



ENERGY-AWARE BUSINESS MODELS

Deliverable D3.7



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SHORT ABSTRACT	The Deliverable at hand describes two business modelling approaches that have been developed within TARGET-X in order to create new revenue streams based on the technical developments that have been achieved within the project. Based on the Business Model Canvas, different aspects of both business models are described in detail pathing the way to monetize the developments of industrial 5G use.
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List of Acronyms and Abbreviations

Abbreviation/Acronym	Term
AC	Alternating Current
BMC	Business Model Canvas
CAPEX	Capital Expenditure
EU	European Union
GWP	Global Warming Potential
KPI	Key Performance Indicator
KVI	Key Value Indicator
MAF	Methodological Assessment Framework
MMS	Marposs Monitoring Solutions
MNO	Mobile Network Operators
MSP	Multi-Sensor Platform
OEM	Original Equipment Manufacturer



1 Executive Summary

The Deliverable at hand provides a comprehensive description of energy-related business models developed within the EU-funded research project TARGET-X. The project focuses on accelerating the digital transformation in sectors such as energy, automotive, construction, and manufacturing through innovative applications of 5G technology. A core objective is to demonstrate the value proposition of 5G-enabled solutions by addressing industry-specific challenges and creating new revenue streams based on technological innovation. The described business models are based on the ability of 5G to enhance real-time data acquisition, particularly energy data, which can be monetized and leveraged for sustainability goals like carbon footprint reporting and compliance with standards such as, for instance, ISO 50001. The Methodological Assessment Framework of TARGET-X is a central tool used to evaluate the techno-economic and societal value of these use cases through Key Performance Indicators and Key Value Indicators and it is connected to the described business models. Following a basic description of the theoretic fundamentals of business modelling using the Business Model Canvas approach, two key business models are explored. First, energy data monetization in manufacturing is considered in detail and second, energy monitoring on construction sites is described. Both business models utilize technical developments of TARGET-X that are integrated with 5G connectivity. By addressing customer needs for operational efficiency, sustainability, and regulatory compliance, the developed business models underscore the transformative potential of 5G in fostering innovation and competitive advantages across industries. In this way, the developed business models contribute to the overall objective of TARGET-X to accelerate the digital transformation of the involved verticals and to bring 5G into use in the industry.



2 Introduction

The deliverable at hand describes the outcome of research activities focused on the development of energy-related business models in the scope of the EU-funded research project TARGET-X. One key objective of TARGET-X is to accelerate the digital transformation of the project verticals energy, automotive, construction, and manufacturing. For this purpose, different 5G-based use cases have been developed over the course of the project, focusing on the value adding utilization of 5G technology in different trial sites. The objective of contributing to the acceleration of the digital transformation is addressed by the development of viable business models, as the broad acceptance and application of an innovative technology like 5G in industry can only be achieved, if the value propositions that the technology brings to customers and stakeholders are clearly defined. In this way, customers and stakeholders are enabled to understand how the technology can contribute to solving industry- or use case-specific problems or challenges. Furthermore, business models outline how the use of an innovative technology can generate new revenue streams and enable the generation of competitive advantages for the companies applying the considered technology.

One central benefit of the use of 5G in different application scenarios is the possibility to enhance the amount of data that is acquired, e.g., during the execution of production processes as well as the speed with which it can be transmitted between different entities. This data has (in many cases) not been available before, and therefore entails a certain value, enabling the development of new revenue streams, based on innovative technical developments. The deliverable at hand reports on business models focusing on the valorization of energy-data in cross-sector application scenarios.

One central development of TARGET-X is the Methodological Assessment Framework (MAF) which employs Key Performance Indicators (KPI) and Key Value Indicators (KVI) to capture the value proposition of the use cases that have been implemented within the project [1]. In this framework, KPI are employed to capture the value proposition from a techno-economical perspective while KVI are employed to capture the value proposition from a societal perspective enabling a multi-perspective evaluation approach. In this way, the MAF creates the basis for the development of business models and the evaluation of the value proposition they have to offer.

