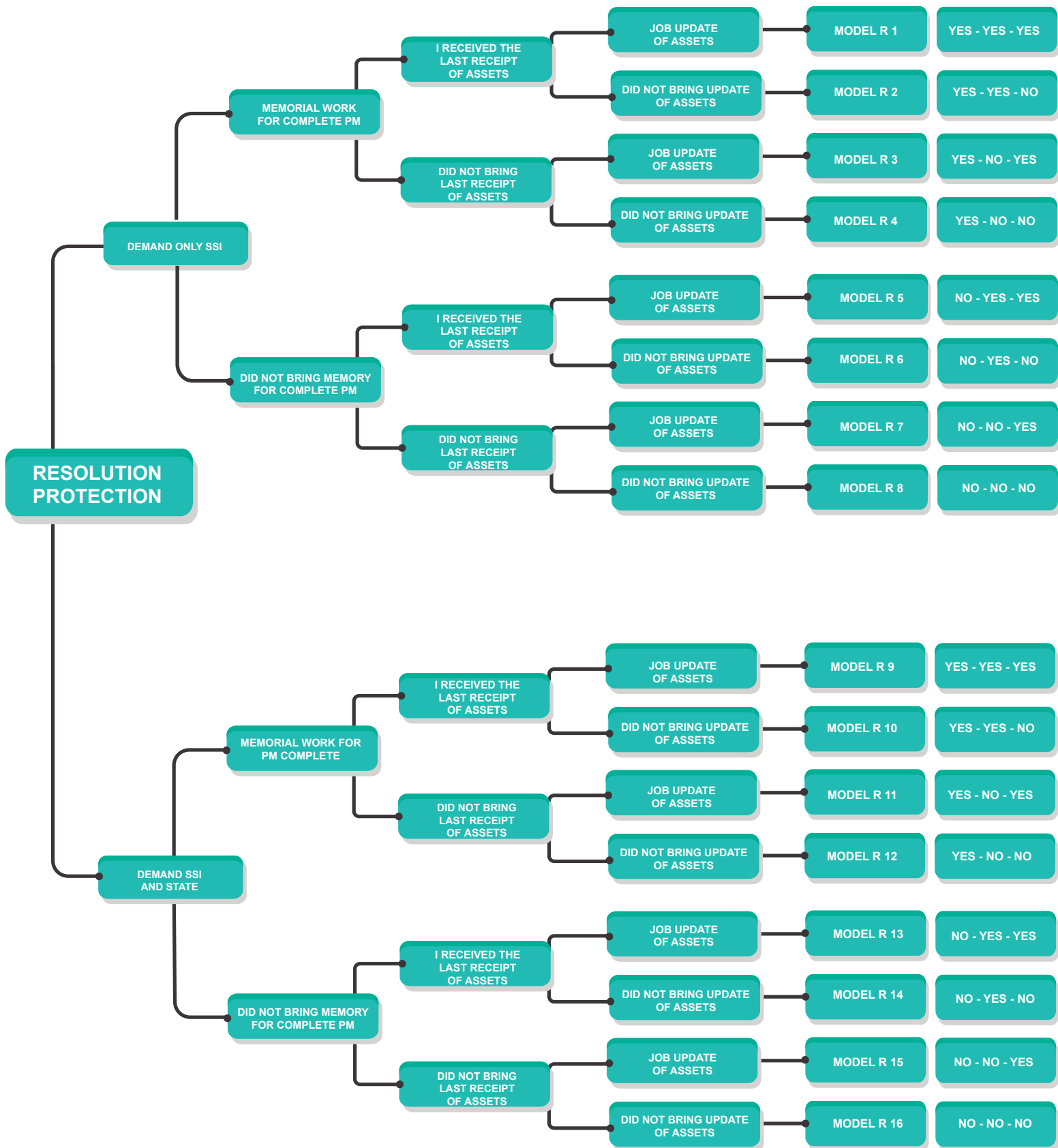


3. Judicial Decision Trees

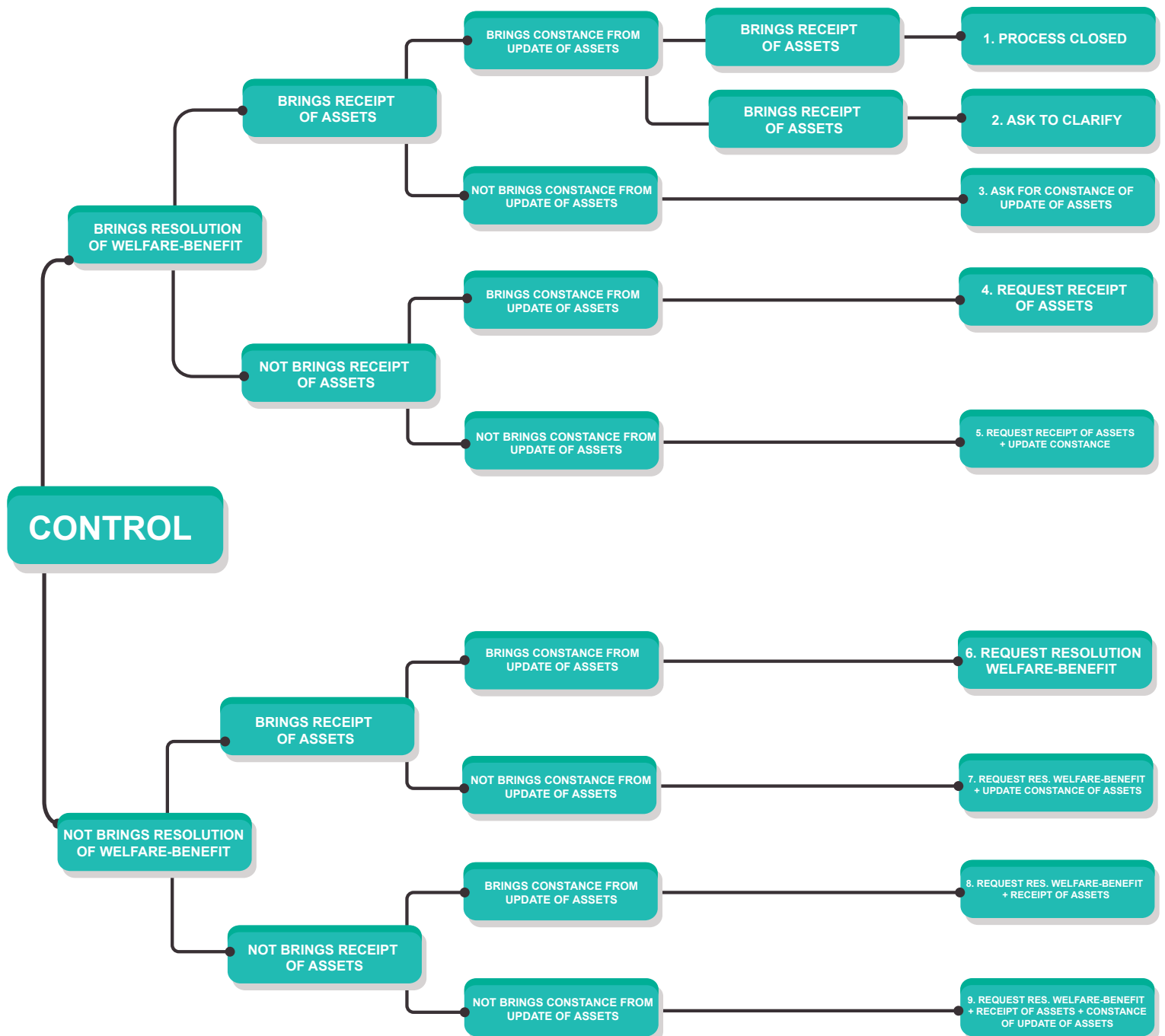
a. Resolutions on Instance Authorizations - First Instance Court of Neuquén on Contentious Administrative Matters



