



interiot

interoperability of heterogeneous
IoT platforms

Interoperability of Heterogeneous IoT Platforms

D2.2 Business Model Design

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Executive Summary

The aim of the Business Model Design is to provide the definition of the business options at strategic level for the exploitation of INTER-IoT results, taking into account economic considerations (i.e., how will project results be sustainable and create value); Component considerations (i.e., how will the business be done: selecting customers, differentiating its offerings, defining the tasks of each organisation, configuring its resources, going to market, providing added value to customers and gathering profit objectives) and strategic outcomes (i.e., the design of key interdependent systems that create and sustain a competitive business). Business model design is of utmost importance in INTER-IoT and it will be directly related to the impact of the project. Thus, this deliverable has made an identification of different business and collaboration models suitable to be used during the first stages of the project. The business models will be assessed including modelling and description of the value propositions, business methods, target customer segments, distribution channels, customer relationships, value configurations, core capabilities, partner networks, cost structure, revenue models, offerings, strategies, infrastructure, organizational structures, trading practices and operational processes and policies to be able to have different business options in INTER-IoT.

The identification of effective business models has helped to start the specification of a business plan for the project's outcomes. This exploitation plan is shown in some of the WP8 deliverables. The business model design has taken into account the interest for stakeholders of new business models and scenarios in which ecosystems of smart objects may enhance operation and efficiency.

This deliverable is the result of activity in T2.2. WP2 as a whole and specifically this task has been developed using the CANVAS methodology that has proved the most adequate to extract conclusions and provide results following a systematic approach. The methodology is explained at the start of the deliverable, in order to provide the required foreground to understand the work developed in WP2.

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Abbreviations

Abbreviation	Explanation
AIOTI	Alliance for Internet of Things Innovation
ARSO	Slovene Environment Agency
B2B	Business to Business
B2B2C	Business to Business to Consumer
B2C	Business to Consumer
BB	Building Blocks
BIP	Best Ideas and Projects
CASE	Computer Aided Software Engineering
CEO	Chief Executive Officer
EC	European Commission
EMS	Electronics Manufacturing Services
FP	Framework Programme for Research and Technological Development
ICT	Information and Communications Technology
IERC	European Research Cluster on the Internet of Things
IoT	Internet of Things
INTER-API	Programming library
INTER-CASE	Computer Aided Software Engineering tool for integration
INTER-FW	INTER-IoT Interoperable IoT Framework
INTER-Health	INTER-IoT Platform for Health monitoring
INTER-LAYER	INTER-IoT Layer integration tools
INTER-LogP	INTER-IoT Platform for Transport and Logistics
INTER-META-ARCH	Architectural meta-model for IoT interoperable platforms
INTER-META-DATA	Metadata-model for IoT interoperable semantics
INTER-METH	INTER-IoT Engineering Methodology
IT	Information Technology
ITU	International Communications Union
PRO	Prodevelop
R&D	Research and Development
SaaS	Software as a Service
SME	Small and Medium Enterprise
TI	Telecom Italia
URSZR	Slovene Civil Protection Service
VET	Vocational Education and Training

1 INTRODUCTION

1.1 Internet of Things

The connection of intelligent machines, fitted with a growing number of electronic sensors, via the Internet, is known as the 'Internet of Things' (IoT). With the IoT, any physical and virtual object can become connected to other objects and to the Internet, creating a fabric of connectivity between things and between humans and things. The IoT is now widely recognised as the next step of disruptive digital innovation.

The International Communications Union (ITU) and the European Research Cluster on the Internet of Things (IERC) provide the following definition: IoT is a dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols where physical and virtual "things" have identities, physical attributes and virtual personalities and use intelligent interfaces. They are seamlessly integrated into the information network.

The design of the Internet and specifically the extension of the Internet to the IoT relies on the convergence of the infrastructure with software and services. A common practice is required to think/design cross solutions between software and infrastructure in order to provide integrated solutions for some of the complex problems in the current and future systems of systems. In the IoT environment, this convergence is evident, and the continuous evolution generates more and more smart connected objects and platforms that are embedded with sensors and their respective associated services, in some cases considering virtualization.

IoT is the network or associations between smart connected objects (physical and virtual) that are able to exchange information by using an agreed method (including protocols) and a data schema. IoT deployments are increasing, the same as standards, alliances and interest for homogenization. All of this is giving a strong push to the IoT to be today's considered as one of the most promising emerging technologies. As an example, Gartner (one of the world's leading information technology research and advisory company), estimates the number of web-connected devices will reach 25 billion by 2020. In other words, more devices appliances, cars, artefacts, and accessories will be connected and will communicate with each other, and with other objects, thus bringing amplified connectivity and better supply chain visibility. The applications of the IoT are numerous i.e. every object could be transformed into a smart object that sends several valuable information to other devices. As an example, in the port industry IoT could be applied to shipping containers, the equipment that handles them, the trucks that carry them and, even, the ships that move them around the globe.

According to the European Commission (EC) the IoT represents the next step towards the digitisation of our society and economy, where objects and people are interconnected through communication networks and report about their status and/or the surrounding environment. Furthermore, IoT can also benefit the European economy generating economic

growth and employment; according to a recent European Commission study revenues in the EU28 will increase from more than €307 billion in 2013 to more than €1,181 billion in 2020 (as shown in Figure 1).

IoT is an emerging area that not only requires development of infrastructure but also deployment of new services capable of supporting multiple, scalable and interoperable applications. The focus is today associated with cloud deployments, virtualizations and the elimination of silos avoiding the existence of application domain specific developments, AIOTI and EC are pressing in this line. IoT has evolved from sensor networks and wireless sensor networks to a most clear description and definition referring to objects and the virtual representations of these objects on the Internet and associated infrastructure. It defines how the physical things and virtual objects will be connected through the Internet and how interact amongst them and communicate with other systems and platforms in order to expose their capabilities and functionalities in terms of services and accessible through open APIs and frameworks. IoT is not only linking connected devices by using the Internet; it is also web-enabled data exchange in order to enable systems with more capacities to become smart and accessible; creating webs of objects and allowing integration of data, services and components.

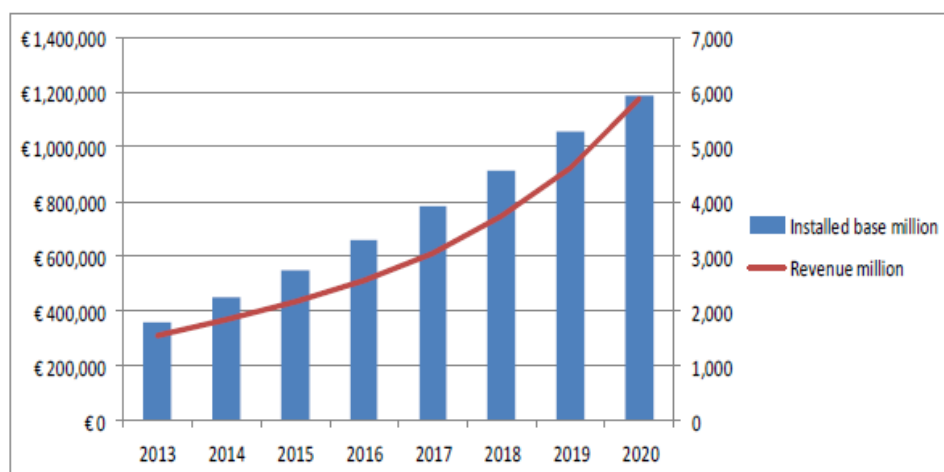


Figure 1: IoT Installed Base and Revenues in EU 28 2013-2018

There are several challenges associated with IoT and its evolution, but one major issue is related with interoperability. IoT is mainly supported by continuous progress in wireless sensor and actuator networks and by manufacturing low cost and energy efficient hardware for sensor and device communications. However, heterogeneity of underlying devices and communication technologies and interoperability in different layers, from communication and seamless integration of devices to interoperability of data generated by the IoT resources, is a challenge for expanding generic IoT solutions to a global scale, with the extra aim of avoiding silos and providing solutions that are application domain agnostic like those proposed in INTER-IoT.

1.2 IoT interoperability

Many projects have dealt and/or are dealing with developing IoT architectures in diversified application domains. However, the conceptual realization of IoT is far from achieving a full deployment of converged IoT services and technology. The widespread of vertically-oriented closed systems, architectures and application areas has generated a fragmentation that needs to be overcome. Lack of interoperability causes major technological and business issues such as impossibility to plug non-interoperable IoT devices into heterogeneous IoT platforms, impossibility to develop IoT applications exploiting multiple platforms in homogeneous and/or cross domains, slowness of IoT technology introduction at a large-scale, discouragement in adopting IoT technology, increase of costs, scarce reusability of technical solutions or user dissatisfaction. Current research in IoT is focused on providing integrated solutions and primarily on the feature that enable convergence or what is called as Interoperability.

Interoperability is a property referring to the ability of systems and organizations to work together. The overall challenge of achieving interoperability of heterogeneous IoT platforms is to deliver an IoT extended into a web of platforms for connected devices and objects. They will support smart environments, businesses, services and people with dynamic and adaptive configuration capabilities. Interoperability of heterogeneous IoT platforms will be the way to achieve the potential benefits derived from a scenario where everything is linked, interoperability between several heterogeneous platforms is of utmost importance.

Interoperability can be generalized as the feature for providing seamless exchange of information to, for example, personalize services automatically or simply exchanging information in a way that other systems can use it for improving performance, enable and create services, control operations and information processing. These types of scenarios require increased interoperability in service management operations. The INTER-IoT Project, aware of this fact, aims to provide an interoperable open IoT framework (with associated engineering tools and methodology) for seamless integration of heterogeneous IoT platforms available in the same or different application domains.

INTER-IoT will provide all the building blocks needed to achieve interoperability, including a framework, methodology and associated APIs and tool-boxes. Assuring that interoperability will be kept as the different products and architectures may evolve in the market. The benefits of INTER-IoT will be:

- At the **device level**, seamless inclusion of novel IoT devices and their interoperation with already existing, even heterogeneous ones. This will allow fast growth of smart objects ecosystems.
- At the **networking level**, seamless support for smart objects mobility and information routing. This will allow design and implementation of fully connected ecosystems.
- At the **middleware level**, seamless service discovery and management system for smart objects and their basic services. This will allow global exploitation of smart objects in large (even extreme) scale (multi-platform) IoT systems.

- At the **application service level**, reuse and exchange (import/export) of heterogeneous services between different IoT platforms.
- At the **data and semantics level**, common interpretation of data and information based on global shared ontology in order to achieve semantic interoperability.
- At the **integrated IoT platform level**, rapid prototyping of cross-platform IoT applications.
- At the **business level**, faster introduction of IoT technology and applications across multiple application domains.

By using the aforementioned approach, IoT platform heterogeneity will be turned from a crucial problem to a great advantage, as there will be no need to wait for a unique standard for an interoperable IoT. Instead, interoperable IoT, even on a very large scale, will be created through a bottom-up approach.

1.3 Scope of the INTER-IoT project

INTER-IoT project aims at the design, implementation and experimentation of an open cross-layer framework, an associated methodology and tools to enable voluntary interoperability among heterogeneous Internet of Things (IoT) platforms. The proposal will allow effective and efficient development of adaptive, smart IoT applications and services, atop different heterogeneous IoT platforms, spanning single and/or multiple application domains. The project and associated approach has been defined to be use case-driven. Moreover, it will be implemented and tested in three realistic large-scale pilots:

- Port of Valencia transportation and logistics involving heterogeneous platforms with ~400 smart objects.
- An Italian National Health Centre for mobile health involving ~200 patients, equipped with body sensor networks with wearable sensors and mobile smart devices.
- A cross-domain pilot involving IoT platforms from both application domains will be deployed and tested in the premises of the Port of Valencia.

Furthermore, the project will analyse usability of the provided solutions from the perspective of IoT platform creators, IoT platform owners, IoT application programmers and users investigating business perspectives and creating new business models. The most important benefits expected for third parties are related with the new features and components that will be released by the consortium: Methodologies, tools, protocols and API. That will be released as open items available to develop new applications and services. The variety and cross availability of the results could be used to build and integrate services and platforms at different layers according to the needs of the stakeholders and developers. The availability of more and new data will stimulate the creation of new opportunities and products, always in the scope of open interoperability.

Open interoperability delivers on the promise of enabling vendors and developers to interact and interoperate, without interfering with anyone's ability to compete by delivering a superior product and experience. In the absence of global IoT standards, the INTER-IoT project will support and make it easy for any company to design IoT devices, smart objects, or services and get them to market quickly, and create new IoT interoperable ecosystems.

The INTER-IoT approach is general-purpose and may be applied to any application domain and across domains, in which there is a need to interconnect IoT systems already deployed or add new ones. INTER-IoT will be based on three main building blocks:

- Methods and tools for providing interoperability among and across each layer of IoT platforms (INTER-LAYER);
- Global framework (INTER-FW) for programming and managing interoperable IoT platforms; and
- Engineering Methodology (INTER-METH) based on CASE tool for IoT platforms integration/interconnection.

The project results will be specifically tested in the two independent application domains that will lead to two independent products, namely: INTER-LogP and INTER-Health. Thus, as an outcome of the project, INTER-IoT will provide these five products that could be introduced in the market for a wider implementation and exploitation. The market analysis and stakeholders will be based in the existence of these five products, and the interest generated in the stakeholders.

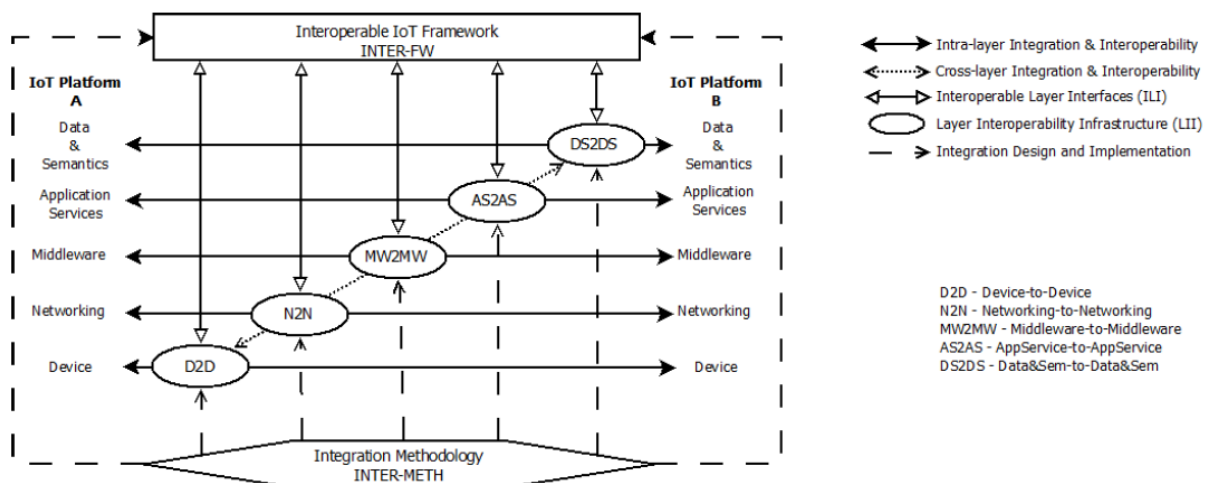


Figure 2: INTER-IoT approach abstract schema

INTER-LAYER

INTER-IoT uses a layer-oriented approach to fully exploit specific functionalities of each layer (device, networking, middleware, application services, data & semantics) (see Figure 2). Although the development of a layer-oriented approach is a research challenge, as compared to a global approach, it has a higher potential to deliver a tight bidirectional integration among heterogeneous IoT platforms,

notably guaranteeing independence, thus providing higher performance, modularity and reliability and, what is extremely important, more control on functional and non-functional requirements. In addition, the data and semantics level provides a global shared ontology and methods in order to achieve IoT platform semantic interoperability.

INTER-LAYER includes the design of device-to-device interaction based on multiprotocol/access mechanisms, the design of software defined interoperable modules for mobility and routing, the development of an open service discovery and management framework for smart objects, the design and implementation of smart IoT application service gateway and virtualization and the definition of a common ontology for IoT platform semantic interoperability.

INTER-FW

The Interoperability IoT Framework (INTER-FW) aims at providing global and open platform-level interoperability among heterogeneous IoT platforms coupled through specifically developed Layer Interoperability Infrastructures (LIIs) and Interoperability Layer Interfaces (ILI). INTER-FW will rely on an architectural meta-model for IoT interoperable platforms, on a metadata-model for IoT interoperable semantics and it will provide a programming API and tools providing global-level management of the integrated IoT platforms.

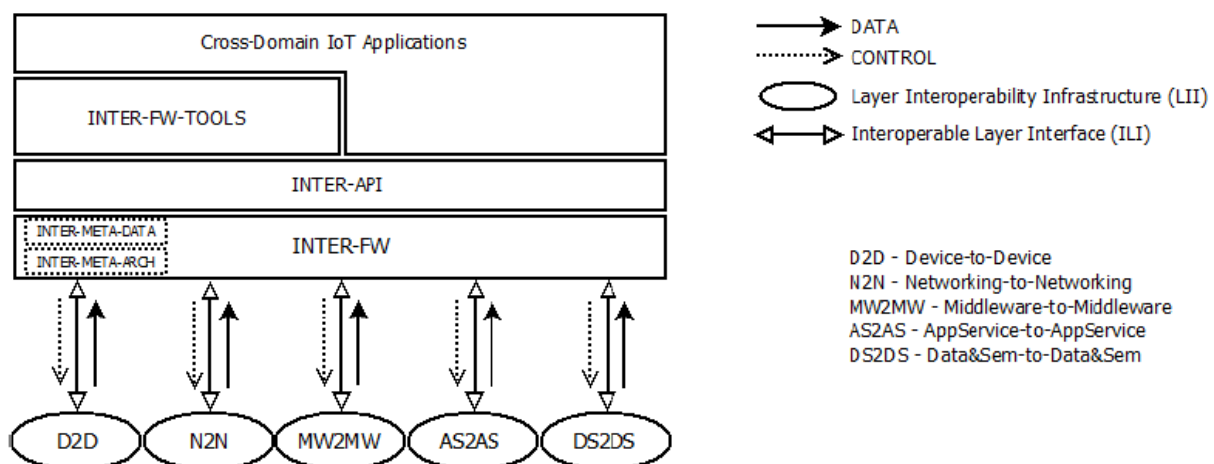


Figure 3: Abstract schema of the INTER-FW

Figure 3 shows the abstract schema of the INTER-FW. INTER-FW will advance the state-of-the-art by providing a general and effective method for inter-platform interoperability, addressing at a global level: real-timeless, reliability, security, privacy, trust. In particular, INTER-FW will thoroughly address privacy and security-related risks and challenges resulting from use of IoT devices.

INTER-METH

The engineering methodology INTER-METH aims at defining a systematic methodology supporting the integration process of heterogeneous IoT platforms to obtain interoperability among them and allow implementation and deployment of IoT applications on top of them. It is widely recognized that using an engineering methodology is fundamental in any engineering application domain (e.g. software engineering, co-design hardware/software, civil engineering, etc.). The manual and non-systematic application of complex techniques, methods and frameworks would very likely lead to an increase of the degree of errors during integration. INTER-METH includes a Computer Aided Software Engineering tool for integration (INTER-CASE).

