



Prepare for the Internet of Things Disruption

Focus on Latin America

An IDB Invest, GSMA, and Frost & Sullivan White Paper

Copyright ©2019 Inter-American Investment Corporation (IIC). This work is licensed under a Creative Commons IGO 3.0 Attribution-NonCommercial-NoDerivatives (CC-IGO BY-NC-ND 3.0 IGO) license (<http://creativecommons.org/licenses/by-nc-nd/3.0/igo/legalcode>) and may be reproduced with attribution to the IIC and for any non-commercial purpose. No derivative work is allowed.

Any dispute related to the use of the works of the IIC that cannot be settled amicably shall be submitted to arbitration pursuant to the UNCITRAL rules. The use of the IIC's name for any purpose other than for attribution, and the use of IIC's logo shall be subject to a separate written license agreement between the IIC and the user and is not authorized as part of this CC-IGO license.

Following a peer review process, and with previous written consent by the Inter-American Investment Corporation (IIC), a revised version of this work may also be reproduced in any academic journal, including those indexed by the American Economic Association's EconLit, provided that the IIC is credited and that the author(s) receive no income from the publication. Therefore, the restriction to receive income from such publication shall only extend to the publication's author(s). With regard to such restriction, in case of any inconsistency between the Creative Commons IGO 3.0 Attribution-NonCommercial-NoDerivatives license and these statements, the latter shall prevail.

Note that link provided above includes additional terms and conditions of the license. The opinions expressed in this publication are those of the authors and do not necessarily reflect the views of the Inter-American Development Bank Group, its respective Boards of Directors, or the countries they represent.

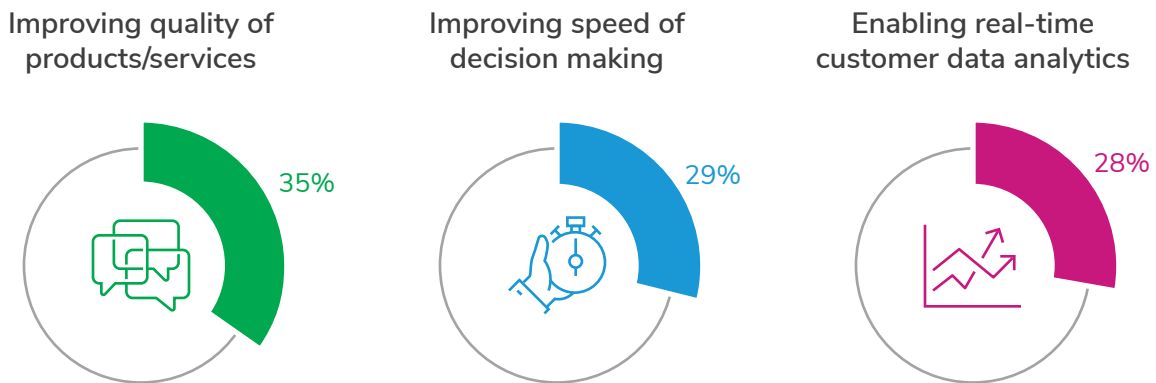
Internet of Things: Latin America Outlook	4
IoT Case Studies	13
Agroindustrial Laredo	13
Agrus Data.	15
Allianz	18
Arqia	20
AZLogica.	23
Carenet Longevity	26
City of Bogota.	29
G7Net	31
Identidad Technologies.	34
InovalnCor	36
ITC	38
Oxzo	40
Taggen	42
Telit	45
Waypoint.	48
IoT Global Providers Profiles	51
Microsoft.	51
Millicom	54
Nokia	56
Qualcomm	59
Telefónica	62
Challenges and Next Steps	65

INTERNET OF THINGS: LATIN AMERICA OUTLOOK

A new wave of technological change is disrupting the world and Latin America. Internet of Things (IoT) is defined as wireless or fixed, two-way communication between geographically distributed remote devices and sensors through a centralized platform. It has to be autonomous, with no human intervention (e.g., alerts, notifications, and automatic machine response). The definition includes hardware (connectivity module and other components), software, and services needed to provide IoT solutions.

Companies and governments alike are investing in IoT solutions. When asked about the reasons for adopting this technology, corporate end users indicate that improving quality of products/services is number one (with 35% of responses). The following adoption drivers include improving speed of decision making (29%) and enabling real-time customer data analytics (28%)¹.

CHART 1. What are the top 3 drivers to invest in IoT in LATAM?



Source: Frost & Sullivan

IoT is at the beginning stages of its growth. Because it offers the ability to capture and leverage data across virtually every aspect of the human experience, its potential is enormous. Organizations that do not yet have IoT on the drawing board must figure out what the IoT looks like, where it fits, and its real-world issues and benefits as they weigh their decisions about whether (or when) to deploy it. One of the reasons the IoT will grow quickly is that people are already surrounded by intelligent devices that capture data about how they live and work. Self-aware machines and data networks can immensely improve companies' productivity; at any point in time, the entire enterprise can be optimized in response to market changes. Other services that will become integrated into IoT platforms include operations management, enterprise resource planning, and business management systems.

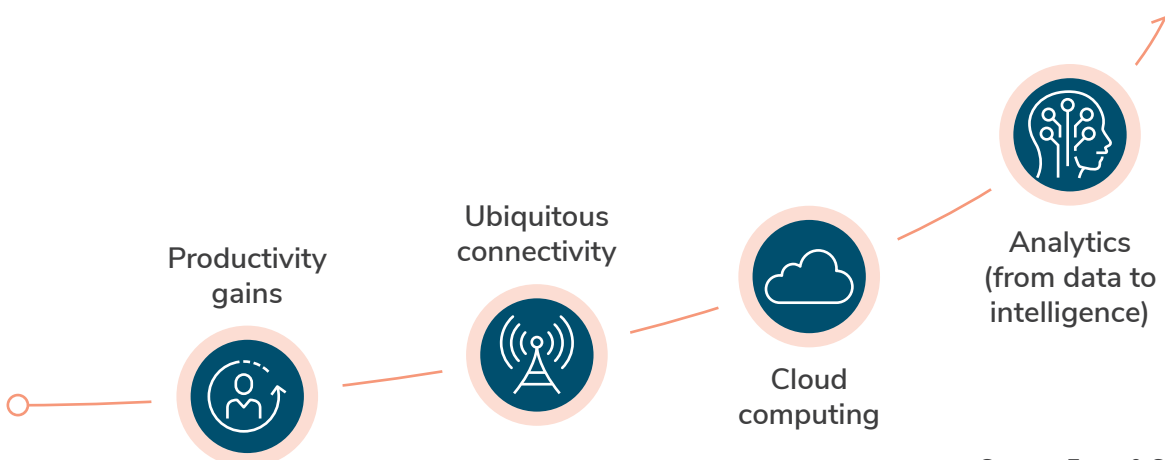
1 Top End User Priorities in Digital Transformation, Global, Frost and Sullivan 2019.

The increasing availability of different types of connectivity (e.g., 5G networks, low-power and wide-area, and narrow-band) present a wealth of possibilities for IoT systems and applications. 5G will offer speeds over 1G with almost zero latency and is expected to start being deployed by 2022. Telcos now work with a broader set of connectivity options, particularly with new LPWAN technologies.

Meanwhile, cloud computing is providing elastic and ubiquitous computing capabilities to IoT solution providers, allowing them to manage the multitudes of connected devices and to cost-effectively deliver IoT applications. The benefits of cloud computing are expected to drive the adoption of IoT in agriculture, healthcare, utilities, manufacturing, and automotive, and in small and medium enterprises.

The complex network of sensors across IoT environments is powered by communication technologies to form a real-time data monitoring network. Real-time asset, machine, and devices data are of immeasurable value. With the wide variety of information generated by connected devices and sensors, an engine that can mine extremely large data sets to extract relevant information will drive IoT adoption. Analytics can derive insights through monitoring, and analyzing the collected data through efficient mining algorithms, as well as offering predictive insights. It is expected to improve the efficiencies of, for example, inventory management, sales, and continuous monitoring of devices.

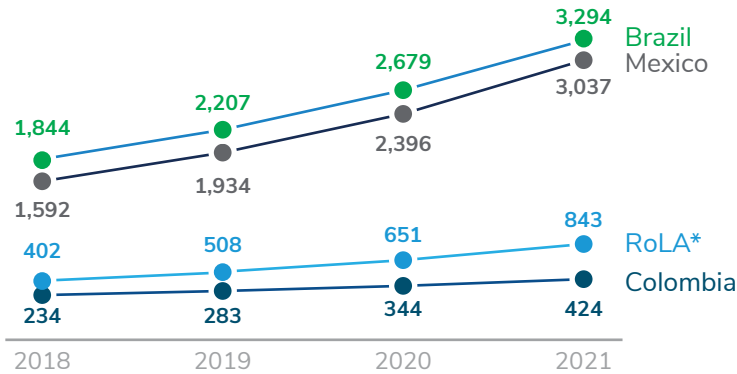
CHART 2. Drivers of IoT adoption in LATAM



Source: Frost & Sullivan

In any case, IoT is already a booming business in Latin America. In 2018, industrial IoT in the region generated an estimate of \$4,071.5 million in revenues. With a compound annual growth rate (CAGR) of 23.1%, the forecast for 2021 is that IoT revenues in Latin America will reach \$7,598.3 million. In terms of IoT devices, the region boasted an estimate of 313.3 million in 2018, including all applications (both B2C and B2B). That number is expected to reach 995.5 million in 2023, a CAGR of 26.0%. Brazil, Mexico and Colombia, in that order, are the main countries in terms of IoT adoption.

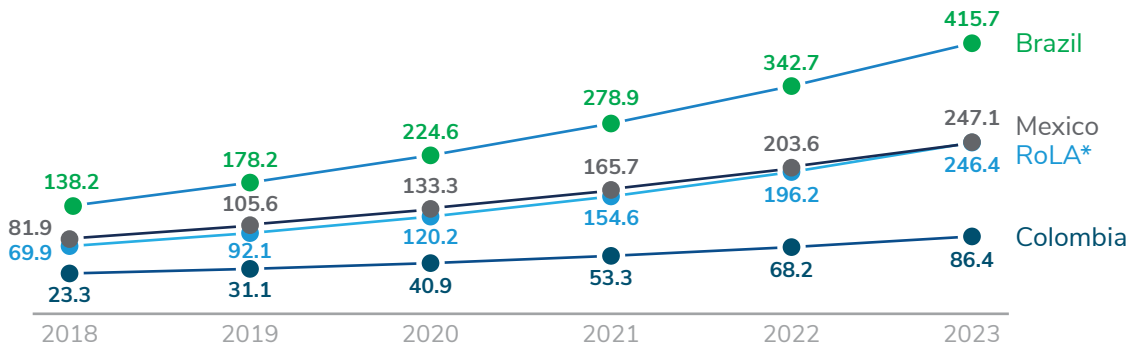
CHART 3. IoT Revenues Forecast (Million USD, B2B)



* RoLA consists of Argentina, Bolivia, Chile, Peru, Uruguay, Paraguay, all countries in Central America and Caribbean.

Source: Frost & Sullivan

CHART 4. IoT Devices Forecast (Million Units, B2B and B2C)



* RoLA consists of Argentina, Bolivia, Chile, Peru, Uruguay, Paraguay, all countries in Central America and Caribbean.

Source: Frost & Sullivan

Main Countries in Focus: IoT in Brazil

Brazilian industrial IoT revenue is projected to reach \$3,293.6 million in 2021—up from \$1,843.9 million in 2018, excluding consumer IoT and things that demand human interface². The Automotive and Manufacturing verticals are the most relevant, representing 23.7% and 23.6% of the total market in 2018, respectively. Commercial vehicle telematics represented the bulk of machine-to-machine (M2M) connections in the Brazilian market in 2018 since the country’s transport and logistics are mainly road-based because of limited rail networks; vehicle and cargo theft are major concerns. Hardware was the main revenue contributor in 2018 at 43.9%, followed by services, software, and connectivity.

2 Brazilian Industrial Internet of Things Market, Forecast to 2021, Frost and Sullivan, 2017

Software and services' revenue shares are expected to increase the forecast period as the cost of communication and sensing modules declines.

While automotive and manufacturing will be more mature by 2021, healthcare is expected to have the highest CAGR, making a reverse trail from other Verticals, starting from B2C business, and then evolving to enterprises. Given the healthcare segment in Brazil is highly regulated with several concerns regarding health data confidentiality and security, the adoption from health institutions will have a longer pathway. Nevertheless, technology driven patients are more willing to adopt mobile services, apps and devices, which will make up a IoT Health market of \$105,4 million by 2021.

There are also significant opportunities in verticals such as Smart Cities, Agriculture and Utilities. There are no smart cities in Brazil yet—only smaller and isolated smart projects that are not integrated into a single platform. Initial smart city projects are mainly focusing on public safety (integrating surveillance cameras into emergency services and managing all data generated by citizens) and urban mobility (extensive public transport systems, traffic management, and greener transportation).

Regarding Agriculture, production and productivity have been setting annual records in Brazil. Along with advancements in genetic and field technologies, the IoT will be key to further increasing productivity. Agricultural data is valuable in all stages of the food production chain, and for the government, commodity traders, and developers of machine learning systems. End customers are not looking to buy the IoT as such. The package that delivers value includes data management and analytics, channels through agricultural suppliers, and a managed service wrap. The potential areas for IoT application in agriculture include precision farming, automation, logistics, herd management, and environmental and productivity monitoring.

Investment in smart meters in Brazil is mainly restricted to pilot smart grid projects undertaken by power distribution companies, financed with compulsory research and development budgets. Brazil is one of the largest potential markets in the world for smart meters, with pent-up demand for replacement of about 70 million meters. However, the 2019 sales outlook is not promising. Challenging economic conditions and regulatory delays are expected to depress the market. Smart meter deployment in Brazil is starting to open space for a series of new value-added services, from the commissioning and maintenance of electric meters and solar photovoltaic modules to demand management programs. Delivering these services represents a great opportunity for power distribution companies and new participants. Many international and local smart meter suppliers are already established in the country, ready to satisfy pent-up demand.

The Brazilian IoT devices market is expected to reach 415.7 million units in 2023-up from 138.2 million in 2018. Smart Home/Building Automation, Alarm Monitoring, Security & Surveillance are the most relevant, representing 40.6% of the total market in 2018, followed by Portable Asset Tracking, with 13.0%.³

The IoT ecosystem in Brazil is still fragmented, and there is the challenge of increasing consulting and integration capabilities in order for Information and Communication Technologies companies to provide end-to-end solutions in IoT. There are two IoT associations in Brazil to encourage the exchange

3 [Latin American Internet of Things Devices Market, Forecast to 2023, Frost and Sullivan, 2018](#)

of information, foster commercial activity, promote R&D and represent the different players in the ecosystem: Brazilian Association of Internet of Things (ABINC) and the Brazilian IoT Forum. Currently, ABINC has 94 associates and the Brazilian IoT Forum has 2,500 participants. New business models are quickly evolving in different verticals in Brazil through both established and startup companies, generating a positive scenario for innovation and co-innovation for solutions that address specific needs in Brazil. The increasing availability of different types of connectivity (e.g., 5G networks from 2020, low-power and wide-area, and narrow-band) presents a wealth of possibilities for IoT systems and applications in the country. However, currently Wi-Fi and Bluetooth still represent the large amount of connections.

The National Bank for Economic and Social Development (BNDES) in Brazil announced in December 2016, the elaboration of an IoT study that resulted in the creation of public policies to be implemented by 2022. This initiative is expected to drive investments in the IoT ecosystem. The study was supported by the Ministry of Science, Technology, Innovations and Communications (MCTIC) and conducted by the McKinsey / CPqD Foundation / Pereira Neto Macedo consortium selected through Public Call. The study included general diagnosis and aspiration for Brazil, vertical and horizontal selection, elaboration of action plan (2018 - 2022), and details of the main initiatives of the action plan.

In June 2019 the decree that created the National Plan of IoT in Brazil was published. The plan pillars are free competition and data flow, respecting the principles of information security and the protection of personal data. In addition, the decree prioritizes four verticals for IoT implementation in the country: Healthcare, Smart Cities, Manufacturing and Agriculture. The plan also extends the definition of M2M, reducing the value of the fees paid to Fistel (Telecommunication Inspection Fund), thus creating more favorable tax conditions to these devices. The decree also created a body responsible for implementing the plan, called the IoT Chamber, which consists of representatives from five ministries including Economy and Health.

In addition to the National IoT Plan, other public policies drive the market: the revision of the LPWAN regulation, the creation of the General Personal Data Protection Act (LGPD), the exemption bill project pending in the Legislative Assembly, the development of LPWAN networks by major operators and the creation of new courses for professional training, for example at SENAI, FIA, FIAP, Mauá, among others.

Main Countries in Focus: IoT in Colombia

Colombian industrial IoT revenue is projected to reach \$424.1 million in 2021—up from \$234.9 million in 2018, growing at a CAGR of 21.9%. Hardware was the main revenue contributor in 2018 at 44.2%, followed by services at 32.1%, software at 16.9%, and connectivity at 6.8% . However, software and services' revenue shares are expected to increase the forecast period as Colombian enterprises are increasingly seeking to exploit the power of their data through solutions like big data and analytics.⁴

Transport and Logistics

The transport and logistics sector, as well as the industrial vertical represent the majority of IoT revenues in Colombia. Transport is the most developed sector in Colombia since Machine to Machine solutions for this vertical have been present in the market for several decades. But in addition to traditional

4 Colombian Industrial Internet of Things Market, Forecast to 2022, Frost & Sullivan 2017

M2M solutions such as fleet monitoring, Colombia is the first and oldest connected car market in Latin America. The offers of connected car services have been present for more than a decade. The market has more than 300,000 cars connected and by the year 2023 Frost & Sullivan expects more than 800,000.⁵

Smart Industry

Despite the fact that the smart industry is at a nascent stage in Colombia, IoT will increase the productivity and efficiency of the Colombian industry and therefore a CAGR of 21.4% is projected for the next 5 years. In fact, at the 2019 World Economic Forum in Davos, Medellin was chosen as the headquarters for the first Center for the Fourth Industrial Revolution in Latin America.

