1. Business Model Design applied to C-ITS

# Business model ontology

The following can be considered as a consensus definition in the Working Group.

**A Business Model describes the way in which organizations produce and deliver value to their customers/consumers.**

## 

## « Model »

Modeling consists in representing a reality by reducing its complexity. This simplification allows a larger amount of people to understand that reality through the “model” point of view. The simpler a model will be:

* The larger amount of people will understand and relate to it,
* the less detailed it will be (the fewer details of a real situation it will represent),
* the less detailed one will be able to design a future real situation by using the model.

The Business Model concept can be situated at the border between strategy and operations. By allowing a larger amount of people to understand a model (compared to the real situation the model represents), the business model is perceived:

* As the missing link between strategy and operations,
* As a mediation support tool for strategists and operational people to understand each other.

## « Organization »

« Organization » can refer to a private company, a public institution, an association or a NGO (non-governmental organization). In principle any entity made of one or several people who build value for third parties on the basis of:

* Resources (e.g. human, materials, tools, finance, patents),
* Processes using those resources.

This concept means that an organization is not necessarily profit-centered.

According to this definition, an organization can be either:

* An whole entity as defined by its juridical status,
* A business unit inside a company,
* Or even an ecosystem of several entities/companies operating together, according to the concept of extended enterprise.

## « Business»

The « business » specificity of business models refers to financial considerations. This means that the purpose of a business model approach is to embrace financial aspects.

In a stable market, considering quantitative financial features as part of the business model is quite conceivable because the business model, the costs and the revenues will be stable from one year to another.

However, on a dynamic market, there is much competition and at any moment there are new organizations that can enter the market. In such a situation, an organization operating on the market has to continuously innovate by proposing new offers or repositioning its offers.

It is clear that C-ITS form part of a dynamic market that will need a progressive investment over several years:

* The amount of vehicles equipped with C-ITS technologies won’t go from 0% to 100% in one year. The “new vehicles” roadmap planned by car makers over next years will define the investment plan in C-ITS technologies for vehicles,
* The same applies to C-ITS road side units: not all investments will be done in one year,
* As a consequence, there will be no significant « revenue » (no safety improvement effect) before reaching some penetration rate of C-ITS technology (both vehicles and road side units)



Figure 1: Illustration of delayed benefits (source: http://www.cours-marketing.fr/marketing/le-cycle-de-vie-du-produit/)

Thus, at this moment it is not feasible to integrate quantitative financial features (revenues, costs, profitability) when describing the business model.

The quantitative features are more about the business plan concerns. The business plan design covers all financial features. It uses the business model as a foundation and comes after the business model design.

Thus it is recommended to limit the business model design of C-ITS to a qualitative description at this stage.

## « Produces »

Production refers to 3 components of the business model:

* Resources supporting the business (e.g. human, materials, tools, finance, patents)
* Activities/processes based on these resources
* Suppliers and partners contributing to producing the value

Production corresponds to the internal part of the organization included in the business canvas model (more detail on the canvas model in section 2.2.1 below):



Figure 2: Business Model Canvas (source: Osterwalder & Pigneur, HEC Lausanne, 2011)

## « Delivers value to its customers/consumers »

The 3 dimensions « Delivers », « Value » and « Customers/consumers » together correspond to the external part of the organization included in the business canvas model.



Figure 3: Business Model Canvas (source: Osterwalder & Pigneur, HEC Lausanne, 2011)

The organization targets customer clusters according to the market configuration. On this basis, it defines:

* Its offer to each cluster,
* The price for each offer,
* The delivery channels it will use to deliver the offer,
* The communication channels to reach prospects and to manage customer relationship.

**◼ Value**

The customer value corresponds to advantages perceived by the customer in using the service or the product proposed.

What the customer is willing to pay to get the offer is the counterpart of the customer value, which can be called the business value.

**◼ Customer/consumer**

The value can be attributed to the customer and/or the consumer according to the context:

* In the case of a private company, the customer is most of the time the consumer too.
* However, the customer can also be different from the consumer, each of them having specific criteria in selecting an offer :
  + In a B2B configuration, the one who buys will scarcely be the one who will use the product/service,
  + In a B2C configuration, we can give the example of a father buying a car for his daughter: the father will be the customer and the daughter the consumer.
* In the case of a NGO, the consumer will benefit from the service delivered. Considering that the customer is the one who pays, private/public donators will be the customers.