INTER-IoT considers two application domains: transportation and logistics in a port environment and m-health. Around these two application domains, three use cases will be built and packaged as products of the project:

1. INTER-LogP for “Smart Port Transportation for Containers and Goods”;
2. INTER-Health for “Decentralized and Mobile Monitoring of Assisted Livings” and
3. INTER-DOMAIN in which IoT platforms from both application domains plus some additional ones will be integrated.

INTER-LogP

INTER-LogP use case illustrates the need to achieve seamlessly interoperability of different heterogeneous IoT platforms, oriented to port transport and logistics. The considered application domain identifies several physical transport entities (trucks, containers, semi-trailers, cranes, tractors and other container handling machines) owned by different companies. The possibility to capture in real time sensor-based data coming from these physical moving assets and connecting them to transport and logistic infrastructures is an opportunity to drive optimal real-time execution as well as automation of transport and logistics operations. The capture and sharing of real time sensor-based data across different organisations is today a big challenge as there is not any solution in the market able to attend this need and overcoming the complexity of implementing IoT solutions connecting different sensors, systems and products. Sensor-based technology is already being pushed by the transportation and logistics industry. However, what it is lacking is the ability to effectively capture and share the data relative to the movement of vehicles and goods and convert it into actionable insights capable of driving improvements across the supply chain. The lack of use of IoT oriented platforms and their interoperability is today a main obstacle.

For example, almost any person, truck, machine and piece of equipment has been outfitted or it is relatively easy to do so with GPS devices and other sensors to capture information such as location, speed and idle time. With this information, companies have been able to compile and assess several indicators like delivery times, fuel consumption or emissions. However, these companies are not able to design and establish connections with platforms managed by other operators in the supply, logistics and transport chains. The global and interconnected nature of today's supply chains needs a greater collaboration among supply chain partners.

The interoperability of heterogeneous IoT platforms can provide a framework for real-time multidirectional information sharing to help in creating true supply chain collaboration.

INTER-Health

INTER-Health scenario for Decentralized and Mobile Monitoring of Assisted Livings' Lifestyle aims at developing an integrated IoT system for monitoring humans' lifestyle in a decentralized way and in mobility, to prevent health issues mainly resulting from food and physical activity disorders. By exploiting the integrated system - INTER-Health - the patient's monitoring process can be decentralized from the healthcare centre to the monitored subjects' homes, and supported in mobility by using on-body physical activity monitors.

The INTER-DOMAIN solution has not yet been considered as an initial product to be offered since its requirements and domain is still unknown until the open call takes place. Only when a couple of third party entities with the clear goal of fostering the adoption of INTER-IoT developments are selected, the INTER-DOMAIN could be considered as a product to be offered to the market.

1.4 Scope of the deliverable

This deliverable will provide the INTER-IoT business model options, which will support the project business goals in different use cases.

This task will initiate the definition of the business options at strategic level for the exploitation of INTER-IoT results, taking into account economic considerations (i.e., how will project results be sustainable and create value); component considerations (i.e., how will the business be done: selecting customers, differentiating its offerings, defining the tasks of each organisation, configuring its resources, going to market, providing added value to customers and gathering profit objectives) and strategic outcomes (i.e., the design of key interdependent systems that create and sustain a competitive business). Business model design is of utmost importance in INTER-IoT and it will be directly related to the impact of the project. Thus, it is foreseen to make an identification of different business and collaboration models suitable to be used during the first stages of the project. The business models will be assessed including modelling and description of the value propositions, business methods, target customer segments, distribution channels, customer relationships, value configurations, core capabilities, partner networks, cost structure, revenue models, offerings, strategies, infrastructure, organizational structures, trading practices and operational processes and policies to be able to have different business options in INTER-IoT.

2 METHODOLOGY

The methodology that has been used as a reference for generating and designing business models is CANVAS. This worldwide-accepted method is already used and applied in organizations such as IBM, Ericsson, Deloitte, the Public Works and Government Services of Canada, and many more.

CANVAS is a management and entrepreneurial tool for generating business models through nine basic building blocks (BB) that show the logic of how a company intends to create value and make money. The nine blocks are presented in Figure 4 and cover the four main areas of a business: customers, offer, infrastructure, and financial viability.

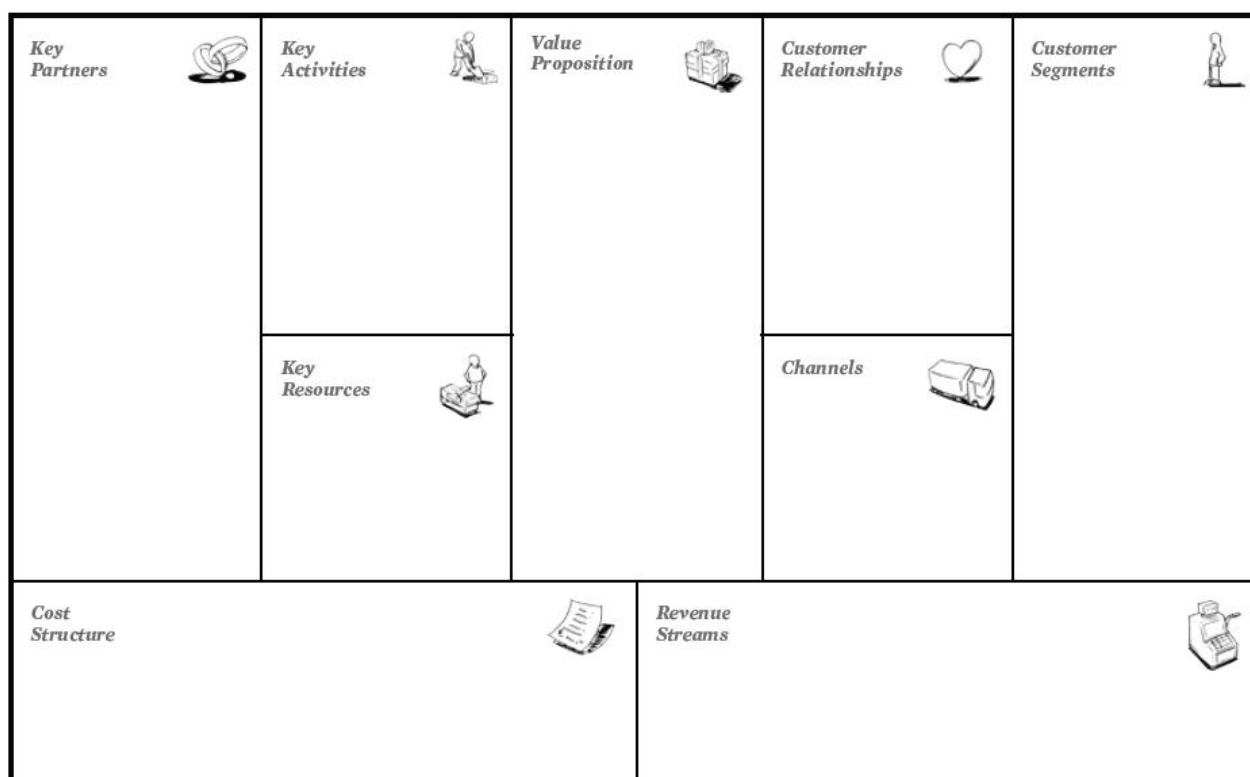


Figure 4. Business Model Canvas

The **Customer Segments** BB defines the different groups of customers to reach and serve. Customers may be grouped into distinct segments with common needs, common behaviours, or other attributes.

The **Value Propositions** BB is the reason why customers turn to one company over another. This block describes the value that is delivered to a specific customer segment and which customer's problems are solved and satisfied with the bundles of products and services that the company is offering.

The **Channels** BB describes how a company finds the right mix of channels to communicate and reach its customers when delivering its Value Proposition.

The **Customer Relationships** BB describes the kind of relationships a company establishes with specific Customer Segments. How a company interacts with its customers when providing their value.

The **Revenue Streams** BB describes how the customers are going to pay the company and for what value. For instance, a telecom operator may charge customers for the number of minutes spent on the phone while a gym sells its members monthly or yearly subscriptions in exchange for access to its exercise facilities.

The **Key Resources** BB describes the most important assets (i.e. physical, financial, intellectual, or human) required to create and make a particular business model work.

The **Key Activities** BB describes the most important things or actions a company must do to make its business model work and to operate successfully. For instance, for PC manufacturer Dell, Key Activities include supply chain management. For consultancy McKinsey, Key Activities include problem solving.

The **Key Partnerships** BB describes the network of suppliers, partners and alliances that different companies make to optimize their business models, reduce risk, or acquire resources. Partnerships are becoming a cornerstone of many existing business models.

Finally, the **Cost Structure** BB describes all the important costs incurred while operating under a particular business model.

Each partner of the consortium has designed an individual Canvas Business Model containing its particular vision of how to create value with the INTER-IoT expected results. By designing multiple suitable business models, the INTER-IoT project will show and demonstrate how different partners (universities, research organisations, industry organisations, SMEs, public body organisations, etc.) can create and provide value to different market segments when commercializing and exploiting the main results and outcomes of the INTER-IoT project.

Once the CANVAS sheet of each partner is completed, we get a big picture and some ideas of how the project results will be sustainable and create value among different segments of population.

In addition, this deliverable includes some business and collaboration models for the joint exploitation of the INTER-IoT results. These additional joint business models have been designed around INTER-LAYER, INTER-FW and INTER-METH outputs.

To conclude, it is important to mention that there is not a single and universal INTER-IoT business model design that can be considered the best. On the contrary, several choices and possibilities can be optimal and valid for the variety of products that the INTER-IoT project is considering. The knowledge gained during the work sessions (TF4) with the other EPI-projects has been extremely useful to build INTER-IoT business cases.

3 BUSINESS MODEL DESIGN

It is very well known that IoT is changing the way people live and the way businesses are done. The Internet of Things have changed business models and the way companies obtain benefits from their products and services.

The main difference between old and new business models is that now, in a connected world, products are no longer one and done. That means that companies can sell the product one time but after the product is sold, several updates, new features and functionalities can be pushed to the final customer on a regular basis extending the working life of a product and enabling further revenue streams after the initial product sale.

The Internet of Things is also leading to new analytics and new services for more effective forecasting, process optimization, and customer service experiences. This can be clearly seen in how clothing stores or commercial banks are using IoT devices to identify customers' patterns and then offer real-time advertising through its cell phones.

As it can be deduced from the above mentioned examples, the Internet of Things could be exploited in several ways. However, the problem that many new IoT products and innovations are facing is that it has a short shelf life when the companies that implement these new solutions lack a clear and organized plan to generate profit and revenue. Therefore, the design of good business models is essential to lead great ideas into great business experiences for its users and strong cash flow generation for its owners.

In this deliverable, the INTER-IoT consortium will show how different entities could take advantage of the interoperability of heterogeneous IoT platforms through the design of specific business models. The identification and design of profitable business models based on the Internet of Things is a key factor that will ensure the success of the INTER-IoT action and the spread of its final results.

In closing, it is important to remark that, in addition to our individual business models, joint business cases have been designed based on the project's platform technology. The participation of all the INTER-IoT partners are essential to achieve successful results when exploiting those collective business models. Finally, it is clear that the identification of different business models for the INTER-IoT results will demonstrate that there are more than one possible option to exploit the results of the project.

3.1 UPV Canvas Business Model

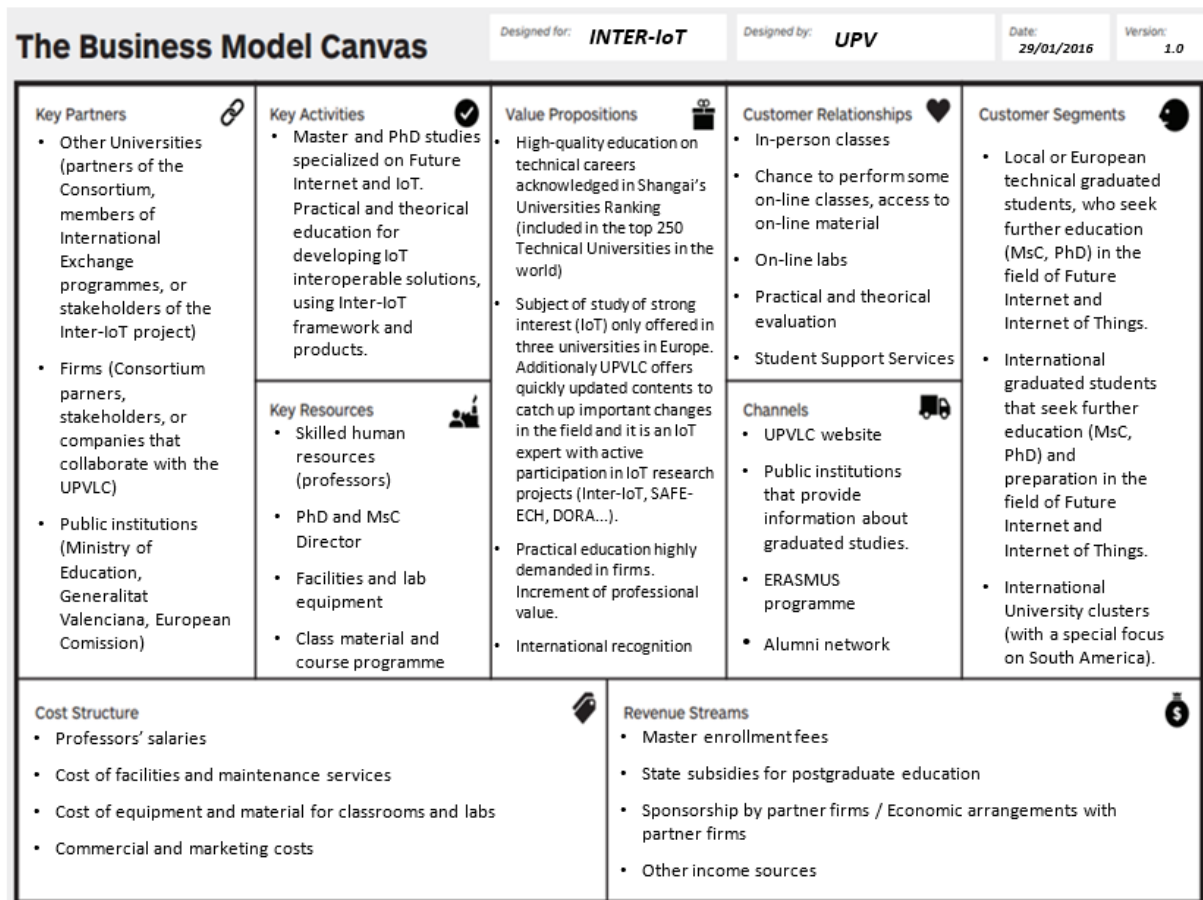


Figure 5: Business Model Canvas – UPV

The UPVLC is a public, dynamic and innovative university dedicated to researching and teaching. UPVLC maintains strong bonds with its social environment and a strong presence abroad. Year after year, UPVLC is positioned in the top 250 best Technical Universities in the world, according to renowned international rankings. In particular, studies related to Computer Science are in the top 50 positions in Shanghai ranking. UPVLC has an intense research activity, and participates in several important IoT research projects (INTER-IoT, SAFE-ECH, DORA.). Moreover, UPVLC has a close relationship with firms and provides a fast integration of their graduates in the workplace. UPVLC includes 15 centres: ten schools, three faculties, two higher polytechnic schools and five associated institutions, and has a wide offer of MSc and PhD programmes in technical areas.

UPVLC aims to take advantage of INTER-IoT potential by the creation of the Master and PhD studies specialized on Future Internet and IoT. This programme will be named as IoT Academy, and will provide practical and theoretical education for developing IoT interoperable solutions, offering the possibility of using INTER-IoT framework, tools and other INTER-IoT products to promote and ease these developments. UPVLC envisions a great academic opportunity in the exploitation of INTER-IoT, which will propel research on IoT, the

implantation of IoT solutions, as well as rebranding the UPVLC in academic and professional contexts.

For the creation and development of this INTER-IoT academic product it will be necessary to count on skilled human resources - expert professors on this area-, appropriate facilities and lab equipment, to designate a Director for each programme, and to prepare the necessary class material and course programme. The project will have as fixed costs the professor's salaries and expenses related with the acquisition of facilities, necessary services and equipment for classrooms and labs. Other costs must be considered, such as commercial and marketing costs, still undefined costs, and unexpected expenses.

IoT Academy will attract different groups of potential customers: European or non-European graduated students seeking for further education in the areas of Internet of Things and Future Internet, and International University clusters. These clusters will have a special focus on South America.

Regarding to the IoT Academy product, UPVLC has defined a general value proposition. The MSc and PhD programmes will provide to the student a high-quality education from a prestigious technical University, acknowledged in the most renowned international rankings of universities. Both MSc and PhD degrees have prestigious international recognition.

These programmes offer a highly demanded subject of study (Internet of Things and Future Internet), with paradoxically very scarce offer: only three European Universities offer an MSc degree highly related to Internet of Things. UPVLC can differentiate its offer from other universities due to its high expertise in the area, and the involvement on important IoT research projects, such as INTER-IoT or Dora, providing a high benefit to the degree.

UPVLC also provides an education oriented to achieve a fast integration of graduates in the workplace, by enhancing their professional value and skills, and closely collaborating with firms to provide them qualified employees. A very high percentage of recently graduated engineers (92%) start working in less than two months. As the IoT Academy offers qualified knowledge in very highly demanded areas for firms nowadays such as Internet of Things, IoT Academy drastically increase the professional value of IoT Academy graduates. For all these reasons, UPVLC can provided a product proposal differentiated and with high value.

UPVLC envisages the consolidation of strategic alliances with other Universities, firms and public institutions that will lead to powerful synergies in academic, professional and economic scopes.

The aforementioned universities are in first place partner universities from the INTER-IoT Consortium. Secondly, universities that participate in Student Exchange programmes in which IoT Academy is involved are strategic partners as well. Finally, other universities may show interest in collaborating with the INTER-IoT or the IoT Academy project.

The partner firms will be Consortium partners, stakeholders, or companies that collaborate with the UPVLC. As well, UPVLC has the support of several public institutions, such as the

Generalitat Valenciana (regional government), the Ministry of Education and the European Commission.

In the IoT Academy, MSc students can attend in-person classes, receiving high-quality learning of cutting-edge technologies related with Internet of Things and Future internet. Students will be also able to access to on-line labs, in which they can experiment with INTER-IoT products (INTER-FW, INTER-LAYER, INTER-METH, INTER-Health, INTER-LogP) and develop IoT solutions. Contents will follow latest advances in the areas of Internet of Things, will be quickly updated, and materials will be available on-line. MSc students will have a practical and theoretical evaluation. PhD students will also enjoy from the expertise of the professors guiding their Thesis, and the chance to participate in important IoT research projects. Participants will be able to enjoy and benefit from several on-line campus services, including the option to take some classes on-line instead of in-person, and the attention of the Student Support Services.