Energy and Utilities

Energy and Utilities rank third in terms of revenue share in Colombia. Smart services revenues in Colombia will mainly come from electricity and water supply in the short and medium term. Additionally, the major advances will be related to smart grids and smart metering and distributed generation in particular. Several utilities companies in Colombia have developed projects with smart meters and prepaid electricity measurement, with the aim of reducing non-technical losses. This vertical has a growth potential of 24% (CAGR).

Smart Cities

Smart Cities represent one of the main growth opportunities for IoT in Colombia (26% CAGR until 2021). The smart city concept is developing in Colombia as many cities face problems including waste management, natural disasters, public safety, and traffic congestion and Smart City projects are underway in both primary and secondary cities around the country.

Agricultural Vertical

The agricultural vertical represents less than 10% of IoT revenues in Colombia, but it provides many of the largest advances in IoT in Colombia. Some of the first IoT implementations in the country came from agricultural companies. From coffee growers, to flower and sugar companies, the agro vertical is increasingly taking advantage of IoT solutions to expand productivity. Its projected growth potential is 23%.

IoT for Healthcare

IoT for Healthcare is at a nascent stage in Colombia, it accounts for only 2% of IoT revenues in the country. One of the main reasons why it has not taken off yet is because clinical-grade wearables, sensors, and connected devices are still high-cost products, hindering the delivery of platforms tied to monitoring solutions. However Expected price reductions for wearables, services, medical devices and new vendors offering new solutions will drive growth in this segment and Frost & Sullivan expects that the revenues of this vertical will reach \$ 11 million in 2021, growing at a compound annual rate of 26%.

5 OEM Strategies for Connected Cars in Latin America by 2023, Frost & Sullivan 2018

Colombian IoT devices market

Similarly, the Colombian IoT devices market is expected to reach 86.4 million units in 2023, up from 23.3 million in 2018. Smart Home/Building Automation, Alarm Monitoring, Security & Surveillance are the most relevant, representing 43% of the total market in 2018, followed by Portable Asset Tracking, with 14% and Fixed Asset Monitoring with 10% of the market.⁶

Colombia's IoT ecosystem

The IoT ecosystem in Colombia is very fragmented, with different entities working together to provide end-to-end solutions. Some companies in Colombia have started to collaborate on IoT projects and more partnerships are expected. In fact there are an increasing number of Colombian companies offering end-to-end IoT solutions and IoT-related services, such as big data and analytics (AZLOGICA, Identidad IoT, Bismark, Ubidots, among others, as examples).

Moreover, according to a recent study by CET.LA (Centro de Estudios de Telecomunicaciones de América Latina)⁷ Colombia is not far away from OECD standards for adequacy of the regulatory framework for ICTs (Colombia has a mark of 4,05, while the standard is 4,89). As a result of an adequate regulatory framework and improving macroeconomic conditions (e.g. economic and political stability) the local presence of global providers is high.

The Colombian government is also advancing in different initiatives to promote IoT development. In 2016 The Center for Excellence and Appropriation of the Internet of Things (CEA-IoT) was created, in a partnership between universities, world technology leaders and anchor companies to boost the country's economic development through technology and innovation and IoT development.

Some other initiatives in Colombia include the public entity called Ruta N Medellín that has achieved a synergy with local government, academia, industry and citizens to create an environment conducive to science, technology and innovation. Formed by the government of Medellín, Empresas Públicas de Medellín (EPM) and Telecommunications operator UNE, Ruta N developed a Science, Technology and Innovation Plan with a roadmap until 2021. Medellín's Smart City program has been a pioneer in the use of digital technologies since 2007 and resulted in the selection of the city as 1 of the 5 worldwide centers for the development of Industry 4.0 in the world, next to India, China, Japan and the US. This puts the Colombian city at the epicenter for technological development in fields including Artificial Intelligence, data science and IoT.

The sectorial initiative "Colombia Inteligente", created in 2011 by different companies, including the public utility companies Celsia, Electricaribe, Emcali and Codensa; plus different technological development centers like the Corporation for Research and Technological Development of the Electricity Sector and CINTEL (a Telecommunications Research Center) and industrial associations such as CNO (National Operation Council), CAC and COCIER proposed a first version of a roadmap for the use of smart grid technologies in Colombia.

In terms of infrastructure, the rise of IoT is forcing mobile carriers to re-strategize network development to meet local needs and therefore LPWAN technologies deployment is gaining traction in Colombia.

6 [Latin American Internet of Things Devices Market, Forecast to 2023, Frost & Sullivan 2018.](#)

7 [IoT para el Sector Empresarial en América Latina, CET.LA, Julio 2018](#)

NB-IoT and LTE-MTC are positioned as the leaders with the momentum of the main operators in the region, Telefónica and América Móvil, which have already announced and begun deployment of licensed LPWAN cellular technologies in Colombia (mostly Narrow Band).

Additionally, WND- Sigfox's business partner for Latin America- has an ambitious plan for the region in the coming years, and the first Sigfox pilot in the region was in Colombia.

Long Range Wide Area (LoRa) network rollout is not as pervasive as Sigfox in Latin America, but still LoRa is present in at least 3 Latin American countries, Colombia included.

Additionally, in July 2019 the government presented a road map for 5G implementation in 2022, as a way to provide the level of performance needed for the further development of IoT.

Main Countries in Focus: IoT in Mexico

Mexican industrial IoT revenue is projected to reach \$3,036.9 million in 2021—up from \$1,591.6 million in 2018, excluding consumer IoT and things that demand human interface ⁸. The Automotive and Manufacture verticals are the most relevant, representing 49.2% and 19.2% of the total market in 2018, respectively. Brazil and Mexico are expected to account for over 80% of the connected cars in LATAM. BMW, GM, and Ford are expected to be among the OEMs with the most offerings. Embedded connected car strategies from BMW, GM, and Daimler will push the segment into the majority over tethered technologies. Mexico will be LATAM's second-largest connected car market by 2021. GM and BMW are the top market participants. The country is expected to be among the fastest adopters of smartphone 2.0 connected infotainment and new Human Machine Interface (HMI), driven by North American consumer trends and patterns for service offerings and increased in-vehicle connectivity. Hardware was the main revenue contributor in 2018 at 43.9%, followed by services, software, and connectivity. Software and services' revenue shares are expected to increase during the forecast period as the cost of communication and sensing modules decline.

Utilities

While automotive and manufacturing will be more mature by 2021, utilities are expected to have the highest CAGR. Although the utilities vertical includes gas, water, and power, smart utilities revenue in Mexico will come mostly from power and water in the short and medium terms. Mexico will continue to be the second highest consumer of energy in LATAM in the next decade. However, demand for renewable energy will increase at a CAGR of 7.16% from 2015–2025 in Latin America and Mexico has a clean energy target of 35% by 2025 and 50% by 2050; additional 13,030 MW of hydropower in the next 5 years; 8,922 MW of wind, 1,018 MW of geothermal, 748 MW of bioenergy, and 627 MW of solar power. The need to control energy consumption and the resulting rise in energy cost for consumers and industrial segments are acting as key drivers for the development of smart metering. Smart grids and smart metering are gaining pace in Mexico with prevalent potential in distributed generation systems.

Finance

Finance is another vertical that will see substantial IoT uptake. The first M2M projects in Mexico were Point of Sale terminals, which contributed to the representation of the banking and finance vertical in

⁸ Mexican Industrial Internet of Things Market, Forecast to 2022, Frost & Sullivan 2017.

the IoT total market. However, as the IoT ecosystem and business model matures, it is expected that most of the revenues will come from value-added services (VAS) and applications rather than the mere connectivity. Mobile operators, however, are not likely to stop at providing connectivity. In the future, Frost & Sullivan expects collaboration with cross-industry players, indicating a possible deviation from the traditional business model. Solutions in restocking, maintenance visits, ATM machines management, and managed security are expected to gain ground in this vertical. Additionally, financial services are relying on IoT to deliver better customer experience as IoT is expected to increasingly provide better, more rewarding, easy-to-use services to financial services customers.

Mexican IoT devices market

The Mexican IoT devices market is expected to reach 247.1 million units in 2023-up from 81.9 million in 2018 ⁹. Smart Home/Building Automation, Alarm Monitoring, Security & Surveillance is the most relevant vertical, representing 38.9% of the total market in 2018, followed by Portable Asset Tracking, with 16%.

Mexico's IoT ecosystem

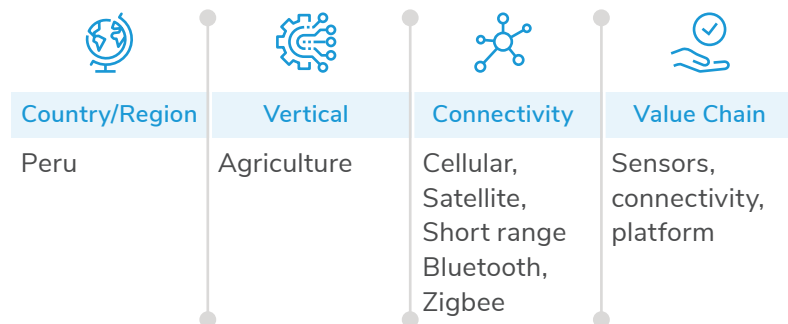
Although the IoT ecosystem in Mexico is still fragmented, with a large number of companies competing at each stage of the value chain, it is maturing rapidly. The first three levels of the value chain (chips, hardware and connectivity) are mature, with some large companies like Intel, Qualcomm, AT&T, Telcel, Telefónica or SigFox, while the last two levels (enablement platform and systems integration) are yet to be fully developed as the market shows a large number of small participants competing.

The government, through the regulator IFT but also through different levels like state governments or even city governments, the academy (represented by various universities like Politechnic University of Yucatan or the Technologic Institute of Monterrey), and industry chambers like CANIETI (National Chamber of Electronics Industry, Telecommunications and Information Technology), the Mexican Internet Association or the Mexican Association of the Information Technology Industry (AMITI) have been developing different initiatives in order to foster IoT development. For instance, the government invested some 500,000 dollar to help 20 Mexican start ups (selected out of 86 companies, with a majority of them focused on IoT) to be part of one of the largest ICT events in the world, CES Las Vegas, in 2018. Another university, the Jesuit University of Guadalajara is the home of ITESO, a technological park that in turn hosts a wide range of tech companies including a diverse array of IoT companies. Making sure regulations also enable IoT development is another aspect of these initiatives, like supporting the transition from IPv4 to IPv6 or ensuring the efficient use of the spectrum.

9 [Latin American Internet of Things Devices Market, Forecast to 2023, Frost & Sullivan 2018](#)

IoT CASE STUDIES

AGROINDUSTRIAL LAREDO



The strategy and value proposition

Agroindustrial Laredo is dedicated to the sugar production in Peru. It started in 1813 with a first sugarcane mill in the province of Laredo. In 1998 it was acquired by the Colombian Consortium Azúcar Manuelita.

Agroindustrial Laredo went through an image renewal in 2014 with the commitment to offer high quality sugar, through the sustainable use of natural resources and a positive impact on the well-being of neighboring communities. Agroindustrial Laredo is characterized by the constant seeking of the best state-of-the-art technologies to support business goals and principles and often becomes the market referent and determines the innovation roadmap for the industry.

Agroindustrial Laredo was an early adopter of M2M solutions, but the company understood that taking data and measurements was not enough and was looking for tools to make real-time decisions and thus continue with its legacy as a market innovator.

Hands-on IoT

In light of this, Agroindustrial Laredo partnered with IoT provider AZLogica to develop an IoT solution for harvesting logistics optimization.

The harvest in the Sugar Mill was optimized by connecting all kinds of indispensable machinery (harvesters, cane trains, aircrafts, tractors and other support providing vehicles) online, as

FAST FACTS

Competitive Differentials

- Production efficiency through mechanized harvest processes.
- Development of high impact projects including a challenging sugarcane plant in the desert that makes Laredo a referent for national and international agribusinesses.
- Demonstrated commitment with the social development of local communities and environmental responsibility.

Partners

TECHNICAL PARTNERS:
AZLogica, AWS

well as machinery operators and supervisors for non-mechanized processes.

The information captured through the sensors installed in the machinery was used to calculate an Overall Equipment Efficiency index (OEE) the company uses to optimize production processes, significantly reducing the time between the cane collection and the moment it is taken to the plant for processing, while using the minimum required resources.

The deployed solution was a telematics system that allows managing the field process, through the identification of the tasks that each group of machines does within a specific process being monitored. The system included a satellite management system that enabled machine efficiency measurement online and thus making informed decisions to improve the harvest and logistics operation.

The IoT platform provided online monitoring of all the connected devices and sensors, operating alarms that enhanced decision making processes and a powerful business intelligence module, which generated performance and efficient, tailored reports.





Impact and value of IoT solutions deployed in business operations

- +10X Return On Investment.
- Timely delivery of product: Significant increase in the level of compliance.
- 16% Fuel Consumption Reduction.
- Reduction of emissions of polluting gases
- Improved driving habits and increased total machine availability

Next steps

Initially the IoT project was deployed for machines associated to the adaptation and soil preparation stage of the harvest, but it evolved until involving all kinds of different processes including the harvest logistic operation. In the future IoT is expected to be applied to other operational activities.

AGRUS DATA

 Country/Region	 Vertical	 Connectivity	 Value Chain
Brazil, Argentina, Chile and Ecuador	Agriculture	Satellite Broadband and LPWAN (for small farmers) and Mobile Network (for large corporations and cooperatives)	LPWAN providers, MNOs, farmers and agribusiness

The strategy and value proposition

Agrus Data is a Brazilian IoT provider specialized in the agriculture vertical. The company, which was founded in 2016, offers from consulting services to deployment and support. Agrus Data's value proposition includes sensors, connectivity, cloud platform, control panel, artificial intelligence and machine learning.

The company has direct and indirect sales. In April of 2019, Agrus Data and Embratel, a telecommunications operator in Brazil, have partnered in order to collaborate in the development and sale of connectivity solutions for agriculture. Embratel offers Agrus Data's products to its large customers and both companies will build new solutions as well. Embratel offers infrastructure in remote regions through mobile network (2G, 3G and 4.5G) as well as new IoT networks (NB-IoT and CAT-M), in addition to satellite broadband. Data collected is also hosted at Embratel's data center, which brings more security by being stored in the country. To reach the small farmer, Agrus Data also have partnership with others IoT network providers such as Sigfox and LoRa.

In addition to Brazil, Agrus Data is still present in Argentina, Chile and Ecuador due to Libelium's partnership, as well as relationships with local MVNOs.

FAST FACTS

Competitive Differentials

- Extensive LPWAN coverage
- Proprietary communications telemetry module for machines and grain bin silos
- Proprietary data storage and data processing platform
- SimCard ready and Hotswap agro meteorological stations with high resolution images
- Low cost sensors due to partnership with Libelium
- Control panel with easy interface (e.g. SMS, WhatsApp and Voice interaction)
- As-a-service business model—simple hiring and increased adoption

Partners

- Amazon Web Services—cloud computing
- Tago—industrial automation
- Intel—modules and processors
- UniSafe—agriculture advisory services
- Libelium—wireless sensor network devices
- Sierra Wireless—IoT integrated services from devices, cloud computing to connectivity
- Embratel—network services

Hands-on IoT

Currently, farmers seek cost savings, increased productivity, and added value to their products. Agriculture is complex with the interaction of biology, climate and human actions. This is why science-based methods have been employed to offer insights into agricultural and livestock production. According to Agrus Data, it is estimated that 1 hectare of agriculture will produce over 32 Gb of data per year. Without an IoT solution it would be very difficult to assess correlations between climate and soil, seed and soil, and seed and climate. In addition, over time and with more data, algorithms improve recommendations, generating maximum efficiency and productivity.

In this scenario, to help farmers and agronomists, Agrus Data has combined digital technologies such as IoT and Big Data & Analytics with industry knowledge to create 3 main products: digital agriculture as-a-service, connected silos platform and connected forestry. The digital agriculture as-a-service for large customers includes installation of communication networks covering the entire farm area with 4G for voice and data, 30 meter towers and using 850 MHz frequency. In addition, Agrus Data is responsible for the physical installation of agro meteorological stations and sensors. The company offers telemetry of tractors and trucks, monitoring of irrigation pumps and level of reservoirs and river, as well as field data collection through tablets. The data is integrated with ERP systems and production control algorithms create better planting management windows, control of rates of loss risk and water balance and predictive machine maintenance.

The connected silos platform offers real time data about the amount of grain stored in each silo. The solution also allows monitoring the storage conditions and health of the grain. Currently, the grain storage market is totally dependent on

manual control, with professionals climbing to the top of the silos for analysis. The platform provides more security with automated control and avoids employee's risk. The Paraná Integrated Agroindustrial Cooperative is one of the customers of Agrus Data's smart silo technology.

The connected forest enables automated asset management and real-time forest tracking through algorithms, reducing operating costs by analyzing data collected from machines and plantations and stored in the Cloud. The solution makes it possible, for example, to control fuel use on harvesting machines (equipment used for tree felling, felling, delimiting, debarking, tracing and log piling) and forwarder (machine used for harvesting and transporting logs).