To be applicable to a larger range of real situations, the customer and the consumer should be distinguished when defining the business model concept.

This distinction is all the more important in the case of C-ITS as several national business models could co-exist in the EU. Indeed, data being the hart of C-ITS, one can consider that a business model could be defined which maximizes data value in proposing more services than those focused just on safety. Such a business model would be more complex because it would involve more stakeholders.

# Business Model Design

## Design approach

According to the definition given for « Business Model » in the previous chapter, any organization has its own business model. However, the reality is that business models of organizations were often not formalized or described (just implicit) till the early 90’s because they were reproduced along the time, with no necessity for changing them.

In the early 90’s, some startups built offers with a new way to make business, particularly due to the emergence of the internet. To convince investors to give them cash, they had no other solution than to explain how they would make money, to describe how they would produce and deliver value to their future customers. That’s the way the concept of business model became more exposed and the subject of different research fields such as strategy, management, innovation and design.

An organization which would directly develop the business plan for a new project without considering the business model, often tends to reproduce what they already know, i.e. a well-known business model on the market they operate.

However, an innovation needs to find its market. In that purpose, the business model has to be adapted to its global environment, i.e. to each component defining the environment:

* The political context,
* The regulation context,
* The economic context,
* The ecologic context,
* The technological context,
* The social and cultural context.

If it’s not adapted to its environment, an innovation will most likely meet very strong barriers before it is adopted. The following case of electric vehicles provides a good example as an innovation that has a strong infrastructure component and is further developed than C-ITS.

*A car maker decides to design and sell an electric car. If he decides to only focus on the vehicle, he will get low market share: people are used to high kilometer range vehicles offering them some freedom. An electric vehicle can’t have the same kilometer range for the same price. It will generate concerns about:*

* *The possibility to be out of energy on the way,*
* *Loss of freedom.*

*The electric vehicle is not adapted to social and cultural context. A way to face this situation is to develop a charging infrastructure network. But, will both the electric vehicle and the charging infrastructure network have a positive business case?*

* *In case of low speed charging, the charger will be occupied 8 hours long for a full charge, with a revenue of 2 euros per vehicle.*
* *In such conditions, who will accept to invest a non-profitable charging infrastructure network?*

*Even if the car maker doesn’t want to support charging infrastructure activity, he will have to focus on it too. He will have to focus on the whole system “vehicle + infrastructure”. He will have to search and find a partner he will negotiate with to decide with him:*

* *Who produces what?*
* *How is value shared between partners?*

|  |  |
| --- | --- |
| *Car maker focus* | *Ecosystem adapted to its environment* |
| *The car maker only focuses on the electric vehicle with some margin perspectives ($$$).*  *Because customers/consumers won’t find an adapted charging infrastructure, selling volume perspectives are low.* | *The car maker joins a partner for charging infrastructure deployment. They both agree on the way they are going to share the business value.*  *This « ecosystem » approach will allow to adapt the offer to its environment. Selling volume perspectives are better.* |

*The whole ecosystem “vehicle + infrastructure” will have to be profitable. Both will have to:*

* *Design the business model of the ecosystem, adapted to its environment.*
* *To make financial calculations in order to check that the ecosystem offer is profitable. If not, the partners may decide not to launch the innovation, except for example for strategic innovations.*
* *Negotiate their respective place in the ecosystem and the way they will share value.*

*Even in this simple case, there will be more than 2 stakeholders involved in the project. The two partners will have to involve public actors such as the government, the regions and or the towns, and/or private actors:*

* *To negotiate the possibility to install charging units in public (and/or private) space,*
* *To negotiate the allocation of parking places.*

It is clear that C-ITS also have to be adapted to their environment. According to the previous example, C-ITS process design would need the following:

* « System » scope to be designed to be adapted to its environment,
* Identification of stakeholders to be involved according to that scope,
* Negotiation between stakeholders to define:
  + The ecosystem architecture (activities, resources),
  + Who will support which activities in the ecosystem,
  + The financial evaluation of the whole project (i.e. the business plan),
  + The way the value will be shared between stakeholders.