2.1 Relation to other Activities

The research activities in the area of energy-aware business models were carried out in Work Package 3 of TARGET-X in collaboration with Work Packages 1, 2 and 5. Work Package 1 («Methodological Assessment Framework») focuses on the evaluation of 5G-based industrial use cases and the basic principles developed in this work package to capture the value proposition of a use case was considered during the development of the business models. In Work Package 2 («Construction»), a multi-sensor platform (MSP) was developed enabling the measurement of energy and power consumption of manufacturing operations. Work package 5 («Construction») focuses on the development of 5Gbased use cases on construction sites and also developed an energy-related use cases in which energy consumption data of construction operations is recorded and analyzed. Therefore, the activities and results described in this deliverable have been carried out in an interdisciplinary manner.

2.2 Document Overview

The document is structured in the following way. First, a brief introduction to the fundamentals of business models is given with a focus on the Business Model Canvas (BMC) and its underlying guiding



questions that must be answered to fill out the template. Second, the BMC is applied to structure to different business models that are based on products that have been developed within TARGET-X. The first one was developed in Work Package 2, and the second one was developed in collaboration between Work Package 3 and 5. After the description of both business models, a conclusion as well as an outlook on the next steps are given.



3 Fundamentals of Business Models

For the term business model, a variety of different definitions and understandings exist [2]. A shared characteristic of the different definitions is the consensus that business models can be described as frameworks that outline how an organization generates revenue by creating and delivering value propositions to customers in a structured way. The value proposition is the core component of the business model, and it can - for example - either be delivered in physical products, services or a combination of both. This chapter provides a brief overview over the theoretical foundations of business models and how they can be applied on the context of industrial 5G.

3.1 Theoretical Background

A well-established methodology to describe business models is the use of the Business Model Canvas which has been developed in the year 2010 [3]. In the process of developing business models, companies must prioritize the identification of target customers for whom they plan to create added value with their offerings (products, services or the combination of both). For this purpose, the BMC provides a structured framework for systematically capturing the key components of a business model. This standardized format aids in both internal and external communication, ensuring a comprehensive overview of the company's strategy. Additionally, the BMC facilitates the visualization of intricate interactions among various elements. The BMC consists of the following elements which are defined by answering the associated guiding questions:

Cost Structure:

- *What are the most important costs inherent in our business model?*
- *Which key resources are most expensive?*
- *Which key activities are most expensive?*

Key Partners:

- *Who are our key partners?*
- *Who are our key suppliers?*
- *Which key resources are we acquiring from partners?*
- *Which key activities do partners perform?*

Key Activities:

- *What key activities do our value propositions require?*
- *What key activities do our distribution channels require?*
- *What key activities do our customer relationships require?*
- *What key activities do our revenue streams require?*

Key resources:

- *What key resources do our value propositions require?*
- *What key resources do our distribution channels require?*
- *What key resources do our customer relationships require?*
- *What key resources do our revenue streams require?*

Value Proposition:

- *What value do we deliver to the customer?*
- *Which of our customer's problems are we helping to solve?*
- *What bundles of products and services are we offering to each customer segment?*



- *Which customer needs are we satisfying?*

Customer Relationships:

- *What type of relationship does each of our customer segments expect us to establish and maintain with them?*
- *Which ones have we established?*
- *How are they integrated with the rest of our business model?*
- *How costly are they?*

Channels:

- *Through which channels do our customer segments want to be reached?*
- *How are we reaching them?*
- *How are our channels integrated?*
- *Which ones work best?*
- *Which ones are the most cost-efficient?*
- *How are we integrating them with customer routines?*

Customer Segments:

- *For whom are we creating value?*
- *Who are our most important customers?*

Cost Structure:

- *What are the most important costs inherent in our business model?*
- *Which key resources are most expensive?*
- *Which key activities are most expensive?*

Revenue Streams:

- *For what value are our customers willing to pay?*
- *For what do they currently pay?*
- *How are they currently paying?*
- *How would they prefer to pay?*
- *How much does each revenue stream contribute to overall revenues?*



Business Model Canvas Template				
Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
			Channels	
Key Resources				
Cost structure				