In addition to connectivity and scale adoption, the main challenge in the agricultural vertical is the amount of data of different formats, as there are different protocols for different machines of different brands, for example. That's why Agrus Data has a broad portfolio of sensors to capture so many types of data, such as soil and air temperature, atmospheric pressure; solar radiation; soil, air and leaf moisture; anemometer; machine and field data entered (tablets); precipitation; volume, gas and telemetry of silos.

Impact and value of IoT solutions deployed in business operations

Agrus Data has already 10 million data collected and 20 developed projects. The company allows:

- Cost reduction by knowing exactly how to act, using adequately each resource
- Production efficiency with more assertive and fast decisions
- ROI of up to 7x the invested in 5 years

Among the benefits of digital agriculture-as-a-service, which is Agrus Data's first product

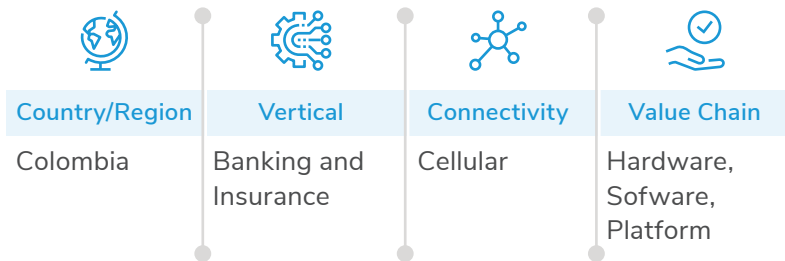
launch, are better setup-based planting period, better agrochemical application window, real-time agro meteorological conditions, forecasting production, possible harvest date, health plantation use in real-time of machines and implements.

Next steps

Agrus Data aims to continue its research, development and innovation in digital products specifically for agribusiness. Agrus Data is an

associate of the Brazilian Association of IoT (ABINC) and Inovabra and Ag Tech Garage, an agribusiness innovation hub, which promotes the ecosystem and creates strategic partnerships among startups, producers, investors, academics and other stakeholders. Agrus Data is constantly working on improving its algorithms to anticipate scenarios/occurrences and deliver better recommendations, thus proving ROI for the farmer with real use cases.

ALLIANZ



The strategy and value proposition

The Allianz Group is a leading, global financial services provider serving more than 70 countries around the world with first-class insurance and asset management solutions. In Colombia, Allianz has a comprehensive portfolio of insurance services for both Personal and Commercial segments.

Allianz is focusing strongly on its digital transformation initiatives to become a 'digital by default' insurance company and its Colombian operation is following these premises. In order to support its risk management processes Allianz started using Internet of Things tools, developed by Colombian IoT provider AZLOGICA, for the visualization and reduction of risk management with some of the company's most important insured clients.

Hands-on IoT

Allianz's starting point was the necessity to optimize the management of real-time data acquisition from diverse insured assets (vehicles and various sorts of assets). Initially, the IoT solution was designed as key part of Allianz's Prevention programs for Vehicle Insurance.

The IoT solution included different types of Hardware: GPS, sensors, biometric devices and smartphones; in accordance to the type of asset to be monitored; as well as data transfer and parameterization of early alerts and intelligent reports that facilitate the decision-making process of Allianz's clients, impacting risk mitigation.

Allianz's clients actively connected different types of vehicles and industrial assets involved in production processes and

FAST FACTS

Competitive Differentials

- Enhanced risk management
- Increased trust and loyalty of insurers
- Added-value services.

Partners

TECHNICAL PARTNER: AZLogica

were empowered with management tools that enabled the proactive visualization of operative data obtained from the different vehicles and assets through an online interface. This data is associated with the fulfillment of scheduled tasks for each vehicle and operator, the appropriate use of machines and resources, and the sustainability of the insured and its operation.

AZLOGICA's Team Manager platform enabled Allianz and Allianz's clients to have control over resources, processes and connected people, providing tools for operational and decision making through the Business Intelligence engine. Team Manager provided operational and managerial tools such as direct communication systems between teammates, electronic form submission, and route control, among others.

Furthermore, the platform "EVOLUCION" for mobile asset management provided real-time control functionalities for vehicles, including optimal position, operational status and maintenance alerts, among others.

The implementation of IoT tools enabled Allianz to reduce operating costs, have control over processes, assets and work teams, detect fraud, and overall significantly improve risk management.

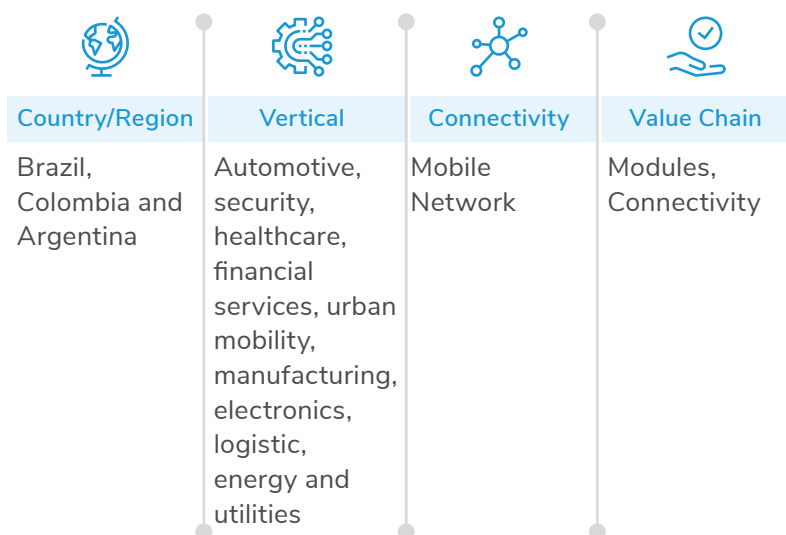
Impact and value of IoT solutions deployed in business operations

- 20% increase in operational margin
- Increased trust and loyalty of the insured client
- Renewal of insurance policies with greater guarantees and added-value services.
- Risk reduction in critical customers.
- Adaptation to each contractual scenario and optimization of resources

Next steps

In other geographies, Allianz has partnered with OEMs (Original Equipment Manufacturers) and AD (Autonomous Driving) technology companies to collect and use vehicle and driver data to develop insurance products for future vehicles such as fleets and driver assistance systems with telematics functionalities. Moreover, Allianz is also launching various core insurance products on Mobile Application Platforms to satisfy customers' new requirements for on-demand service. It could be expected these initiatives to be replicated in Colombia and Latin America.

ARQIA



The diagram illustrates ARQIA's value proposition through four interconnected pillars: Country/Region, Vertical, Connectivity, and Value Chain. Each pillar is represented by an icon above a table column. The Country/Region pillar (globe icon) lists Brazil, Colombia, and Argentina. The Vertical pillar (gear icon) lists Automotive, security, healthcare, financial services, urban mobility, manufacturing, electronics, logistic, energy, and utilities. The Connectivity pillar (network icon) lists Mobile Network. The Value Chain pillar (hand holding a checkmark icon) lists Modules and Connectivity.

Country/Region	Vertical	Connectivity	Value Chain
Brazil, Colombia and Argentina	Automotive, security, healthcare, financial services, urban mobility, manufacturing, electronics, logistic, energy and utilities	Mobile Network	Modules, Connectivity

The strategy and value proposition

Arqia is a Brazilian M2M and IoT provider with global reach, with offices in US, Sweden, Guatemala and Spain. The company was founded in 2013, under the name Vodafone Brazil. In 2018, Vodafone Brazil made a brand repositioning and changed its name to Arqia. The company is part of the Datora group, which has been operating in the telecommunications market for 26 years and represents Vodafone IoT clients in the country.

Arqia has historically been an innovative B2B telecom service provider, and this strategy has led the company to pioneer the development of the MVNO and M2M/IoT markets in Brazil. As opposed to larger telcos, Arqia’s entrepreneurial approach to its wireless business and focus on acting as an enabler for its clients, whether competitors or not, gives the company flexibility to better tailor solutions to suit customers’ needs.

The company has only direct sales and has improved their sales channel strategy with segmentation between SMBs and large enterprises, with plan profile for each segment and specialized pre and post sales for each technical need. Arqia’s customer value is guaranteed by the consultancy it provides to interested parties in pre-sale, differentiated customer support directed to each vertical, a management platform that enables clients to

FAST FACTS

Verticals of Focus

AUTOMOTIVE: tracking, fleet management and connected car

SECURITY: Conectivity management and control.

MOBILITY: Tracking, connectivity management and controlling.

Competitive Differentials

- Premium care with global support and qualified technical team
- Customized products and services
- Global communication and management

Partners

- ZTE—advanced telecommunications systems
- Amazon Web Services—cloud computing
- Idemia—IoT modules, terminals and modem cards
- ST Card—IoT modules, terminals and modem cards
- Sierra Wireless—devices, cloud computing and connectivity services
- Telit—cellular communication modules, GNSS, short-to-long range wireless modules, IoT connectivity and platform services
- Suntech—Trackers and hardwares
- TIM—Telecom Italia—Mobile Network

make real-time decisions and enhance network reliability, and SLAs. IoT agreements are not simple contracts, requiring a more thorough foundation. Arqia depends on its Solution Architects to accompany sales representatives and design agreements that meet the business and equipment needs of customers with the target goals and connectivity in mind. Similar to its pre-sale process, Arqia crafts SLAs to best meet the technical and price sensitive needs of customers. The SLAs provide flexibility and enable greater price per performance value in Arqia's expanded portfolio, in service types and VAS such as content delivery.

Hands-on IoT

Arqia combines technical hardware expertise, managed connectivity and software applications to offer an end-to-end, single point of contact solution for IoT capacity. Arqia's value proposition includes from sensors to communication (2G, 3G and 4G), Big Data & Analytics and information access. Device and connectivity are bundled and IoT connectivity service is managed, including network, SIM, logistics, IoT platform, SLA and customer support. The main IoT applications for Arqia are asset tracking, telematics, fleet management and remote monitoring.

Unique in the market, Arqia addresses M2M/IoT exclusively and focuses all of its product development and networking energies to generating value in the market. Directing investments specific for IoT, Arqia maintains its network core only for IoT/M2M clients. Where competing service providers subdivide networks and face connectivity issues when social networks or video on demand consume inordinate portions of bandwidth, Arqia operates and maintains availability entirely for its IoT/M2M customers.

The main IoT solution deployed in Brazil is the embedded universal integrated circuit card

(eUICC), which is an innovation due to the subscription management software. The eUICC is a secure element that contains one or more subscription profiles, which includes Arqia's credentials and applications. Profiles are remotely downloaded over-the-air into a eUICC. Beyond operators, the change from the removable SIM to an eSIM provides benefits for many players: end users, enterprises and device manufacturers. Enterprises no longer have to manage several SIM cards due to simplified and remote management of subscriptions. The eUICC allowed Arqia to expand their presence in the automotive vertical since SIM card distribution costs were eliminated. For distributors or enterprise customers managing fleets, simplified logistics became possible. Arqia is well positioned to lead the market in applications such as telematics-based insurance.

In addition, Arqia built out a management platform that enables clients to make real time decisions and enhance their network reliability. In some deployments enterprises have no idea how to manage connectivity of many devices; their consumption rates, location, and usage are unknown. Arqia's comprehensive management platform ensures visibility into all aspects and activities, including consumption, performance, and full capacity to suspend or expand access. Furthermore, Arqia builds new native functions into the platform to better serve customers, such as SMS accountability and LBS that understand where the devices are but also segment the deployment by market, by feature set, or geography. Also, Arqia can customize APIs to streamline communication with the existing asset management systems and end user support systems.

Impact and value of IoT solutions deployed in business operations

Arqia has over 1.000 enterprise customers, over 800 thousand M2M connections and a cloud network core, capable of supporting up to five million SimCards. Empowering the customer organization, Arqia's management platform helps reduce costs and increase technological and operational efficiency across an IoT network deployment, and individual device level controls.

The impact of eUICC solution on cost reduction is over 20% for customers. Depending on the level of evolution of the solution, it is also possible to generate about 20% increase in new revenues.





Next steps

The newly created brand aims to promote the evolution of the B2B business model. The name Arqia was inspired by information architecture,

artificial intelligence and connection, and was released in major industry events such as Futurecom, the largest ICT event in Latin America and WTM, considered the largest mobility event in the world. In addition to events, the company promotes content in press releases, newsletters and whitepapers, with the objective of attract the attention of potential customers and generate leads. Arqia also promotes the Vodafone IoT Barometer, which is an annual survey of the market.

The company is investing heavily in encouraging new applications, using its IoT ecosystem to show potential clients the possibilities IoT allows, even if none of the applications are currently in use, meaning Arqia is ready to support IoT clients in developing original and innovative applications.

AZLOGICA

 Country/Region	 Vertical	 Connectivity	 Value Chain
Latin America	Logistics and transportation, connected cars, retail, utilities, agro, government, manufacturing, security, oil and gas and insurance	Mobile	Hardware, Software, IoT multi-platform (End-to-end solution), Machine Learning

The strategy and value proposition

AZLogica provides end-to-end solutions for IoT and was established in Colombia in 2008. Its management team realized that if an IoT solution could not be adapted according to specific customer needs, it would not be sustainable in the Latin American market and subsequently, the company created the technological base, and IoT platform that was 100% developed in-house and leverages the expertise of a team of highly specialized engineers. AZLogica's value proposition is centered on its owned platform flexibility, that can deliver the exact information that customers want and need regarding their physical assets (mobile, static and processes), vehicle fleets, and machines (physical location, temperature, illumination intensity, vibration intensity, power-line voltage, chemical concentrations, among many others).

While other market competitors are only currently developing full IoT solutions, AZLogica's solutions are based on a flexible and easily, adaptable, in-house developed platform that can be customized to meet the requirements of companies in all verticals. It is flexible and adaptable because it can be integrated with hardware, software, and applications that customers already own, and in doing so it makes the most of the existing infrastructure.

FAST FACTS

Competitive Differentials

- Flexible platform that allows high customizations to adapt to customers' needs and available resources.
- Co-creation process focused on ROI
- 100% owned platform
- Continuous R&D investment independent of market maturity or revenue stream
- Information Security based on ISO27001 standard

Partners

TECHNOLOGY PARTNER: AWS, Oracle, Microsoft, Nokia, Millicom, Telefónica, Intel, Huawei, Dell, Ubuntu, Claro among others.

45 Business partners that distribute AZLogica's solutions in Latin America.

There are two main factors that differentiate AZLogica from its competitors. First, the flexibility of its business model enables the solution to work wherever the customer's need is. AZLogica's horizontal platform can operate with any hardware (such as sensors or gateways) and the company works with most operators and cloud providers in the region to be able to connect to whatever network the client prefers. AZLogica's solutions are available through Amazon Web Services since their launch, but, in addition, the company currently offers its solutions with many others, such as Oracle Cloud, or on customer premises.

This gives clients the flexibility to connect an IoT application to their own platforms and their own servers. Because AZLogica can integrate existing hardware from any vendor with software application programming interfaces (APIs) from different companies (e.g. Tableau, Power BI, Oracle DV, Tibco, or Analytic Systems), customers can leverage the infrastructure they already have, such as sensors and gateways, and work with the preferred data visualization provider.

The second differentiator is that the company co-creates the IoT solution directly with the client in order to ensure ROI and therefore increase the impact of the IoT project. As a rule, AZLogica works directly with its potential clients in order to create a business case that makes sense for them from a financial point of view. The result is always associated to the main pain points each company has. For example, the project ROI for a large logistics company was a 25% reduction in fuel consumption from its fleet of trucks. For a shrimp production company, the ROI was the reduction of production theft near to 99%.

AZLogica offers a solution based on an architecture that can connect any type of devices and collect any type of data. As a result of the ability to cater to all sizes and segments,

AZLogica has more than 560 customers in 9 different countries—Spain, Colombia, Peru, Costa Rica, Mexico, Panama, Paraguay, Brazil, and the United States.

Hands-on IoT

Independently of the industry, AZLogica designs IoT solutions for companies that want to automate their data management. Data control software, is co-created and customers can operate their models of production and operations management from a computer or a cell phone. The IoT solution automates information generation by collecting and integrating it into a single application. It does this for the information that is specifically important for the different processes of a company, and it facilitates timely decision-making in many different situations. For example, it can help detect possible machinery failures and in doing so, facilitates timely corrections and provides operation cost savings.

One of the first projects the company delivered in Colombia was for Manuelita, a large sugar production consortium. Manuelita was in 2008 an early adopter of machine-to-machine (M2M) solutions, but it understood that taking data and measurements was not enough and was looking for tools to make real-time decisions. AZLogica and Manuelita worked together and developed a solution for harvest and field logistics management, where AZLogica provided the whole IoT solution—from the creation of the hardware and sensors required by the client to developing the whole technical solution and end-user platform.

AZLogica understands that while it knows all about IoT, it does not know the customers' business like they do. The co-creation process included many interviews with not only Manuelita's IT team, but with many different client business areas, such as the production area, commercial, operations and processes. AZLogica and

Manuelita then determined the main pain points and started the IoT project with a diagnostic report. After sharing the diagnostic report with the client, together they establish the key points the IoT solution must address and the business case was created.

The ROI of this solution was 10 times cost savings by a 16% reduction in fuel costs as well as maintenance supplies cost reductions, and increase in efficiency.