## Business Model Design tools

In this section we explore different business model design tools and their suitability to describe C-ITS business models. This section doesn’t aim at presenting all business model design tools, rather we focus on three well-known tools:

* Canvas model
* Value network model
* Value chain model

### Canvas model

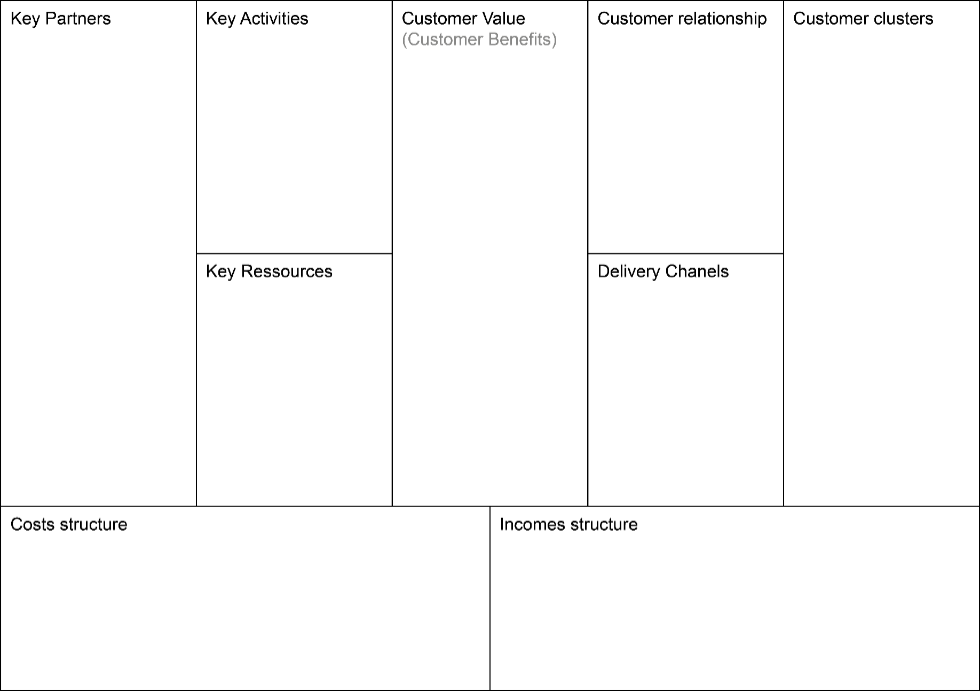


Figure 4: Canvas model

The Canvas model is presented as an « all in one » model representation in one sheet. It is very well known due to its clear structuration (division between 9 components) and its simplicity. Simplicity is both its main advantage and disadvantage:

* The Canvas model doesn’t propose a detailed description of the business model. It focuses on its main elements (key activities, key resources, and key partners) and excludes others. Thus, it may be difficult to embrace detailed financial considerations (business plan) on the basis of the Canvas model
* The Canvas model is a very static point of view: it doesn’t highlight relationships between stakeholders: contracts, data flows (data, service, product), cash flows.
* Organizations will share and communicate about the right side of the Canvas: Value proposition, selected customer segment and price. But the left side of the Canvas is full of trade secrets and will not be shared. This limits the potential to make an aggregated analysis for the whole eco system.

The CANVAS modal is more suitable to describe an organization with one linear value chain (left) than an organization with multiple value chains. Even a rather simple model with multiple value chains (right) is rather difficult to describe in the Canvas model.

|  |  |
| --- | --- |
|  | Figure 5: linear and multiple value chains |
|  |  |

As a consequence, the Canvas model is not really adapted to design the business model of a network.

In the case of C-ITS, one could consider that each stakeholder (providing their correct identification before) directly builds his own business model based on Canvas with no overarching ecosystem business model design. The business model could be simple and look like the one represented on le left side above. Based on such an approach, the whole ecosystem would be described through several Canvas descriptions. However, when putting all together single Canvas, one would see:

* + That they are often not complementary but in conflict,
  + That each stakeholder wants to maximize the value for himself.