Figure 3-1: Template for the Business Model Canvas

The template for the Business Model Canvas is illustrated in Figure 3-1. Answering the guiding questions leads to a stepwise definition of the business model, an approach which takes a multitude of different aspects into account. After its publication in 2010, a variety of modifications and extensions have been made to the BMC for its application in different disciplines [2], [4], [5]. Although the framework is not free from criticism (e.g., simplification, abstraction, lack of agility), it offers a valid method for business modelling and therefore it has been used within TARGET-X to develop novel business models to enable the commercialization of the solutions developed in TARGET-X to contribute to the key objectives of the research project.

3.2 Application of the Business Modeling Methods within TARGET-X

One of the key elements of innovation for the industrial use of 5G is the availability of shared data which is enabled by fast and reliable wireless communication. In this way, energy-related- measurements like measuring the energy consumption of a construction machine on a construction site are enabled at scale so that more data can be acquired, processed and used to create added-value transparency about certain impactful aspects such as energy consumption. The use of 5G enables the integration of a higher number of measuring points which in turn increases the amount of usable data. This aspect is exploited in the creation of the energy-aware business models which are described in the following sections using the BMC. However, it should also be noted that the newly acquired data should be selectively collected and processed, ensuring that only the most significant insights are stored long-term to avoid creating an unmanageable data pool that consumes resources without being utilized effectively.



4 TARGET-X Business Models

In the following section, two different energy-aware business models are described that have been developed within Work Package 3 of TARGET-X

4.1 Monetization of Energy-measurement Data in Manufacturing

The key objective of the creation of the business model «monetization of energy -measurement data» is the monetization of energy data in cross-sector business models in the manufacturing domain. The integration of the MSP into manufacturing processes like among others milling, drilling, etc., offers the potential to create more insight into the power consumption of the monitored process. This insight into the consumption data represents an added value that makes it possible, for example, to learn more about the process under consideration and to optimize it based on the newly gained knowledge. The MSP has, among other sensors, an Energy and Power Measurement Sensor (described in Deliverable 2.4 [6]) specifically devoted to concurrent AC voltage and current monitoring and is pictured in Figure 4-1. The integration of this MSP offers the potential to measure the consumption of electrical energy inline in the process during execution in real-time so that high -quality measurement data is created through the sensor. The MSP is also equipped with a 5G modem which enables the integration of the platform into a 5G network.

This business model is aimed at manufacturing companies that use machine tools to produce metallic workpieces that are used in a wide range of applications, such as in the automotive, aerospace, and medical technology sectors. These manufacturing companies are the customers that are targeted with this business model.



Figure 4-1: MSP for Energy and Power Measurements



The acquired high quality data can be used to calculate a real-time carbon footprint which is also expressed through the Key Value Indicator (KVI) “Global Warming Potential, GWP” that has been described in Deliverable 1.2 of TARGET-X [1]. The calculation of the carbon footprint offers the potential for monetization of the solution as a growing number of companies is interested in their carbon footprint and requires it for purposes like reporting or the derivation of optimization measures. The energy-aware business model that was developed for the monetization of energy-measurement data by Marposs Monitoring Solutions (MMS) and Fraunhofer IPT is described following the BMC framework. The business model is described from the perspective of MMS as a provider and an operator of the business model with a manufacturing company employing machine tools as a customer.

Cost Structure:

The cost structure is designed in the following way. Initial costs are incurred for the hardware (MSP) including the modem for 5G connectivity and the required software. Regarding the software costs, different cost models are possible. For instance, the software could be offered with a Software-as-a-Service (SaaS) which enables the provider to use subscriptions and pay for usage models to generate revenue. Another option is to make the software available after a one-time purchase. The decision which software cost model is to choose, depends on different factors like the scale of the use (is the solution only employed for a couple of machines or for high numbers?) and as of the creation of this deliverable has not been finally decided on.

Next to the costs that customers need to pay to the provider of the solutions, they also need to consider costs that arise from establishing a connection to a network which is also accompanied with different types of costs (e.g., private vs. public 5G). However, these costs are not taken into account for the business model, as it is up to the customer to decide what type of connectivity they want to realize.