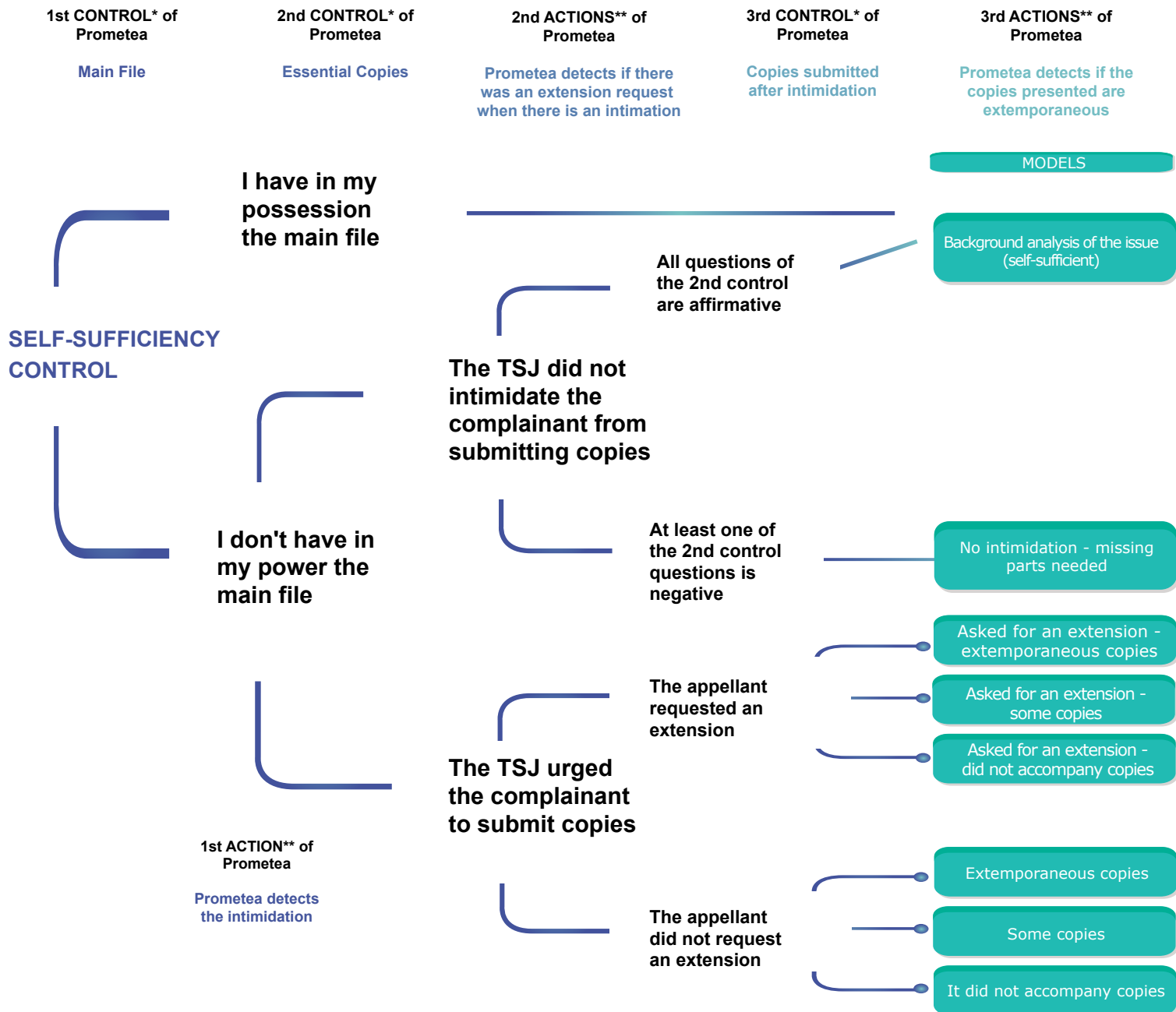
b. Initial Resolution for The Formation of Incidents - First Instance Court of Corrientes on Contentious Administrative Matters



c. First Instance Court of Corrientes on Contentious Administrative Matters



d. Auto Sufficiency Control - Public Prosecutor's Office on Contentious Administrative and Tax Matters - Autonomous City of Buenos Aires



*CONTROLS Prometea: these are questions that you ask the user and depending on that choose a branch of the tree.

