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Knowledge Brief

Replicability of innovative smart grid business models

New assessment methodology for business models in smart grid research & innovation projects

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Issued
October 2023

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Ebalance-plus project

The ebalance-plus ICT platform and related solutions enable better communication and collaboration to improve common goals of different stakeholders and contribute to unlocking Europe´s energy flexibility markets in distribution grids and thereby support energy prosumers and electric grid operators.

Introduction: replicability of innovative business models

Replication of innovative business models that are identified or developed in EU-funded projects is a key step in enhancing and accelerating smart grid development in Europe. Understanding the replicability potential of smart grid business models across different EU countries, is oftentimes complex because of different contexts (I.e. in terms of regulation, state of the electricity sector, attitudes towards innovation, etc.).

In the ebalance-plus project, we created a replicability assessment methodology that focuses on the replicability potential of business models, not as a copy-paste exercise, but rather a “process of adapting the most relevant components” to the new local context [1]. Our methodology introduces a new indicator for the replicability of innovative smart-grid business models.

Replicability in BRIDGE

In 2020, the BRIDGE Scalability and Replicability Task Force developed a methodology to quantify the scalability and replicability of a project´s result [2]. This approach relies on the Smart Grid Architecture Model (SGAM) [3] that has different layers – one of them being the business layer.

Previous projects showed that analysis in the business layer is mostly qualitative - with the exception of the economic dimension and with approaches varying significantly among the different dimensions identified (regulatory, economic, business model, stakeholders).

Replicability in ebalance-plus

Our method is an innovative and more quantitative approach that offers four structured dimensions for rating replicability, based on the validated concept of innovation systems. By considering the business model as the main value delivery “vehicle” of the project’s results, we assess the model’s replicability against the country´s obstacles/barriers in identified dimensions. The method is based on the following core rationale:

> **The more Key Exploitable Results (KER) are involved in a business model and the more obstacles to innovation are**

presented in a country for the KER, the less replicable the business model will be.

Methodology formulation

Step 1: Identify your project’s Key Exploitable Results (KER)

In this first step, a project should identify its Key Exploitable Results:

> *“A Key Exploitable Result (KER) is an identified main interesting result, which has been selected and prioritized due to its high potential to be “exploited” – meaning to make use and derive benefits- downstream the value chain of a product, process or solution, or act as an important input to policy, further research or education. In order for you to select and prioritize your results, we would recommend that you use the following criteria: degree of innovation, exploitability and impact.” [4].*

Example of an ebalance-plus KER:

KER3: Smart-storage solution to unlock and manage building flexibility. This solution unlocks and manages building’s energy consumption flexibility, either locally or by receiving flexibility requests from an external

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management system or platform like ebalance-plus.

Step 2: Identify and assess the KERs´ obstacles to innovation

2a: Identify the local "country" KER obstacles to innovation

To identify the obstacles of smart grid innovations we propose to use a methodology based on the concept of *Technological Innovation Systems (TIS) [5]*. TIS consists of *actors* and their *networks*, that act under a set of institutions in a technological field to generate, diffuse and utilize *new technology [6]*. TIS is a concept commonly used in the field of innovation studies to analyse and understand the rate and status of technological change. It can be used to identify all relevant obstacles for the generation, diffusion and utilisation of technological innovations in a specific country. We use the TIS-based categories to identify the obstacles to innovation of a project´s KERs [7] (Table 1).