IoT Academy project will use different channels for offering information, promoting and advertising the MSc and PhD programmes, in order to make them known to potential students and stakeholders. UPVLC website will spread information about the IoT Academy, where it will be always available information regarding to the programme description and enrolment. As well, several public institutions offer information about graduated studies, which include IoT Academy MSc and PhD studies. In addition, the ERASMUS programme will spread information about IoT Academy. Former students will make it known locally and abroad by word of mouth. The university network for former students, Alumni, is an important medium of diffusion, as it may be UPV TV, UPV Radio, and internal newspapers and magazines of the university. In addition, UPVLC will offer informative leaflets, and may advertise IoT Academy through the internet by other means, such as using Google Ads, or publishing videos on YouTube, for instance. Strategic partners, such as other universities, firms and public institutions will also contribute, directly or indirectly, to the diffusion.

Another media for publicity should be considered, such as newspapers, another websites and blogs related with IoT, in which mentions to IoT Academy may appear. This impact is strongly reinforced and positively influenced by the strategic alliances of IoT Academy with universities, firms and public institutions. Research publications will also contribute to IoT Academy rebranding and diffusion.

UPVLC will get revenue streams from the commercialization IoT Academy from diverse sources. Core sources of income are Master and PhD fees and important state subsidies for graduated education in public Universities. Revenues from firm's sponsorships or economical agreements with partner companies should also be considered. It must be noted that strategic partnerships and alliances –not only with firms, but also with other universities and public institutions- will probably lead to synergies and business opportunities capable of provide economic benefits. The possibility of further income sources, that are not devised in this first canvas iteration, or not initially expected, must also be considered.

3.2 Telecom Italia Canvas Business Model

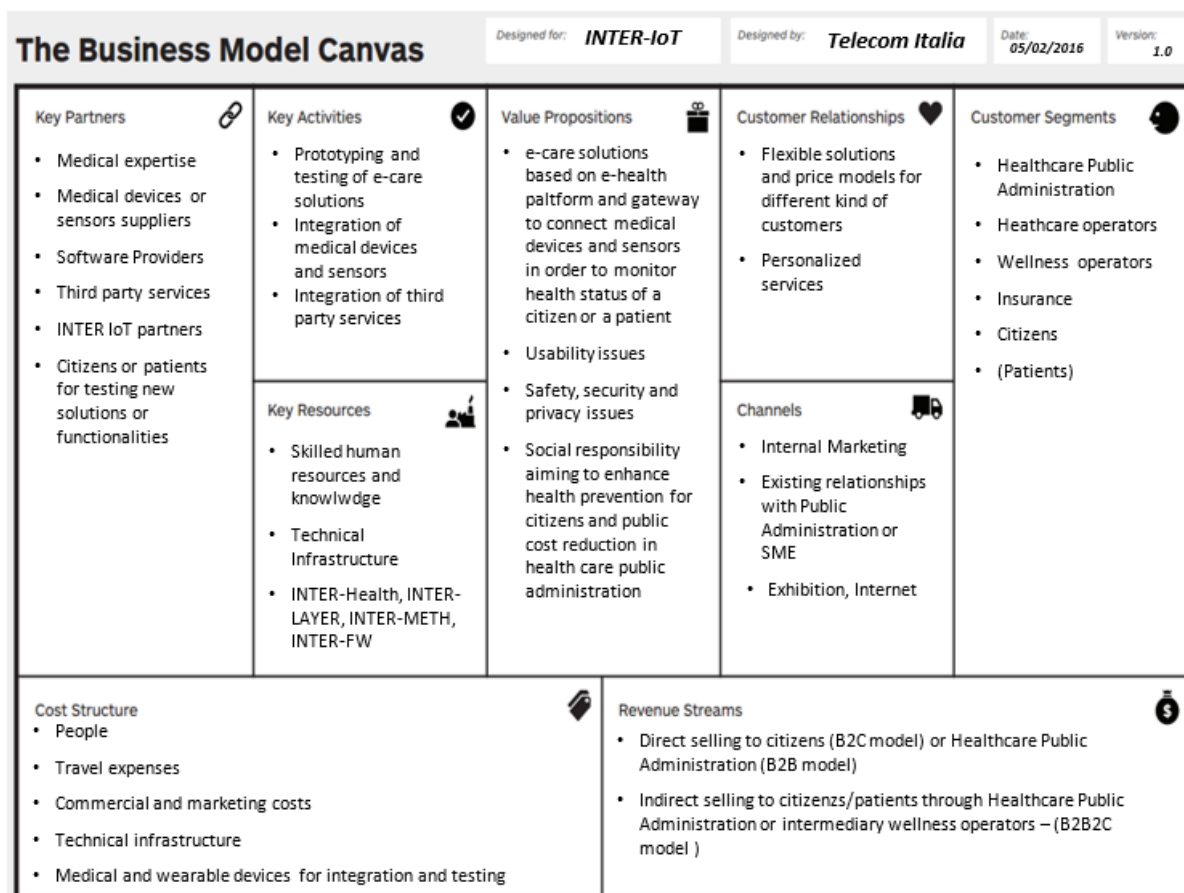


Figure 6: Business Model Canvas – Telecom Italia

Telecom Italia Group is the major Italian enterprise ICT player with 31.2 million mobile lines and 13.2 million connections to its fixed network, of which more than 6.9 million are broadband accesses. Abroad its main strength is Brazil, where TIM Brazil, supplying 73.4 million lines, is a major player on the market. As it has done throughout its industrial history, the Group is focusing its strategy on innovation, and over the next three years, the group will be investing 3.4 billion euros on the development of new generation technologies. Driven by technological innovation and a commitment to service excellence, Group companies operate in fixed and mobile communications, Internet & Media, Information Technologies. R&D activities include areas like evolution of mobile communication, diffusion of broadband bandwidth, identification and localization systems with embedding tagging technologies, value added services based on IT infrastructure on vertical markets like health and informability. Concerning e-health activities, Telecom Italia is very active in the research community and offers a number of commercial or experimental solutions integrated on e-health platforms, in particular in the tele-monitoring field. These experiences could be useful and applied in the context of INTER-IoT project within the INTER-Health Pilot.

Telecom Italia (TI) aims to take advantage of INTER-IoT results by creating an offering of new enhanced e-health services for citizens and patients. These solutions will be flexible, personalized and will be offered at affordable prices so that different customers could access to these services.

The Telecom Italia customer segments include different types of users; they could be simply citizens that want to monitor their health status or patients in a follow-up environment, healthcare operators in private or Public Administration or wellness operators.

The most important customer segment that Telecom Italia will serve are those healthcare professionals (such as private or public hospitals, nursing homes, and local or regional health organizations) who need to reduce costs, increase productivity and follow their own patients while maintaining quality services.

Speaking of citizens, target customers are people who want to maintain a healthy lifestyle and are interested in controlling autonomously some physiological parameters according to their objectives and their state of health, social inclusion and nutrition: diet, physical activity, weight, blood pressure. They are generally people who have gained a degree of knowledge and awareness on the importance of health and who have a minimum of familiarity with the technology and the use of smartphones

Other customers are the wellness and fitness centres, gyms but also insurance companies that want to offer value-added services to their customers (citizens).

Telecom Italia Value Proposition refers to how its offering meets the needs of its target customers. Telecom Italia provides value through its acquired know-how on e-care solutions based on e-health “cloud-based” platform and gateway to connect medical devices and sensors in order to monitor health status of a citizen or a patient, to the independence from the biomedical devices, to the safety, security and privacy issues and to the social responsibility aiming to enhance health prevention for citizens and public cost reduction in public health care.

Moreover, for these services there are some characteristics like the Quality of Service, the Security and the Proximity to the customer that are relevant and they are peculiar of a Telco operator.

Telecom Italia will use different channels for offering information, promoting and advertising. Those channels include the internal Telecom Italia marketing departments (Business or Consumer depending on the customer), the network of TIM stores in the territory, the existing relationships with Public Administration or SME and also the exhibitions or the world wide web.

Core sources of income are reached in two different ways: through a direct selling to citizens (B2C model) or Healthcare Public Administration (B2B model) or through an indirect selling to citizens/patients through Healthcare Public Administration or intermediary wellness operators (B2B2C model).

The pricing model is flexible and is influenced by the type of customer (consumer or business) and the type of service offered (only service, management of devices and equipment, type of SLA required, modes of delivery such as SaaS, maintenance and assistance services, etc.).

In order to provide the e-health solutions that Telecom Italia is willing to exploit in the market, several key resources are needed. Among others, some of the results of the INTER-IoT project (i.e. INTER-Health, INTER-LAYER, INTER-METH and INTER-FW) are essential to meet these objectives. In addition, skilled human resources, knowledge and an optimal technical infrastructure is needed.

The most important activities that Telecom Italia will do to ensure the successful exploitation of its business model will be related to the prototyping and testing of new e-care solutions, the integration of different medical devices and sensors and the integration of third party services on the Telecom Italia infrastructure using the INTER-IoT products. These activities allow TI to quickly develop business solutions, to expand the portfolio of service offers and to be time to market to customer requests.

Since the key activities for TI are the integration on the basis of Telecom infrastructure services and telco capabilities, the key partners could be: the devices and sensors suppliers with all their specific knowledge of the measurements made by devices; the medical domain and health experts to manage the services properly and according to the needs; the services and software providers specific to certain specialized fields, and / or niche (e.g. electrocardiograms interpretation, dosage medications based on your measurements, data analysis, etc.); the INTER-IoT partners for the products of the project; and also, citizens or patients for testing new solutions or functionalities. This approach allow TI to foster the development of "platform-based" services by expanding the product portfolio of TI.

The success of this business model depends on how Telecom Italia manage the different costs that are necessary for developing its offering. Those costs are mainly people, travel expenses, software developments, commercial and marketing costs, technical infrastructure, hardware, medical and wearable devices.

3.3 Prodevelop Canvas Business Model

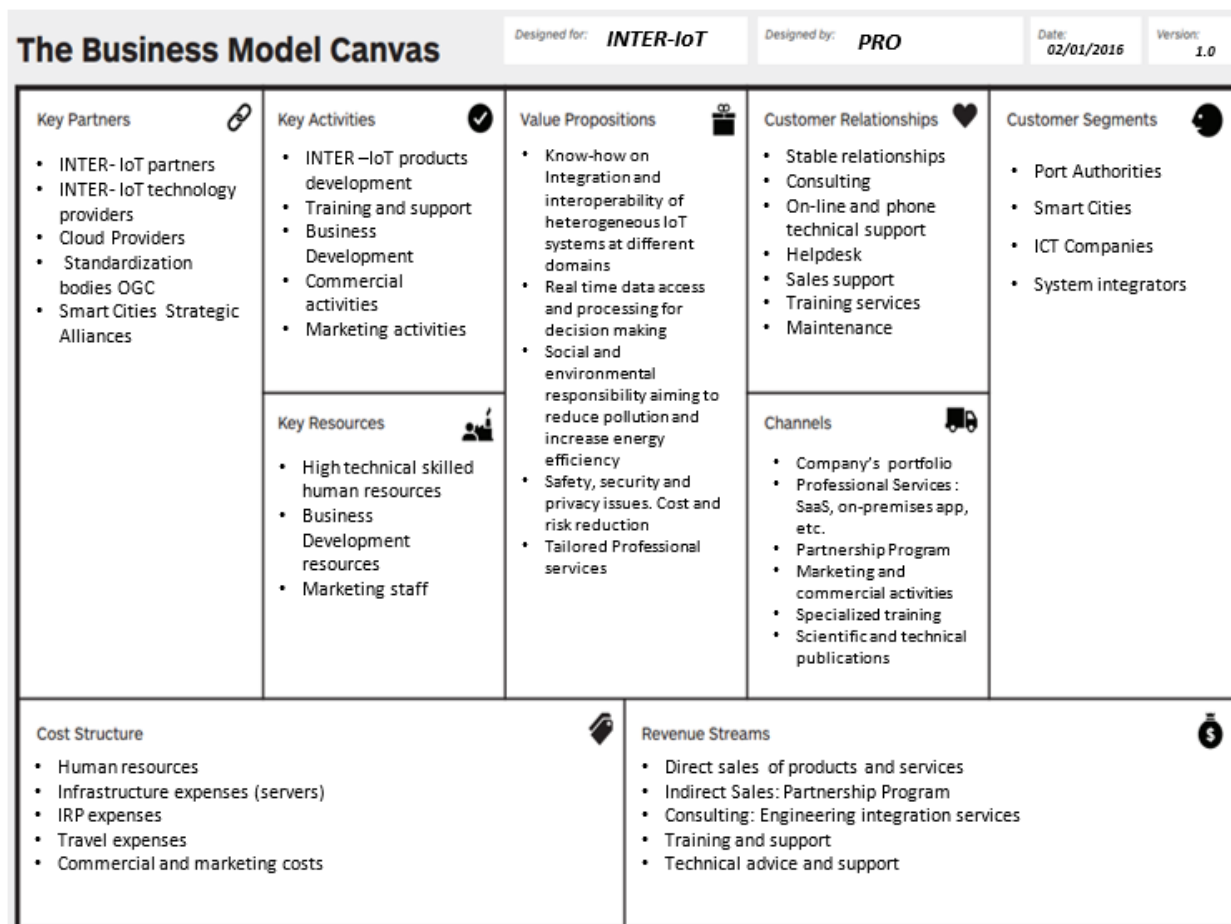


Figure 7: Business Model Canvas – Prodevelop

Prodevelop (PRO) is a leading ICT company with more than 20 years of expertise offering IT solutions based on cutting-edge open source geospatial solutions for Maritime, Agriculture, Transport, Environment and Public Administration sectors. PRO is continuously evolving and adapting to new approaches, keeping working on the use of cloud, IoT and Big Data technologies to create innovative market products for improvement of its services and portfolio's solutions.

All along this enterprise trajectory, PRO has consolidated a solid customer base on all these sectors by offering innovation, quality and a close relationship to their customers.

The 60% of PRO's activity is related to the Maritime sector, where PRO offers to its customers a professional portfolio of solutions for managing and optimizing Port Authorities through POSIDONIA SUITE ©: Port Solution Suite for Port Management.

In this sector, PRO also has been involved in several Smart Port Projects dealing with the most innovate technology related with IoT.

On the other hand, the 30% of PRO's activity is related to Public Administration, where PRO offers consultancy and open software development services. Currently PRO has been involved on several projects within the framework of the Smart City domain, where integration of IoT systems is an aspect to be foreseen in the near future.

Due to the lack of interoperability between the smart objects of the heterogeneous IoT systems in these type of projects, PRO envisions a great business opportunity in the integration of INTER-IoT exploitable products into its already established commercial products or the creation of a new line of products and services in aforementioned sectors.

PRO aims to take advantage of INTER-IoT potential by providing services and solutions for the integration of heterogeneous IoT architectures, being a key factor to differentiate PRO services and solutions from the current competition.

The main goal of PRO is to become a reference technology provider of INTER-IoT technology and to bring to market a suite of cutting-edge products and services based on INTER-IoT exploitable products INTER-LAYER INTER-FW, INTER-METH and INTER-LogP, for heterogeneous IoT platforms specifically addressed to Smart Cities and Port Authorities.

Thus, the main PRO target customer segments contemplated in this business model are Port Authorities and Smart Cities. PRO, plans to select their potential customers in successive phases during the first year of the project.

In the short term, PRO will take into account the results of the interviews with stakeholders achieved at T.2.1 and will select their customers from its current customer base, both at national and international level. Therefore, PRO will attract also the attention of new customers through the assistance and participation in trade shows, professional fairs of both sectors.

The results of the interviews carried out with stakeholders and potential new customers in both sectors help PRO to concrete needs by means of lack of interoperability between IoT systems on Port Authorities and Smart Cities markets that have been not resolved by the competition.

The value promised of PRO is based on offering cutting-edge technology through commercial products and professional services in the cloud based on the combination of INTER-IoT exploitable products to allow the integration of Port Authorities and Smart Cities and their relevant existing or new IoT heterogeneous platforms for the improvement on the efficiency of management and decision making of their daily operations.

Some intrinsic advantages of INTER-IoT exploitable products for both segment sectors are:

- Real time data access and processing for decision making
- Social and environmental responsibility aiming to reduce pollution and increase energy efficiency
- Safety, security and privacy issues.
- Cost and risk reduction

- More efficient transport service

PRO will go in deep in both markets with the detection of a common need between customers of each segment sector, through interviews and desk researches. The detection of common needs will allow PRO foster the design of unique markets solutions oriented to both customer segments.

Each market solution will have a unique value promise, being a different alternative among the competition alternatives. This value promise will convert into the marketing message to use in the Marketing Strategy Plan to define the product and to be ready to go into the market.

PRO points out some initial and particular features contemplated in the respective market solution for both customer segments:

- INTER-IoT Port Solution: The Port Authorities will be able to access and share real time information about traffic, vehicles or events and to know what's happening in the port and its environments for current improving decision-making. This solution will also allow the automation of the location of containers throughout the port, or the notification of events affecting all the logistic chain, or ensuring the quality of the value chain. The integration of all these features into PRO existing commercial products such as POSIDONIA OPERATIONS© will give it a great add value in front of the current competition alternatives on the market.
- INTER-IoT Smart City Solution: Smart Cities will be able to integrate all the real time information from its IoT systems for geospatial visualization, geoprocessing and geospatial aware complex event processing in order to obtain patterns and alerts that will improve the current city management decision making for urban Planning, mobility and environmental policies, citizen engagement, etc.
- The integration of all these features into the existing PRO services for the Smart City domain will give them a great add value in front of the current competition alternatives on the market.

On the other hand, being a technology provider in INTER-IoT, PRO would benefit from the INTER-IoT framework by reinforcing its position in the open-source community and as a provider of open-source solutions for Public Administrations.

Therefore, its offering will also be different from the competition, because the company's philosophy is based on innovation, quality and the promotion of stable relationships with their clients. It goes beyond a simple commercial relation, as PRO considers each client a strategic partner. Thus, the customer becomes part of the solution in a collaborative project, thereby satisfying both client and PRO expectations.

In order to be competitive respect the competition alternatives in the market, PRO will configure the needed human and material resources to face INTER-IoT business, marketing and technical aspects having on mind the pillars of its company's philosophy: Innovation, quality and close relationship to the customer.

To achieve innovation, PRO relies on the know-how of its technical staff that is composed of high qualified technical human resources that have been previously involved in R&D and software development projects, dealing with geospatial technologies and IoT Systems. The proposed technical team is ready to face the technological challenges of the INTER-IoT and give support and training to the end users.

From the business development and marketing strategy point of view, PRO relies on the expertise of its management staff supported by its current commercial branches and agents in Belgium, Morocco, Brazil and Abu Dhabi. This business team will elaborate the Business Development, Marketing and Exploitation plans covering aspects such as dissemination activities, commercial activities, Partnership agreements, etc. All of these aspects are a need to deploy and scale the market-ready exploitable INTER-IoT products and services, taking into account the current customer general base and the company's market national and international strategy.

With the aim of being always close to the client, cutting distances through swift and personalized service, with INTER-IoT exploitable products PRO will offer phone technical support as well as training services. All these services will be addressed to help the customers to manage the INTER-IoT technology to improve their current decision-making.

To raise awareness of the project dissemination activities will be contemplated as follow: landing page generation, participation in national and international technical conferences and workshops, generation of articles and interviews in national newspapers and magazines, scientific reports published in international journals and so forth and elaboration of marketing stuff such as leaflets among others.

From the point of view of the commercial activities to be carried out in order to attract the attention of customers, PRO will take part in trade shows and fairs dealing with its target marketplaces.