**ACTIONS Prometea: these are detections that you make alone and depending on that choose a branch of the tree.

Footnotes

1- The expression “artificial intelligence” is often used to designate briefly the increase of independence, speed and the magnitude related to the adoption of IT and automated decisions. Artificial intelligence is not just one thing, but a constellation of processes and technologies that allow computers to complement or replace specific tasks that will otherwise be executed by human beings, such as making decisions and problem solving. “Artificial intelligence” can be a problematic term, because it suggests that the machines can work according to the same concepts and rules as human intelligence. It is not like that. Artificial intelligence usually optimizes the execution of computerized tasks, assigned by human beings, through repetition and iterative tries. See: United Nations General Assembly, Resolution N° 73/348, “Promotion and protection of the right of freedom of opinion and expression”, A/73/348, August 29, 2018, whereas III [Online] <http://undocs.org/es/A/73/348> [checked on: 03/08/2019].

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3- Some individuals became “business men” and “millionaires” in the Middle Age. On these subject, read Lyons, M., “Historia de la lectura y de la escritura en el mundo occidental”, ps. 68 y ss; Carr, N. (2011) “Superficiales ¿Qué está haciendo internet con nuestras mentes?”, Editorial Taurus, ps. 78 to 101..

4- One example of this are the Luddites, a movement lead by English textile workers on the 19th century, against the introduction of machines that replaced their labor practices. See: Hobsbawm, E. (1952) The Machine Breakers [Online] <https://elsalariado.info/2016/04/18/los-destructores-de-maquinas/>;

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<https://www2.deloitte.com/global/en/pages/financial-services/articles/automation-here-stay-but-what-about-your-workforce.html> [Checked on: 03/8/2019]; Accenture (2018) América Latina: habilidades para el trabajo en la era de las máquinas inteligentes, p. 6 [Online]

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14-China kept unemployment almost immobile, recording 4.1% between 2010 and 2015, with a slight decrease to 3.9% in 2017. See: International Monetary Fund, IMF DataMapper. Unemployment rate. China [Online]

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16- The Japanese unemployment rate is significantly decreasing regarding the 5.1% presented in 2010, to reach a 2.4% in 2018 and keeping stable until 2023. See: International Monetary Fund, IMF DataMapper. Unemployment rate. Japan [Online]
<https://www.imf.org/external/datamapper/LUR@WEO/OEMDC/WEOWORLD/JPN> [Checked on: 03/8/2019] and Datos Macro, Desempleo de Japón [Online] <https://datosmacro.expansion.com/paro/japon> [Checked on: 3/8/2019]

17- In 2017, South Korea had 4% of industrial robotics incorporations, representing 39.732 units. In 2016, industrial robots installations reached 41,373 units, see: International Federation of Robotics (2018), Executive Summary World Robotics 2018 Industrial Robots, op. cit. p. 14

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22- Reducing 600,000 job positions in the early 19th century resulted in significant imbalances in the society. However, it was almost impossible to predict that, by the end of the 20th century, the employed civilian population of the United States would increase from one-third to two-thirds. In 1800, 800,000 workers were needed for manual looms, while in 1830 only 200,000. At the beginning of the 20th century, in the United States, one third of the population worked in agricultural production. At the end of that same century, only 3% of individuals worked in this task. In 1870, only 12 million individuals had jobs, a figure that represented one third of the civilian population. At the end of the last century, the number of people employed was 126 million; that is, two thirds of the civilian population. See, Kurzweil, R. (1999), *La era de las máquinas espirituales*, Editorial Planeta, ps. 249 and 250

23- Germany began with the incorporation of robots in the automotive industry with 14,000 units, reaching 93,000 in 2015. See: International Federation of Robotics, *Robots Create Jobs!* [ONLINE] <https://ifr.org/robots-create-jobs> [checked on: 3/8/2019]

24- International Monetary Fund, IMF DataMapper. Unemployment rate. Republic of Germany [Online] https://www.imf.org/external/datamapper/LUR@WEO/OEMDC/WEO_WORLD/DEU [Checked on: 3/8/2019]

25- In 2017, Germany reached a 7% increase in Robotics, from 20,074 units in 2016 to 21,404, see International Federation of Robotics (2018), *Executive Summary World Robotics 2018 Industrial Robots*, Op. cit., p. 14.