Table 1. Identification of obstacles to innovation in 4 categories

Obstacle category	Description of obstacle type	Example(s) of obstacles identified in ebalance-plus
Infrastructural/ technical obstacle	Absence or non-functioning physical infrastructure in relation to the innovation. For example, communication and energy infrastructures such as high-speed ICT infrastructures, electricity grids, or smart meters.	Smart meter penetration & smart-meter functionalities is not sufficient.
Institutional obstacle	**Hard institutional obstacle:** All written, formal mechanisms that may hinder innovation. E.g., technical standards, laws, rules, regulations, or the legal system related to IPR. **Soft institutional obstacle:** Wider context of political culture and social values, "the rules of the game" that may hinder the innovation. E.g., social norms and values, cultures, entrepreneurial spirit, or political culture.	**Hard:** Regulatory hurdles for independent aggregators to access the market. **Soft:** People do not want to share their energy data: personal reasons and privacy concerns
Coordination obstacle	**Strong coordination obstacle:** Too strong cooperation between actors, failing to supply each other with required knowledge, failure to exchange with actors who perform a bridging role, or failure to bridge to other industries. "Locked in" relationships with specific actors, **Weak coordination obstacle:** Poor connectivity between actors, missing out on interactive learning and innovation, lack of shared vision for future technology developments.	Lack of general standardisation (e.g. for processes, data formats, data models and communication protocols) and interoperability.
Capabilities obstacle	Companies and organisations might lack competencies, capacity, or resources, they are unable to make the leap from an old to a new technology or paradigm.	DSOs lack of organisational structures and capabilities to contract, administer and settle flexibility services.

2b: Quantitively assess the country´s KER´s obstacles to innovation

In this step, we rate the obstacles to innovation per category per KER for a country or region. Base the ranking on how many obstacles you identified in a chosen category, and how strong these obstacles hinder a specific KER in the country in focus. We propose a scale from 1 to 10, with 10 representing the highest obstacles.

(Country)					
	Obstacles to Innovation Categories				
KER	**Technical**	**Institu-tional**	**Coordina-tion**	**Capabili-ties**	**Average Rating**
KER-1	(1-10)	(1-10)	...	(1-10)	Average for KER-1
...	...	...	...	...	...
KER-N	(1-10)	...	...	(1-10)	Average for KER-N

Example for the four obstacle categories and for one KER:

KER	Technical	Institu-tional	Coordina-tion	Capabili-ties	Average Rating
KER-1	6	7	5	4	(6+7+5+4)/4 = 5.7