PRO will also take into account the consolidation of strategic alliances with INTER-IoT partners, cloud providers, standardization bodies and Smart Cities, to go into the market with the maximum trusted add value, thus the best quality.

Therefore PRO will elaborate a Partnership Program to identify different types of partners such as resellers and technology integrators among others. Thus, PRO as technology INTER-IoT provider will also offer professional engineering services to other ICT companies and system integrators in this sectors that would have interest on using INTER-IoT Technology for its projects.

PRO intends to get revenue streams of the commercialization of INTER-IoT exploitable products and services in the first iteration of INTER-IoT through its commercialization via B2B services and products based on SaaS, on-premises or apps.

Depending on the needs of the main customer, PRO will categorized the products with an associated pricing strategy as well as the channel for its selling. On the other hand, PRO will contemplate revenues streams from direct and indirect sales of the products made by partners through Partnership agreements and revenue incomes from consulting through professional engineering INTER-IoT integration, training and technical support services.

Finally, the cost structure identified for the exploitation of the project results will take into account mainly cost of human resources for product development and optimization, infrastructure, commercial & marketing, IRP issues and travel costs.

3.4 VPF Canvas Business Model

For the Valenciaport Foundation (VPF) is an opportunity to participate in the project as it will allow to demonstrate the potentiality of Internet of Thing (IoT) solutions in port, transport and logistics sectors and, afterwards, to exploit the results and knowledge achieved during the project following the strategy explained in this business model design.

The business model designed herein intends to be the most suitable and complementary with the VPF culture and values as an innovation and research centre dedicated to ports, transport, logistics and intermodality within the supply chains. This business model also wants to define the positioning of the organisation in the market and it describes and explains what will be the role of the company in the IoT domain and how the company wants to create value, reach its customers and what the main activities will be in the value generation process.

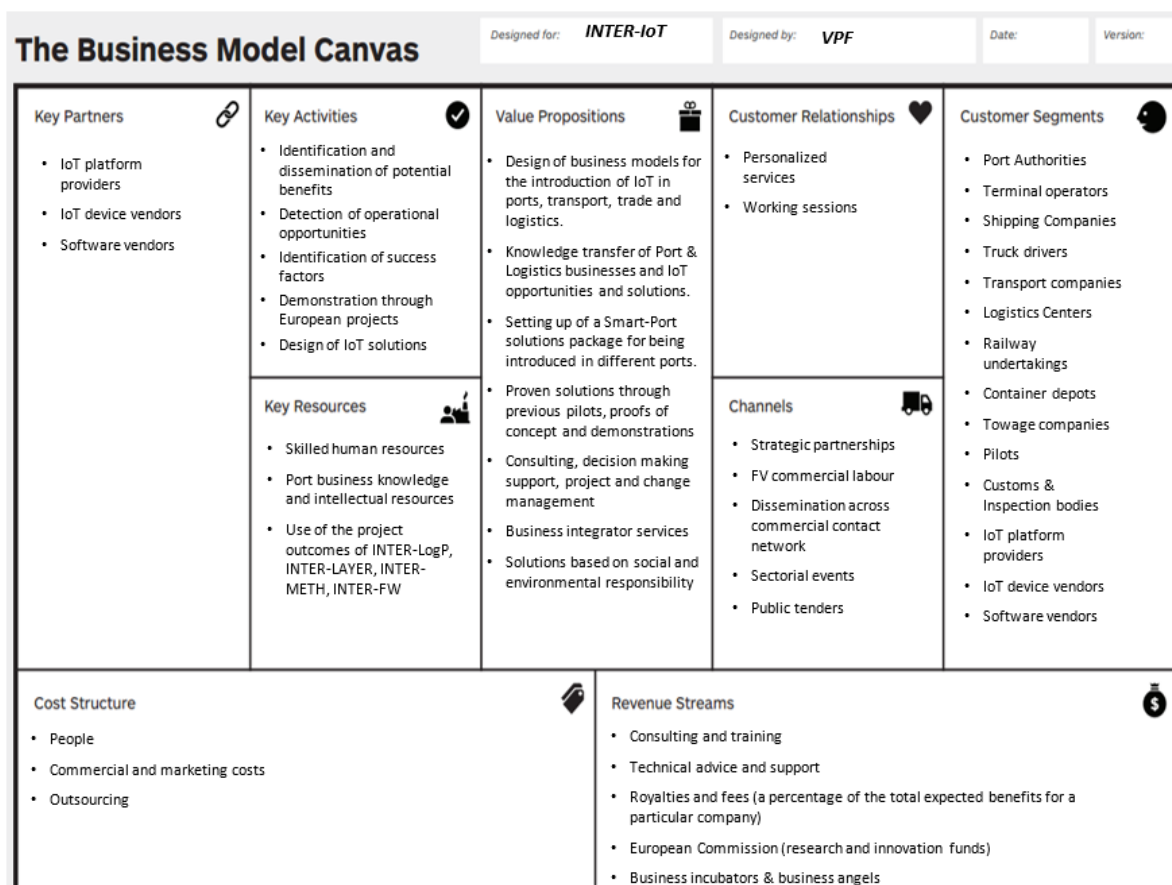


Figure 8: Business Model Canvas – VPF

As shown from the above CANVAS, the value proposition of the VPF consists of detecting and pinpointing business opportunities both for IoT solution providers and operators, authorities and administrations belonging to trade, transport, logistics and port sectors. To do this, VPF will take advantage of its current knowledge in these areas of application along with the knowledge gathered on interoperability of heterogeneous IoT platforms during the execution of INTER-IoT project. VPF will be able to identify the best business opportunities for its clients

and offer them the most appropriate IoT solutions that meet their particular needs. To reach this value proposition, several IoT solutions will be designed to transform existing processes to be more competitive and efficient, leading to higher profits, thanks to the use of technologies based on an interoperability of IoT platforms.

The value proposition to generate new business opportunities for IoT technology suppliers and vendors as well as to potential users of these technologies on the sectors where VPF is focalising its activities requires:

- The design of adequate business models both the introduction and use of IoT technologies.
- A bidirectional knowledge transfer between trade, transport, logistics and port operators with technology providers and IoT software and device vendors.
- Setting up of Smart-Port solution packages able to be introduced in different ports with different needs and sizes.
- The supply of proven solutions through a previous execution of pilots, proofs of concept and demonstrations.
- The provision of consultancy services, decision making, project management and change management support as a business integrator
- The design and provision of solutions based on social and environmental responsibility criteria.

In order to build up the value proposition, it is important to identify and disseminate the expected benefits or operational and productivity improvements that drive the decision of a potential client to purchase and acquire IoT solutions based on their interoperability (e.g. a road transport company will be willing to pay for an IoT solution if it allows them to obtain 10-15 extra services). The identification of these potential benefits obtained by different actors involved in transport, logistics and port operations based on previous demonstration of results, will allow VPF to offer solutions with a measurable and attractive return of investment.

Therefore, key activities of VPF will be:

- analysis and detection of business opportunities in the port, transport and logistics sectors;
- identification of key success factors for adopting IoT solutions;
- demonstration and proof of concept of different solutions through European R&D projects or sponsored activities;
- definition, search and creation of packages of solutions adapted to different market segments that allow different companies and organisations to improve their competitiveness, efficiency and turnover.

Once the business opportunity for the VPF has been detected, one of the most important key actions in the VPF business model design is to generate prototypes, pilots and demonstrations of the solutions before its commercialisation and roll out. In this way, all these possible solutions will be tested and proven to cover the identified needs of the different

stakeholders before its wider adoption. The participation in R&D projects with the aim of demonstrating in advance the potential savings and benefits is vital to reduce risks, customise and optimise the final product to be introduced into the market. At the time the result of the pilot is satisfactory and after some possible improvements, the next step where VPF can provide value is in the commercialisation of the product or service together with other key partners that have participated in the process. This new product or service will be included in the IoT solutions portfolio to be offered to the market through the VPF contacts network, the communication and dissemination sectorial channels or the own VPF commercial activities around the world. Following this business model, IoT platforms providers, device providers and software developers could be both key actors and customer segments of VPF within the exploitation model of the results obtained in INTER-IoT.

Another market segment of VPF IoT solutions will be port authorities, terminal operators, logistics centres, logistics operators, road or rail transport companies, piloting services, towage, mooring, container depots and any other administration or operator involved within the supply chain execution. The channels to reach all these customers include strategic partnerships, VPF commercial labour force, dissemination across its commercial contact network, sectorial events, or public tenders in which VPF participates.

Key actions require the combination of three key resources:

- participation of skilled and multidisciplinary human resources available in the organisation;
- recognised port, transport and logistics business knowledge, expertise and intellectual resources of the organisation;
- use of the INTER-IoT project outcomes for the products INTER-LogP, INTER-LAYER, INTER-METH, and INTER-FW which will allow to have a common methodology for rolling out interoperable IoT solutions, a framework to achieve the required interoperability and a set of tools and gateways to simplify the connectivity and compatibility of devices, networks, middleware, services and data for its application in the focalised areas of VPF.

Customers' relationships will be vital to engage potential clients and to promote and publicise the different services derived from the interoperability solutions for heterogeneous IoT platforms at port, transport and logistics levels. The most effective customer relationships identified at this moment are through personalised services and work sessions carried out with stakeholders from different market segments.

The cost structure identified for the exploitation of the project results will be mainly based on the cost of the human resources, commercial & marketing efforts and the costs of solutions and technologies provided by key partners.

This cost structure shall be compensated through the following revenue streams to guarantee sustainability:

- consulting contracts and training seminars;

- technical advice & assistance and support services;
- kind monetary contributions as a non-profit research and innovation foundation and
- European Commission (research and innovation funds).

The following is an overview of the main steps in the designed VPF business model:

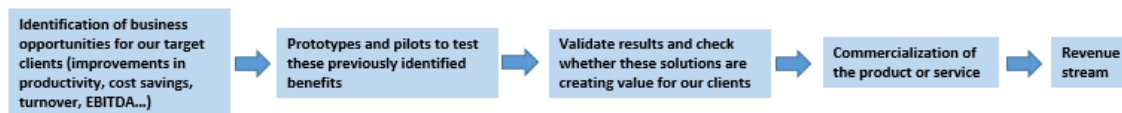


Figure 9. VPF business model steps

As stated above, one of the next steps in the VPF business model will be to analyse and assess the best solutions that will create business opportunities for the target customer segments. In order to design the business models of these customer segments, its main needs, current procedures and the room for improvement, it will be essential to organise several work sessions with different companies where VPF could better detect what are these needs and where IoT solutions could fit to generate business and profits for their users.

After these work sessions, a draft document with several critical points to improve sales, reduce costs or improve productivity will be prepared (e.g. in a work session it can be concluded that one critical point for a road transport company is to reduce kilometres carrying empty containers). Therefore, these work sessions with different agents involved in a particular supply chain could allow VPF to assess the potential gaps and existing inefficiencies and therefore to provide IoT solutions that improve current procedures. These possible solutions will be tested in future prototypes and pilots before its implementation and exploitation in the market.

In addition, these work sessions will allow VPF to detect the key issues that create real value and savings to customers and what will be the price range for becoming attractive. It will be crucial to define what will be the revenue streams and the market size to assess the potential value of the proposed solutions and verify their feasibility.

3.5 Rinicom Canvas Business Model

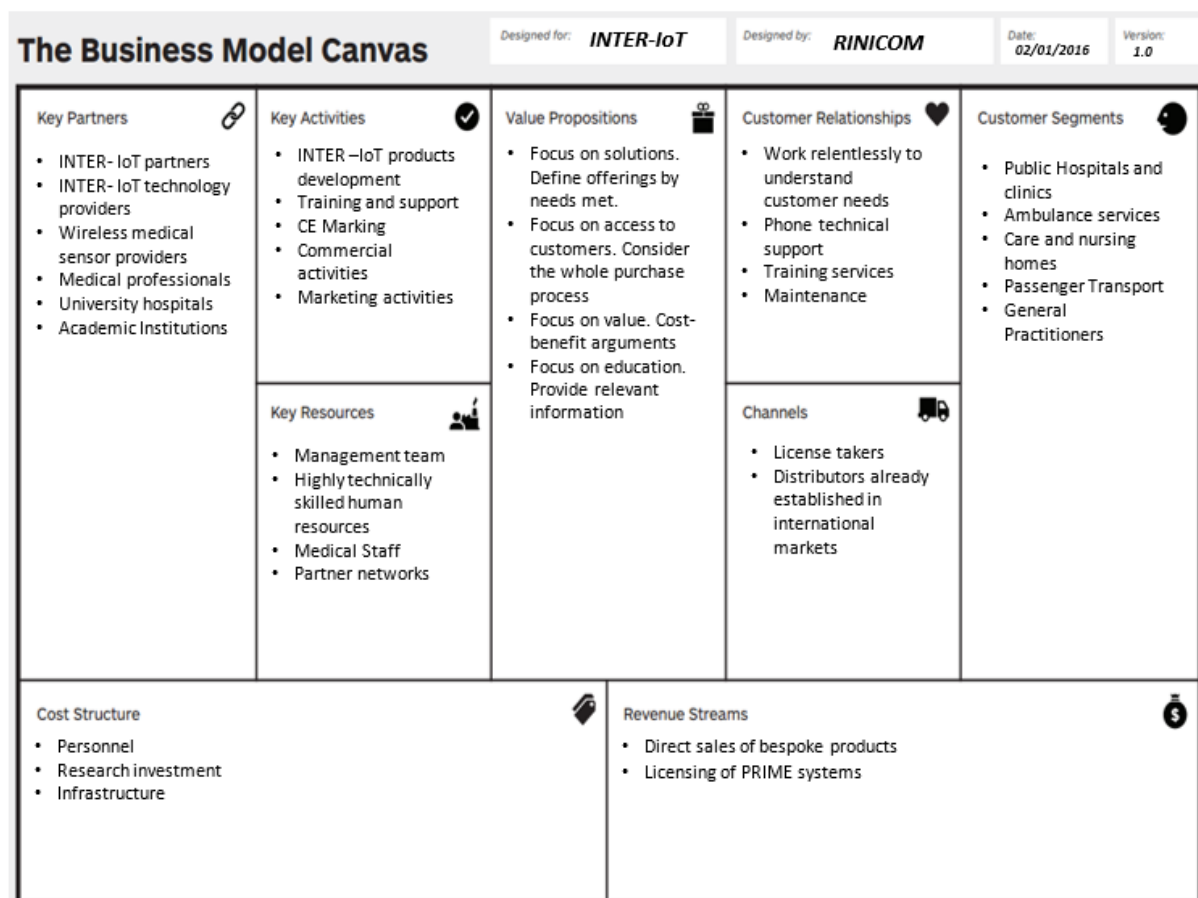


Figure 10: Business Model Canvas – Rinicom

Rinicom Ltd is a Lancaster-based (UK) SME that offers state-of-the-art technology solutions for security, communication and healthcare applications. Products and solutions provided by Rinicom utilise the latest information and communications technologies and provide solid foundation for enhancing its users' quality of life.

Rinicom aims to take advantage of INTER-IoT potential by addressing the major public issue of lack of hospital beds in many regions of Europe. The value proposition can be summed up in the following marketing slogan: "Make any bed a hospital bed". This slogan covers the main attribute of the system by indirectly conveying the unique selling proposition of remote consultation and critical decision-making support with the PRIME system.

Therefore, Rinicom aims to take advantage of the INTER-IoT results by exploiting the interoperable IoT platform to avoid unnecessary transport and admission of patients, who could be treated by the paramedics or their GP rather than in a hospital.

Rinicom's sales strategies are based on the environmental circumstances discovered during the market and industry analyses. The recommendation is to pursue a two-pronged sales strategy that can be adapted to each niche market to suit local considerations.

A licensing strategy supports both the market entry strategy and utilises the company network of industry contacts. Furthermore, a classic key management account strategy should be implemented to seek out prospective license takers.

In a marketplace where information about products and prices is abundantly available for purchasers the selling message must revolve around the advantages and benefits the products offer in outcomes and efficiencies through reduced cost of care, shorter hospital stays, and lower rates of repeat treatments. These messages must include the benefits obtained from avoiding unnecessary transport and admission of patients, who could be treated by the paramedics or their GP rather than in a hospital. The key messages will revolve around decreasing the cost of care and improving the efficiencies of resources available.

In the first stage of bringing IoT technology to the healthcare industry, work will be done with the established partners, who have uttered their support and interest in the platforms and systems created. Such partnerships have the added advantages that product development could be sped up and improved because of the amount of feedback inherent in partnerships. This iterative approach to product development and market entry will ensure a positive outcome in early stages.

Following on from the positive experiences of the partnerships in phase 1, the positive work with IoT partners, and with a base of customers and clinicians who can vouch for the product value, the aim is to become the competitive standard in the market. This will of course require a targeted marketing effort to raise the awareness, including attending tradeshow and conferences, networking events, and actively create 'buzz' through the use of social media and public relations through industry magazines and journals. In addition, academic papers will be valuable to support the case for the IoT.

This IoT product is aimed for the healthcare industry and as such, the core sources of income are categorized as business-to-business (B2B). The product will be distributed through personal selling using key account managers, who will offer options for both direct sales and licensing agreements to prospective customers. Each identified market niche will require a bespoke approach based on geography and industry.

An effective management team is essential to the successful delivery of the INTER-IoT solution. Maintaining relationships with medical professionals and partner organizations is a priority. They have the ability to inform product development through initial testing and running of trials. They also have a commercial benefit, as they will facilitate market entry and provide reviews of the product to develop further the reputation of the INTER-IoT solution. Highly technically skilled human resources will also be invaluable in the implementation of end user requirements and the assurance of a reliable end product.

In addition to key development partnerships with end users, and because the markets in general are quite complex and very well-established, it is important to seek out prospective partnerships with large incumbent players to facilitate fast access to the market. Just a few sales to one or two of the major players will go a long way towards fulfilling the achievement of targeted forecasts for the first year. Participation in INTER-IoT will raise the profile of

Rinicom and may offer opportunities to develop relationships with larger firms well established in the industry.

The main costs for Rinicom to develop its business model are due to people, software developments, commercial and marketing costs, research and consulting fees, and purchase of medical wearable devices for integration.