Key Partners:

Next to MMS as provider and operator of the business model, the key partners are Original Equipment Manufacturers (OEMs) of machine tools and Mobile Network Operators (MNOs), like for instance Vodafone who provide the network infrastructure. The OEM is needed to provide their machine tool as well as access to the machine tool control so that the MSP can be integrated into the machining process while the MNO is required to provide 5G network connectivity

Key Activities:

The key activities comprise the tailoring of the solution according to the customer needs, the development of the solution and the deployment into the machining process. The monetization of energy-measurement data business model does not focus on an off-the-shelf solution but a highly specialized combination of a product and a service. First, the product needs to be defined according to the customer’s needs and requirements. These needs and requirements are defined by collaborative discussion between the product manager and the customer, i.e. the manufacturing company. After the requirements have been agreed on, product development is carried out by MMS. The goal is to develop a basic hardware package (MSP) that can be modified according to individual use cases and application scenarios. The software also needs to be adapted according to the defined requirements. Both developments, hardware and software, take place in an iterative manner.

Key Resources:



The key resources for the energy measurement data business model include the machine tool (with access to the machine tool control), the hardware for the MSP as well as the required software. Both hardware and software are available in basic formats and are customized to the respective application according to the defined individual customer requirements. In addition, extensive knowledge about specific measurement approaches is required (e.g., measurement intervals, granularity of measurements, etc.). For the deployment of the solution, onsite resources like access to equipment and personnel are required.

Value Proposition:

The value proposition is the core element of the business model characterization as it defines the added value that customers, which are targeted by the business model, are to be provided. For the energy focused measurement of process and product data, a variety of solutions already exist. Therefore, special attention was awarded to the description of a unique selling point (USP) that differentiates the developed solution from competitors.

The USP for the energy-measurement data business model is the independence from the network that the MSP is connected to. As the MSP is equipped with an integrated 5G modem, it can be integrated into any 5G network. This can either be a public network or a private network. In this way, barriers to entry are reduced as companies that want to employ the MSP do not need to fulfill extensive connectivity requirements. Furthermore, companies employing the solution have the possibility to act independently from the internal company IT, as a connection to the internal IT system is not a prerequisite. Especially Small and Medium Enterprises (SMEs) often struggle with the adoption of innovative technology due to technical barriers like connectivity. Another aspect of the value proposition is the fact that a joint analysis of production process data and energy data is enabled by the solution. MMS offers a broad portfolio of solutions for machine monitoring as well as tool and process monitoring with a focus on the generation of data -driven process insights. In this way, users can learn more about their own processes and the underlying cause-and-effect relationships they contain. As stated above, the measurement of energy data can also be used to calculate an individual product -specific carbon footprint using primary data directly from the manufacturing process. This aspect represents an enormous advantage and potential competitive advantage for a large number of manufacturing companies, as these companies are increasingly confronted with challenges in the context of both product and corporate carbon footprints. These challenges are driven, for example, by increasing reporting obligations or customer demands to provide more sustainable products. In addition to the product carbon footprint, monitoring the energy consumption also enables enhanced diagnostic capabilities so that in case of deviations from regular energy consumption, further analyses like a deep -dive to identify root -causes for energy consumption anomalies (e.g., unusual spikes, etc.) can be initiated.

The MSP employs 5G as an enabler for the transfer of high-quality primary data, contributing to the accurate calculations of carbon footprints and real-time monitoring capabilities. The presented solution addresses customer needs regarding the calculation and visualization of KVI (GWP) so that automated reports can be created. In addition, raw data can also be exported so that it can be transferred along the supply chain. In this way, manufacturing companies can supplement their physical products with both, a product -specific carbon footprint as well as the raw data (measured energy data) and monetize the data. Furthermore, the measurement of energy data also enables a contribution to compliance with ISO 50001 (Energy Management Systems), enabling manufacturing companies to optimize their energy efficiency.



The description shows the multifaceted value propositions of the developed solution. On the one hand, this shows the significant market and impact potential. On the other hand, it shows the need to record customer requirements in detail, so that the development of the solution can be precisely aligned with them.