Impact and value of IoT solutions deployed in business operations

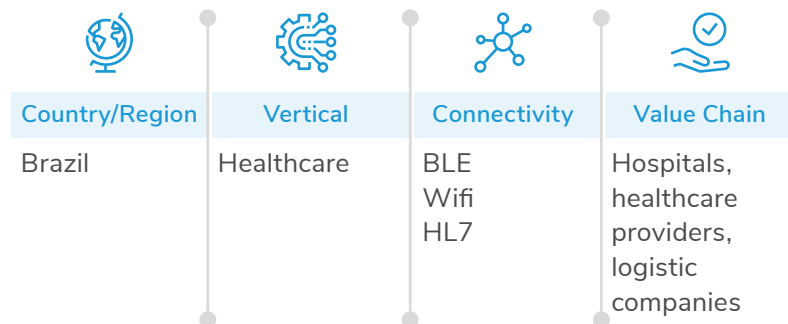
- AZLogica's business model that specialize in the co-creation of solutions guarantee high ROI and high client impact of IoT projects.
- 100% owned technological solution that allow customers to monitor and manage their assets in a robust, scalable, and flexible way.
- AZLogica's IoT platform provides online monitoring of all connected devices and sensors, operating alarms that enhanced decision-making processes, and a powerful business intelligence module that generates performance and efficient, tailored reports.

Next steps

AZLogica is seeing important IoT developments in all the countries in the Latin American region. In Peru the company sees many opportunities for growth in the agricultural sector (from IoT phytosanitary apps to logistics, fields preparation and harvest efficiency and fuel and supplies management); in Central American countries and Mexico AZLogica is experiencing increasing demand for IoT solutions for fish production management; in Brazil for smart buildings; and in general in the region the demand is growing for Smart Cities Solutions.

AZLogica has several expansion plans for the future: in 2020 the company will open a direct operation in Chile (currently this country is being served from Peru) and also in 2020 it is expanding to Europe, starting with a first office in Spain. AZLogica already has IoT projects in Europe and therefore launching an operation in that region is a key current priority.

CARENET LONGEVITY



The strategy and value proposition

Increasing numbers of medical devices of several providers such as GE, Philips and Baxter, along with advancements in capture and transmission of medical data, have been driving IoT services in the healthcare market in Brazil. This is why Carenet Longevity uses technologies such as IoT, in addition to Big Data, Machine Learning, and applications to become the main data integrator of digital health in the country. The company is a SAAS that provides fast information access, operational efficiency, cost reduction and predictive risk analysis, which are the key challenges for monitoring patients today.

Carenet Longevity's value proposition includes:

- **Integration:** of all mobile and digital health data generated by patients in and out of hospital clinical setting (using smartphones, wearables and medical devices).
- **Processing:** of real-time data transmission to B2B customers' systems and configurable rules definition signaling which data should be acted upon for healthcare.
- **Communication:** of patients and doctors with engaging experiences and digital tools (applications, portals, email, SMS).

Hands-on IoT

The company was established in 2014 with a private label wearable device and self-monitoring application for end users,

FAST FACTS

Competitive Differentials

- Over five years' experience in the recent Brazilian healthcare IoMT (Internet of Medical Things) services market
- Modular approach that enables customers to incorporate parts of the portfolio into their existing solutions
- Scalable solution with current implementation of up to 45 days

Partners

- Medical equipment providers such as Philips, Baxter, Nihon Kohden, WelchAllyn, Mindray, etc.
- Business partners such as Temed and Oncomed

but became a platform provider to support Netshoes' entry into the segment the following year.

After Inseed, a Brazilian venture capital firm, started in 2018 to invest in Carenet Longevity, the company has been providing several off-the-shelf products for the healthcare segment. Carenet's unique Medical Device Information Platform, Orchestra, captures and contextualizes clinical data, providing real-time and mobile patient information that can facilitate early intervention and enable better clinical outcomes. This product is today the main solution, hired by 90% of their customers. The new business model reduced the weight of the high cost of importing devices, logistics and marketing, which made a competitive price in the market unfeasible.

Target: Hospitals

- Orchestra—Integration of all connected devices from the hospital intensive care unit, which allows centralized supervision in the nursing room and continuous feeding of medical records, facilitating patient management. The platform solves 3 key workflow challenges: Documentation, Patient Monitoring and evidence-based Interventions.
- Fast Track Check-in—Fast emergency room check-in, with artificial intelligence that enables smart interaction, pre-screening and efficient patient journey.

Target: Healthcare providers

- Primary health—Primary care management, including pre- and post-medical appointment processes.
- Remote Patient Monitoring (RPM)—Customized remote patient monitoring using a portfolio of wearables and medical devices.

Target: Logistic companies

- Morpheus—Remote monitoring of drowsiness through a brainwave cap (using an EEG), predictively identifying sleep levels.

The stakeholders of Orchestra, the main product of Carenet Longevity, include the patient, doctor, nurse and hospital. For the patient, the primary benefit is improved reaction time in a crisis. For the doctor, it is remote access in real-time, configurable alerts and diagnostic assistance. For the nurse, it is the elimination of manual data capture (burn-out risk reduction), focus on care and communication with the patient, as well as configurable filters and alerts. For the hospital, it is the database for the development of predictive algorithms.

Despite security and data protection has been the major issues in the healthcare market, in the long term, Carenet Longevity aims to develop algorithms with the anonymous collected data from patients and create scores and risk warnings, in addition to deliver health data integration.

Impact and value of IoT solutions deployed in business operations

Carenet Longevity has already performed more than 200 integrations on devices of different brands and has monitored about 140 thousand lives over the last couple of years. The changes created by Orchestra, the company's main solution, in business operations also include:

- Time saved for ICU nurses: 33%
- Reduced probability of errors copying and logging patient data from 4% to zero
- 30% of decreased mortality through 24/7 patient monitoring, early diagnostic and quickest response via smart alarms (in similar cases in the US)

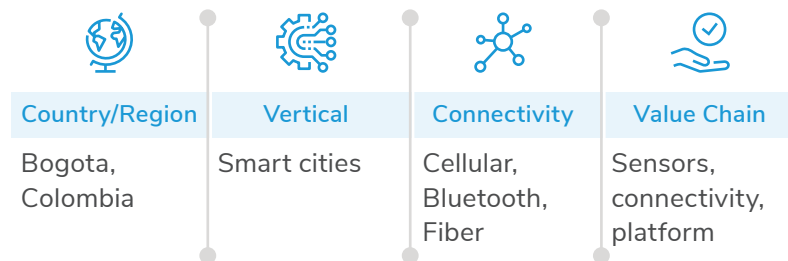
- Automatic and flexible configuration of vital signs collection and storage in the medical record
- 20% of reduced length of stay after 6 months of Tele ICU implementation (for similar products in the US)
- Vital signs cloud storage for later use in BI tools and history retrieval

Next steps

Since May 2019, the company has a project in production at Hospital Santa Catarina, in São Paulo, based on the Orchestra solution and the expansion will occur until the end of the year for the remaining eight hospitals of the group.

Carenet Longevity has the target of monitoring one thousand ICU beds in Brazil in 2020, corresponding to 2% of the total number of ICU beds in the country. Hospitals are leading disruptive innovation in the healthcare market due to the need of increasing patient loyalty and expand their value-added services. In addition, health plans are starting to charge for results, for example depending on the admission of recurrence cases, which also motivates hospitals to invest in IoT in the healthcare market. Hospitals are often left alone when it comes to integrating new IOMT & monitoring tech with their existing legacy systems. Carenet bridges that gap.

CITY OF BOGOTA



The strategy and value proposition

The current traffic light system of Colombia's capital city, Bogota, is over 40 years old, clearly unfitted to meet the needs of a city of 8 million inhabitants and about 2,5 million vehicles.

A large portion of the +1,400 traffic light intersections operating today use halogen bulbs and are connected through an inadequate copper network, without sensors for vehicle detection and in many cases not communicated with each other.

In this scenario, the city government of Bogota, through the city's Secretaría Distrital de Movilidad (SDM), designed a transportation master plan that includes the modernization of the city's traffic light system.

Hands-on IoT

Bogotá's transportation master plan includes the development of an intelligent transportation system with several components:

- **Management Center:** Already operating, is a control center deployed by SDM 3 years ago that feeds on the information of the city's traffic system: it feeds on sensors, cameras, patrol reports and social media posts. Through the Management Center the city's mobility authorities are enabled to monitor traffic status and different variables like traffic accidents rate, average speeds and vehicle detection.
- **Intelligent Traffic Light System:** A control system that combines traditional traffic lights with sensors and AI solutions to intelligently route vehicle traffic. The project of Intelligent Traffic Lights consists of the replacement of analog by digital traffic lights that are linked to the

FAST FACTS

Competitive Differentials

- Travel times will improve by 30%.
- The new system takes into account not only vehicles but pedestrians and cyclists as well.
- Monitoring efficiency: when operated from a single central, thanks to the smart controller, traffic lights data can be easily collected and analyzed and thus real time decisions can be made.

Partners

TECHNICAL PARTNERS: ETB, Siemens, ECG, SKG, Isitel, ETRA, Auto Traffic.

Management Center. The traffic light platform goes beyond data measurement to data analytics, using the information of the management center and also feeds the management center. The platform will be smart enough to activate a signal that subsequently activates a road corridor to accelerate traffic after detecting traffic incidents that impact vehicle circulation.

- **Electronic detection of infractions:** It has no fiscal or collection purpose. The aim of electronic infraction detection is not to increase the city's administration income but to reduce accidents by aiming at the objective of zero mission (cero lives lost due to traffic accidents).

With an investment of around USD\$50 million SDM started the Intelligent Traffic Light System project in August 2018 and it is expected to be completed by August 2020.

Impact and value of IoT solutions deployed in business operations

- With the new system travel time will be improved by 30% in Bogota.
- After project completion the city will have a total of 1,496 traffic light intersections powered with intelligent monitoring.

Next steps

The old copper network will be replaced by a fiber optics networks that enable greater data transfer capacity with higher speeds.

Halogen lights that have a lifespan of just one year will be replaced by led bulbs that last up to seven years and spend 90 percent less energy. To date, about 8,000 of these light modules have been changed.

Almost 2,000 detection cameras will be installed at the top of the smart traffic lights to help SDM make real-time decisions to improve traffic in the city. A new traffic light central station will soon start operations to centralize traffic information and manage vehicle circulation in real time.

G7NET

Country/Region	Vertical	Connectivity	Value Chain
Argentina	Manufacture, Transportation, Utilities	LPWAN, NB-IoT, WiFi, cellular, satellite	Sensors, middleware, application framework

The strategy and value proposition

G7Net is an Argentina IoT provider specialized in manufacture and utilities verticals. The company, which was founded in 2017, has an IoT business unit (Giotrace) focused on providing sensors and middleware and integrating them with the rest of the value chain to arrive at a full IoT solution. G7Net is located at the Austral University technology hub in Pilar (Buenos Aires province), thus benefitting from the interaction with other similar companies.

In terms of connectivity, G7Net sensors can communicate with most networks (LORA, Sigfox, NB-IoT, cellular, WiFi), and its middleware integrates well with the client's platform of choice (though in the case of clients with a small IT department they may be willing to receive even the final screen that the users see, in which case G7Net will look for the right partners to deliver the end-to-end solution).

The company works with a direct sales force to reach its clients, as their primary focus is utilities (where there are only a handful of clients). Eventually they can work with systems integrators that bring new clients to develop IoT projects.

The strategy of G7Net is to focus on the part of the value chain where they think they can add more value, and integrate the rest of the elements. Thus, they have developed their own middleware, and they can provide the full lifecycle of both device management (deployment, monitoring, registration, authentication, maintenance and diagnosis) as well as data management (capture and storage, real time processing and integration with the client's systems). Finally, they provide visibility and control via a web interface that is flexible in terms

FAST FACTS

Competitive Differentials

- Flexibility in terms of connectivity
- Proprietary middleware
- Integration with the rest of the value chain
- Both cloud and on premise options

Partners

Strategic alliances with iCondor, Yeap, BGH, Sirius, Claro, BlueStar

TECHNOLOGY PARTNERS:

Elemon, Chainway, Sinocastel, Microchip, Impinj

CLOUD PROVIDERS: Amazon Web Services and Microsoft

of management and offers reports, traceability and geolocalization, all under a personalized user interface (all these can also be viewed using a mobile app).

Hands-on IoT

The key verticals for G7Net include utilities (gas and water metering), manufacture and transportation (in particular cold chain logistics), market segments where they can leverage their experience and flexibility and deliver differentiated solutions that are of value to the clients. Each vertical has its own requirements, for example gas utilities mandate the use of batteries for security reasons (as opposed to connecting to the electrical grid). As batteries have a certain life, to avoid having to replace them frequently they need to maximize the battery life and thus decide on specific communications protocols.

One key utility client is MetroGAS, the company that provides natural gas service in the Buenos Aires metropolitan area, reaching 2,4 million clients (61% in the city of Buenos Aires). MetroGAS was looking to use IoT to identify some 2,800 high pressure gas valves, with geolocalization with centimetric precision at a reasonable cost. G7Net proposed the use of handheld terminals with RFID technology and high precision GPS for geolocalization, including terrestrial error correction. The RFID tags were specifically designed for aggressive and metallic environments. In turn, a mobile app for Android OS was developed, together with web interfaces that were integrated with the Geographic Information System (GIS) systems the client was already using.

Impact and value of IoT solutions deployed in business operations

Utilities usually have already sensors, not in the customer premises but for internal use, integrated

with SCADA systems. In the case of cold chain logistics the clients don't necessarily have the sensors in place (which at the same time makes it simpler to install as a new deployment). But in both cases the reason behind G7Net's focus is that these companies need to measure various parameters in order to increase production or efficiency, or for security reasons (sometimes even for compliance with regulatory bodies, environmental laws, etc), and they can easily see the impact of an IoT solution.

In the specific case of MetroGAS, in a short timeframe the client was able to identify assets that are essential for the operation, reducing the time of on-site visits and at the same time making more efficient the maintenance process, thanks to real time information that is integrated with their GIS systems.

The project's scope of work implied replacing unreliable, outdated infrastructure documentation with up-to date, reliable, digitally collected data. Manual reports and dubious site survey location data had to be replaced by objective, structured information of the site's state, sub-meter GNSS location data, and site pictures. All of this data had to be collected in real time via mobile network and updated into the server.

Critical curbside infrastructure to be surveyed included over 3000 underground high pressure gas valves, some dating from 60 years ago. By using Handheld terminals, accurate GNSS receivers and RFID tagging on site, the system allowed paperless, reliable information to be collected, and automated reports to be issued in case a gas leak or a safety hazard is detected upon inspection.

Furthermore, reliable and traceable job order management can be used to trigger maintenance, inspection and optimize crew resources.

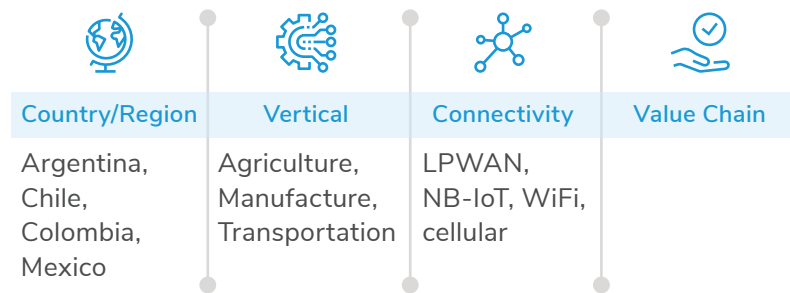
Next steps

G7Net believes that once the sensors are in place, the real value emerges, correlating data and making better decisions. However, Latin America is still not at that stage, as connectivity is still expanding and many decisions continue

to be made by humans instead of using Big Data Analytics.

In terms of footprint, the next steps for the company include expanding to new markets like Bolivia, Chile and Colombia.

IDENTIDAD TECHNOLOGIES



The strategy and value proposition

With more than 18 years of experience, Identidad Technologies is a telecommunications and IoT provider headquartered in the US but with operations in Latin America. Colombia is the main country for the company, as they develop their software and conduct research activities there.

The business model of the company in IoT is to offer a module of proprietary hardware that connects to 80% of the market's sensors and the main connectivity protocols (Sigfox, LORA, CAT-M1, NB-IoT and WiFi). This box, together with a software platform and an application, is flexible enough for any client's need. Besides, Identidad Technologies allows its clients to mix and match sensors according to its own needs and the variables to analyze. The company's solution allows for data management and the use of dashboards (also developed by Identidad Technologies) to generate reports, monitor alarms and notifications (that use different channels like phone, SMS or even Twitter or that can provide an input for a database). The company also uses a mobile app for a simple and quick auto configuration process, together with a modular web portal that show real time data. As the company sees IoT, the real challenge is to understand the client's need and then devise the solution accordingly. Instead of selling technology, they want to sell a solution based on technology.

Hands-on IoT

While Identidad Technologies started with a focus on agriculture, the most developed verticals nowadays are manufacture and

FAST FACTS

Competitive Differentials

- Flexibility in terms of connectivity
- Proprietary hardware that integrates with most networks and sensors

Partners

- LoRa
- Sigfox
- Microsoft

transportation, but the company has relevant success stories in all of them.

Casa Luker is a Colombian client that uses IoT to monitor industrial refrigerators used to store perishable goods. The client needed to ensure that the products had a controlled temperature from the moment of production to the delivery to its final destination. The challenge was increased by the fact that the client has presence in 17 cities, with different weather conditions affecting temperature and different connectivity contexts. Besides, the energy consumption of the refrigerators was very high, as they remained open for a long time until the goods were stored.

Identidad Technologies developed hardware that was able to connect to different thermometers, and at the same time use different connectivity protocols (initially Sigfox and WiFi, then LoRa). The sensors also reduced the use of energy, by limiting the opening time of the refrigerators' doors.