26- For example, the production of high-end German automobile factories of BMW, Audi and Mercedes Benz. See Nübler, I. (2017) "Transformación productiva. Oportunidades para países de ingresos medios", en BID-INTAL (2017) *Robotización. El futuro del trabajo en la integración 4.0 de América Latina*, p. 314 [Online] <https://publications.iadb.org/en/integration-and-trade-journal-volume-21-no-42-august-2017-robot-lucion-future-work-latin-american>

[Checked on: 3/11/2019]

27- Ernst et al. (2019) Economics of Artificial Intelligence: Implications for the Future of Work, IZA Journal of Labor Policy 9:4, p. 9 [Online] <https://doi.org/10.2478/izajolp-2019-0004> [checked on: 21/08/2019]

28- Banco Mundial, Desempleo total de América Latina y el Caribe [Online] https://datos.bancomundial.org/indicador/SL.UEM.TOTL.ZS?locations=ZJ&name_desc=false [Checked on: 3/11/2019]

29- Organización Internacional del Trabajo (2018) Perspectivas Sociales y del Empleo en el Mundo. Tendencias 2018, p. 19 [Online] https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_631466.pdf [checked on: 3/12/2019]

30- For example, in the field of industrial robots, Mexico is the only country that became an emerging market, although the production figures are not significant (a total of 6,334 units in 2017, 7% more than in 2016). Neither Brazil, the second market, shows a significant advance in robots production and sales. In fact, in 2017 it decreased to 961 units regarding the 1207 obtain in 2016, see International Monetary Fund, IMF DataMapper. Unemployment rate. Mexico [Online]

https://www.imf.org/external/datamapper/LUR@WEO/OEMDC/WEO_WORLD/MEX; International Federation of Robotics (2018), Executive Summary World Robotics 2018 Industrial Robots, Op. cit., p. 15. Although Brazil has an unemployment rate of 3.5% and it projects the same figure until 2023.

31- Banco Interamericano de Desarrollo (2018) El futuro del trabajo en América Latina y el Caribe. ¿Una gran oportunidad para la región?, Op. cit., p. 9.

32- On the contrary, one of the main concerns is linked with the “vulnerable employment.” While in 2014 it increased to 87 million individuals, in 2018 it is more than 91 millions. Also, adding the fact that informal and precarious work presents one of the highest rates globally. Organización Internacional del Trabajo (2018) Perspectivas Sociales y del Empleo en el Mundo. Tendencias 2018, Op. cit., p. 20.

33- The Synthetic Indicator of automation risk, by IDB, measures the risk. See: BID-INTAL (2018) Algoritmolandia. Inteligencia artificial para una integración predictiva e inclusiva de América Latina, Op. Cit., p. 20; De Angelis, J. (2018) La automatización en la región: actualidad y perspectivas, Conexión INTAL [Online]
<http://conexionintal.iadb.org/2018/09/03/la-estructura-productiva-regional-y-el-uso-de-robots-actualidad-y-perspectivas/>
[Checked on: 3/11/2019]

34- Ovanessoff, A; Plastino, E. (2018) “Una explosión de productividad”, p. 46, en BID-INTAL, Algoritmolandia. Inteligencia artificial para una integración predictiva e inclusiva de América Latina [Online]
<https://publications.iadb.org/en/integration-and-trade-journal-volume-22-no-44-july-2018-planet-algorithm-artificial-intelligence>
[Checked on: 3/11/2019]

35- Ibíd., p. 34-35.

36- BID-INTAL (2018), Op. Cit., p. 18 [Online]
<https://publications.iadb.org/en/integration-and-trade-journal-volume-22-no-44-july-2018-planet-algorithm-artificial-intelligence>
[Checked on: 03/11/2019]; For the resolution of judicial cases by means of intelligent prediction, Prometea was created within the scope of the Public Prosecutor's Office of the Autonomous City of Buenos Aires. This is a successful case at a global level, which has been studied by the Inter-American Development Bank, has motivated the interest of the Bloomberg Magazine, and has been presented in different international organizations such as the Organization of American States, the Office of the UN of Vienna, the French Council of State, the Agency of Fundamental Rights of the European Union, the Administrative Court of Lombardy, Italy, among many others. It has also shown great results in its application in the area of the Public Prosecutor's Office of the Autonomous City of Buenos Aires, the Inter-American Court of Human Rights, the Ministry of Justice and Security of the Autonomous City of Buenos Aires -for the case of public hiring's -, the Association of Women Judges of Argentina, and various administrative institutions and national and foreign judicial offices related to the protection of rights. Expand in: Corvalán, J. (2019)