Customer Relationships:

The customer relationships for this business model are threefold. First, it is assumed that customers expect to be supported with the definition of technical details regarding the measurements (e.g. measurement intervals, granularity, consideration of different energy costs for day and night, etc.), enabling the development of a solution that is customized to each individual use case and especially to the needs of the customer. Second, the tailor-made development of hardware and software as well as the subsequent installation is to be carried out by the organization offering the business model (MMS). Third, iteratively carried out further developments will be offered to customers of the business model. The described approach shows significant differences to the use of an off-the-shelf solution and exploits the advantages of tailor-made solutions with a high focus on customer needs, so that a collaborative relationship is built with the customer.

Channels:

For distribution of the business model and its associated solution, providers can rely on existing sales networks and the existing customer base, as the presented solution is an extension of already available products. For the acquisition of new customers, regular marketing platforms and channels like LinkedIn, trade shows and conferences, SEO and content marketing, newsletters, etc.

Customer Segments:

The developed solution targets especially SMEs from the manufacturing industry that employ machine tools to manufacture workpieces made from metallic materials and are faced with challenges resulting from energy intensive production. The value that is created for them can be summarized with increased sustainability of their production as well as novel revenue streams as they can be enabled to monetize their energy measurement data. As bigger organizations are predominantly looking for all-in-one solutions or an overall concept, they are not in the main target group. However, these companies are not excluded as potential customers.

Manufacturing companies of machine tools represent another customer segment as they can be targeted for joint activities to directly combine their product (machine tool) with the developed solution (MSP hardware and associated software). In this way, the MSP can be marketed directly with the machine tools in a bundle.

Revenue Streams:

For the creation of the business model, customers (end users of the offered solution) are expected to be willing to pay for the initial hardware costs, as well as recurring costs for software usage. The willingness of customers to pay recurring costs for software usage is assumed, as the software can be updated and optimized over time through updates, which is not possible for the hardware. Next to the advantage through a recurring revenue stream, the introduction of recurring costs also entails the risk that customers cancel their subscription if they feel that the gained advantages are not significant enough. For this reason, the value proposition of the offered solution described in this business model needs to be very clearly communicated to the customer.

The second group of potential customers, machine tool OEMs, are expected to be willing to pay hardware fees as well as fees for the software license



4.2 Energy-awareness on Construction Sites

The energy-awareness on construction sites business model was developed based on the newly gained capability to measure the electrical consumption of individual construction machinery with a simple to use plug and play device. This was enabled by the development of the Meter-X -device. The device was developed by the RWTH-ACS (Work Package 3 of TARGET-X) and integrated into the construction testbed of Work Package 5 of TARGET-X and its 5G network, enabling the wireless transmission of measurement data to an edge server for analysis. Meter-X can be employed to measure and understand energy consumption of construction machinery performing construction operations on construction sites and is also explained in more detail in Deliverables 3.4 [7] and 5.2 [8]. The use of Meter-X on a construction site in a dedicated use case (“5G for Energy Analytics”) has been described in Deliverable 1.2 of TARGET-X with the main benefit that can be gained through the use case being the calculation of the environmental footprint of lift operations for load transport. With this use case, the goal to increase transparency about ecological impacts of construction operations has been addressed. The Meter-X device is pictured in Figure 4-2 on the construction site testbed.



Figure 4-2: Meter-X connected to a Small Tower Crane



In this chapter, the use of Meter-X to accurately measure the energy consumption of construction machinery and monetize this measurement data is explained utilizing the BMC. The according business model is designed from the perspective of a company offering the Meter-X device for sale to companies operating construction sites. Regarding energy consumption, one pressing challenge is the fact that the operators of construction sites cannot break down the individual energy consumption of the different trades and therefore cannot allocate the costs on a fine-grained basis based on actual consumption of the different trades and machinery. The use of Meter-X is one way to achieve consumption transparency on construction sites since real-time measurement can be combined with time logging so that energy consumption data can be allocated to the actual consumers (trades and their respective machines).