Agrícola El Redil is another Colombian client that uses IoT in their roses production in the Bogota savannah. The client was faced with extreme and unpredictable weather (frost in particular) threatening to ruin the delicate flowers' production. A very precise control is needed once there is a warning that such weather is approaching, in order to take preventive measures. But false positives were very common, triggering an unnecessary alarm in 80% of the cases. For an IoT solution, an additional challenge was that there is no energy in the area. So, the solution developed included a weather report station with an alarm system that sends an SMS to the estate keeper, and if nobody responds makes a phone call to the agricultural engineer, and if that does not work either, calls the owner.

The solution uses batteries that last some 5 months, and that also have solar energy panels that charge the battery in one day. Additionally, the weather station can measure rain and solar radiation in order to activate a special curtain that protects the flowers. The impact was remarkable, as false alarms were reduced 90%.

Impact and value of IoT solutions deployed in business operations

As indicated above, Identidad Technologies clients' use IoT to reduce costs (either in the form of energy consumption, labour, etc), increase productivity and ensure product quality.

Either in the case of environmental factors affecting transportation or storage conditions or production, the company's solutions leveraged sensors and data to effectively solve the client's pain points.

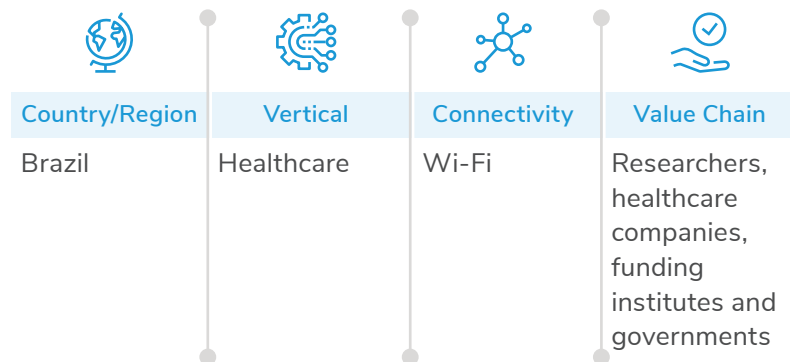
Next steps

Identidad Technologies believes that as the Return On Investment (ROI) of the IoT projects becomes more clear for the clients, the technology will speed up its adoption. While IoT still represents a small share of the company's revenues, 80% of their research and development budget is devoted to IoT.

The main challenge is still connectivity, as the region needs maturity in that aspect for more solutions to become viable at reasonable costs.

One of the verticals that Identidad Technologies understands has great potential is smart farming, in particular given the relevance of agribusiness in Latin America. But in essence, all verticals that need to measure something will eventually need IoT.

INOVAINCOR



The strategy and value proposition

Currently, the main challenges in the Brazilian healthcare market include over engineered and unnecessary solution complexity, lack of interoperability regarding systems and devices, failure to meet expectations regarding patient engagements, lack of clinical staff acceptance of new technologies, lack of ecosystem partners, and failure to create value for multiple stakeholders.

The need to transform scientific production into technological innovation led the Zerbini Foundation and InCor, the Heart Institute of the Hospital das Clínicas (of the Medical School of the University of São Paulo), to create InovalnCor. It is an initiative to develop innovative projects in the healthcare market in cooperation with strategic partners in Brazil, such as researchers, companies, funding institutes and governments. The joint actions aim to identify opportunities for accelerating and attracting human, financial and technological resources.

Among the new technologies, InovalnCor believes that the use of the Internet of Medical Things (IoMT) will boost the process of consumerization of health, patient empowerment and valuation of cost-effective clinical practice. IoMT should pave the way for self-care and high fidelity remote monitoring, facilitating cheaper, smarter and integrated care models with broader scope, as IoMT will be present in most medical devices, whether hospital or personal information, and bringing integration and collaboration of health information from different health sites.

Hands-on IoT

The InovalnCor team established innovation working groups with the governments of UK, Israel, Denmark and South Korea,

FAST FACTS

Competitive Differentials

- Generation, modeling, and transfer of applied knowledge

Partners

- Governments of UK, Israel, Denmark and South Korea
- SAP
- Intel

to evaluate new business models and map the startup ecosystem. More than 20 global companies have been contacted and are working with InovalnCor in co-innovation opportunities and strategic projects.

Some results are already emerging, such as the project developed with SAP for InCor's intensive care unit (ICU), which has about 160 beds. The objective was to assist health professionals in the agile monitoring and decision making in the clinical conduct, increasing safety and optimizing working time, especially nursing. The solution, called Smart Care Unit, integrated real-time data from multiple devices that are used to treat ICU patients through IoT and electronic patient record data, adding intelligent analysis of the information. The solution also includes a programmed trend alarm, guidelines based on the diagnosis and risk scores, and summary of the patient's clinical condition.

SAP sent a team to the hospital to analyze exactly how doctors, nurses, physiotherapists, and other hospital health professionals interact in the ICU. Thus, they understood the complexity of treating patients in a large and dynamic hospital such as InCor, which helped the SAP team develop empathy with the end user and improve the architecture of the solution. On the other hand, InCor's innovation team worked closely with SAP at every step of the project to develop the best solution.

In addition, InovalnCor has a collaboration agreement with Intel since 2016, for digital projects such as big data analytics and artificial intelligence applied to information management and predictive analytics. Besides this main project, the collaboration also focuses on process improvement of patient safety, virtual training and digital platforms, patient blood management, telemedicine, genetics and biohealth, nanotechnology and bioengineering.

Impact and value of IoT solutions deployed in business operations

The Smart Care Unit prototype was the big winner of the Innoweeks Innovation Olympics, promoted by SAP Labs in 2016. The results of the project were:

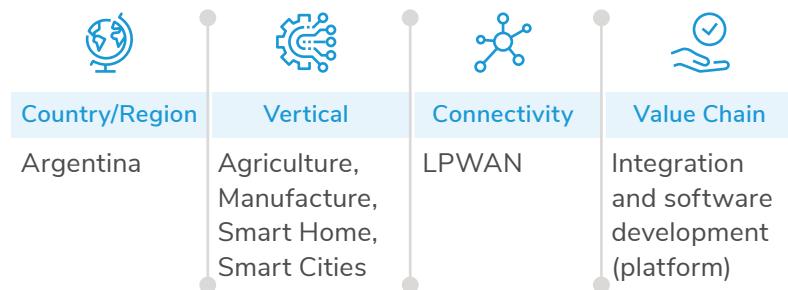
- 85% reduction in manual data collection
- 7% increase in bed availability
- 16% less time per ICU patient
- 10% increase in support from employees to patients
- Full integration between HL7 protocol monitors

InovalnCor intends to broaden the concept and solutions for monitoring all equipment after fulfilling tests and parameters required to be approved and used in the institution's ICU, also through other partners.

Next steps

The development of new technologies is one of the factors that have progressively increased patient care in the healthcare market. This is why developing new technologies at national level is generally more affordable than relying on importation. Therefore, InovalnCor seeks to develop internal projects through partnerships that benefit patients and others stakeholders. The generation, modeling, and transfer of applied knowledge make InovalnCor a differentiated partner to leverage business in the healthcare market. The institution has a collaborative approach with public and private sectors and takes on the role of standardizing information exchange in a clinical system. The key focus of their IoT alliances for the next years is to facilitate seamless information sharing between devices in electronic medical record systems.

ITC



The strategy and value proposition

ITC is an Argentina company that started more than 20 years ago as a wireless connectivity provider and then recently moved to providing IoT services. The company focuses on integrating the different components of the IoT value chain to come up with a full end-to-end solution. In terms of connectivity, ITC has deployments in LPWAN but can also work with most networks (LORA, NB-IoT, cellular), depending on the needs of the project and the client's choice.

The company works with a direct sales force to reach its clients, but they can also work under a revenue share agreement with other providers that have clients willing to deploy IoT in their own regions of the country.

The strategy of ITC is to focus on the integration of the projects, bringing the best partners onboard and developing the business model behind the IoT project, thus solving the client's needs in a sustainable way.

Hands-on IoT

ITC covers many verticals with its IoT solutions, including agriculture, manufacture, smart home and smart cities. One of the key company's recent deployments has been a Smart Cities project for the Municipality of Rio Tercero (in the province of Cordoba and with an estimated population of 50,000). As the traffic in the city and country doubled in the last ten years, it was a pressing need to solve the various problems associated: cars waiting at the street crossings, problems to prioritize traffic in the case of accidents, pollution, etc. ITC worked nearly two years

FAST FACTS

Competitive Differentials

- Flexibility in terms of connectivity
- Ability to integrate multiple vendors
- Open to revenue share agreements

Partners

- Sigfox
- SEEBOT
- Solutions 4 IoT
- Ecoclimasol (ClimaVista Agro)

with a Brazilian partner, SEEBOT, the developers of both hardware and software, to adapt the solution to the needs of the client.

The project implied installing a box to convert conventional traffic lights into a smart traffic lightning solution, the first of its kind in the country. Equipped with cameras, image recognition and artificial intelligence algorithms, the smart traffic light can identify images and detect different types of traffic (including bikes) or pedestrians, for instance reducing waiting times if there is nobody else at the street crossing, or prioritizing emergency vehicles. It can also identify vehicle plates or help to recreate a traffic accident even using 3D. The smart traffic lights are controlled from a centralized monitoring center run by the city officials.

Impact and value of IoT solutions deployed in business operations

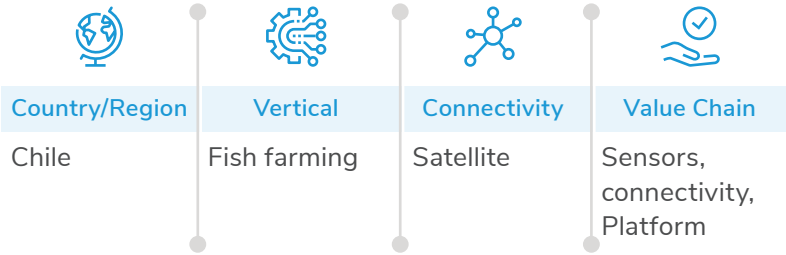
The benefits of the smart traffic lightning solution deployed by ITC reach citizens, municipalities and enterprises, and they include:

- real time traffic optimization (including intelligent green wave, prioritization for emergency services, less wait times)
- remote management, monitoring and control (including statistics, plate search, 3D accident reconstruction)
- increased security for drivers and pedestrians
- a decrease in both air and audio pollution
- an overall decrease in costs associated to mobility for the city inhabitants

Next steps

With the support of CABASE (Argentine chamber of ICT vendors and service providers) and IncubaCor (a start up program in the Cordoba province), ITC expects to continue deploying Smart Cities and other IoT solutions throughout the country. In that line, the Municipality of Rio Tercero helps showcasing this type of solutions, and in the near future can also integrate smart traffic light with connected cars solutions. Monitoring the quality of the air is another potential area of expansion in the city of Rio Tercero, as a chemical hub is located there.

As the company expects IoT to account for approximately 50% of its revenues in the next decade, it keeps working to develop other verticals. For example, ITC is working on agriculture solutions that combine meteorology stations and satellite images to help improve production. In manufacture, ITC has solutions to monitor electricity consumption or cold chains (in partnership with a Mexican hardware vendor, Solutions 4 IoT).



The strategy and value proposition

Founded in 2010, Oxzo provides oxygen and ozone for the fish farming industry in Chile (salmon in particular). Its Oxymar system generates oxygen in the sea and helps fish farms to accelerate their production. With more than 22 Oxymar units in operation, and more than 180 tons of oxygen of installed capacity, it is the main oxygen producer in the Los Lagos and Aysen region in Chile.

Fish farms (which are giant nets connected to boats anchored in the open sea) need to have a constant level of oxygen in the water for the fishes, and eventually inject more, in a region without cellular coverage and in a context where weather conditions discourage the use of conventional satellite alternatives. While the company tried to use VSAT (Very Small Aperture Terminal) in Ku band (which has a reasonable bandwidth price), this technology suffers with adverse climate conditions like heavy rain, and the movements of the sea impact the alignment of antennas and thus connectivity. Each time an antenna was misaligned, a technician had to be sent to the site to realign the antenna and restore data communication, with the high cost associated.

Hands-on IoT

In line with the challenges described, TESACOM and Inmarsat proposed the use of BGAN (Broadband Global Area Network) in band L, a point to point satellite technology that is best suited for the weather conditions of Oxzo fish farm clients (ensuring constant data communication and providing 99.99% availability). BGAN terminals also have IP55 status, thus being protected against dust and water. The remote antennas communicate with Oxzo's monitoring center in Puerto Montt as well as the oxygen generators on site, thus allowing for a complete automation of

FAST FACTS

Competitive Differentials

- Flexibility to adapt to extreme weather conditions
- Direct impact on productivity

Partners

- TESACOM
- Inmarsat

the oxygen delivery. Performance was also key, with a speed of 448 Kbps (while the total data consumption is usually 3 Gigas per month) and low latency (some 800 milliseconds). The low cost of the complete solution was also a significant driver, with a 1,500 dollars equipment and a 600 dollars monthly data plan, with free and automatic firmware updates for a better support.

Impact and value of IoT solutions deployed in business operations

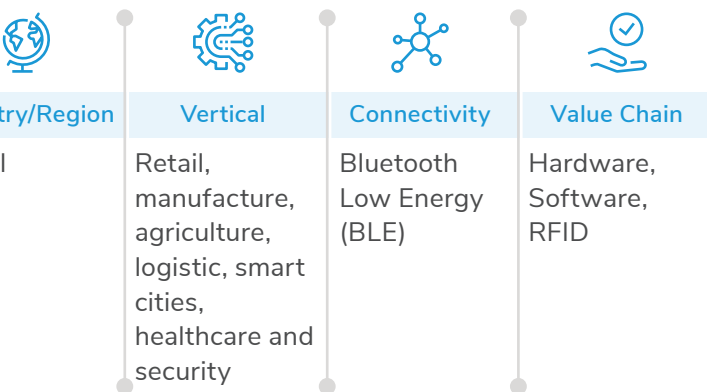
As the IoT solution implemented allowed to exactly determine when to inject oxygen to each farm, it allowed fish farms to increase production from 3 to 4 cycles per year (33% increase). In addition, fishes' health conditions are improved, as they suffer less stress and fish mortality is reduced by the presence of the right amount of

oxygen in the water. Finally, instead of Oxzo having to have staff on site to monitor oxygen flow, which is costly, the new IoT solution allows for remote monitoring and control, thus increasing productivity, reducing costs and increasing client satisfaction.

Next steps

Initially the solution was deployed in 24 sites, but now Oxzo is working with its providers to expand it to an additional 14 sites. Additionally, the company is considering the installation of cameras and radars. The radars will help to prevent boats from stealing salmons from the farms, and the cameras will help to optimize the use of food pellets, as there is a difficult balance between ensuring that fishes at the bottom of the tank can eat what they need versus applying too much food (which implies wasting resources).

TAGGEN



Country/Region	Vertical	Connectivity	Value Chain
Brazil	Retail, manufacture, agriculture, logistic, smart cities, healthcare and security	Bluetooth Low Energy (BLE)	Hardware, Software, RFID

The strategy and value proposition

Taggen offers software, components, and technology solutions focused primarily on IoT and RFID, which include:

- Beacon—proprietary device that uses Bluetooth Low Energy (BLE) technology
- Gateway—hardware that allows automatic collection of Beacon data (including sensors) and homologated RFID UHF readers (acting as embedded Middleware)
- IoT link—software for data push and data pull for applications

The company has direct and indirect sales, with partnerships with companies such as Biocam, in the healthcare vertical, in addition to Smartech and Sawluz, in the automotive and manufacturing verticals.

Taggen has RFID certified professionals by CompTIA and strong relationship with universities and technology parks, which support R&D, such as CPqD, Tecno Sinos and Inova Unicamp. In addition, the company is member of several associations like ABES Software, Softex and GS1 Brasil. Taggen was winner of the Creative Technology category of the Estadão SMB Award, a renowned newspaper in Brazil.

Hands-on IoT

The use of Beacons for marketing and POS is the main application, because it allows to run sales campaigns and

FAST FACTS

Verticals of Focus

RETAIL: customer experience

HEALTHCARE: access control

MANUFACTURE: logistic and system integration

Competitive Differentials

- Secure and scalable platform
- Intuitive web portal
- Affordable Beacon price as it is a national technology
- Ability to use a customer's existing IT infrastructure and provide cloud service
- Partnership with Alien Partner to distribute RFID UHF Gen-2, which is a stepping stone to potential IoT market

Partners

TECHNOLOGY PARTNER:

Qualcomm, Microsoft, Allien Partner and Sierra Wireless

BUSINESS PARTNERS:

Sawluz, Biocam and Smartech

customer relationship actions, providing product information and discount coupons. In addition, retailers are able to collect data about customer paths within the store, view items consulted by the consumer and analyze this information to understand consumer preferences and guide their trade marketing and promotion strategies.

In 2017, Taggen, in partnership with Biocam, deployed an IoT solution in the intensive care unit of Santa Casa de Valinhos Hospital, in São Paulo State. The deployment is called “Criquet”, a real time location system for hospital assets control, which includes equipments (multiparameter monitors, infusion pumps, ventilators, newborn incubators, among others), professional team, patients and ambulances. Cricket was developed by Biocam, based on Taggen’s platform, which utilizes readers and Taggen RFID tags. Biocam was already a supplier of hospital equipment for Santa Casa de Valinhos prior to the project. Beacons send signals that are captured by antennas connected to a control center, responsible for checking and storing data on a server, over a Wi-Fi network. Data monitored can be integrated with ERPs, such as Genesis Clinical Engineering system, to be analyzed by IBM’s Watson, which is able to answer voice commands by querying the status of the equipment. The solution also generates alarms and statistics. The solution promises to help with the main challenges that the hospital faces, which are inventory update, replacement of manual controls, reduction of maintenance costs, and optimization of product audits and hospital resources. The solution was chosen by the hospital’s clinical engineering area, which is responsible for asset management. In addition, the IoT deployment allows the hospital to meet the current norm of annual inventory counts, as well as the maintenance of Brazil’s National Accreditation Organization (ONA) certificate. This certification evaluates the quality of health services and establishes transparent

management with continuous improvements. The main challenge of the project was the adaptation of the hospital’s Wi-Fi network coverage.