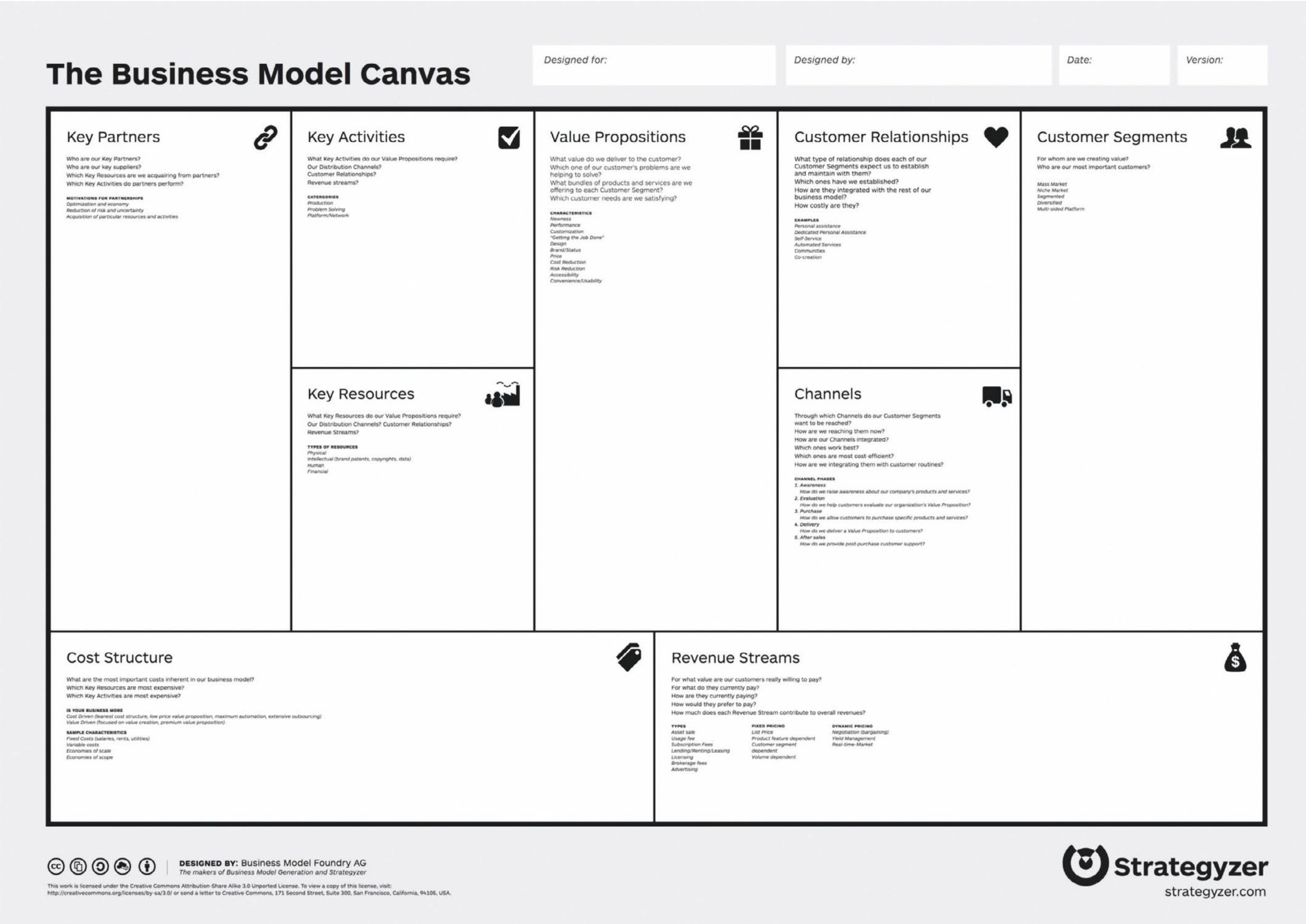
> **Repeat this step for each country or region you are interested in replicating the business model**

Step 3: Develop your Business Models

In this step, the project develops relevant business models (BM) using the **Business Model Canvas (BMC),** or another relevant tool.[1] The BMC is a visual tool, commonly used in business management literature [8]. It has four main areas broken down into 9 building blocks as they can be observed in the image on the next page.

When applying the BMC, it should be thoughtfully employed taking into account its key criticism. The BMC has repeatedly been criticised for only capturing economic value, without explicitly considering normative issues and excluding social and environmental aspects in the value proposition [9, 10]. Energy business models can provide numerous advantages beyond the services to the energy clients, for the energy system [11]. Furthermore, classic BMCs are meant for existing companies. Research and innovation projects like ebalance-plus are much more uncertain and the “mission” of the project can be different from a commercial company´s mission.

1 This step is not essential in quantitively assessing the business model replicability using the current approach, but documenting the business model with a tool like a canvas helps you in the next step, which is to assess where and how much each KER is involved in the value creation, delivery and capture.



Step 4: Assess each KER involvement in each BM

In this step we assess each KER's involvement in a chosen business model. We suggest that a team (ideally more than 10 persons) of technical and business experts "from the consortium" rate the KERs involvement in a business model in the range of 1 to 10, with 10 representing the highest involvement[2]. Then, for each KER an average rating shall be calculated.

KER involvement in Business Model X				
Expert assessments	**KER-1**	**KER-2**	**...**	**KER-N**
EXP-1	(1-10)	(1-10)	...	(1-10)
...	...	...	...	...
EXP-N	(1-10)	(1-10)	...	(1-10)
Average	KER-1-Avg	KER-2-Avg	...	KER-N-Avg

2 Ideally, this step will be improved by defining a systematic way to assess each KER´s involvement in a chosen business model.