Cost Structure:

The cost structure for the monetization of the developed Meter-X only contains fixed costs for the company that wants to offer the product to the market. Variable costs are not to be expected. The costs are based on the individual costs for the required hardware (purchasing of single components and subsequent assembly of the purchased parts) as well as the costs for the required software (development and maintenance costs). In case the offered product is scaled up to high quantities, positive effects of scale are to be expected with both costs for hardware and software decreasing in comparison to the expected revenues.

Key Partners:

The key partners for this business model (which describes the business from the perspective of the company selling the Meter-X device) are the companies operating construction sites with an interest to conduct measurements of energy consumption data on their sites.

As the Meter-X device is based on standard electronic components, no dedicated partnership with suppliers is required as special, tailor-made components do not have to be designed and purchased for the construction of the device.

Key Activities:

The key activities to achieve the targeted value proposition is to market the Meter-X device including a clear and illustrative explanation of the potential benefits that transparency regarding energy consumption offers. The benefits of this transparency must be communicated to both the operator of the construction site as well as the trades working on the construction site.

The installation of the Meter-X is another key activity required to realize the value proposition. This includes the selection of measurement spots, deployment of hard- and software as well as testing to verify a well-functioning system. Furthermore, additional development steps must be carried out, since as of the time of the creation of this business model description, no software has been developed for the allocation of different energy consumption measurements to individual trades or construction machines.

Key Resources:

The required key resources for realization of the value proposition are:

- Meter-X hardware, installed in strategically important measurement positions (already existing)
- Software for operation of Meter-X to conduct energy measurements (already existing)



- Software for fine granularity allocation of energy consumption to individual machines/trades and calculation of individual carbon footprints for construction operations (not yet existing)
- 5G network for connectivity: as the true advantages of Meter-X (especially flexibility and scalability) can only be realized with a wireless communication network fulfilling high technical requirements, the availability of a 5G network is another key resource that is estimated to be required so that the targeted value proposition can be achieved.

Value Proposition:

The main value proposition of the technical solution that the described business model is based on is the precise allocation of costs for consumed energy on construction sites. A large number of trades work on construction sites, often all of which obtain the electricity for their activities from one or more shared sources. This makes it impossible for construction site operators to break down which trade uses which amount of energy with which machine and what costs are incurred as a result. Therefore, the established practice is that electricity consumption on construction sites is billed on a flat-rate basis and invoices are not issued on the basis of actual consumption values. The use of the Meter-X devices addresses this problem, creating more transparency and the allocation of individual costs based on consumption measurements.

In addition, the measured data can also be used to calculate individual carbon footprints, e.g. of isolated construction operations or of certain segments of construction sites. This helps the operator of construction sites with increasing sustainability tasks like reporting. The measurements can also help create energy-consumption profiles for specific construction operations. These profiles can be used for process monitoring which is already an established best practice in different industries like manufacturing. For example, if the energy consumption of an operation deviates from the usual range, corrective measures can be taken. First, the root cause of the deviation can be identified. Then, steps can be taken to eliminate the cause of the detected deviations. In addition, the acquired measurement data helps building a data stack that can be employed to apply Machine Learning (ML) models to generate forecasting of energy consumption through the recognition of patterns in energy consumption data. This will also contribute to an overall optimization of energy consumption as operators are enabled to better plan the energy consumption in advance so that they do not necessarily have to pay for the highest possible peak of energy costs.

Customer Relationships:

Customers are not assumed to expect a close or high-maintenance customer relationship. After provision of the hardware, close attention must be paid to the software being able to run reliably during operations on the construction site. For this reason, regular software updates and security patches are required. As operators of construction sites usually operate a multitude of different construction sites, a roadmap to scale the use of Meter-X up across different construction sites and in different settings is also required.

Channels:

As Meter-X is a newly developed product, a dedicated go-to-market strategy is required to introduce the product to the construction industry, since no existing customer network is currently existing. This aspect is not extensively considered in the business model, since it must be worked on in different activities. Once a go-to-market strategy has been defined and a first customer base has been built, new customers can be acquired using regular marketing platforms and channels like LinkedIn, trade shows and conferences, SEO and content marketing, newsletters, etc.