3.6 AFT Canvas Business Model

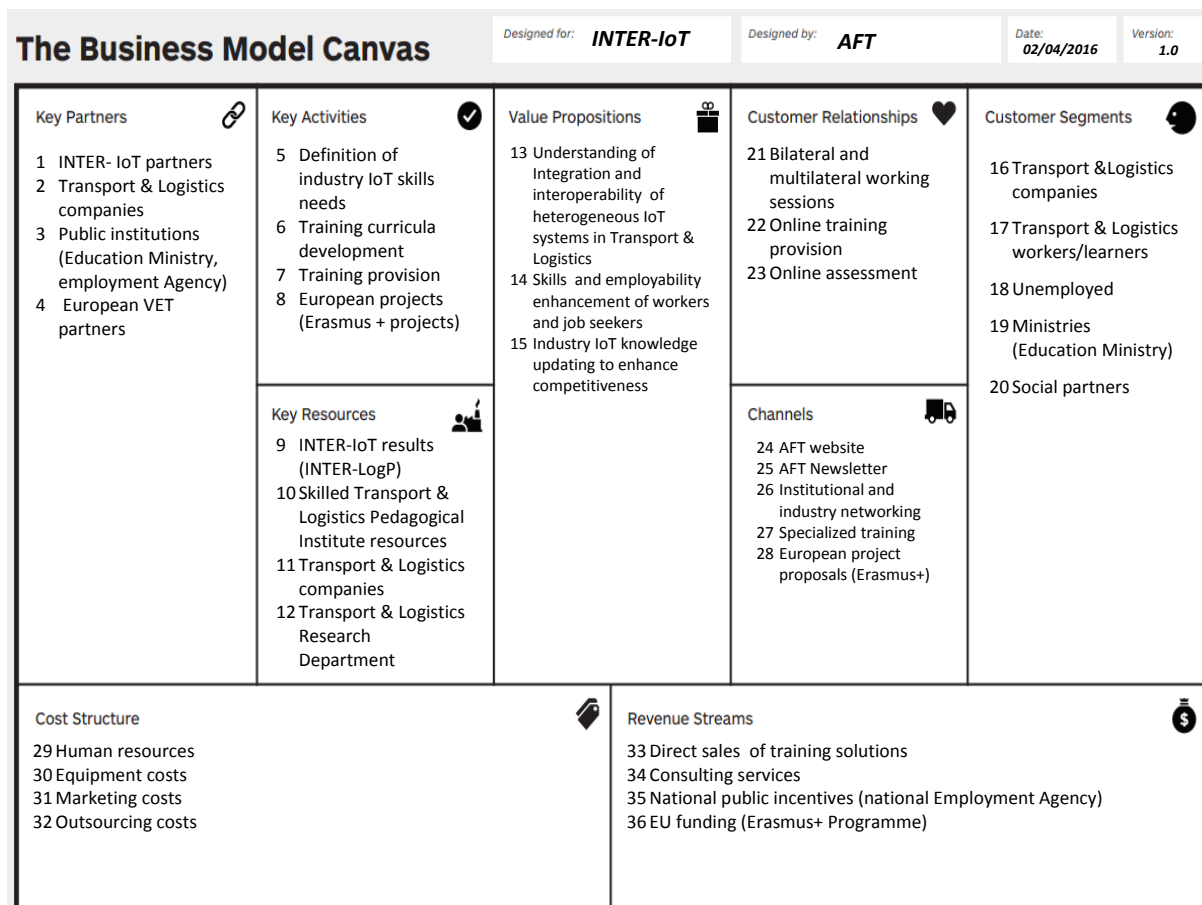


Figure 11: Business Model Canvas – AFT

AFT is a non-profit organisation responsible for the development of Vocational Education and Training (VET) in the Transport and Logistics industry. Its mission is to work for companies covered by the French national collective agreement for road transport (passengers/ goods) and related activities such as logistics and forwarding, as well as industrial and commercial companies with their own means of transport (private - or own-account - transport), to provide them expertise, guidance and technical assistance with VET matters that also encompass employment skills trends.

In this regard, the development of IoT in the transport and logistics sectors, and it is mastering by the sectors' workforce and management, are deemed to be crucial to maintaining and enhancing companies' competitiveness in the upcoming years.

Hence, AFT will use INTER-IoT results to develop training curricula specifically adapted to different target groups, allowing for:

- Transport and Logistics managers to understand where the economic efficiency of IoT in general, and interoperable solutions developed by INTER IoT more specifically lies.

- Transport & Logistics workers or job seekers (professional drivers, Logistics warehouse workers, port management etc.) to extend their skills and competences to efficiently using IoT devices in regular professional environments, thus increasing their employability.
- The overall Transport and Logistics training offer to be updated and compliant with labour market new skills requirements, thus reinforcing the industry's competitiveness.

Moreover, the training material of AFT will be designed to allow for multiple format application ranging from generic fully-fledged training curricula to on-demand and tailor-made training units required by specific industry stakeholders.

By increasing the employability of the learners trained, by facilitating companies' productivity and competitiveness, AFT can offer training solutions with high added value.

AFT aims to take advantage of INTER-IoT solutions by designing its business model in keeping with their main customers such as:

- Transport and Logistics companies growingly resorting to IoT solutions in everyday business activities and seeking adapted training offers and counselling.
- Transport & Logistics workers needing to update competences to adapt to ever-evolving work processes.
- Job seekers currently unemployed who will stand a better chance of finding a job in the Transport and logistics industry if their skills are in line with the industry's new technological skills requirements.
- Education Ministry seeking to update existing Transport & logistics-related curricula.
- Social partners in need of a better understanding of innovative and upcoming professional skills requirements and working conditions.

AFT will use various channels to promote the IoT training offer specifically targeting the Transport & Logistics sectors. It will naturally make good use of its in-house communication channels composed of the AFT website as well as the bi-monthly newsletter addressed to 10 000 sector-related companies in France. AFT will also channel the communication regarding its training offer through AFT's extended network of domestic institutional stakeholders (ministries, social partners, national employment agency, national and regional public authorities etc.). AFT will finally offer its services to its European network of partners (training providers, ICT developers, Communication specialists, consultancies, universities etc.) who regularly unite within the framework of EU-funded programmes such as the Erasmus+ programme through which AFT has successfully implemented a wide range of VET-related projects developing common European approaches and training contents consistent with EU transparency tools (EQF, ECVET, EQAVET etc.).

The training solutions to be developed aiming at facilitating the use of IoT and INTER-IoT results in the Transport and Logistics sectors will be offered/developed to the targeted stakeholders through bilateral (e.g. AFT + Transport & Logistics company) or multilateral (e.g.

AFT + social partners + company) working sessions organised with the customers so as to define what the content of the training offer should encompass (*e.g.* interoperability features, use of IoT for daily operational activities, IoT for strategic efficient transport rounds planning etc.). Moreover the material developed will be designed so as to allow for online provision of training as well as online evaluation of learners performance).

The training solutions developed will receive revenue from different avenues, the first naturally resulting from the sale of training solutions. Other revenues can also come from consulting services that AFT will be able to provide to companies, ministries, social partners, public institutions, learners/workers with regard to existing IoT applications, including INTER-IoT results (especially INTER-LogP results), leading to the best way their application could be guaranteed by their mastering by different industry professionals at an operational level but also at management level. Additional revenue may come from public incentives coming from the national employment Agency for instance to foster updated training in the transport sector in order to enhance employability of workers. Finally, the training offer can be further enhanced through more research and innovation at a European level through the implementation of projects funded by the EU (Erasmus + funding Programme).

The training offer will be built first by building on INTER-IoT results on the INTER-LogP results and outcomes. AFT will also be able to rely on the skilled pedagogical and didactical specialists that work for its Transport and Logistics Pedagogical Institute that routinely develops training solutions for outside “customers” such as the Ministry of Education. AFT will also be able to rely on the vast network of Transport & Logistics companies to provide input on where exactly industry needs lie. Finally, for further enhancement of the training material as well as for fostering a European dimension into the material, the Transport & Logistics Research Department will endeavour to generate opportunities of VET research and development at a European level.

AFT will therefore undertake to define and describe industry skills needs regarding to operational and strategic management use and planning of IoT in Transport and Logistics. On this basis, it will develop key training curricula, potentially - depending on customer demand - encompassing diverse aspects of a training solution, from job profiles, through competence standards, assessment procedures to training units including training approaches and settings descriptions etc.

AFT will further enhance the developed IoT training solutions by extending its geographic scope and coverage through the implementation of European projects (*e.g.* Erasmus + Programme projects)

For the development of AFT IoT training packages, AFT will rely on the valuable assistance of AFT members that are composed of Transport and Logistics companies, on the support of public institutions that promote the development of the VET offer (*e.g.* Education ministry, national employment Agency) and their network of European partners specialized in the development of VET solutions.

The development of the training package will naturally bear fixed costs covering the salaries of AFT personnel involved and will entail equipment costs for delivering training and marketing costs for promoting their training offer. There will also be a need to outsource the development of specific aspects of the training package (development of web-based features, communication material, training supporting syllabus and documentation etc.).

3.7 Noatum Canvas Business Model

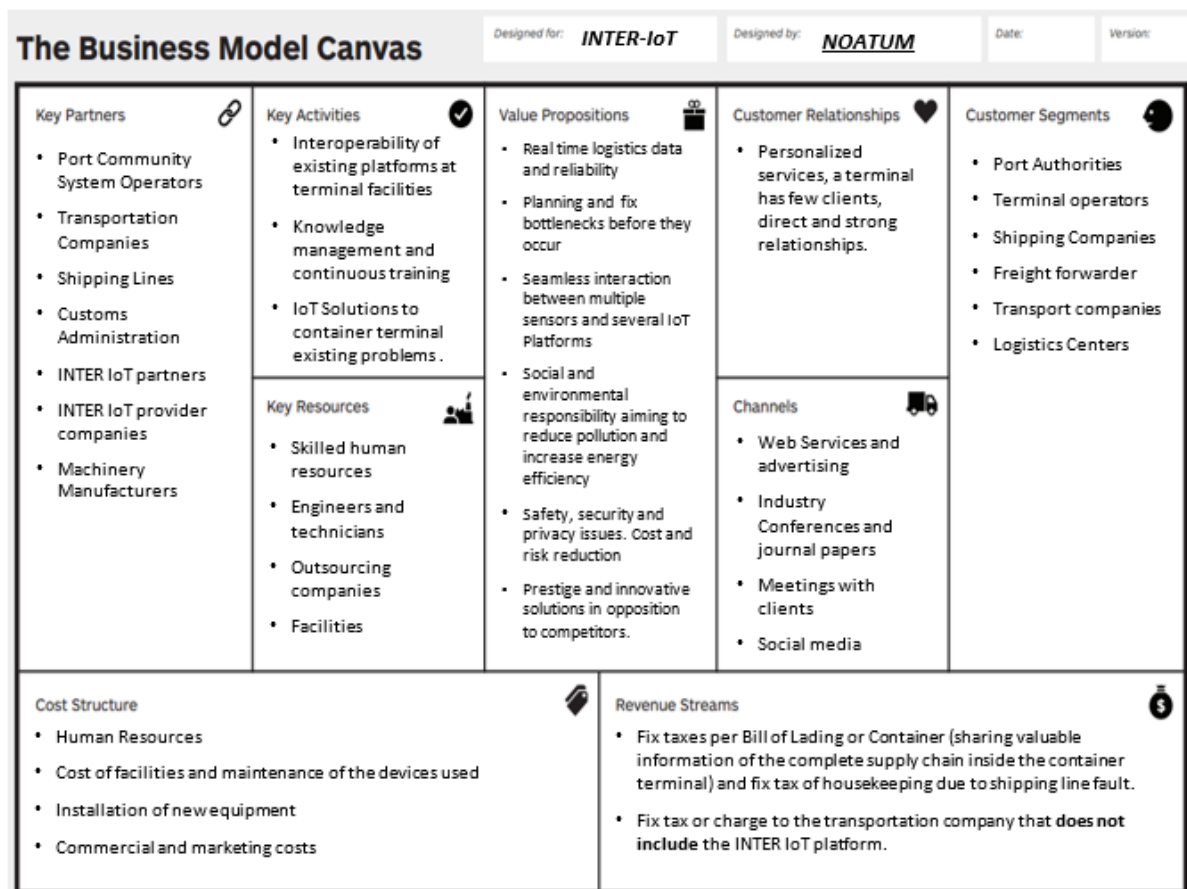


Figure 12: Business Model Canvas – Noatum

Noatum group is the Spanish leader in port-logistic operations. The group operates long term concessions of terminals and port handling facilities managed by an expert team of professionals, with significant investment in facilities and the latest equipment: container, multi-purpose, bulk, conventional cargo, Ro-Ro and vehicle as well as rail terminals.

Noatum Container Terminal Valencia (NCTV) is the main terminal at the leading Spanish port in the Mediterranean Sea especially concerning container traffic. The world's biggest container shipping lines call at the terminal and there are important connections via feeder services. It is the ideal maritime gateway for the Iberian Peninsula and its connections to the centre of Spain, making it the natural port for Madrid. Valenciaport's direct area of influence encompasses a radius of 350 km, which generates 55% of Spain's GDP and includes half the entire working population of the country. The proximity of the Suez-Gibraltar axis, route of the main deep-sea shipping lines is also significant.

Noatum aims to take advantage of INTER-IoT potential by offering enhance visibility of their cargo to its customers. Additionally, Noatum will use the IoT platform to offer value-added services such as reefer container monitoring, parking spaces information and just-in-time operations.

Noatum adds value to its customers by offering real time information and care of the temperature of the reefer containers (refrigerated cargo). The remote inspection and monitoring of reefers also reduces the danger associated with people walking among container stacks and handling electricity. Noatum customers will be sure that its reefer containers are well connected to Noatum's power supply to feed the container with electricity and that the temperature parameters are correct while the container is at the terminal. Additionally, Noatum will provide the necessary network and data connectivity to its customers so that they can easily check these data from their smart phones.

Noatum value proposition also includes security and parking space availability for road haulier companies operating in Noatum. Thanks to the interoperable IoT platform, Noatum can give an order to the road-haulier truck drive in order to indicate the safety area where each truck should be placed for reviewing the cargo and the safety and security tasks that each driver has to perform in order to comply with the norm and regulations.

As for Noatum group and NCTV they have few clients that are shipping lines, freight forwarders, port authorities and other terminal operators. They have to take great value of their relationship with their clients and to strength, their relationship by taking innovative approach such as developing products, like the INTER-IoT project aims to produce. The main target customers are those shipping lines and freight forwarders that trade with reefer containers and need further logistics information and visibility of their containers.

Additionally, Noatum expects to provide its know-how to other ports and container terminals that want to improve their efficiency with the other companies that interact with the Container Terminals'. To address these necessities, Noatum can sell their know-how as consultancy services to other port terminals.

Noatum will use different channels for offering information, promoting and advertising its new reefer container monitoring and consultancy services. Those channels include social networks, inbound marketing, corporate web page, port industry magazines (port strategy, port technology, containerisation, etc.), and other promotional campaigns at different events and forums. Noatum will also consider the communication of these new solutions by means of attending to conferences, journal papers, meeting with clients, social media and web advertising.

Noatum's key partners for developing its new value added services include Port Community System operators, machinery and industry manufacturers, INTER-IoT partners, software and application designers and other IoT experts.

Noatum's key activities are strongly oriented to the solution of existing problems via INTER-IoT solutions, especially developing the interoperability of existing platforms inside NCTV and their customers. Another key activity is the continuous training of their personnel and the companies that provide INTER-IoT products to Noatum and Noatum's customers.

The core source of income for Noatum is a new fix tax to every shipping line or freight forwarder that trade with reefer containers. The price strategy for this new service will be

calculated considering the extra profit that this new service generate for its users. Some of these benefits are the reduction in times and thus in operative costs by sharing information with their main clients. The principal and great saving is the reduction of operative costs to increase the efficiency of the overall supply chain and logistics operation inside the terminal e.g. reduction of traffic congestions, idling time of cranes and external trucks, improving efficiency of reefer containers monitoring.

Other revenue stream identified by Noatum is the provision of consultancy services, decision making, project management and change management support as a business integrator. This second revenue stream will be obtained from those container terminals and port authorities that want to adopt Noatum solutions.

In order to develop these solutions, Noatum will need several resources from their facilities, personnel, engineers and technicians and thus leads to direct costs into new equipment installed at the Container terminal, human resources and maintenance of the devices installed at the terminal.

3.8 XLAB Canvas Business Model

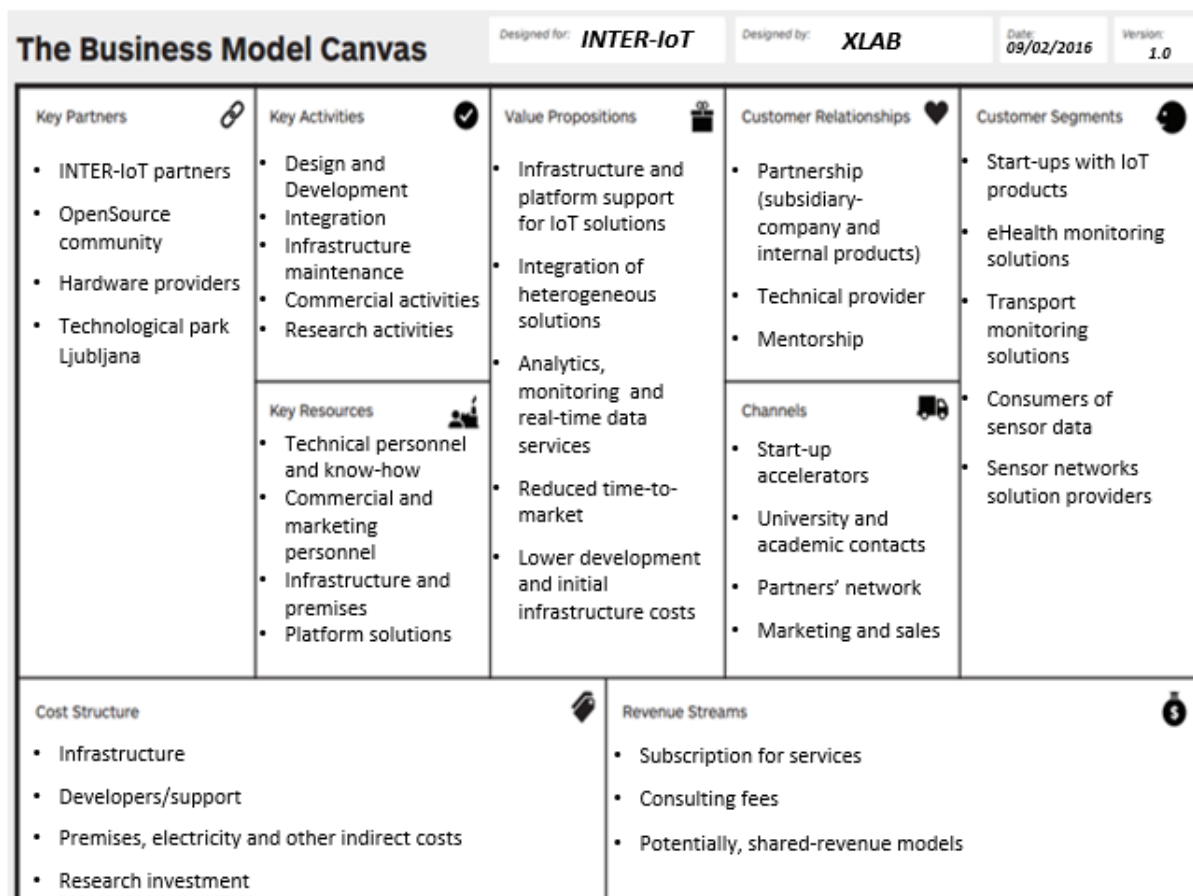


Figure 13: Business Model Canvas – XLAB

XLAB is recognized as one of the strongest computer science research teams outside the academic world in Slovenia. It employs 35 people including 10 PhDs, and the vast majority with MSc or BSc degrees. XLAB also currently runs a program in education with 4 PhD students from various fields (economics, machine learning, computer science e, etc.). XLAB collaborates with 34 external experts, with access to more than 100 experts in the fields of computer science, electronics, mathematics, design and marketing.