“Prometea. Inteligencia Artificial para transformar organizaciones públicas”, Editorial Astrea, Editorial Universidad del Rosario, Derecho para Innovar, Institut du Monde et du Développement pour la Bonne Gouvernance Publique (IMODEV) [Online]
<https://www.astrea.com.ar/blog/39>

37- See: <https://entelai.com>

38- See: <https://entelai.com>

39- See: <https://www.genlives.com/>

40- See: <http://unima.com.mx/>;
https://d335luupugsy2.cloudfront.net/cms/files/37501/1535487149Reporte_Inteligencia_Artificial.pdf

41- See:
[https://www.pqs.pe/tecnologia/uni-primer-robot-minero-hecho-en-peru](https://www.pqs.pe/tecnologia/uni-primer-robot-minero-hecho-en-peru;);
https://www.accenture.com/t00010101T000000Z__w__/ar-es/_acnmedia/PDF-49/Accenture-Como-la-IA-Puede-Generar-Crecimiento-En-Sudamerica.pdf#zoom=50

42- See: <https://www.auravant.com/>

43- “AI is a technology that allows machines to do tasks as if they were persons. When it is boosted with human intelligence, it is known as augmented intelligence” See: BID-INTAL (2018) , Algoritmolandia. Inteligencia artificial para una integración predictiva e inclusiva de América Latina, Op. Cit. p. 80

44- TIME, Business: THE AUTOMATION JOBLESS, 24/02/1961 [Online]
<http://content.time.com/time/subscriber/article/0,33009,828815-2,00.html>
[checked on: 3/11/2019]

45-World Economic Forum (2018) The Future of Jobs Report, Op. cit., p. viii.

46- Everis- Endeavor (2018) El impacto de la Inteligencia Artificial en el emprendimiento, p. 24

[Online]

<http://www.endeavor.cl/wp-content/uploads/El-impacto-de-la-IA-en-el-emprendimiento-en-Am%C3%A9rica-Latina-everis-y-Endeavor.pdf>
[Checked on: 3/11/2019]

47- AfDB, ADB, BID, EBRD (African Development Bank Group, Asian Development Bank, Banco Interamericano De Desarrollo, European Bank for Reconstruction and Development), Op. cit., p. 10.

48- There are debates about these new forms of work and the lack of protection for the worker, since they often face difficulties when it comes to accessing basic labor rights such as health care paid by the employer, pensions, minimum wage, and trade union rights, among others. To face this context, it is essential the role of the State to comply with its obligation to guarantee labor rights, through concrete policies that control these new forms of employment.

49- McKinsey Global Institute (2016) Independent Work: Choice, Necessity, and the Gig Economy, p. 26 [Online]
<https://www.mckinsey.com/~media/McKinsey/Featured%20Insights/Employment%20and%20Growth/Independent%20work%20Choice%20necessity%20and%20the%20gig%20economy/Independent-Work-Choice-necessity-and-the-gig-economy-Full-report.ashx> [Checked on: 3/11/2019]

50- International Labor Organization (2018) Digital labor platforms and the future of work. Towards decent work, p. 3 [Online]
https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_645337.pdf [Checked on: 3/11/2019]

51- BBC, Kylie Jenner and David Beckham make Instagram rich list, 25/07/2018 [Online]
<https://www.bbc.com/news/world-44952480> [Checked on: 3/11/2019]

52- On all these matters please expand on: Banco Interamericano de Desarrollo (2013) La Economía Naranja: Una oportunidad infinita, p.40 [Online]
<https://publications.iadb.org/es/la-economia-naranja-una-oportunidad-infinita> [Checked on: 3/11/2019]; Banco Interamericano de Desarrollo

(2017) Economía Naranja. Innovaciones que no sabías que eran de América Latina y el Caribe, p. 5; 13 [Online]
<https://publications.iadb.org/es/publicacion/17263/economia-naranja-innovaciones-que-no-sabias-que-eran-de-america-latina-y-el>
[Checked on: 3/11/2019]; Banco Interamericano de Desarrollo (2017) Economía Naranja. Innovaciones que no sabías que eran de América Latina y el Caribe, p. 13 [Online]
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53- DQ Institute, What is DQ? 8 Digital Skills We Must Teach Our Children [Online] <https://www.dqinstitute.org/what-is-dq/>;
Organización Internacional del Trabajo (2016) La iniciativa del centenario relativa al futuro del trabajo. Los cambios tecnológicos y el trabajo en el futuro, Nota informativa 1, p. 9-10
[Online]https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_543154.pdf [Checked on: 3/11/2019]