Customer Segments:

The most important customers for the considered business model are operators of construction sites who want to establish a fine granular break down and allocation of energy consumption data to individual trades and construction machinery on construction sites. As the construction sites also need to be equipped with a running 5G network, the target group for the marketing of this solution is limited to a certain degree.

Furthermore, individual trades can also be a targeted customer group for the Meter-X devices, because the device also enables them to measure their own energy consumption and calculate the carbon footprint of their work.

The described customer segment shows that the addressable market currently is a rather niche market with the necessity for a 5G network being a strong limiting factor. Looking ahead though, the market potential is assumed to grow. One of the main driving factors are rising energy costs that will force both parties, operators of construction sites and the trades operating on them to manage their energy consumption (and especially the prices they pay for it) more strictly. Before the energy consumption can be managed, it must be monitored so that an increasing market potential is assumed for the Meter-X product. Other driving factors include increasing regulatory requirements forcing companies from all industries to manage their corporate carbon footprint and derive measures to decrease it.

Revenue Streams:

The revenue stream consists of a fixed part which is the initial revenue that is generated when a Meter-X device is sold, for instance to an operator of a construction site. Next to this fixed parts, recurring revenues can be achieved, if customers are willing to pay a fee for the use of the software. A prerequisite for this is the availability of a high-quality software with high customer acceptance that can be achieved through characteristics like high reliability and usability of the software. Customer must – when using the software – have the impression that the software adds a significant value to their operations so that they consider the use of the software indispensable. This is achieved through a clear value proposition as well as high reliability and usability.



5 Conclusion and Outlook

Both business models described in this deliverable are based on products that have been newly developed within TARGET-X focusing on the aspect of energy-awareness. For this reason, the business models are in an early development stage, with some unclarities remaining. One example is a potential trade-off between collecting a lot of data and really utilizing it to create added value. Even though data is highly valued in today's research as well as industry, it must be usable for specific purposes, otherwise the potential value cannot be realized. Since data handling also incurs costs (e.g., for processing or storage), the cost-benefit ratio must be within a range that enables users to achieve a profitable benefit despite initial (CAPEX) and ongoing (OPEX) costs. Therefore, interested users must start with an estimation of the potential costs and benefits to assess whether they can make use of the presented solutions. Another remaining uncertainty is the question regarding the ownership of the acquired data. If the data is to be utilized by different parties for different purposes, mutual consent regarding the ownership rights of the data must exist. This can create a potential bottleneck in contract negotiations for new projects, especially on construction sites. Another important aspect is the integration of the technical solutions into day-to-day business, both in production and on construction sites. The use of the solutions requires organizational changes, such as the allocation of responsibility for the application of the solution. In this respect, particular attention must also be paid to the reliability of the knowledge gained on the basis of the data: if the knowledge gained is to provide the basis for decisions, e.g. which construction operations should be carried out in which order, then the underlying data must also be checked for validity. This usually requires specially trained personnel, which also results in additional initial expenditure. These are just some uncertainties that remain to be solved for the technical solutions to be employed in the described business models.

Nevertheless, the presented business models offer great potential for use in industrial settings. Even though the measurement of energy consumption has been established for some time now, precise measurements are often not implemented in operational practice. The presented business models address this fact as both are centered around a measurement device that is integrated into a (construction or manufacturing) use case. Both business models rely on the measurement - based- acquisition of high-quality data that acts as an enabler for further purposes like selling the data or using it as a starting point for optimization approaches.

Nevertheless, future developments must be achieved in order to further develop the business model. First, both products, the MSP and Meter-X, need to reach market maturity of the product, so that they can enter commercial markets. Second, willingness of customers to pay for the solutions must be tested. The value propositions described in 4.1 and 4.2 must be discussed with potential customers and research must be carried out to find out how the value propositions are perceived by customers so that a pricing model can be derived to calculate expectation values for revenues. If these challenges are overcome, the described business models can help transfer the technical development of 5G technology into industry.



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