The most recent project concerns Industry 4.0, in partnership with Faurecia, which offers cutting-edge solutions for cockpit and sustainable mobility, in one of its manufacturing plants located within the Fiat Chrysler Jeep Northeast complex. The OEM recently announced the investment of R\$ 7.5 billion by 2023 in expansion of Jeep SUV plant in Goiana (PE), including development and manufacture of new products and technologies. The project with Faurecia includes Taggen’s beacon, gateway and IoT link, supported by SW Stock cloud software and SawluzNet module. The solution can run in Microsoft Azure and AWS environments. Taggen’s beacons have been installed in about 400 racks where parts such as instrument front panels, door panels, airfoils and bumpers circulate between the production line, the safety stock and transportation to the car assembly plant. The only manual activity is to associate the parts with the transport and storage rack in an application on the smartphone. The solution allows managers know exactly where the rack is and what parts are in it, and can generate a wide range of dashboards, KPI reports, and real-time tracking and warnings in case of rack handling errors. The solution meets the plant’s need for real-time speed and accuracy of safety stock levels, enabling better visibility of risks to the customer as well as the definition of stock recovery strategies. In addition, the project allows First In First Out control as well as inventory turnover, which is currently parameterized for every three months.

Impact and value of IoT solutions deployed in business operations





- Beacon uses industry standards set by Apple and Google, which allows international compatibility and increasing adoption.
- Beacon reduce energy consumption and have a 15% increased durability compared to others technologies. In addition, the signal is capable of reach about 150 meters in the open field.
- Asset tracking avoids fraud or abuse and unnecessary purchases of new assets, utilization rates improvement and creation of virtual fences.
- Inventory management of spare parts and racks in real time with 100% accuracy.
- Zero gap between the inventory data recorded in the ERP system and the effective amount of parts in the warehouse.

Next steps

Given the success of the IoT initiative in the Santa Casa de Valinhos Hospital, the goal now is to expand the project by installing Beacons in the emergency room and surgical center. Thus, approximately 100 equipments will be monitored, with improved quality of health care for patients.

The project with Faurecia also has plans of expansion, which should reach 2 thousand racks, hundreds of types of items circulating in the factory and thousands of part numbers. The expansion also includes artificial intelligence, machine learning and visual recognition such as equipment monitoring and factory use optimization, adding value to Industry 4.0 projects. Other beacon models are being evaluated, such as temperature and light sensors, and badge beacons, which are used to analyze employee movement and performance. Taggen aims to become more than a national reference in IoT and RFID, but also a reference in identification, management, security and technology trends.

TELIT

 Country/Region	 Vertical	 Connectivity	 Value Chain
Brazil, Argentina, Colombia and Mexico	Aftermarket automotive, manufacturing, smart buildings, smart cities and smart transportation, energy & utilities, security and surveillance, healthcare, retail and agriculture	LPWAN, 2G, 3G and 4G, LTE, Wi-Fi, Bluetooth, Global Navigation Satellite System (GNSS)	Device and technology partners, system integrators, and MNOs

The strategy and value proposition

Telit offers IoT solutions and services globally, including cellular communication modules in all technologies, GNSS, Wi-Fi and Bluetooth wireless modules, IoT connectivity SIMs and plans, and IoT platform services. Telit helps companies, large and small, with IoT concept idea, system architecture, prototype development and commercial deployment, resulting in business transformation, improved operational efficiencies and innovation. The company sells its products and services directly, and through a network of distributors to enterprises, OEMs, system integrators and service providers.

Telit's headquarter is located in UK, with regional headquarters in Italy (EMEA), North Carolina (North America), Korea (APAC) and Brazil (Latin America). The global expansion with regional operations has made Brazil the largest market share of the company in Latin America. In addition to the establishment of the sales office in Brazil, a manufacturing facility was also created and has been the production center of its modules for the entire region since 2010.

FAST FACTS

Verticals of Focus

- Smart meters
- Vehicle and asset tracking
- PoS

Competitive Differentials

- Flexibility
- Scalability
- Innovation
- IoT pure play
- Global IoT data plans

Partners

- Telit deviceWISE: Dell, Intel, SAP
- Industry: GSMA, Intel, LoRa, Qualcomm
- Technology: Amazon, Cisco, Google, IBM, Intel, Oracle, SAP, Siemens
- Network: Telefonica, Claro, Oi, TIM, Orange, Telcel
- Integrator: Tech Mahindra

Telit's value proposition includes 3 points:

1. IoT modules
 - a. Cellular modules: high-speed and LPWAN, 2G, 3G and 4G LTE
 - b. Ultra-low-power Wi-Fi and Bluetooth: standalone, hybrid, or add-on
 - c. Positioning, timing: turnkey micro GNSS modules
2. IoT connectivity
 - a. Global IoT data plans and SIMs
 - b. IoT connectivity management
 - c. Connectivity trial
 - d. simWISE: module-software embedded SIM technology
3. IoT Platforms
 - a. IoT portal
 - b. IoT platform overview: mission-critical performance with all the components needed to develop, deploy and manage
 - c. DeviceWISE for factory IoT
 - d. SecureWISE IoT platform: for OEM machines and semiconductor equipment

Hands-on IoT

In February of 2019, the company announced Telit OneEdge, an initiative developed to speed IoT deployments and reduce the time required to monetize the digitalization of businesses. OneEdge is an innovative software suite enabling solutions for a new generation of Telit's cellular LPWA IoT modules. With integrated, secure, easy-to-use tools, it dramatically simplifies design, deployment and management of IoT products and solutions, enabling a leap ahead into the new 5G super-connected world. OneEdge solves

long-standing challenges related to integration, scalability, management and costs that solution architects and their enterprise customers face as they implement IoT to transform their businesses. OneEdge is available on the ME910G1, ME310C1/G1, ML865C1/G1 category M1 and NB1/NB2 module series.

One of Telit's main cases is power telemetering (RMT 5.0), which uses the company's LTE Cat M1 and NB-IoT (ME910) connectivity module. Cat-M1 and NB-IoT technologies represent an effective reduction in the complexity of connecting devices over mobile networks, as well as a reduction in power consumption, enabling more effective coverage and meeting the needs of an even wider range of applications for the most diverse types of companies. Due to the remote control for easy access to mobile assets, commands can be sent to the modules, with parameters being modified in the module itself. This is of fundamental importance for hard-to-reach applications such as smart meter applications where data such as battery status or voltage needs to be monitored.

Another vertical that benefits from the remote control is the aftermarket automotive industry. The use of IoT solutions for vehicles is one of the most mature sectors for Telit as well. The use of GPS for vehicle tracking, traffic navigation, stolen vehicle recovery, telematics, and fleet management has been prevalent among logistics and transportation companies in developed markets, where demand is high due to security concerns. Vehicle telematics service providers often use mobile access as backup connection for these location services, although mobile technologies only provide approximate locations through cell tower triangulation. More recently, they have also begun to include real-time applications that use mobile connectivity more effectively, such as usage-based telematics, diagnostics, and emergency calling and alerts. Telit has agreements with global carriers to

provide tracking in several countries with a pre-defined tariff, which is a differential for the segment as there is advance cost control. Porto Seguro is one of the companies that use Telit's simWISE solution. The module-software embedded SIM technology allows low cost IoT devices and remote control without costly truck rolls.

Impact and value of IoT solutions deployed in business operations

Through the IoT Portal, Telit makes IoT onboarding easy, reduces risk, time to market, complexity and costs for asset tracking, remote monitoring and control, telematics, industrial automation and others. Telit connected devices power more than 7000 customers worldwide.

Telit is a partner of the IoT multi-sector collaborative laboratory, launched in Campinas in 2016. TeN - Tech Experience Network is the result of a network of agents involved in innovation,

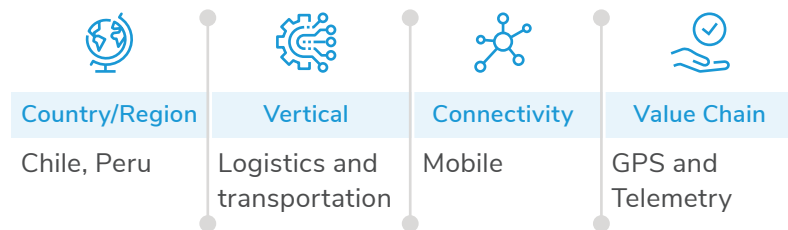
bringing together diverse competencies and businesses. The goal is to turn massive IoT projects into reality, bringing together large corporations, startups, technology providers, researchers, agencies and professionals from various fields in an experimentation environment, oriented to generate business transformation.

Next steps

As a major player in the IoT module industry, Telit aims to support customers by enabling future projects and deployments with new technologies such as Cat-M1 and NB-IoT. LTE in Cat M1 and NB-IoT technologies are two major advances in connectivity and represent an important opportunity for the market in Latin America.

Telit has become a business partner in Latin America, in addition to a technology provider. And to maintain this status, the company will expand their production capacity by about 30% and bring new product lines to local production, as well as expand local laboratory for testing.

WAYPOINT



The strategy and value proposition

Waypoint was created 12 years ago as a startup that did GPS tracking of various types of vehicle fleet: waste collection trucks, logistics companies, transport companies for retail, couriers, utilities companies, etc; any type of company that has assets needed to be remotely monitored. At the beginning the company's portfolio was only geo-location to prevent vehicle theft but it has transformed over time as clients' needs have evolved. Waypoint value proposition goes beyond geo-localiton to collecting data and enabling critical measurements monitoring (temperature, fuel level, coolant level, etc) enabling customers to identify risk conditions, schedule preventive maintenance, etc. Waypoint's solution for Cold chain management, as an example, ensures perishable products' quality and food safety.

Waypoint has greatly diversified the case of initial use of fleet tracking, taking advantage of telemetry. GPS is now used as a means of communication between the different sensors that are in a vehicle. Waypoint telemetry solutions also enable route tracking and policy compliance, essential tools for a specific niche of customers like ambulance operators. Waypoint's Trackview is a platform that enables the control of the last stage of the logistic process of companies allowing the monitoring of deliveries.

Enhanced services offered by Waypoint also include Security solutions that focus on CCTV and different accessories that allow the control of places, actions and transfers associated with driving safety.

Additionally, customers are increasingly demanding more insights to the fleet management and so Waypoint is always adding new variables and parameters, beyond those being requested

FAST FACTS

Competitive Differentials

- Platforms developed in house allowing remote access, flexibility and integration.
- Strong commitment on R&D.
- Post-sales 24x7 customer support.

Partners

TECHNOLOGY PARTNERS: AWS, Google maps, Cisco, Telit, Acti, Iridium.

BUSINESS PARTNER: Telefónica as a distribution channel

by the clients. R&D is one of Waypoint's strong differentiators, the laboratory area works nonstop to incorporate new types of data, sensors and researching the variables that can make an impact to the business of its clients. As an example, Waypoint is currently studying how to do parallel analysis of crash detection to record when possible impacts can take place and record road anomalies.

An additional part of Waypoint's value proposition resides on its customer service. Waypoint offers 100% personalized service and customized post-sales support through an account executive and specialized technicians in the field committed to provide immediate support.

Waypoint's go to market strategy is mainly direct sales. The company only has one business partner that acts as a reseller, Telefónica, for both Chile and Peru, but in this business model the solution is offered as a white flag, even though the support is provided by Waypoint.

Hands-on IoT

ESACHS, a health center services company and Chile's largest rescue network partnered with Waypoint to enhance the capabilities of its Regulatory Center (RC), the area responsible for managing, coordinating and monitoring rescues in Chile.

Waypoint's web platform enable the RC to monitor the GPS systems installed in each rescue vehicle, viewing their location in real time and being able to optimize response times of ambulances, prioritizing critical patients.

In addition, Waypoint's solution provides the optimal route to the accident site and allows

online monitoring of the rescue process. After the solution deployment, response times in high complexity rescue requests improved by 20%.

Also, a large part of Waypoint's installed base of customer are fleet of trucks that transport some type of cargo, and they are demanding solutions to ensure road safety, not from the point of view of the cargo, but from driving: tools to monitor speed, driving characteristics (staying inside of the road, as an example), and driver fatigue among others. Smart cameras are being used by Waypoint not only outside of the vehicles to monitor route conditions, but also cameras that can detect signs of fatigue in the driver and send alarms to a monitoring system.

Impact and value of IoT solutions deployed in business operations

- Instant and Flexible information for every type of industry.
- Web platforms for online monitoring of critical measurements
- Integration of software and accessories for the systematic control of the operation

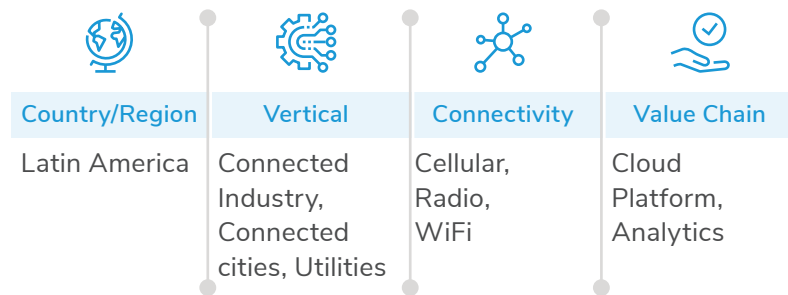
Next steps

Waypoint has an expansion plan for the short term that includes launching new operations in Colombia through a partnership with a security specialized company; and the re-opening of its operation in Mexico, a market they served in the past.



IoT GLOBAL PROVIDERS PROFILES

MICROSOFT



Country/Region	Vertical	Connectivity	Value Chain
Latin America	Connected Industry, Connected cities, Utilities	Cellular, Radio, WiFi	Cloud Platform, Analytics

The strategy and value proposition

Microsoft's Azure IoT It is a set of cloud services that enable companies to connect, monitor and control multiple IoT resources. Azure IoT simplifies the management of manifold IoT devices and the associated cloud-based back-end services.

There are several IoT related services in Azure such as IoT Central (SaaS based) and IoT solution accelerators (PaaS based) that provide templates to help enterprises create their own solution and get started faster. Another service, IoT Hub, allows businesses to connect from devices to an IoT center and monitor and control IoT devices when they need two-way communication between the IoT devices and the backend.

In addition to that, translating data analysis to the edge IoT devices instead of in the cloud provides customer with valuable cost savings. Microsoft's IoT Edge moves parts of the workload to the perimeter so that fewer messages need to be sent to the cloud. Workloads that run on the device are free, and what runs in the cloud is on demand, making the devices smart.

But Microsoft's value proposition resides not only in the power of Azure for IoT but in providing a platform customers can use to create end-to-end IoT solutions.

Starting with IoT devices, Microsoft developed Microsoft's basic IoT Devkit MX chip and Raspberry PI devices that are frequently used for prototyping. The Devkit MX chip has integrated sensors for temperature, pressure, humidity, as well as a gyroscope and an accelerometer, a magnetometer and a Wi-Fi chip. Raspberry PI is an IoT device to which many different types of sensors can

FAST FACTS

Verticals of Focus

CONNECTED INDUSTRY: Field Management and Retail

CONNECTED CITIES: Smart Transportation

UTILITIES: Oil and Gas.

Competitive Differentials

- Microsoft is one of the main market leaders in IT, they have a strong market positioning and customer trust
- Robust, reliable cloud platform
- Great expertise in cloud services and devices manufacturing. Customers know that security and compliance standards are very high

Partners (Not Exhaustive)

IOT DEVICES MANUFACTURERS: MXChip, Seed, Wistron, Via, Sharp, Atmark Techno, Covia, Stratus, Moxa, Lenovo, Siemens, among many others, there are over 1,000 Hardware IoT devices certified for Azure

CHIP MANUFACTURERS: Intel, Microchip, Nvidia, Broadcom

IOT VERTICAL SPECIALIST COMPANIES: PTC (for manufacturing vertical)

IT INTEGRATORS: Accenture, Syntegra, NTT, Logicworks

CONNECTIVITY: América Móvil, Sigfox, Centurylink

be connected and so customers can select exactly what they need for the solution they are creating.

Then, Microsoft's Software Development Kits (SDK) enable the creation of applications that run on IoT devices so they can perform the necessary tasks according to the client's project. SDKs allow sending telemetry data to the IoT center and receive messages and updates from the IoT center.

Microsoft does not sell HW or telecommunications services but through an extended network of business partners, the company has a catalog of more than one thousand third party devices, chips and sensors that are Azure compatible for IoT so that clients can easily find the HW they need for their IoT projects.

Microsoft's value proposition also includes providing value to IoT data by adding an analytics layer to IoT. For Microsoft it is not only about collecting information but also how to analyze it and enable companies to make informed, smarter decisions. Azure Digital Twins is another IoT service that allows companies to create comprehensive models of the physical environment so that they can model relationships and interactions between people, spaces and devices. In manufacturing, as an example, mathematical models of ML are added for predictive analytics, improving maintenance, detecting possible failures, improving industrial safety, analyzing real-time energy requirements, etc.

Microsoft's go to market strategy includes having experts in every different vertical, consultants that possess a deep understanding of the businesses and needs of every industry, understand the terminology and can therefore have more agile, truly useful conversations with potential clients.