The one who design a business model based on Canvas has to keep in mind what is not represented in the model. Without proper information, a Canvas modeling will be hardly readable by anyone else. It will also be hardly a support of negotiation between stakeholders. The Canvas is not really a good support to design a network business model for C-ITS. However, it can be used as follows:

* A communication tool to explain what is a business model and what are its components,
* A support to design stand-alone business models, i.e. specific business models of each stakeholder, but only after the whole ecosystem model being designed.

One can also consider the Canvas model as a good support to highlight internal and external components of a business model. Such segmentation could be used as a guideline and a checklist support to make sure that the whole ecosystem business model is captured.

### Value Network Model

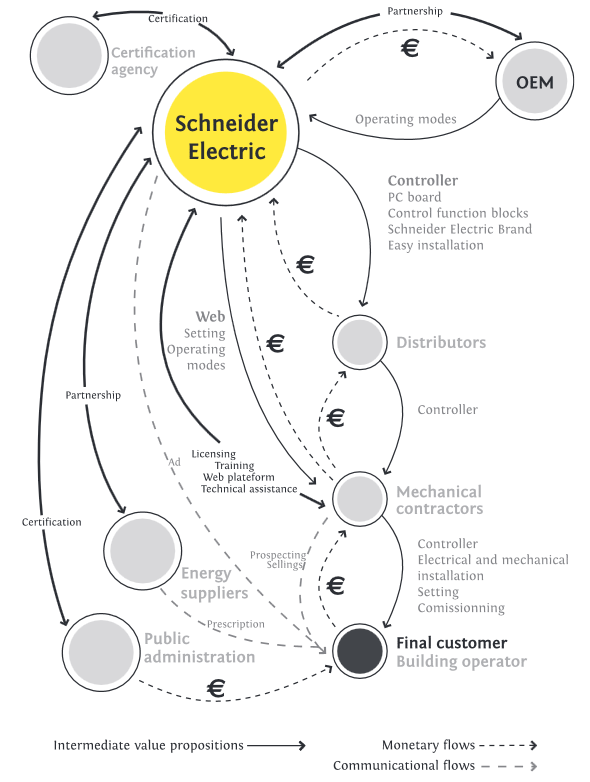


Figure 6: Example of value network (source: Haggège et al., 2013)

Compared to the Canvas, the Value Network looks more dynamic because it highlights relations between stakeholders:

* Types of contract,
* Both financial and non-financial transactions between stakeholders,
* The model can highlight complex transactions involving more than two stakeholders, like the transactions shown in blue in the figure below.

A Value Network representation is often readily interpretable by a large amount of people. This quality is all the more important as stakeholders have to negotiate all together which position each of them will occupy in the ecosystem.

However, the Value Network has some disadvantages.

Risk of information overload:

This risk can be countered as follows:

* + Through several layouts : for example, with one focused on contracts, another one on transactional flows,
  + Through using color to dissociate transactional flows inside the network.

Non-description of activities and resources within individual stakeholders (inside each bubble of the model):

Activities and resources should be represented using other tools. This is not necessary a problem, since a structured organization is familiar with designing and representing its processes.

The Value Network approach is more of a systemic approach, when compared to a “Functional Analysis” approach which defines first the scope of the system to be designed and then won’t change it till the end of the design process. Complexity makes it difficult to define the scope of the system to be designed at the beginning of a project. In a systemic approach, the scope of the system to be designed can evolve along the project depending on opportunities. As a consequence, new skills can be needed, and new stakeholders can join the project at any moment. Thus the systemic approach of the Value Network is somewhat an open approach.

### Value Chain Model



Figure 7: Example of value chain

The Value Chain model focuses on activities and processes and on who performs the different activities in the whole ecosystem. As an ecosystem contains multiple value chains, it cannot be entirely described in this model.