Distributed and Cloud systems are the main area of work at XLAB, which has a long experience in very important European projects. The company has participated in FP5, FP6, and FP7 and H2020 projects, as well as several national research projects, most related to Cloud architecture, scalability, security, but also in the fields of interoperability, Big Data, energy, Internet of Things and GIS systems. XLAB aims to further extend its knowledge on Internet of Things, and expand its commercial potential.

XLAB aims to exploit INTER-IoT results by being able to offer a flexible platform that can be used in many contexts of the IoT field, particularly to those related to its business of smart-transport, environmental monitoring, smart grids and people's wellness, that would allow it to extend its commercial potential in those areas.

Current clients to which new and extensive services can be offered include the Slovene Environment Agency (ARSO), which is looking to create a sensor network for the monitoring of water courses, and another one for weather and air quality; the Slovene Civil Protection Service (URSZR), which would benefit with transport sensors for the logistic management of rescue teams; and the Croatian Sentinel start-up, which provides a hardware and software personal monitoring systems for private vessels.

All these current business are based on providing services to third parties for the communication, management and analysis of sensors and smart-sensors. XLAB projects to create standard services for such cases in order to commercialize them for different use-cases with minimal effort.

Another exploitation path being studied is that of consulting, helping businesses to build up their IoT solutions based on existing and open technologies such as INTER-IoT itself.

The value provided by XLAB is thus focused on infrastructure and technology that will allow clients to reduce their technical and knowledge requirements, and lower the time-to-market and operational costs in order to allow for new and innovative businesses.

Its customer segments include on the one hand government institutions and SMEs, which are expected to benefit from the simplification of seamlessly connecting different IoT network, but on the other hand also universities and start-ups, that can bring innovative services and applications to the market that can be beneficial for a wider number of use-cases by jumping over the incompatibility barriers currently existing in the IoT environment. XLAB is currently collaborating with a number of start-ups that can benefit from the platform, and its CEO Gregor Pipan is a mentor at Slovenia's ABC start-up Accelerator. Providing tools and technical support for start-ups allows for them to bring their innovative solutions to the market with lower costs, lower technical requirements, and a wider potential market.

INTER-IoT is expected to open up new channels widen the areas of activity for XLAB, not only with potential cooperation with consortium partners and associated parties, but also new areas such as eHealth, and IoT services in general. Having the infrastructure and deployed services for managing and analysing high-volume, high-velocity data from existing IoT systems allows XLAB to extend these services to other business by means of integration with the INTER-IoT platform, and without heavy investments in additional infrastructure or know-how.

Current revenue streams are focussed in subscription for infrastructure and services, which are negotiated in a per contract basis, but further business models are expected to emerge, including consulting for the deployment of new solutions, and potentially shared-revenue models in which the service profit is split between the application provider (e.g. a Start Up) and the infrastructure and platform provider (i.e. XLAB).

3.9 ASLTO5 Canvas Business Model

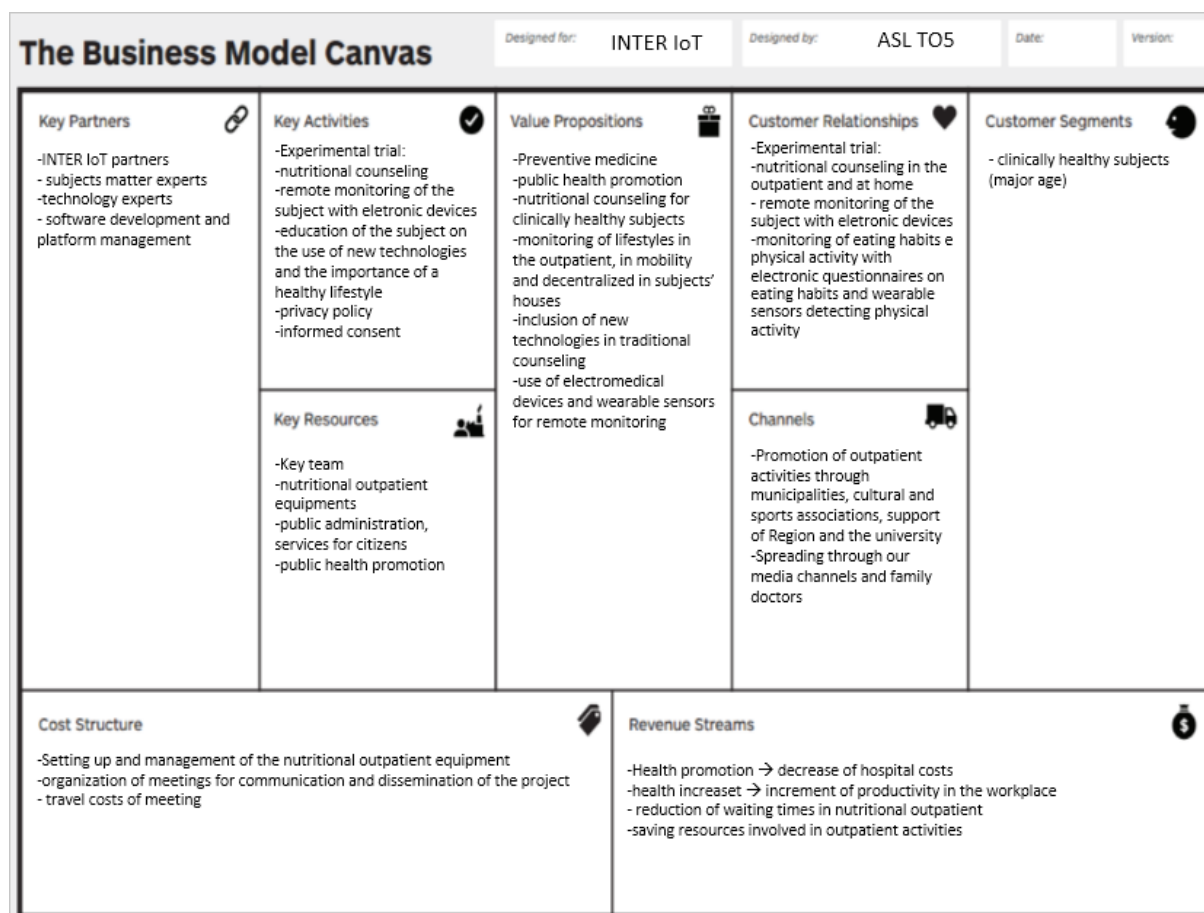


Figure 14: Business Model Canvas – ASLTO5

ASL TO5 is a public body that works in an area of 794.670 square kilometres. In particular, the Hygiene Nutrition Unit of the Complex Unit of Food and Nutrition Hygiene works in preventive field: promoting an appropriate healthy state and practice of physical activity to prevent the development of chronic degenerative diseases, nutritional counselling and educational interventions on the population. Within the project, it will work to demonstrate the importance of IoT in health care, building a network of connections between users and medical staff to ensure increased effectiveness and health benefits, using same resources, with high impact on users.

ASL TO5 is a partner of the project and is responsible for the development of the health use case concerning monitoring of lifestyles "Decentralization and monitoring of lifestyles" during the Integration and Pilot deployment to improve and overcome the methods, tools and traditional protocols. Therefore, ASL TO5 aims to take advantage of INTER-IoT potential by offering healthcare solutions to its potential consumers.

ASL TO5 has identified different customer segments among its potential customers. Those segments are: clinically healthy subjects (major age) who want to monitor their health status. Subjects eager to reach and maintain a healthy lifestyle, who want to control themselves their health status. Any time, using IoT technology, they will be able to check their physiological parameters, collected during the visit in the outpatient by the health care operators, and data collected with electronic devices and wearable sensors at home and in mobility about their eating habits and physical activity. Subjects and health care operators will be able to check any improvement or worsening of health status during the health pilot through the nutritional counselling of health operators in the outpatient and follow their development with the applicative on their electronic devices.

The value proposition that distinguish ASL TO5 offering from its competitors can be summed up as follows:

- Preventive medicine: Prevention is a tool, which demonstrates its long-term effectiveness, counteracting today the possible spread of disease that may be manifested in the individual tomorrow. The goal of prevention, however, is not addressed to the individual but to the community, proving the importance of not only the promotion of a healthy lifestyle but also education and information for the citizen in the field of health. The use of INTER-IoT will allow ASL TO5 to offer its clients a completely innovative point of view in the prevention medicine. The technologies could add value to nutritional counselling and this approach could be translated in other preventive fields, becoming a key factor to differentiate the provision of services and solutions for the integration of heterogeneous IoT platforms.
- Public health promotion: ASL TO5 outpatient offers citizens a nutritional counselling service, promoting the field of preventive medicine, a healthy diet and a proper and active lifestyle.
- Nutritional counselling for clinically healthy subjects and monitoring of lifestyle in the outpatients, in mobility and decentralized in subjects' houses: the proposed service is a nutritional counselling that monitoring the subject not only during the visit in the outpatient but also at home and in mobility with the help of IoT technologies.
- Inclusion of new technologies in traditional counselling: M-health, through the use of mobile devices or sensors for the collection of data, fits into this technological evolution context, in the transition from the replacement operator technology to the control of the user technology, improving the efficiency of services, giving to the user a great accessibility to health services and growing their involvement of their own health.
- Use of electro-medical devices and wearable sensors for remote monitoring: Despite the widespread dissemination of technologies and smart objects, not everyone is able to understand this opportunity for development, the goal meant to address the whole community, offering an innovative service but at the same time clear and accessible to all citizens.

ASL TO5 will use different channels for offering information, promoting and advertising:

- Promotion of outpatient activities through municipalities, cultural and sports association, support of region and the university: Through media channels, municipalities, sports and cultural associations, ASL TO5 recruit all over the territory, people who have a basic knowledge using smart objects and awareness on the importance of an health lifestyle, who may be suitable for testing new solutions or functionalities of electronic devices. Subjects must be at least 100, of major age and clinically healthy.
- Spreading through media channels and family doctors: Research tools and strategies for helping the communication between physician and subjects, inserting the concept of using electronic medical devices as part of the outpatient healthcare-centre equipment, including on the top the education to a responsible use of these devices, for both the operator and the subjects.

ASL TO5 will carry out an experimental trial of a nutritional counselling in the outpatient with a remote monitoring of subjects with smart devices, decentralized at home recording their eating habits and physical activity with electronic questionnaires on eating habits and wearable sensors detecting physical activity. Following their health status analysing data collected during visit in the outpatient and through the electronic devices and body sensors ASL TO5 will be able to constantly monitoring them and suggesting actions to be undertaken to improve their health status through a cloud-based platform to connect medical devices and the health care centre allow at the same time subjects to check their own health status.

With this trial ASL TO5 could prove the maintaining, or even the increase, in well-being of the individual health, a new kind of health care service for the whole community. A reduction of outpatient costs, given by the resource and equipment use, the work of health care professionals team, the occupation of the outpatient rooms, could allow ASL TO5 to develop an increase productivity for expand service offers to user's request: An increment of productivity means follow a higher number of subjects with the same amount of resources, maintaining the same level of quality services. Reducing users' waiting times in nutritional outpatient, and offer an ease health service, with the resulting increase in the number of activities and services from the starting outpatient proposals. A healthy individual guarantees greater production activities in the socio-economic field, reducing the days of absence for sick days. According to H2020 objectives in the medium to long term integration should cover all the main areas of health care, To invest today on health promotion means decreasing hospital admissions in the future, reducing hospital costs and saving resources involved outpatient activities.

ASL TO5 will need several key resources to meet the above-mentioned goals:

- Key team: physician, biologist nutritionist, dietitian, food technologist
- Nutritional outpatient equipment: During the nutritional counselling, the health operator records subjects' data that arrive to the nutritional outpatient on a nutritional folder. The nutritional folder is a tool used to manage the subject data, which are

collected during visit and check with health care professionals. This type of nutritional folder is an off line folder managed with EPI INFO software creating pages in excel format. It is used to record health and sensitive data of subjects such as: personal data (name, surname, age), anthropometric data (weight, height, BMI, waist circumference, blood pressure), eating habits and physical activity. The data collected is protected under national law "Code regarding the protection of personal data". Their reference for service for citizens are healthcare professionals, such as private or public hospitals, nursing homes, local or regional health organizations, Public administration for spread and communicate health promotion.

The key activities that ASL TO5 has to develop in order to meet its expectations and achieve a successful business case are the following:

- **Experimental trial:** The nutritional counselling activity in the outpatient during visits and pre-checks is timely action. The goal is to achieve a constant monitoring of the individual, both at home and in mobility. The subject use electronic devices through filling electronic questionnaires, scoring his/her eating habits and use wearable sensors that send data recorded directly to the outpatient. This action is based on objective measures (weight, height, BMI, waist circumference, blood pressure) and subjective measures (eating habits and physical activity). However, it could be even more effective and impressive if, thanks to the introduction of new technologies, as electronic devices and wearable sensors, can act on the common modifiable risk factors and relying on, no more subjective, but objective measurements of the subject. Thus, the data will be measurable, quantifiable and comparable and it will be also possible for the subject keeping track on his/her profile through the application of electronic devices.
- **Nutritional counselling:** The health care staff operators collect during the first visit the subject personal data and anthropometric data (weight, height, BMI, waist circumference and blood pressure) that they will be monitored during subsequent checks. At home the subject, with the aid of electronic devices, will compile questionnaires on eating habits, and in movement, with wearable sensors, data can detect the physical activity performed by the subject by counting calories consumed or mileage tracking.
- **The remote monitoring of the subject with electronic devices may demonstrate the effectiveness of a possible future integration IoT activity of outpatient nutritional counselling.** We inform and educate those who, do not know or do not routinely, use such technology, the use of smart objects, such as smartphones or tablets, and their applications and we have to show the functionality and operation of wearable sensors.
- **Including technologies in the nutritional outpatient: teaching and training physicians and subjects the use of software and hardware essential for the patient's health.** Education of recruited subjects on the use of technologies involved in the experimental study, in order to acquire adequate skills for appropriate use of such tools. It should also be guaranteed non-discrimination for those who cannot or will not be able to

access these technologies, always guaranteeing the offer of alternative solutions for health treatment.

- Privacy policy: The subject will be informed about the modalities of the nutritional counselling, on the management of their data and on the functionality of these devices and sensors through an information sheet, signed by the person involved and through an informed consent, in accordance with current legislation on privacy and protection of personal data signed by the subject for the safety, security and privacy issues and for the social responsibility, aiming to enhance health prevention for citizens health care.

ASL TO5 will need several partners to achieve its objectives and facilitate the implementation of IoT results in the health care industry. Those partners are:

- INTER-IoT partners: Partners suppliers of devices and sensors for the medical domain, services and software providers specific for the healthcare field, in which their experiences and their specific technological knowledge could be useful and applied in the context of INTER-IoT project within the INTER-Health Pilot: the possibility of integration of different platforms and the creation of m-health services for citizens and patients with the integration of different medical devices and sensors.
- Subjects matter experts: Integration between partners in the management and organization of health and social services with links between the different health care settings, hospitals and territory, including healthcare and social operators in private or Public Administration. Wellness operators collaborate with the key team of the nutritional outpatient to implement and involve the population, in particular recruited subjects. Outside the outpatient, family doctors, private or public hospitals, nursing homes, local or regional health organizations could need some information, related to the subject, to get a picture of his/her health status through the data collected on eating habits and physical activity, in order to intervene, in a timely manner, and ensure an ongoing basis on the health conditions of the subject.

ASL TO 5 is available to spread its research to evolve and adapt its offer, keep working on the nutritional field, using cloud, IoT and Big Data technologies, to create innovative approaches with the subjects and the whole population, for improvement its services and solutions in the healthcare.

- Technology experts: The INTER IoT project will analyse usability of provided solutions from the perspective of IoT platform creators, IoT platform owners, IoT application programmers and users investigating business perspectives and creating new business models. The availability of even more medical data will stimulate the creation of new opportunities and products: training doctors and patients using electronic devices and offer continuous technical support to them. Exploiting experimental solutions in particular in the telemonitoring field, collaborate to build platforms for the case inter-health study, designing intuitive and simple applicative to ensure adequate tools useful for both physicians usability and for subjects accessibility.

- Software development and platform management: Overcome the lack of interoperability between smart objects of the heterogeneous IoT systems in health care field programming the development of web platform with systems engineers for configuration, management and maintenance of dedicated servers in the cloud.

The cost structure on which the business model is based is the following:

- Setting up and management of the nutritional outpatient equipment
- Organization of meeting for communication and dissemination of the project
- Travel costs

3.10 ABC Canvas Business Model

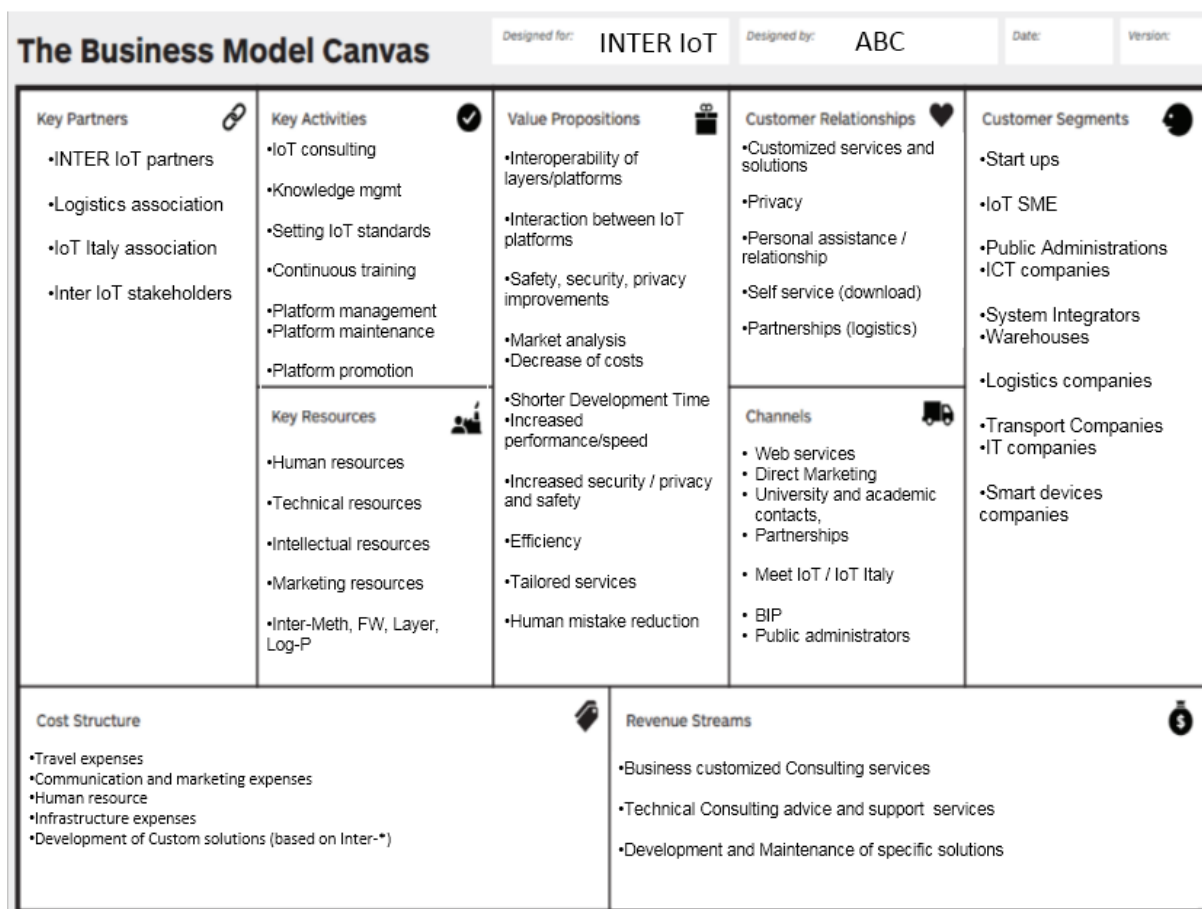


Figure 15: Business Model Canvas – ABC

Alessandro Bassi Consulting (ABC) was created in 2010 with a specific vision: help its clients to get beyond stereotypes and enable real innovation in different application fields using advanced ICT solutions. In particular, Alessandro Bassi Consulting has a significant experience in managing multi-millions cooperative research projects, spanning geographically from Japan to Brazil, from China to the United States, from Europe to Taiwan.