Step 5: Calculate and assess the BM replicability indicator

In this last step the BM replicability indicator is calculated for a country. This indicator is based on the rationale that the more KERs are involved in a business model and the more obstacles to innovation are presented in a country for the KER, the less replicable the business model will be. Thus, low score = higher replicability, high score = lower replicability.

Thus, for Country *Y* and for *i=1* to *N* KER, with average ratings of obstacles to innovation $KER\_obs\_avg_i$ and business model *X* involvement $KER\_bm\_avg_i$, the business model replicability indicator BMR_{local} will be calculated as follows:

$$BMR_{X,Y} = \sum_{i=1}^{N} KER\_obs\_avg_i \times KER\_bm\_avg_i$$

In words: Replicability indicator = Sum of [(KER involvement in BM's Country application) x (KER Country obstacles to innovation)]

Example:

Obstacles to innovation in member state Y	
KER	**Average Rating**
KER-1	**8.3**
KER-2	**5.7**
KER-3	**6.7**

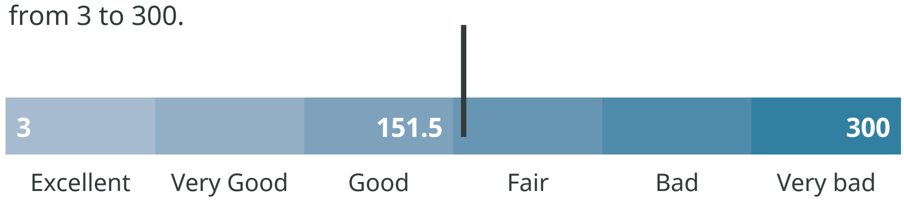
KER involvement in business model X	
KER	**Average Rating**
KER-1	**7.2**
KER-2	**6.1**
KER-3	**8.8**

$BMR_{X,Y}$ = 8.3 x 7.2 + 5.7 x 6.1 + 6.7 x 8.8 = **153.49**

So how replicable is this business model?

For *N* number of KER and a rating range between *a* and *b*, the lowest result for the replicability indicator will be $N \times a^2$ and the highest result $N \times b^2$.

In our example we used *N=3, a=1* and *b=10*, thus $BMR_{X,Y}$ can take a value from 3 to 300.



It seems that business model X is of fair replicability.

When the replicability indicator has been calculated for all countries and for all business models, a colour map per country and business model can be created as in the following example.

Replicability of business models – colour map				
Country Business Model	**Country-1**	**Country-2**	**Country-3**	**Country-4**
BM-1	Very Good	Excellent	Bad	Good
BM-2	Excellent	Very bad	Good	Bad
BM-3	Fair	Good	Fair	Very bad
BM-4	Bad	Very Good	Very Good	Fair

Additionally, an arithmetic comparison between countries can be created for a business model´s replicability:

Replicability of business models – comparison map				
Country BMR	**Country-2: 35**	**Country-1: 83**	**Country-4: 165**	**Country-3: 233**
Less replicable compared to Country-2 by a factor of:		2.4	4.7	6:7

Discussion & Conclusion

In this knowledge brief, we presented a new assessment methodology that focuses on the replicability potential of business models based on KER involvement and the country´s obstacles to innovation. It has been developed and tested in the ebalance-plus project, and we expect the method to have added value for other research and innovation projects to assess the replication potential of their smart grid solutions in different countries. However, the method is not yet been reviewed by peers, which would be a first next step. We thus encourage other research and innovation projects to test this replicability assessment methodology to create an iterative feedback loop towards improvement and validation.

Further reading/watching

- Ebalance-plus KERs: https://www.ebalanceplus.eu/project/#results
- Video introducing ebalance-plus project: YouTube Link
- Video of the ebalance-plus demonstration case in Lille (France): YouTube Link
- Video of the ebalance-plus serious game on altering energy consumption habits at home: YouTube Link
- Report on obstacles to innovation for flexibility solutions in ebalance-plus: Report Link
- BRIDGE 2020 annual report of the Replicability and Scalability Task Force: Report Link

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°864283.