However, the Value Chain model could be used to describe an ecosystem such as C-ITS. To do so, different value chains should be represented according to the different types of C-ITS use cases, and more especially to resources every use case uses. The different use cases could be segmented as follows:

* V2V services,
* I2V services,
* V2I services,
* P2V services, i.e. services offered by third parties on the basis of information stored on the national platform.

# Synthesis

Based on the analysis of the different business model design tools, it was decided to use a combination of Value Network and Value Chain models to analyze possible C-ITS business model designs as they are complementary.

The Canvas model has not been further used, but could be used as a complement (i.e. checklist support of all components to be integrated).

Value chain models have been developed for various use cases in different C-ITS projects, and are presented in section 4. The value network model has been used to describe the Scoop@F business model in section 5.

Building on these models and different stakeholder perspectives, we have identified a set of key issues, which can help in further defining and negotiating the business model between stakeholders.

# Value Chain Analysis

The figures in this section present worked-out examples of value chains for set of different C-ITS services in different implementations/environments.

* Figure 8: Road Works Warning (short distance) in Germany with ITS-G5 implementation
* Figure 9: Road Works Warning (short distance) in Finland with cellular implementation
* Figure 10: Road Works Warning (short distance) in the Netherlands with ITS G5 implementation
* Figure 11: Road works warning triggered from the Traffic Control Center-France-ITS G5
* Figure 12: Road works warning triggered from a road operator OBU -France-ITS G5
* Figure 13: Hazardous location notification V2V-France ITS G5
* Figure 14: Hazardous location notification I2V-France ITS G5
* Figure 15: Probe Vehicle Data-France ITS G5



Figure 8: Road Works Warning (short distance) in Germany with ITS-G5 implementation



Figure 9: Road Works Warning (short distance) in Finland with cellular implementation



Figure 10: Road Works Warning (short distance) in the Netherlands with ITS G5 implementation



Figure 11: Road works warning triggered from the Traffic Control Center-France-ITS G5



Figure 12: Road works warning triggered from a road operator OBU -France-ITS G5



Figure 13: Hazardous location notification V2V-France ITS G5



Figure 14: Hazardous location notification I2V-France ITS G5



Figure 15: Probe Vehicle Data-France ITS G5

# SCOOP@F Value Network Model

The SCOOP@F business model is the result of a compromise, i.e. the result of a negotiation between different stakeholders, each of them holding specific issues, stakes and expectations to be addressed:

* The member state,
* 5 road operators,
* 2 car makers,
* A specialist of cybersecurity,
* The CNIL, a public institution representative for “privacy and personal data security” stakes.

The different technologies embraced by the SCOOP@F project involve several possible combinations. Due to this particularity, some adjustments are still to be done by stakeholders. As a consequence, the following representations of the SCOOP@F Business Model should be seen as a snapshot at a particular moment of an ongoing project.

These graphics focus on the organization between stakeholders and flows between all of them. They don’t describe all activities and resources supporting these activities.



Figure 16: Value network model index



Figure 17: Global organization of SCOOP@F (detailed step by step in the following pages)



Figure 18: Organization of the legacy situation (without Service Providers)

|  |  |
| --- | --- |
| 1a | It corresponds to the amount of taxes payed to the government for all public services addressed to the whole society. There will be no need to expose it for socio-economic studies. |
| 1b | It corresponds to the public cost of actual situation (accidents, pollution…). |
| 2 | It corresponds to all components bought by OEM to suppliers to build the cars. As for “1a”, there will be no need to expose it, since the profitability study will be done on the basis of difference between a situation without C-ITS and a situation with C-ITS. |
| 3 | It corresponds to the transaction between the OEM and the customer who buys the car. For the same reason as for “2”, it won’t be exposed. Only the price of components specific to C-ITS will be exposed. |
| 4 | It corresponds to equipment payed by road operators to equip the infrastructure. Only equipment which will be impacted by C-ITS will be exposed here whether it is :   * A supplementary equipment (example of UEV-G equipped with C-ITS technology), * A reduction of equipment (example of AK14 panels, since Road signage will become vehicle in-signage, thanks to ITS technology). |
| 5 | It corresponds to driver support offered by actors like road operators, such as road signage, audio information delivered through 107.7 FM radio or traffic information delivered through FM RDS service (RDS-TMC).  The € counterpart depend on the service and on the type of road:   * In the case of a highway, the counterpart is the toll, * In the case of a single road, there is no direct counterpart, since it’s taken into account in “1A”. |
| 6 | Road operators send to the National Access Point information in Datex format such as traffic conditions, events on the roads (detected by video cameras or by road agents). |