Alessandro Bassi, the founder of ABC, has a deep knowledge of Internet of Things baseline technologies and solution, having pioneered the space since 2007. Currently, ABC focuses on three convergent topics: the set of technologies belonging to the Internet of Things domain, with particular regards to the Smart City domain, technologies and mechanisms for high performance data transfers for Cloud Computing and Storage, and advanced security analysis for developing a Secure Internet of Things.

Alessandro Bassi was nominated as one of the members of the IoT Expert Group, advising the European Commission to address technical, legal and organisational challenges of IoT and contributing to a shared vision for the development and deployment of IoT in the Digital Agenda for Europe. He is an expert for ENISA, the European Network and Information Security Agency, on possible threats coming from the adoption of IoT technologies.

ABC's most important customer segments related to the INTER-IoT products are on two different segment sides: Start-Ups and Medium-to-Large Enterprise. Those may belong from different application domains, spanning from Information and Communication technologies companies, System Integrators, or Logistic companies. As ABC is also a founding member of Best Ideas and Projects (BIP), an Italian association that has strong links to several Logistics enterprises, the Customers segments are clearly enlarged beyond the more natural Technological companies to Warehouses, Logistics and Transport companies. Furthermore, as ABC has strong ties with Public Administrations, this can also be a strong segment for proposing INTER-IoT artefacts.

ABC's main value proposition to its customers is a thorough understanding of the IoT market, technologies, business models, leveraging the customers' existing knowledge and organization. This naturally translates to radically new business models, a higher operational efficiency and a shorter development time. Furthermore, ABC brings in a solid experience in the Security and Privacy domains, improving the customers safety and compliance to privacy policies.

Usually, ABC leverages different channels for reaching customers. While the presence on the web and social media acts as a very direct and powerful mean, strong channels are also through the different associations ABC is partner with, such as BIP or IoTItaly, or the organization of events such as MeetIoT. Another important channel is though the Universities and academic contacts that may lead to strong partnership with industry, particularly with innovative start-ups.

The personalized and custom services that ABC is providing to its customers lead to long and strong relationships. ABC strive to understand the customer culture, first and foremost, and to study its current operational strengths, in order to build a solid relationship that is able to last through several projects and several areas.

ABC's revenue stream is through consulting services, providing advices and guidance to different customers. This will be also the case for INTER-IoT related activities: as the source product of INTER-IoT will not produce any direct revenues, ABC will use its knowledge in order to help customers to exploit all features and capabilities of the tool. Furthermore, ABC could provide guidance and management in case of specific and custom developments based on the INTER-IoT tools.

The first and foremost key resource for ABC within this project will be the technical knowledge developed during the course of the implementation of the solutions.

The main activity spamming from INTER-IoT will be consulting to customers that are embracing INTER-IoT tools. Other important activities will be related to developing IoT standards and promoting the INTER-IoT tools among different groups of stakeholders.

Partners in this venture will be the INTER-IoT consortium partners, as we hope to develop a strong and solid working relationship that goes well beyond the space and time boundaries of this project, and the participants of several industrial associations such as IoT Italy and BIP.

The main costs related to ABC activities within this field are linked to communication and marketing, travel, and some infrastructure expenses. Clearly, if there will be a need of developing a custom solution for a specific partner, based on one of the INTER-IoT tools, this implementation will have a specific cost.

3.11 Neways Canvas Business Model

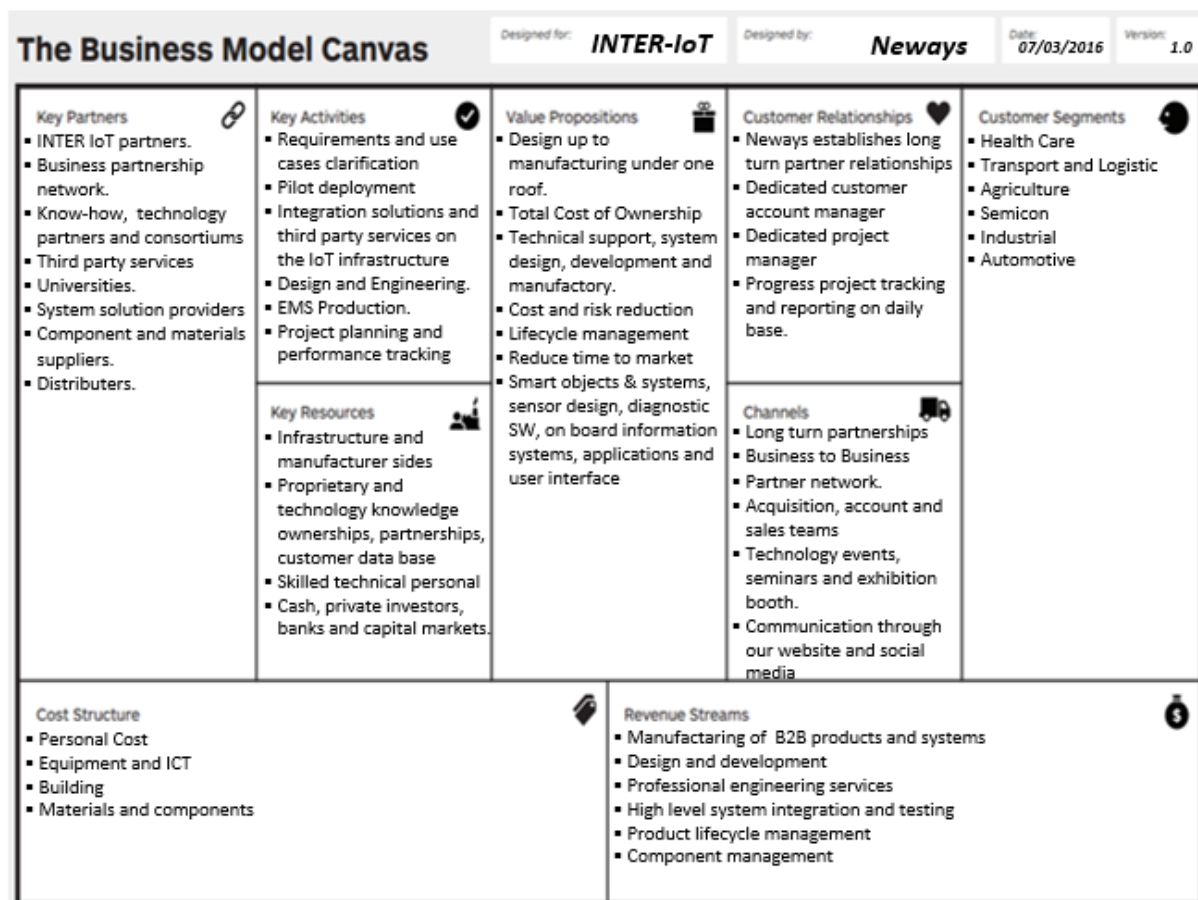


Figure 16: Business Model Canvas – Neways

Neways Technologies BV (NT) offers a combination of services covering the entire product life cycle of high quality industrial electronic applications. These services range from co-development up to sustaining services. NT is a member of Neways Electronics International NV, listed on the Euronext Amsterdam Exchange, a global operating developer and supplier of electronic solutions for the industrial and professional electronic industry.

Neways develops, produces and assembles: from (micro-) electronics, printed circuit board assemblies and cable assemblies to complete box-built products and systems. Neways has operating companies in the Netherlands, Germany, Eastern Europe, Singapore and China.

Neways has a strong technical know-how base on electronics, electro-mechanics, industrial realisation and production. Their expertise is embedded in the solutions and products developed for world class leading high-end technology industrial partners within health care, transport & logistic, agriculture, semiconductors, industrial, automotive, defence, marine, industrial test and analysis, telecom, and aerospace. Neways specialises and deploys in their daily work enabling embedded systems solutions, peripherals, (remote) sensing, system interfaces designs, standards, safety requirements, medical requirements, mobility with low power consumption, mesh networking, wireless technologies.

Neways Technologies creates value to different user activities of its customer base. Focusing on the INTER-IoT application domains Neways has identified and distinguish the following types of Customer segments: mobile health, transportation & logistics, agriculture, semicon, industrial and automotive.

Some intrinsic advantages of INTER-IoT exploitable products for these segment sectors are:

- Smart objects will be significantly more intelligent, identify the spot and monitor processes.
- Smart objects will self-standing autonomous, in most cases, without intervention; communicate directly with various (end) users. Only user's relevant data will be transmitted.
- Real time data access and processing for decision-making.
- Without the intervention of human activity onsite processes or adjustment will be managed.
- Instead of responding as feedback on issues, we will move on more models driven prediction processes.
- Continues challenging issues as the interoperability, big data, safety, security, privacy, and digital fingerprint and information ownership.
- Service improvement lead to more efficiency, cost and risk reduction.
- Delivering other (new) services changes many traditional business models.
- Social and environmental responsibility aiming to reduce pollution and increase energy efficiency.

The value proposition of Neways is design up to manufacturing under one roof.

The needs (problems) of Neways' customers consist in embed new methodologies into, and to improve the technology (robustness, cross platform interoperability, total cost of ownership) and the applicability. Analysing these customer needs, Neways expect a specialized IoT technology and applicability coverage per segment in more detail for:

- Healthcare; smart sensing, smart objects, wireless network platform, merge and combine databases, application & SW-program integration, analysis, diagnostics, safety, administration & security, privacy & business critical.
- Transport and Logistic; smart sensing & actuation, smart objects, rugged design, long term-stable operation, wireless network platform, smart nodes & gateway routing, network range, data-dependability, big data, merge and combine databases, application & SW-program integration, analysis, check, track & trace, safety, administration & security, privacy & business critical.
- Agriculture; smart agriculture, smart weeding, smart transport, logistic & warehousing, smart sensing, smart objects, rugged design, user interface, agriproduct sampling, long term-stable operation, wireless network platform, smart nodes & gateway routing, network range, dependability of data, big data, merge and combine databases, predictive processing, analysis, diagnostic, application & SW-program

integration, position, check, track & trace, remote control, administration & security, privacy & business critical.

- Semiconductors; smart sensing, long term-stable operation, ultra-high-speed network, dependability of data, big data, analysis, diagnostics, high speed forward error process control, technology attributes at the edge of industrial standards.
- Industrial; smart sensing, long term-stable operation, wireless network platform, low power robust network communication, smart nodes & gateway routing, network range, data-dependability, analysis, diagnostics, predictive processing.
- Automotive; smart sensing & actuators, innovative smart power electronics, robust wired and wireless communication network & bus systems, data-dependability, SIL-safety, safe critical remote update, diagnostics, check, track & trace.

The Neways' customer needs are the translation of use case scenarios into: requirements, specifications, system design, development, technical support, manufacturing, cost and risk reduction, lifecycle management, reduce time to market and total cost of ownership.

Bundles of products and services which Neways is offering to each customer segment are: smart object systems, design, diagnostic SW, on-board information systems, applications, solutions for collecting and connecting smart object data, location-specific data and time-specific data (hardware and software) to a database and also develop the user interface to visualise the data to user and the value chain in a user friendly way.

The business relation focus of Neways is to maintain a long-term partnership with its customers. Neways operates in a B2B model. The current customers within the segments prefer to be reached by account, sales or project teams.

New customers and potential market within the segments will be reached by communication through Neways website and social media, technology events, seminars and exhibition booth, but also via acquisition of Neways account and sales teams.

As part of its business model Neways has established long-term partner relationships with the majority of customer's base. Within this model Neways fulfil the business need of its customers to maintain on different levels relationships, such as:

- Dedicated customer account managers
- Dedicated Project manager
- Progress project tracking on daily base

Neways will contemplate revenues streams in the first iteration of INTER-IoT by design, development and manufacturing B2B products and systems. Depending on the needs of the main customer, Neways as technology IoT provider offers too: product lifecycle management, component management, high-level system integration, high-level quality buy testing, professional engineering services.

In order to create and offer a value proposition, reach markets, maintain relationships with INTER-IoT customer segments, and earn revenue, Neways benefits from their resources are categorized as follows:

- Physical assets include; manufacturing facilities, buildings, systems, machine and Test equipment in the Netherlands, Germany, Eastern Europe and China
- Intellectual resources are an important component to maintain their business model, such as proprietary and technology knowledge ownerships, partnerships, customer database, ownership and management for their partners of product life cycle and obsolete component.
- Human resources are crucial in Neways knowledge-intensive and creative industries. This requires experienced and high skilled technical personnel, project-managers, and account manager, commercial and marketing personnel.
- Financial resources and/or financial guarantees, such as cash, lines of credit are borrowing funds from private investors, banks and capital markets.

The most important things and activities for Neways to operate its IoT business successfully is related to; understanding and clarification of the requirements and use cases; define and analyse methods for the device, network, middleware layer interoperability and integration; pilot deployment within transportation, mobile health and cross-domains; integration of different solutions, devices, sensors and third party services on the IoT infrastructure; research, design and engineering of prototypes; Electronics Manufacturing Services (EMS, production), supply chain management, project planning and performance tracking; testing of INTER-IoT solutions; problem solving related to coming up with new solutions.

Long turn strategic alliances with world class leading high-end technology industrial partners within health care, transport & logistic, semiconductors, agriculture, automotive, industrial test and analysis is most common and the cornerstone of Neways business model. As part of a stable relationship alignment of know-how, solutions, technologies and product needs are embedded in frequent planning-meetings with the alliances.

To be competitive in design, develop, manufacture and deliver INTER-IoT solutions and products at the edge of industrial standards Neways maintain a strong strategic partner/relationship with human and materials resources. To achieve innovation, Neways relays on the INTER-IoT consortium partners, IoT business partnership network, know-how and technology partners, its relationships with universities, system solution providers, third party services, material and SW-suppliers, distributor as key source for its knowhow planning and resources management.

The Neways costs structures for INTER-IoT business development can be distinguished by; personal cost, equipment, technical infrastructure and buildings, materials and components.

4 JOINT BUSINESS MODELS

Once we have presented the individual business model of each partner, it is in the scope of this deliverable to include some business and collaboration models for the joint exploitation of the INTER-IoT results. These joint business cases have been designed based on the project's platform technology and around INTER-LAYER, INTER-FW and INTER-METH outputs. The participation and the expertise of the INTER-IoT partners are essential to achieve successful results.

Finally, it is important to stress that the collaboration and participation with other EPI Projects, in TF04 Business Models, has been of utmost importance to gain the necessary knowledge to build these joint business cases.

4.1 INTER-LAYER Business Model

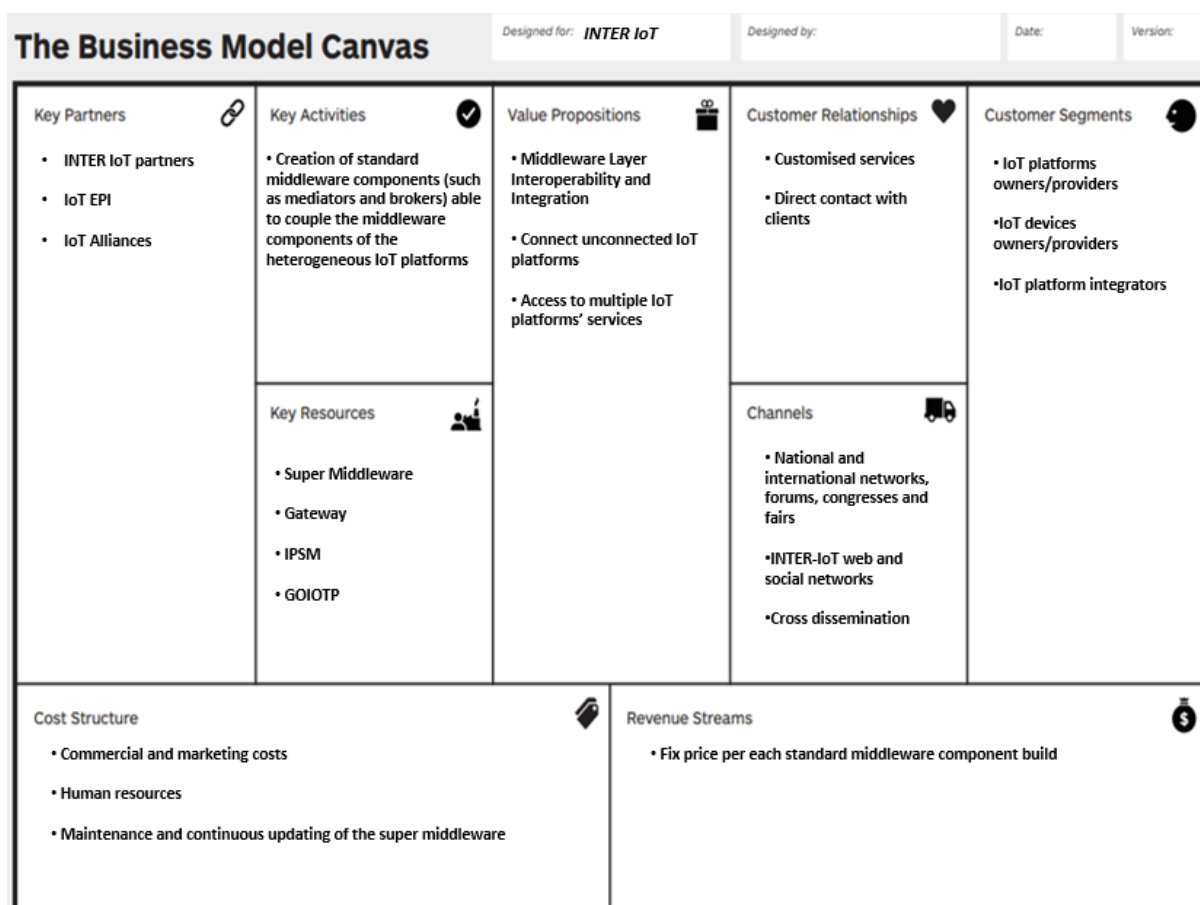


Figure 17: Joint Business Model Canvas – INTER-LAYER

The INTER-IoT consortium is creating a new tool for providing interoperability among and across each layer of IoT platforms. The INTER-IoT “Super Middleware” is a software that allows the interoperability between two or more heterogeneous IoT platforms. Therefore, the INTER-IoT consortium aims to take advantage of the INTER-LAYER product by offering customised middleware components (such as mediators and brokers) able to couple the middleware components of multiple heterogeneous IoT platforms.