54- Accenture (2016) The promise of artificial intelligence. Redefining management in the workforce of the future, ps. 11 y 13 [En línea]
https://www.accenture.com/t20160928T230416__w__/us-en/_acnmedia/PDF-32/AI_in_Management_Report.pdf [Consulta: 11/03/2019]; AfDB, ADB, BID, EBRD (African Development Bank Group, Asian Development Bank, Banco Interamericano De Desarrollo, European Bank for Reconstruction and Development), Op. cit., p. 15; Organización Internacional del Trabajo (2016) La iniciativa del centenario relativa al futuro del trabajo. Los cambios tecnológicos y el trabajo en el futuro, Nota informativa 1, Op. cit., p. 9-10.

55- AfDB, ADB, BID, EBRD (African Development Bank Group, Asian Development Bank, Banco Interamericano De Desarrollo, European Bank for Reconstruction and Development), Op. cit., p. 24.

56- Banco Interamericano de Desarrollo (2018) El futuro del trabajo en América Latina y el Caribe. ¿Una gran oportunidad para la región?, Op. cit., p. 27, World Bank, Op. Cit. p.3

57- World Economic Forum (2018) The Future of Jobs Report, Op. cit., preface p. v.

- 58- Béliz, G. (2018) "5-R/E. Las cinco r/evoluciones de la inteligencia artificial en América Latina", en BID-INTAL, Algoritmolandia. Inteligencia artificial para una integración predictiva e inclusiva de América Latina, p. 17 [Online]
<https://publications.iadb.org/en/integration-and-trade-journal-volume-22-no-44-july-2018-planet-algorithm-artificial-intelligence>
[checked on: 3/11/2019]
- 59- BID-INTAL (2017) Robotlución. El futuro del trabajo en la integración 4.0 de América Latina, p. 99 [Online]
<https://publications.iadb.org/en/integration-and-trade-journal-volume-21-no-42-august-2017-robot-lucion-future-work-latin-american>
[Checked on: 03/11/2019];
<https://www.intuitive.com/en-us/products-and-services/da-vinci>
- 60- BID-INTAL (2018) Op. cit., p. 101;
<http://dharma.frm.utn.edu.ar/proyectos/vise>
- 61- BID-INTAL (2018) Op. cit., p. 101;
<https://www.rosario-conicet.gov.ar/ver-noticias/item/420-informatica-aplicada-para-remover-malezas-del-campo>
- 62- BID-INTAL, Algoritmolandia. Inteligencia artificial para una integración predictiva e inclusiva de América Latina, Op. cit., p. 245;
<http://www.icrisat.org/tag/sowing-app/>
- 63- "“Blockchain is a technology designed to manage a registry of online data , characterized by being transparent and practically incorruptible. Broadly speaking, blockchain can be thought of as an accounting book, a logbook or a database where you can only enter new entries and where all existing ones cannot be modified or deleted. These entries, called transactions, are grouped into blocks that are added, successively, to the record in the form of a sequential chain, each of them necessarily related to the previous one. In this scheme, if we wanted to correct information already registered, we can only do it by adding new information. The original data will always remain and can be checked at any time. " See:
<https://bfa.ar/blockchain/blockchain>

64- DPI Cuántico, Inteligencia artificial en la Corte Constitucional Colombiana: otra experiencia Prometea [Online]

http://dpicuantico.com/2019/02/04/inteligencia-artificial-en-la-corte-constitucional-colombiana-otra-experiencia-prometea/#_ftnref1
[Checked on: 3/8/2019]

65- On these matters, please expand on Corvalán J. (2018) “Estados eficientes. La productividad del sector público bajo la lupa”, en BID-INTAL, Algoritmolandia. Inteligencia artificial para una integración predictiva e inclusiva de América Latina, p. 263 [Online]
<https://publications.iadb.org/en/integration-and-trade-journal-volume-22-no-44-july-2018-planet-algorithm-artificial-intelligence>

[checked on: 03/11/2019]; Asamblea General de Naciones Unidas, Op. cit., whereas19; BID-INTAL (2018), Algoritmolandia. Inteligencia artificial para una integración predictiva e inclusiva de América Latina, Op. Cit. p. 21

66- International Labor Organization (2018) The economics of artificial intelligence: Implications for the future of work, p. 9.