Figure 19: Service providers Organization

This organization specific to Service Providers is reliable whether in the legacy organization or in the framework of C-ITS deployment (C-ITS organization presented in the following pages).

|  |  |
| --- | --- |
| 7 | Services Providers can ask to car makers for data in order to develop or to enrich services. The deal is part of a commercial agreement. |
| 8 | Any European service provider can access data stored in the National access point. |
| 9 | A service provider can propose the OEM a car-embedded service solution (or enriched service solution). The service or enriched service can be monetized or not according to a negotiation between stakeholders. |
| 10 | The car-embedded solution is addressed to the customer in counterpart of money or not. |
| 11 | A service provider can address a service solution or enriched service solution directly to the driver. This service can be supported by an App on the driver smartphone. |

Example for “9”+”10”:

A cartography provider such as HERE or TomTom enriches his service by integrating on the map embedded in the car the events corresponding to DENM.

Example for “11”:

A cartography provider such as WAZE or TomTom can do the same for a driver not using an embedded system (Smartphone, PND - Personal Navigation Device).



Figure 20: G5-based Organization

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| --- | --- |
| 12 | It’s the price of the ITS ECU bought by the OEM to the supplier. It won’t be exposed since only “13” is important. |
| 13 | It’s the price the customer will pay for ITS functionality. It includes “12” but also its integration into the vehicle (screws, electric cables). |
| 14 | It corresponds to the road side units and maintenance services bought by the road operators to suppliers. |
| 15 | It corresponds to the certificates and pseudonyms delivered to units (RSU, OBU-RO, OBU-U) to communicate on the ITS network. This service is paid for by road operators and OEMs since it is provided by a private actor (PKI). |
| 16 | It correspond to messages exchanges between user vehicles (CAM, DENM, according to use cases and ETSI standards). |
| 17 | It corresponds to messages exchanges between road operators (RSU, OBU-RO) and user vehicles (CAM, DENM, according to use cases and ETSI standards). |
| 18 | It corresponds to a reduction of equipment cost compared to the actual situation. For instance:   * Sensor under the road to detect vehicles speed and traffic conditions, * AK14 panels, since Road signage will become vehicle in-signage, thanks to ITS technology, * Video camera along the road side. |
| 19 | It corresponds to a reduction of “1b” costs, thanks to C-ITS. |

Remark:

ECU: Electronic Control Unit

OBU-RO: Road Operator Onboard Unit

OBU-U: User Onboard Unit, which includes ITS-ECU

RSU: Road Side Unit

PLTF RO: Road Operator Platform (Local SCOOP@F Platform)

TMS: Traffic Management System (SAGT)

**“LTE/G5” Hybrid based Organization (under construction)**

The SCOOP@F communication is supported by a hybrid solution based on G5 and LTE/3G. On roads not equipped with RSU (no RSU is detected by vehicles), the ITS-TCU (Telecommunication Control Unit) of the vehicle will send the data using Cellular network. In such a situation, two cases can be considered according to each OEM policy.



Figure 21: “LTE/G5” Hybrid based Organization: Case 1

|  |  |
| --- | --- |
| 20 | V2N (Vehicle-to-Network): the vehicle sends information to the OEM back-end server, using the SIM card included in the TCU. |
| 22 | It corresponds to LTE/3G fees payed by OEM to TELCO to send vehicle data to the OEM server. |
| 23 | O2P (OEM-to-Platform): the OEM sends aggregated data to the National Access Point. |



Figure 22: “LTE/G5” Hybrid based Organization: Case 2

|  |  |
| --- | --- |
| 21 | The vehicle sends information directly to the National Access Point, using the SIM card included in the TCU. |
| 22 | It corresponds to LTE/3G fees payed by OEM to TELCO to send vehicle data to the National Access Point. |