In Latin America Microsoft has specialized sales teams, account managers and account executives

focused on vertical business clients and it also has a telemarketing and telesales team focused on the SMB segment and dedicated executives for the upper part of the pyramid. Through this dedicated sales force Microsoft detects opportunities and understands, articulates and analyzes how to solve a customer specific need. When a customer decides to implement an IoT project Microsoft has two ways for project development and deployment:

- A professional services area with dedicated engineers: SW architects assigned to a specific client, so they help developing a proof of concept and support the project. The basic implementation has no cost for the client, since Microsoft's aim is to provide a better understanding and use of its platform.
- Through strategic partners (more than 7,000 partners worldwide and partners in each country of Latin America).

Microsoft has a recruitment program for business partners that include training and technical support.

Hands-on IoT

In Latin America Microsoft has main offices in Mexico, Colombia, Brazil, Argentina, Chile and Uruguay but provides services to the entire region.

Microsoft looks at the region in tiers, according to country size and IoT development:

- **Tier 1:** Mexico and Brazil
- **Tier 2:** Colombia, Argentina, Chile and Peru
- **Tier 3:** Rest of the Latin America.

In Argentina, Microsoft partnered with the city government of Buenos Aires to develop an IoT solution for auditing the pollution in the Matanza-Riachuelo River. The Gobierno de la Ciudad de Buenos Aires (GCBA) needed a drone solution

that enabled measuring water conditions in every sector and collecting and showcasing this information on a map. There are many factories along the Matanza-Riachuelo and the amounts of industrial waste that contaminate the river include dangerous contaminants like arsenic, chromium, copper, zinc, and lead. GCBA had already used drones in the past but in a not cloud-based solution, so GCBA partnered with Microsoft because it offered versatility in terms of process power and connection to sensors. The developed solution included Microsoft Azure IoT Hub, a Global System for Mobile communications (GSM) and the use of Raspberry Pi 3 running Windows 10. The sensors and the GSM module to send the data to the backend services were attached to the Raspberry Pi device. The sensors measured pH, temperature and flow, levels of chlorine, calcium, iodides, nitrates, nitrites, dissolved oxygen, turbidity and conductivity among other measurements.

The drone went from one point to another, read the data from the sensors, stored it in a local memory and then synchronized to Azure IoT Hub and the backend services. Azure IoT Hub acted as the bi-directional connection between the drones and the cloud, triggering and ingesting the rest of the process. Microsoft and GCBA experts worked together to create the best solution in terms of architecture enabling the authorities to implement the project in a time frame of 4 weeks.

Microsoft has 3 IoT labs worldwide to help accelerate IoT projects and time to market, they are located in the US, China and Germany.

Customers of any size and vertical can attend the lab and they are assisted by a team of SW and HW engineers, as well as cloud, AI and ML experts.

In addition to this, Microsoft has a startup program to help accelerate IoT development. As part of Microsoft's startup program these companies not only receive knowledgeable support from Microsoft experts but have also access to other benefits such as being able to use Azure for free for up to a year.

Impact and value of IoT solutions deployed in business operations

- Azure IoT Hub offers a cloud-hosted solution back-end to connect to virtually any device
- Communication channel to send and receive data from IoT devices with enhanced security.
- Very strict company policies with the confidentiality of customer data.
- Integrated device management and provisioning to connect to IoT devices and scale.

Next steps

IoT has become one of the pillars for Microsoft and last year the company announced \$5M investments for IoT exclusively, to continue developing platform, partners and capabilities for IoT.

MILlicom

Country/Region	Vertical	Connectivity	Value Chain
Bolivia, Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Paraguay	Finance, Logistics and Transportation, Smart Cities	Cellular	Connectivity management

The strategy and value proposition

Millicom is a global telecommunications service provider with presence in Africa, Europe, Latin America and the US. Operating under the Tigo brand in Latin America, the company has service in Bolivia, Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama and Paraguay. While originally the company focused on mobile services, Millicom then included fixed services. Its IoT offer is already available in most countries, with the exception of Costa Rica, Nicaragua and Panama, where the markets are still not mature enough and the company has recently entered (Millicom acquired Telefónica’s operations in these three countries in 2019).

The company reaches its clients using its direct sales force, and they also leverage their partners in order to capture new opportunities offering demos. An additional channel to uncover opportunities is the company’s website, where clients can also ask for a demo.

Millicom offers a complete solution aimed at automating the connected devices, controlling communications and allowing for flexible consumption patterns and customizable data plans. A web platform is used for self-management, including device life cycle, inventory, consumption, reporting and diagnostics, thus optimizing and minimizing operating costs associated with connectivity. The clients can benefit from the company’s regional footprint, being able to escalate regionally while receiving a

FAST FACTS

Verticals of Focus

- Finance (ATM management, POS)
- Logistics and Transportation (asset tracking, fleet management and monitoring, cold chain monitoring and control)
- Smart Cities

Competitive Differentials

- Flexible connectivity management platform
- Extensive footprint
- Customizable plans

Partners

- Strategic alliance with Cisco (Jasper platform)
- Integrators like AZ Logica

standard service in all the countries where Millicom has presence.

Hands-on IoT

For Millicom, the key verticals include finance, logistics and transportation and smart cities. In particular, verticalization is a more relevant strategy in Colombia and Paraguay, the more mature markets, while that is not the case in Central America.

Colombia is the most developed market for the company, involving mainly smart cities solutions in the city of Medellin in particular (the most advanced city in the country in terms of technology adoption). One salient project involves traffic tickets in Medellin using connected cameras (the first of its kind in the country), leading to reduced response times for traffic agents or emergency responders, and making Medellin the city that achieved the greatest reduction in traffic accidents in the country in the first quarter of 2018.

Impact and value of IoT solutions deployed in business operations

The main impact of IoT solutions is that once clients have the experience of managed connectivity they don't want to go back to the regular connectivity, as they enjoy more visibility, more control, and the whole business becomes more dynamic and more efficient.

That was the case with a smart metering client in Honduras that after implementing IoT started to receive data regularly and was able to manage the meters remotely. This led to an expansion of the original project well beyond what was initially expected, replacing conventional meters with new ones supporting a SIM.

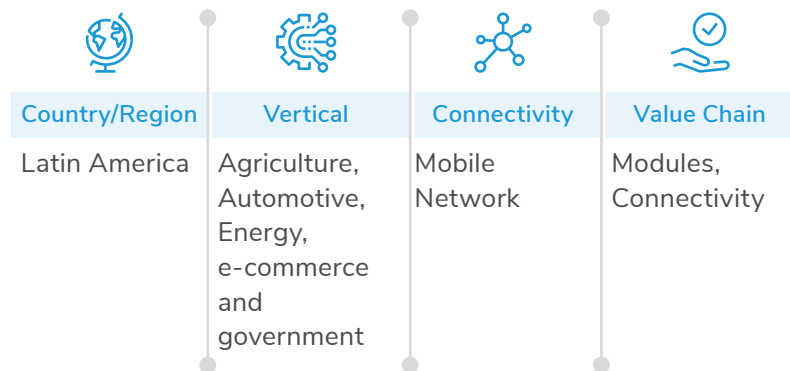
Additional IoT benefits come in the form of savings and expense control, productivity increases and reduction in the time needed to launch new services.

Next steps

As the region matures in terms of technology adoption, Millicom expects to continue expanding its IoT offer to its footprint. Besides, as each country matures, more vertical solutions will be needed, and the company is ready to address such demands.

As for most mobile carriers, 5G is also in the company's horizon and getting its networks ready for the migration is the first step, starting in Colombia, Honduras and Paraguay.

NOKIA



The strategy and value proposition

Nokia delivers end-to-end portfolio of network equipment, software, services and licensing. Their customers include communications service providers, as well as enterprises in the private and public sector. Nokia's value proposition includes connectivity, analytics, security and device management and data collection platforms.

Hands-on IoT

Nokia's main initiative in Brazil is ConectarAGRO, which aims to promote a technological solution to stimulate the expansion of connectivity in several Brazilian agricultural regions. Nokia provides 4G/LTE and 5G (in the future), and satellite and microwave technology, working in close cooperation with TIM, a Brazilian network operator. The initiative also includes other partners such as AGCO, Climate FieldView, CNH Industrial, Jacto, Solinftec and Trimble.

The goal is to facilitate the integration and management of the entire production chain, and increase the quality and competitiveness of producers through IoT, artificial intelligence and drones. The initiative aims to expand to other Latin American countries; however the initial focus is to address the problem of wireless connectivity in rural areas in Brazil enabling the digitalization of the farms production. The differential of ConectarAGRO is the promotion of open and global standard technologies, which drive farmer adoption and project scalability.

FAST FACTS

Verticals of Focus

- Agriculture
- Automotive

Competitive Differentials

- IoT readiness services: network preparation
- Secure MVNO for public safety: mission critical commercial networks
- Sensing as a service: real-time environmental data monetization
- Worldwide IoT network grid (WING): flexible IoT business models

Partners

- ConectarAGRO AGCO, Climate FieldView, CNH Industrial, Jet, Solinftec and Trimble
- IoT Labs and IoT projects—being developed in partnership with MNOs like TIM, Oi, Algar.

The 4G LTE 700MHz band was chosen due to its greater range in rural areas. This technology solution requires less investment than proprietary infrastructure, as well as maintenance costs. With a 1% increase in productivity, the farmer already has return of investment.

One project delivered in 2018 was to SLC Agrícola, a cotton, soybean and corn producer, based in Porto Alegre, which installed a 78-meter Nokia tower with 16 km of coverage in Bahia, for crop monitoring through precision farming tools. The project allowed the visualization of crop yield variations directly from Porto Alegre, with the aid of harvest maps, coupled with soil information and other agricultural practices, intervening in specific locations to correct problems, standardize areas and increase average yield of crops.

In 2019, Nokia has been conducting a project with Amaggi, a trading company based in Mato Grosso, to connect 700 farm equipments, also in partnership with TIM. The operator, using technology from Jacto (agricultural machinery company) and Nokia, uses the 4G network to exchange information between tractors and other devices. The project, called Telemeclima, seeks to streamline agribusiness by collecting and analyzing, in real time, information that can be used to prevent production failures and waste.

Impact and value of IoT solutions deployed in business operations

Brazil is usually the country where Nokia first launches their IoT solutions in the Latin America. That is why Nokia developed in 2019 four off-the-shelf products for the Brazilian agriculture vertical: crop and livestock monitoring, logistics and asset management. In crop monitoring, sensors capture environmental, soil and crop data, which are then analyzed to provide insights that help farmers manage crops more efficiently,

saving irrigation costs, pesticides and fertilizers. In livestock management, tracking devices and biosensors monitor animal health and welfare, alerting ranchers in advance of any abnormalities detected, protecting livestock and improving their yields. In logistics, IoT sensors track the movement and overall condition of goods across the entire supply chain to help companies instantly identify incidents and even predict events, optimizing the efficiency of the delivery and logistics process. In asset management, the status and performance of assets are centrally monitored, connecting goods anywhere in the world. The company will continue to create more specific vertical-oriented IoT solutions to be launched throughout the year.

Nokia is expanding its Worldwide IoT Network Grid or WING offer into Brazil and the broader Latin American market. With instances in Sao Paulo and Rio de Janeiro locations, WING will enable MNOs to more easily expand existing IoT services, both domestically and globally, and do so on a pay-as-you-go basis. This investment in Brazil will help serve opportunities across the region, including customer interest in countries such as Chile and Argentina, while ensuring compliance with strict data sovereignty laws in Brazil.

WING features a globally distributed, cloud-native IoT mobile core with integrated connectivity management platform, all offered as a managed service to mobile network operators (MNOs). In this way, MNOs can more closely match investments in IoT to customer revenue. It is a multi-tenant, shared infrastructure with each MNO only paying for the part of it that they use. This helps MNOs roll out new IoT services leveraging 3G, 4G, LTE-M or NB-IoT technologies. Additionally, the WING architecture is fully 5G-ready meaning MNOs are assured that they can deliver today's service and seamlessly upgrade to 5G IoT services when the time is right.

Since becoming commercially available in 2018, WING has won projects with twelve operators worldwide, including AT&T, Tele2, Telecom Egypt, ZAIN Saudi Arabia and Marubeni Wireless in Japan. Also, several trials have taken place utilizing the WING off-the-shelf vertical solutions – one agriculture project in Algeria demonstrated how the offer can help reduce water consumption by 40% on a single irrigation line for one hectare. Nokia WING has experienced a strong traction in Latin America and we expect new MNO contract announcements still in 2019 to support relevant global enterprise deals.

In Brazil, Nokia WING, MNO Algar and ICT FITEC were one of the 15 awarded BNDES IoT pilots of the national IoT plan. The project is focused on developing an AgroConnect integrated platform for increasing rural productivity and profitability. The AgroConnect platform integrates data from startup solutions that provide data from weather, production, soil, machines, energy and water efficiency to monitor and recommend actions for the usage of natural resources, supplies, and machinery.

Nokia has also developed an IoT lab with Oi, a Brazilian network operator. The IoT lab, which was created in 2017 and is based in Rio de Janeiro, is a Latin American benchmark for the Narrowband-IoT and evolved Machine Type of Communication (eMTC) technology, also known as LTE-M. Among the activities developed in the laboratory are the evaluation of network elements (terminals, access and core network and platforms) and the development of devices and applications by third parties in Brazil and Latin America. The laboratory allows the use of professional resources, laboratory infrastructure and technology, among others, to enable IoT projects through its own development or partnerships, especially in the crowdsourcing model.

Next steps

Through Nokia's research teams, including the world-renowned Nokia Bell Labs, the company aims to promote their 5G networks and end-to-end IoT capabilities. The pay-as-a-service model gives the flexibility to choose solutions that address customer's unique needs.

QUALCOMM

Country/Region	Vertical	Connectivity	Value Chain
Latin America	Smart bodies, smart homes, smart cities and smart enterprises	5G NR, 4G LTE, Wi-Fi, Bluetooth, NFC, 15.4, GNSS and Power line	Chips, modems

The strategy and value proposition

Qualcomm invents breakthrough technologies that transform how the world connects, computes and communicates. Qualcomm's inventions are the foundation for life-changing products, experiences, and industries. As the world moves to 5G, Qualcomm envisions this next big change in cellular technology spurring a new era of intelligent, connected devices and enabling new opportunities in connected cars, remote delivery of health care services, and the IoT — including smart cities, smart homes, and wearables. Qualcomm Incorporated includes the licensing business, QTL, and the vast majority of their patent portfolio. Qualcomm Technologies, Inc., a subsidiary of Qualcomm Incorporated, operates, along with its subsidiaries, all of the engineering, research and development functions, and all of their products and services businesses, including, the QCT semiconductor business.

Qualcomm's product portfolio enables the IoT ecosystem, which can be served by OEMs and ODMs. In Latin America, the company has offices in Brazil, Mexico and Argentina, but services the entire region. Qualcomm's geographic focus for IoT service provision is Brazil, followed by Mexico.

Qualcomm works with integrators, service providers and collaborates with OEMs and ODMs to provide solutions to the various IoT segments.

FAST FACTS

Verticals of Focus

CONSUMER ELECTRONICS:

cameras, drones and robots, remote controllers, printers and wearables.

SMART CITIES: transportation, energy, infrastructure, buildings and commercial and industrial, cameras

SMART HOMES: home appliances, home lighting & home security & automation.

VOICE AND MUSIC: headsets & headphones, Bluetooth speakers, networked speakers, smart speakers & sound bars & home theater.

PAYMENT: POS devices

SMART AGRICULTURE: quality harvest development, controls for a changing climate, food security, animal tracking, soil scanning, disease prevention.

Competitive Differentials

- Power-efficient, interoperable & secure chipsets & modules.
- Heterogeneous connectivity powered by global standards

Partners

OEMs: GE, Haier, LG, Sony, Samsung, Netgear, Lifx, Amazon and Yuneec

INTEGRATORS: proposing & developing IoT use cases

INFRASTRUCTURE COMPANIES: network & connectivity services

INSTITUTES AND UNIVERSITIES: leverage IoT with different verticals and foster Qualcomm IoT technologies

The company's value proposition includes:

- **Cutting-edge technology:** Snapdragon processors and LTE modems, Bluetooth, Wi-Fi, GNSS and NFC, and cognitive computing
- **Turnkey platforms:** integration expertise and end-to-end systems approach
- **Connectivity history** and experience

In addition, Qualcomm Ventures has presence in the region, stimulating the development of the ecosystem through investments.

Hands-on IoT

Qualcomm offers a ubiquitous connectivity through cellular technologies that are always available and enable a wide range of IoT services. The company provides a mature and interoperable global ecosystem, with scalable performance, high reliability and proven security. Qualcomm's technologies allow seamless coexistence of different services. That is why Gertec, a Brazilian business automation systems company, partner with Qualcomm to create a solution called Smart PoS, which allowed Gertec to meet Brazil's specific demand for low transaction latency (from the moment the card is placed into the PoS until the end of the transaction). The launch was in 2018 and the target audiences are restaurants, major retailers, hotels, gas stations and event planners. The main benefits for these segments are convenience and ease to place orders and payments, and agile service with reduced queues. Other segments can also be attended by customizing the solution with integrated sales and payment management as needed. The solution uses 4G, Wi-Fi and Bluetooth connectivity and Qualcomm chips and processors.

In addition to making payments securely and quickly, the mobile solution includes Android's versatility to create and use applications to the customer's business. With the evolution of consumer behavior, PoS has gained functions

of a mobile phone. The mobile platform with Android-based system has become a demand of customers in the automation and payment market. The solution is Omni commerce, as it promotes the digital experience by connecting to the physical store. Applications available in a marketplace, real-time control and management and over the air upgrade enable more productivity for businesses. Thus, Qualcomm allowed Gertec to improve customer experience and inventory management as a result of applying their retail IoT solution. The solution already has among its customers the main acquiring networks in Brazil.

