DIGITAL ECOSYSTEMS AS A DISRUPTIVE FORCE OF FLEXIBILITY SERVICES IN THE ENERGY SECTOR

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Overview

With the advances of new technologies related to digitization and artificial intelligence (AI) and with the increasing interest in sharing economy, industries and economies of various sectors are being reshaped. The impact of these technological changes (also being commented upon as the Fourth Industrial Revolution [1]), combined with evolving attitudes and interests of modern end-users is by no doubts leaving its trace in the power sector as well. In particular, we could see a vast potential of improved business models in the energy field that capture the new trends associated with the accelerating development of energy-related technologies (such as for distributed energy resources (DER)), digitization and changing customer preferences with strong focus on hi-tech feeling, environment and variety of choice. The anticipated business model transformation points strongly towards the ecosystem development that revolutionizes industry after industry [2]. In this context, we foresee for the energy sector innovative business models where digital ecosystems serve as a disruptive force for enablement of flexibility services.

This paper focuses on business model innovation by means of digital ecosystems which would allow for highly improved utilization of flexibility. We start by proposing a general business model framework for flexibility services centered platform ecosystem. As a next step, we briefly describe two different business use cases that exemplify the model's possible applications. Finally, we provide a set of recommendations that would be supportive to the establishment of the proposed innovative business model. The carried research work is part of the INVADE project (2017-2020) which has received funding from the European Union's Horizon 2020 Research and Innovation program under Grant Agreement No. 731148. The authors are grateful for working on the important topics of business model innovation within the energy field and optimal usage of energy flexibility.

Methods

To utilize on flexibility resources, INVADE develops a disruptive business model that is configured as a platform ecosystem, with a new entity - called flexibility operator (FO) – in the ecosystem's core. The FO should be capable of addressing a whole portfolio of local loads, storage units and feeds and it is anticipated that a number of these will have already been organized in communities. Various actors could take over the role of a FO – e.g., commercial or technical aggregator, an energy system company (ESCO) or an establisher of EV-Community (such as Nissan or Tesla). A FO would distinguish between professional and non-professional flexibility service providers and customers (as exhibited in Figure 1). The value offered by the FO is consolidation of multiple number various flexibility resources. The aggregated flexibility could be harnessed to serve the needs of DSOs, TSOs or other actors for whom energy flexibility is necessary. Thus, both the professional and the non-professional flexibility service providers can be potential customers of flexibility too (Figure 1). In addition, as depicted in Figure 1, the central ecosystem of the FO communicates with the service providers' platforms. As a result, a digital ecosystem for flexibility trade is created with constant two-way flow of data between its inside entities and for which the key characteristics of platform ecosystems, e.g., network effects (where more users beget more users) and multi-sidedness (variety of offers and connections) play a vital role [3], [4].

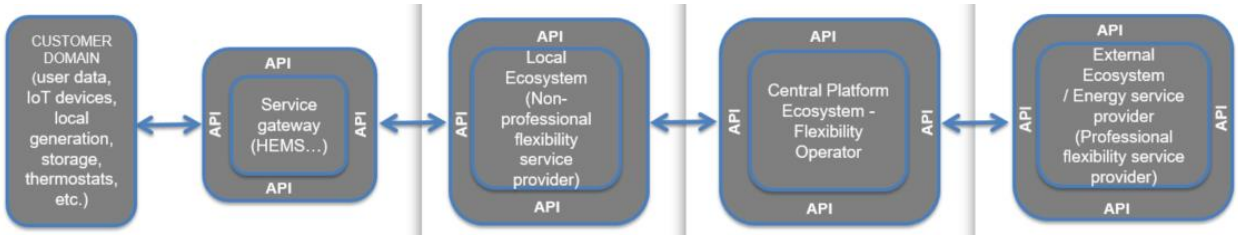

Figure 1 – Major structures within the INVADE platform ecosystem. The service gateway (left) connects to the prosumer side of the system (e.g., customer data, IoT devices, local generation unit, home storage, smart thermostats, etc.). The external ecosystem (right) represents the professional service providers that may dispose larger scale flexibility resources, originating by, e.g., production, storage, EV charging, trading or demand response ("digital natives", such as Apple, Google and Tesla, are good examples)

Having described the overall model framework we will now indicate several relevant business use cases which validate the potential application of the proposed platform ecosystem and which exemplify the non-professional and professional service provider roles respectively. Two major opportunities, indicated within the generic FO business model are represented:

1. A local ecosystem that already follows a platform based business model approach could connect to the FO platform in order to gain additional profit by selling flexibility (to DSO, TSO, other parties – e.g., factories in need for flexibility). Having a large customer base and catering customer loyalty and product diversity strengthens the local service provider's role as part of the central ecosystem. Typical examples are Nest, Tesla, Smartly.
2. A large-scale EV-charging company (representing "External ecosystem") can be both provider and customer of energy flexibility. For the customer role coordination on how flexibility will be distributed between the DSOs and others who need it will be necessary. One possibility is that the DSOs will have priority, while the EV-charging company could harvest the revenue that the provided to the DSO flexibility releases in the customer domain.

Results

The inovative strength of the proposed model lies in the combination of knowledge from the fields of energy and business modelling. This value is mirrored in the creation of a generic platform and ecosystem based business model the application of which has been demonstrated through two specific business cases. We can expect that in the future various local and external ecosystems will have interest to connect to a central platform ecosystem for flexibility in order to exploit economic benefits. In some cases, given increased interest, the local ecosystems can gradually transform into external ones. For that purpose they should have significantly increased their area of operation and exhibited stronger interest in flexibility trading.

Conclusions

Finally, it is important to consider some recommendations that support the feasibility of the proposed business model innovation. Our vision for the positioned around FO central ecosystem (as being developed within the INVADE project) is based on a platform business model, the success of which is achieved through well-defined governance, network effects and open innovation, strong focus on data utilization and customer-centric approaches. The successful implementation of the business model will depend on how well it reflects the most recent trends in both technological and societal developments, particularly the ones related to digitalization, advanced analytics, IoT, complexity, service/product variety and customer preferences.

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