The main objective of this business model is that the target customers that buy the “Super Middleware” solution reach middleware layer interoperability. Additionally, it will be possible for them to access multiple IoT platforms’ services thanks to the integration of unconnected IoT platforms. As an example of this, a global automotive company would be able to integrate its IoT platform with its suppliers’ IoT platform to make them interoperable by using the standard components of the “Super Middleware”. Then, it would be possible for them to improve their logistic operations saving precious time and money.

Other solution that this business model offers is a gateway that allows the connection of all machine sensors or devices to a single system regardless of the communication technology that these devices use (Bluetooth, RFID, WIFI, GSM, etc.). The connection between the gateway and the sensors does not need human intervention.

For the creation, development and exploitation of this “Super Middleware” product it will be necessary to count on skilled human resources - expert professionals on this area-, appropriate facilities and the expertise of each partner of the INTER-IoT consortium. The project will have as fixed costs the marketing and commercial costs, salaries and expenses related with the maintenance and continuous updating of the “Super Middleware”.

The INTER-IoT partners will use different channels for offering information, promoting and advertising its layer oriented product. Those channels include social networks, cross dissemination, corporate web page, national and international networks, forums, congresses and fairs.

An essential piece that differentiates this particular business model from others is the personalised and customised relationship between key customers and INTER-IoT experts. The main goal of these experts is to understand the customer necessities, its culture and to study its current operational strengths, in order to build a solid relationship that is able to last over years. Only with such an approach, the main customers will be engaged and loyal to our solutions.

The principal revenue stream comes through a fix price per each standard middleware component build. When a company aims to implement the “Super Middleware” solution to integrate different IoT platforms and it does not have enough resources to deploy it by itself, an overall price will be charged. A similar tariff would be applicable when selling the gateway solution.

Partners in this venture will be the INTER-IoT consortium partners, as we hope to develop a strong and solid working relationship, the participants of other EPI projects and other IoT alliances.

4.2 INTER-FW Business Model

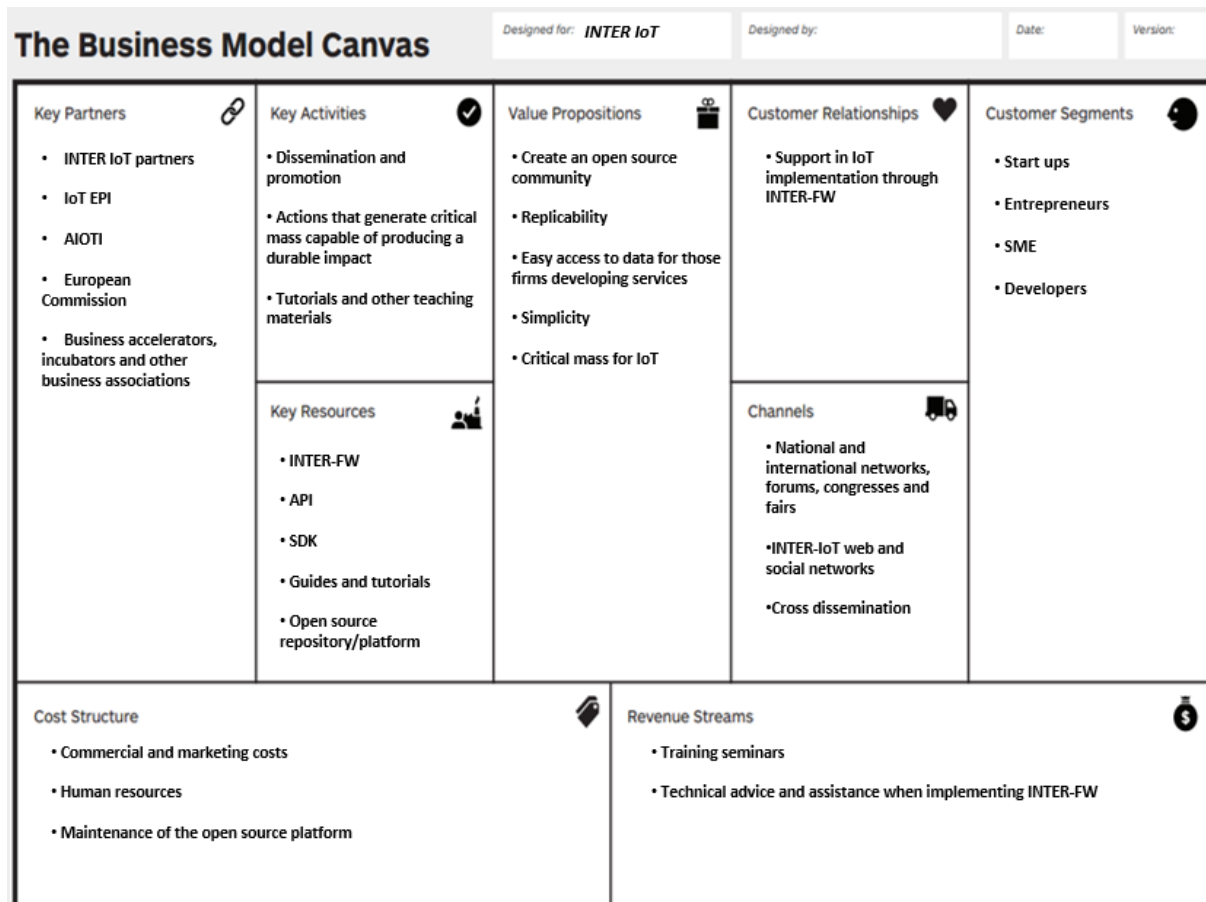


Figure 18: Joint Business Model Canvas – INTER-FW

The business model from above shows how the INTER-IoT consortium aims to create a new open source community on Industrial IoT network management system in order to extend the impact of the project results. A central aim of this business model is to provide benefit to the European member states and their population at large.

The customer relationship is vital for the success of this business case. A healthy open source community depends on the principle of individuals giving back to that community. So, if people have received support from the community, the best way to make sure that situation continues is to reciprocate by providing support to another community member when possible and required.

Some of the key activities to support and deliver value to the community members is the creation of tutorials, reports and other teaching materials that attract the interest of potential users and engage those who are already using INTER-IoT outputs. Engagement is the main aim

of the participation of INTER-IoT partners in open source communities since the main outcome of this business model is that developments within the project participate as a whole or partially in the communities in order to generate impact.

The key customers that the INTER-IoT consortium aims to attract to its open source community are mainly startups, entrepreneurs, medium-sized enterprises (SME) and developers. The INTER-IoT members consider that the target customers should be those who can contribute to the roll out of the project results. Therefore, this business model aims to attract a whole new ecosystem of entrepreneurs and developers that use INTER-FW (API / SDK) and implement the Internet of Things and the interoperability between heterogeneous IoT platforms in as many domains as possible.

The INTER-IoT partners will use different channels for offering information, promoting and advertising its open source community. Those channels include social networks, cross dissemination, corporate web page, national and international networks, forums, congresses and fairs. It is very important to focus the promotion of the INTER-IoT open source community in networking events organized by business accelerators such as the Spanish Lanzadera.

Regarding the previously mentioned content, it can be concluded that the key partners that are needed for achieving a successful and active open source community are mainly the INTER-IoT partners, business accelerators, incubators, the European Commission, other open source communities such as AIOTI and IoT EPI.

For the creation, development and management of the INTER-IoT open source community it will be necessary to count on skilled human resources, appropriate repository/platforms to manage the community, the INTER-FW product (API, SDK, etc.) and the expertise of each partner of the INTER-IoT consortium. The open source community will require some fix resources and costs such as marketing and commercial costs, salaries and other expenses derived from the maintenance and continuous updating of the community platform.

The principal revenue stream in this business model comes through technical advice and assistance when implementing INTER-FW and from training seminars for the members of the community.

4.3 INTER-METH Business Model

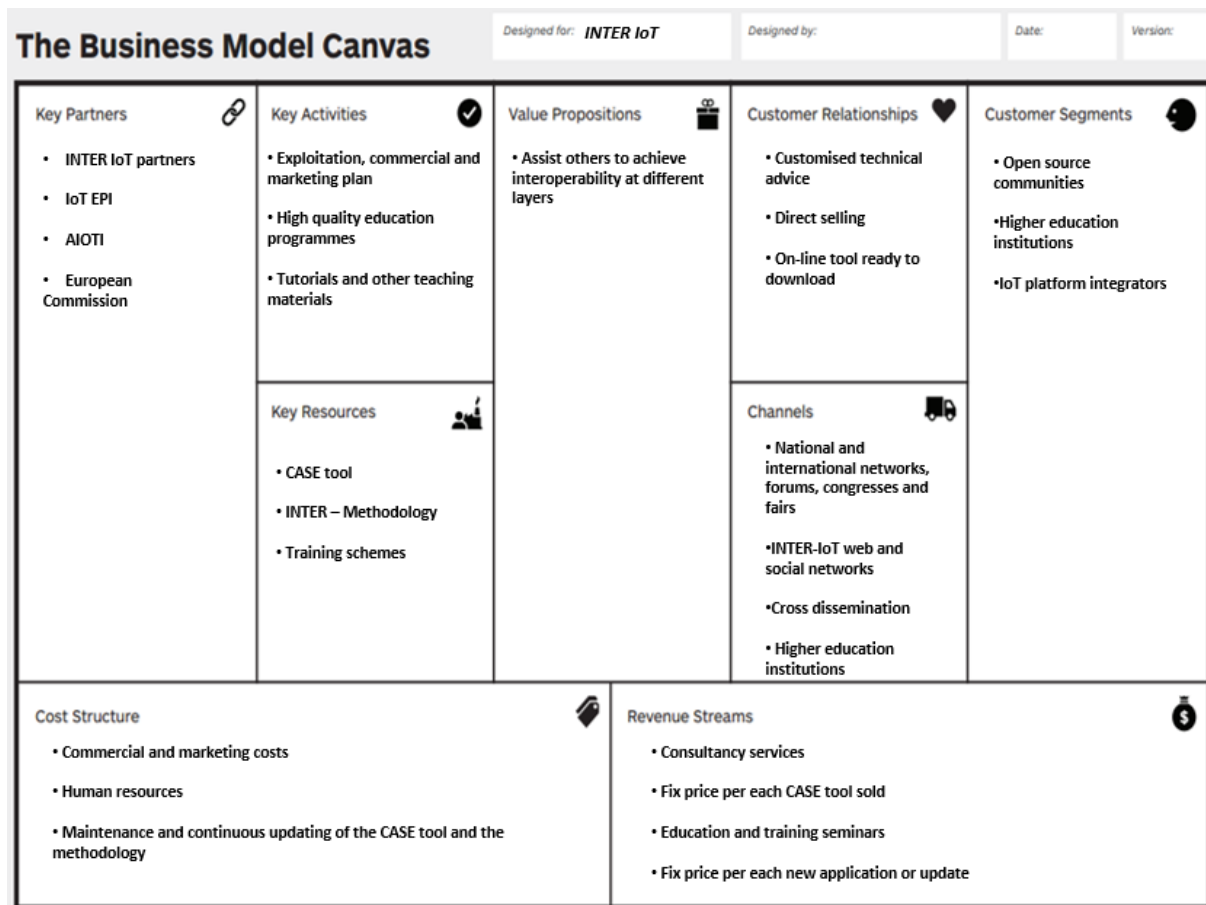


Figure 19: Joint Business Model Canvas – INTER-METH

INTER-IoT will define a special-purpose, systematic methodology, named INTER-METH, that will enable (semi)automation of application of the INTER-FW framework for making heterogeneous IoT platforms interoperate, and guide the process. To support application of INTER-METH, a CASE (Computer Aided Software Engineering) tool will be implemented. It will automate each phase (analysis, design, implementation, deployment, test, maintenance) of the integration process, using the INTER-METH, providing guidelines, graphical facilities, engineering patterns, and project data repositories.

This business model aims to exploit the CASE tool as an indispensable item to support the application of the INTER-IoT methodology. Following the proposed methodology and using the CASE tool, it will be possible to integrate multiple heterogeneous IoT platforms. In other words, this business model is based in consultancy services for those businesses and enterprises that want to achieve interoperability using the INTER-IoT engineering methodology for the integration of IoT platforms.

It is widely recognized that using an engineering methodology is fundamental in any engineering application domain. The manual and non-systematic application of complex techniques, methods and frameworks would very likely lead to an increase of the degree of

errors during integration. Therefore, the value proposition of this business model consist in helping and assisting firms to achieve interoperability among IoT platforms. Different customers may be able to contact INTER-IoT members to ask for technical advice or could also download the INTER-METH product from the corporate website. Helping other firms to connect their unconnected platforms is the way in which the INTER-IoT consortium delivers value to its key customers.

The customer segments to which this business model addresses are divided in three different groups: Open source communities, higher education institutions and IoT platform integrators. The CASE tool and the INTER-METH product can be commercialized in different ways. Customers can buy the products online and use it by their own, they can pay for technical advice and support or they can attend to training and education seminars to learn how to apply the methodology and how the CASE tool works. The customer relationship will depend on how the different customers prefer to access to the products and services offered by the INTER-IoT consortium. In any case, it is important to mention that a close relationship between the client and the INTER-IoT experts will be established when the client demands technical advice and support.

In order to promote and commercialize the CASE tool and its associated methodology, different channels will be used for offering information, promoting and advertising. Those channels include social networks, cross dissemination, corporate web page, national and international networks, forums, congresses and fairs. It is especially important for the successful implementation of this business model to promote the methodology in higher education institutions and other training centres. Therefore, as it can be concluded, some of the key activities are the marketing and exploitation plan, an attractive sales strategy, a well-designed high quality education programme and several easy-to-understand tutorials and other teaching materials.

For the creation, development and management of this business model it will be vital to count on skilled human resources, appropriate repository/platforms, the INTER-METH product (the methodology and the CASE tool) and the expertise of each partner of the INTER-IoT consortium. This business model will also require some fix resources and costs such as marketing and commercial costs, salaries and other expenses derived from the maintenance and continuous updating of the guidelines, graphical facilities, engineering patterns, and project data repositories.

Finally, this business model consider more than one revenue stream that ensures its profitability. In short, the INTER-IoT partners can obtain profit through consultancy services, charging a fix price per each CASE tool sold, per each education and training seminars and also charging a fix price per each new application or upgrade of the CASE tool.

5 CONCLUSIONS

In conclusion, several different business models can be designed to exploit the INTER-IoT results. The preparation and design of these business models at the initial stage of the project ensure that the project solutions will go far well beyond the space and time boundaries of this project on a long-term scope, producing social and economic welfare in each community and European Member States.

The applicable individual business models for IoT that were described above show many good options to deploy INTER-IoT solutions. A representation of the individual business models designed by the INTER-IoT partners for the exploitation of results is shown in the figure below.

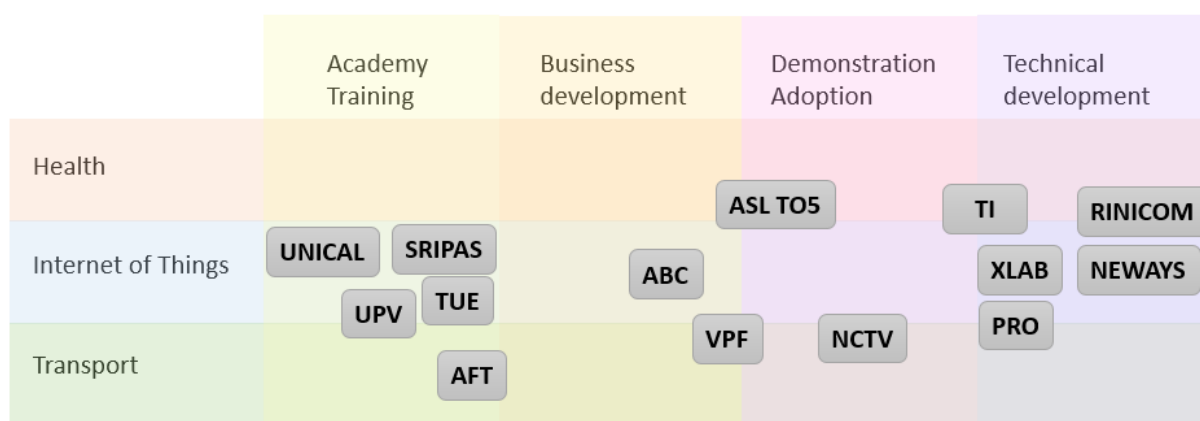


Figure 20. INTER-IoT solutions in different markets

Several business models are addressing transport, logistics and healthcare industries as these has been the target sectors where INTER-IoT will be initially demonstrated. Thanks to the pilot activities to be carried out in WP6, the partners of the project will be able to test the interoperability of heterogeneous IoT platforms in real environments before final implementation at larger scale. Products and solutions to be tested in different pilots will address the interoperability in port environments to prove that an interoperability environment for Internet of Things could improve current procedures and operations, delivering value and efficiency to the supply chain. Pilots in INTER-IoT will also address some health related issues, as for example the lack of hospital beds in many regions of Europe, as well as the use of electro-medical devices and wearable sensors for remote monitoring of patients.

The majority of individual business models have several things in common. As an example, every partner have pointed out that the interoperability of heterogeneous platforms is essential for their value proposition. In fact, all partners have included interoperability among platforms, devices and networks as the indispensable factor for the success and feasibility of the business models.

Another common value proposition that every individual business model address consist in important time savings, reduction of operational costs, better quality of life, social improvements and environmental sustainability to create growth.

INTER-IoT partners' business models show a good balance between academy and training, business development, adoption and demonstration of the results into real environments and technical development of the technologies required. Partners combine a good expertise and are facilitating the connection of technology developers, application developers and complementors that will enhance the impact of the results.

These skills are also well aligned with the IoT-EPI (IoT European Platforms Initiative) Task Forces regarding innovation, platform interoperability, IoT accelerators, IoT business models, educational platform and international cooperation.

Innovation is pursued since the beginning around the demonstration and adoption of interoperable IoT platforms on health and transport industries, creating new enriched environments where wearable and mobile hardware will enable a new generation of applications.

Platform interoperability is at the centre of all activities in the project and it is considering both technical interoperability, semantic interoperability and organisation interoperability. Organisation interoperability will be key in the project as several scenarios in the project are considering an interoperability of a multiplicity of IoT platforms deployed by different organisations.

The provision of an interoperable open IoT framework (with associated engineering tools and methodology) will be given so it will be able to be used by IoT start-up accelerators.

The initial business models presented in the report have allowed getting a broad and analytical view on what are applicable and possible business models within the consortium helping to identify triggers and to find drivers on how business model innovation in IoT can be leveraged.

Educational platforms are also a main element in the business plans of some partners in the consortium, looking for educational needs, based on state-of-the-art of the current educational curricula on relevant IoT technologies device, computing, communication and software layers at academic and professional levels.

The international activities carried out by the partners of the consortium is also considered in the business development establishing liaisons with end-user and IoT technology communities an public administrations.

Finally, all partners have defined joint business models to take advantage of the common outputs of the project. The creation of joint business models, ecosystems, communities and partnerships with the different partners of the INTER-IoT consortium has been identified as indispensable to obtain the necessary synergies and knowledge to implement the proposed solutions. Through strategic business partnerships, it will be possible to create real value for potential target customers.