67- In both cases, the artificial intelligence system Prometea was used. For the preparation of this study on tasks that are carried out both in the Office of the Deputy Attorney General for Administrative and Tax Matters of the CABA and in the General Office on Acquisitions and Contracting of Security and Emergencies of the Ministry of Justice and Security of the CABA, we are based on Pounder K's research; Liu, G. (2018) “Nuevas ocupaciones. Latinoamérica y el espejo de Australia”, en BID-INTAL, Algoritmolandia. Inteligencia artificial para una integración predictiva e inclusiva de América Latina, p. 273-289 [Online]

<https://publications.iadb.org/en/integration-and-trade-journal-volume-22-no-44-july-2018-planet-algorithm-artificial-intelligence>

68- These trees are diagrams of logical constructions, based on rules, which serve to represent and categorize a series of conditions that occur successively, for the resolution of a problem. In a decision tree, from every question that we raise we can deduce two or more possible courses of action. Thus, the bigger and more complete the tree is, the

more ramifications it will have. At the end of each branch, the proposed solution for that course of action is displayed.

69- Innovation and Artificial Intelligence Lab of the School of Law of the University of Buenos Aires and the Office of the Prosecutor of the Autonomous City of Buenos Aires, Artificial Intelligence. Transformando organizaciones (Press)

70- We appreciate the collaboration of Ana Montenegro Alderete and Sebastian Guozden in the analysis of the film and the reconstruction of the possible endings, as well as in the elaboration of the decision trees (See Annex 3.1)

71- Corvalán J., “Estados eficientes. La productividad del sector público bajo la lupa”, en BID-INTAL, Algoritmolandia. Inteligencia artificial para una integración predictiva e inclusiva de América Latina, Op. Cit. p. 263

72- To check booklet please enter:
<https://www.agentes-conversacionales.com.ar/onu2>

73- To check booklet please enter: <http://litigioscomplejos.com/>

74- Keynes, J. M. (1930) Economic Possibilities for our Grandchildren, Essays in Persuasion, pp. 358-373 [Online]
https://assets.aspeninstitute.org/content/uploads/files/content/upload/Intro_and_Section_I.pdf [Checked on: 3/12/2019]

75- Banco Interamericano de Desarrollo (2018) El futuro del trabajo en América Latina y el Caribe. ¿Una gran oportunidad para la región?, Op. cit., p. 9.

76- International Labor Organization (2019) Work for a brighter future. Global Commission on the Future of Work, p. 18 [Online]
https://www.ilo.org/wcmsp5/groups/public/---dgreports/---cabinet/documents/publication/wcms_662410.pdf [Checked on: 3/12/2019]

77- The term transdisciplinarity aims to go beyond multidisciplinary (development of skills in multiple fields) and interdisciplinary

(combination of actors, elements and values of different areas of knowledge). Its objective is to overcome the division and fragmentation of knowledge that reflects the particular disciplines and their consequent hyperspecialization, which prevents the understanding of the complex realities of the current world, characterized by the multiplicity of the bonds, relationships and interconnections that constitute them. See: Martínez Miguélez, M. (2007) Conceptualización de la Transdisciplinariedad, Polis Revista Latinoamericana [Online]

<https://journals.openedition.org/polis/pdf/4623>; Nicolescu, B. (1996) La transdisciplinarité. Manifeste [Online]

<http://basarab-nicolescu.fr/BOOKS/TDRocher.pdf>; ITD CONFERENCE 2017, Transdisciplinary Research and Education – Intercultural Endeavours, Abstract Booklet [Online]

https://www.leuphana.de/fileadmin/user_upload/PERSONALPAGES/_uvwxyz/vilsmaier_ulli/files/ITD17_booklet_26.9.17.pdf

78- Agency for Digital Italy – Presidency of the Council of Ministers (2018) White Paper on Artificial Intelligence at the service of citizens, p. 46 [Online] <https://ia.italia.it/assets/whitepaper.pdf> [Checked on: 3/09/2019]