In addition to the payment segment, there is still demand from other verticals for IoT solutions such as high value assets with large autonomy (1 year for example) and miniature devices (for military use for example). Gertec has other more advanced IoT projects, focused on high-performance trackers (regarding autonomy duration) and high-volume payment terminals. The projects are under development by the engineering team and the solutions are expected to be launched in 2020. The main challenges of Gertec to advance in the IoT market are connecting terminals across mobile platforms and then having Cat-M and NB-IoT networks available to make the solution scalable.

On the Qualcomm side, they believe there is a massive opportunity behind the retail services market, especially regarding payments. PoS devices are shifting from the traditional cash register to embedded devices with larger screens, cameras, Android and HD touch displays that support video. Qualcomm is well positioned to take advantage of this transition and provide the necessary technologies including connectivity, compute, multimedia experience, camera and AI. The company already delivers on-device capabilities complemented with edge cloud (distributed/virtualized core, mobile edge compute and cloud RAN) at wireless edge. The synergistic

balance of Qualcomm's solution allows ultra-low latency, processing to augment on-device, local content, analytics, management, and opportunity to provide tailored value. The on-device sensing, processing, security and intelligence provide privacy and immediacy as data and tasks stay on the device, besides efficient use of bandwidth.

Impact and value of IoT solutions deployed in business operations





- Smart platforms that reduce development times and cost
- Excellent performance of the hardware (battery consumption, speed and communication with networks) and integration with other components
- Competitive cost due to scale (globally more than 1 million IoT chipsets shipped daily)

Next steps

In 2018, Qualcomm announced the launch of the Snapdragon System in Package (SiP), a technology that integrates over 400 smartphone components into one single module. This solution reduces development costs in product designing and allows faster time-to-market by OEMs. The SiP technology integrates the application processor, power management, RF front end, audio codec and others into a single module. It can be used for smartphones and IoT devices. The first smartphones based on Snapdragon SiP were launched by Asus in March 2019.

In February 2018 Qualcomm and USI announced plans to build a SiP factory in the State of Sao Paulo, Brazil. The production is expected to begin in 2020 and should employ between 800 and 1,000 people with an estimated investment of \$ 200 million over five-years. At the moment they are closing partnerships to ensure that there is demand for production.

TELEFÓNICA

 Country/Region	 Vertical	 Connectivity	 Value Chain
Latin America	Mobility, smart cities, energy, retail, manufacturing, ports & airports, mining, utilities/ metering, consumer	LTE-M, NB-IoT, Cellular	Connectivity, platforms, applications, consulting, professional services

The strategy and value proposition

Telefónica is a global telecommunications and IT service provider, with a strong presence in Latin America. Its current footprint extends to Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, Peru, Uruguay and Venezuela. The company's IoT strategy is twofold. First, as a connectivity provider, it has a horizontal approach that focuses on ensuring all clients have the connectivity they need regardless their channel of preference. Then, Telefónica has a vertical approach for some market segments, where it offers end-to-end solutions and also works with systems integrators if needed. These verticals are the ones Telefónica has determined that are mature enough, and include mobility (workforce management, fleet management, asset tracking), smart cities, energy, retail, manufacturing, ports & airports, mining, utilities, and consumer (mainly related to security, tracking individuals or assets).

As Telefónica has operations also in Europe, it is well positioned to capture the new trends and how they translate to Latin America, usually with a few years delay, or quite often, multinationals that conduct initial deployments in facilities in Europe and then move as a next phase of the project, to deploy such solutions in the facilities in Latin America. In terms of IoT, the company is witnessing how the market is evolving and how companies are increasingly understanding the benefits of IoT in terms of productivity.

FAST FACTS

Verticals of Focus

- Mobility (workforce management, fleet management, asset tracking)
- Smart Cities
- Energy (optimization)
- Retail
- Manufacturing (automakers, industrial equipment, food & beverages, etc)
- Ports & airports
- Mining
- Utilities (metering)
- Consumer (security, tracking)

Competitive Differentials

- Horizontal approach to provide connectivity to all IoT clients independently of the channel of choice
- Vertical approach to reach specific vertical clients and provide end-to-end solutions

Partners

NETWORK: Nokia, Ericsson

SYSTEMS INTEGRATION: Erictel, MTN

TECHNOLOGY AND GO-TO-MARKET: AWS, Google, IBM, Microsoft

The company has enabled all its networks for LPWAN, but the plan is to actually activate them when there is enough demand (so far Argentina and Brazil are active).

Telefónica has IoT labs in Chile and Mexico (The ThinX Open Labs) to allow for experimentation and foster adoption, also working with start-ups under their IoT Activation Program to facilitate trials and demos using NB-IoT and LTE-M. In this environment start-ups can test end-to-end solutions including hardware, cloud platforms like Microsoft or AWS, validate business models, access experts and more.

Telefónica has a strong internal division focused on Security, 11Paths. All Telefónica IoT products are secured by design, and that is performed thanks to a common unit among 11Paths and Global IoT division, called IoT Security Lab.

In parallel, Telefónica has a strong focus on Data Analytics at a company level. That is executed via an internal unit called LUCA. This unit is providing expert knowledge on data processing and extraction of insights, which is key in IoT projects, thanks to all the information that is extracted from connected assets.

In terms of go-to-market, the company has different strategies depending on the target. When going after key accounts like multinationals or large companies, they use their direct sales force (with dedicated account managers that also work with the global team). For Small and Medium Businesses Telefónica has its IoT Partnership Programme, that relies on resellers. Partners like AWS, Microsoft and others can also help bringing their own clients.

In the case of enterprises, the adoption drivers have to do with increasing efficiency, optimizing processes, detecting problems at an early stage, providing a better customer experience, and ultimately fighting competition. For consumers,

the main use cases have to do with the peace of mind that can be enabled by tracking any element (like a bike) or individual (a kid).

Hands-on IoT

As IoT is part of Telefónica's offer in all the countries where it has presence, the company has a wide range of IoT projects already deployed in verticals including retail (as the middle class advances in the region), energy (consumption optimization for hotel chains, retailers, office spaces), mobility B2B (for car rentals that need to optimize the location and movement of their assets), and others. Clients range from large multinationals with presence in the region (like Mastercard, Nestle or Honda in Peru or Prosegur in Argentina, Chile and Peru) to local enterprises like Marzam Corporation in Ecuador or small municipalities like San Nicolas de los Arroyos in Argentina.

One remarkable success case involves General Motors' subsidiary OnStar in Mexico. The company provides communications features for GM vehicles (Chevrolet, Buick, GMC, Cadillac), including safety and emergency services, step-by-step navigation and real time remote diagnostic services. OnStar clients, in turn, want peace of mind, knowing that when they press the OnStar button there will be a support service representative to solve their issues. For all these services to run smoothly, connectivity is vital.

Telefónica provides cellular IoT embedded connectivity for OnStar to connect to each car and thus allow all services to be available. The connectivity platform (Kite) also provides management, business intelligence, analytics and security. The project also required specific integrations with OnStar systems, so as to be able to exploit the insights generated by the data and invoke security services in case of an emergency.

Impact and value of IoT solutions deployed in business operations

Being a B2B2C solution, the benefits are multiple and come from different perspectives:

- From the B2B perspective, OnStar was able to offer a quality product and make it more secure and appealing to the end users.
- From the B2C side, clients in particular in Latin America are very conscious of security issues, and with this solution they get the peace of mind they seek.

Next steps

While Brazil is the main country in terms of IoT volume for Telefónica, mainly due to the size of its economy, Argentina is also at the front, and Chile stands out because of its large potential, associated with mining and agriculture.

But Telefónica understands that connectivity is the first step. Once everything is connected and data is generated (we are already approaching that stage), process can be improved, new products can be launched, etc. In summary, analytics, machine learning or artificial intelligence can be applied to serve the client's needs.

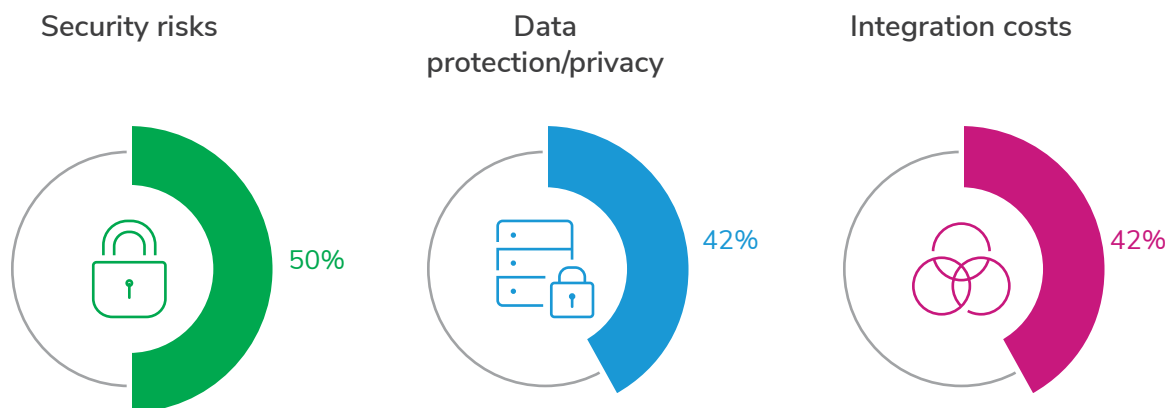
As a mobile telecommunications provider, Telefónica is also closely monitoring the development of 5G. The company is at the early stage of deployment in Europe (in particular in Segovia in Spain and Daimler in Germany). Telefónica is already working in replicating such success stories in Latin America, as big multinationals have manufacturing plants in the region. There are some specific verticals like smart metering where regulation will be key everywhere and in Latin America specially.

CHALLENGES AND NEXT STEPS

However, there are still some challenges that need to be cleared before IoT can really take off in Latin America. Corporate end users cite security risks (50%) and privacy risks (42%)¹ as the main clouds over the horizon of IoT. Security remains a key concern in terms of embedding ubiquitous sensing and communication technology into machines and everyday objects. The ability to cripple an entire process manufacturing plant or hack into a personal medical device is likely to limit or slow the adoption of a few initial IoT deployments. As sensing devices permeate homes and lives, large volumes of information will be gathered from them. Access and ownership of such sensitive data will have to be addressed in the near future. The reliability of communication connections will have to be addressed when offering IoT services. Network connections will need robust service mechanisms to ensure that critical and time-sensitive IoT services are not disrupted.

Integration costs are also mentioned as another challenge by 42% of respondents. The highly customized nature of IoT solutions, along with the need for technologies that span multiple domains, make it challenging to offer end-to-end solutions. The IoT ecosystem is fragmented, with multiple solution providers from adjacent markets competing to establish presence. The need to form partnerships comprising network providers, domain application providers, system integrators, and business/operational support system providers to offer coherent and customized solutions is one of the reasons why adoption has been slow.

CHART 5. What are the top 3 concerns regarding IoT in LATAM?

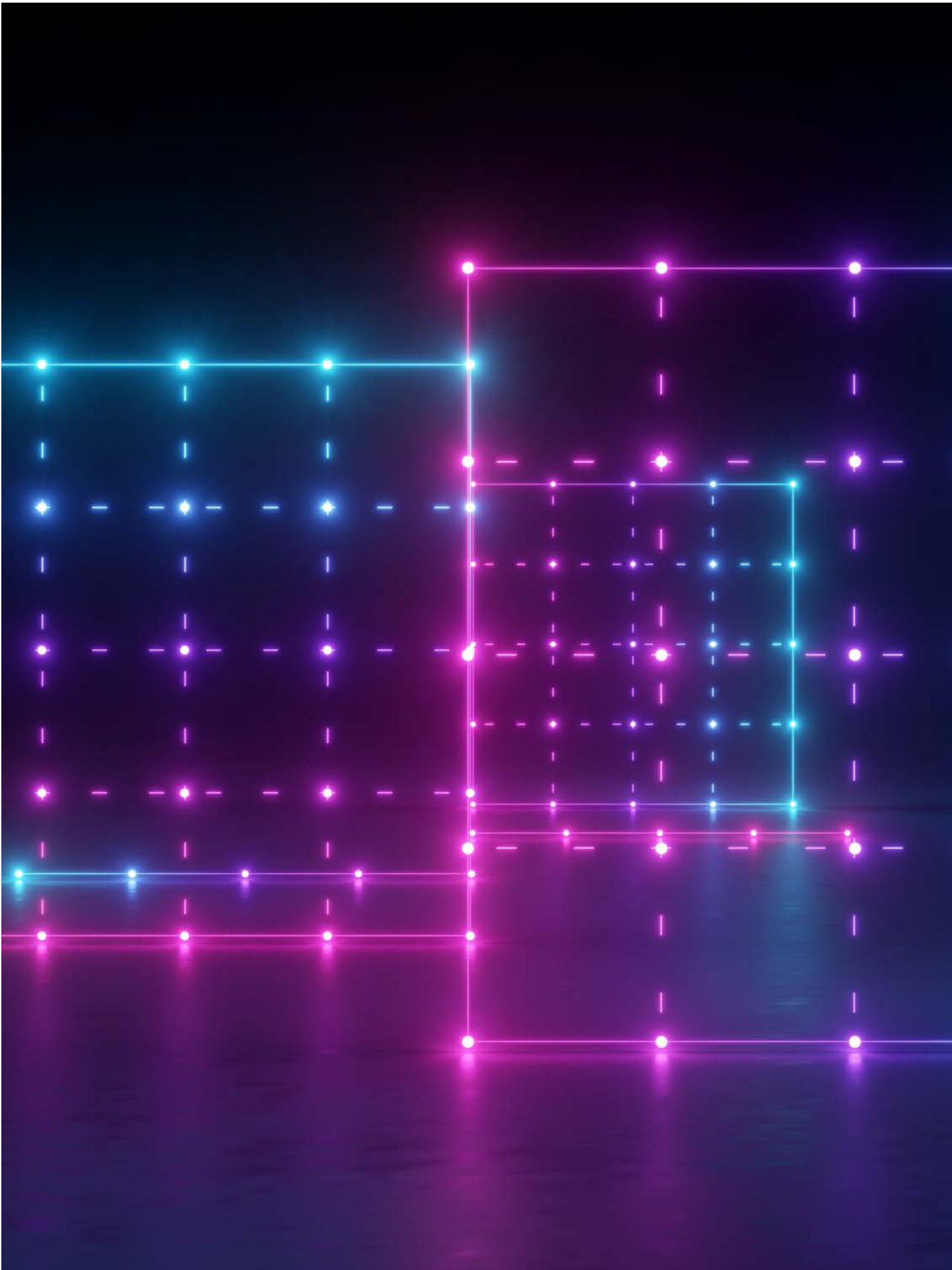


Source: Frost & Sullivan

The last challenge is interoperability. This is a common problem with new and evolving technologies, and the IoT is no different. There is a proliferation of vendor standards, with each supplier taking its own IoT approach regardless of others. As a result, data often is not normalized and merged, which prevents, for example, an IoT-enabled sprinkler turning on when a home's water consumption exceeds a pre-set level. Problems also exist with inconsistent data and private implementation architecture.

Looking at the future of IoT in the region, there are three success factors that everybody should keep in mind. To succeed with an IoT project there are three things to focus on. Ideas, Execution and Money.

There is always the need for a good idea, but an idea it is not an idea for a product. A good idea means a client. To succeed, companies have to be client-centric from day zero. Second, companies need to be able to execute on their strategy to get to those clients in an effective way. And finally, money is needed to fund the project. But money is the less relevant factor out of the three. Just with money companies will go nowhere. Business history is plagued with examples of companies that invested a lot of money and failed. But with a client centric idea, and being able to show that execution is good, the much needed money will always appear.



About IDB Invest

IDB Invest, a member of the Inter-American Development Bank (IDB) Group, is a multilateral development bank committed to promoting the economic development of its member countries in Latin America and the Caribbean through the private sector. IDB Invest finances sustainable enterprises and projects to achieve financial results that maximize economic, social and environmental development for the region. With a portfolio of assets of \$12.1 billion under management and 329 clients in 21 countries, IDB Invest works across sectors to provide innovative financial solutions and advisory services that meet the needs of its clients.

The opinions expressed in this publication are those of the authors and do not reflect the point of view of IDB Invest, its Executive Board, or the clients it represents. IDB Invest, October 2019.

About the GSMA

The GSMA represents the interests of mobile operators worldwide, uniting more than 750 operators and nearly 400 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and internet companies, as well as organisations in adjacent industry sectors. The GSMA also produces the industry-leading MWC events held annually in Barcelona, Los Angeles and Shanghai, as well as the Mobile 360 Series of regional conferences.

For more information, please visit the GSMA corporate website at www.gsma.com. Follow the GSMA on Twitter: @GSMA.

GSMA Latin America is the branch of the GSMA in the region. For more information in English, Spanish and Portuguese, please visit www.gsmala.com. Follow GSMA Latin America on Twitter @GSMALatam and LinkedIn GSMA Latin America.

About Frost & Sullivan

Frost & Sullivan, the Growth Partnership Company, works in collaboration with clients to leverage visionary innovation that addresses the global challenges and related growth opportunities that will make or break today's market participants. For more than 50 years, we have been developing growth strategies for the Global 1000, emerging businesses, the public sector and the investment community. Is your organization prepared for the next profound wave of industry convergence, disruptive technologies, increasing competitive intensity, Mega Trends, breakthrough best practices, changing customer dynamics and emerging economies?

For information regarding permission, write:

Frost & Sullivan: 3211 Scott Blvd, Santa Clara, CA 95054