Value Co-creation through a Digital Platform Business Model in the Power Sector

Alfredo Višković*, Vladimir Franki **
* Energy Platform Living Lab, Zagreb, Croatia
** Faculty of engineering, Rijeka, Croatia; Energy Platform Living Lab, Zagreb, Croatia
vfranki@riteh.hr

Abstract - Digital transformation is occurring across the globe swiftly altering processes and revolutionizing traditional businesses. An increasing number of companies are now realizing the potential and significance of digitalization. Seven out of ten most valuable companies globally are now operating on a platform business model. In most cases, platform-based companies act as matchmakers between supply and demand. The power sector is no exception. However, the creation of a successful platform in the power sector is a much more complicated task. A platform operating in the energy arena needs to be able to draw real-time data from countless physical components of the system. This data needs to be used to optimize system operation and resolve any disturbances on the grid. Only after enabling a digitally controlled, decentralized flow of energy in real-time can the second layer of the platform be constructed: a digital ecosystem. The paper discusses how digitalization will alter utility business models and how energy companies can benefit from using new digital solutions (such as asset management systems, customer billing and information apps, predictive analytics, etc.) in creating added value. In addition, it outlines the strategic significance of creating a digital platform and an open innovation ecosystem for energy utilities.

Keywords - value co-creation; open innovation; sharing economy; big data; digital platform; business model; power sector

1. INTRODUCTION

The energy sector is going through quite a radical transformation. New objectives, new constrictions and new driving factors facilitate changes across the energy supply chain. These changes are dramatically altering business landscapes of the sector. Paired with the emergence of new technological solutions, these changes also affect the way consumers think about energy supply and consumption [1]. Possibly the most obvious impact of market dynamics are the changes in the generation mix. Facilitated by government policies, power producers have switched their interest towards renewable energy sources (RES) [2][3]. Transitioning to a zero-carbon economy is an arduous task that requires the implementation of a combination of policies and technologies. In this context, there are focused efforts towards developing a whole string of new applications such as battery storage, demand response, carbon capture and many other [4][5]. Looking at things from a global perspective, the renewable sector has been recording biggest growth rates in installed generation capacities for years [6]. Significantly raised awareness regarding both environmental issues and the impact of electricity generation on the greenhouse effect caused a stir among power companies forcing them to adapt their business strategies [7]. In this transitional period towards a low-carbon energy system of the future, companies in the sector had to be quick to react to new market circumstances. As the line between energy producers and consumers gets blurred, utilities face several challenges novel to the industry.

The complexities of the electricity system make the energy sector less agile than others [8]. However, while focusing on the supply process, numerous utilities disregarded the need to ennoble their business models with new customer orientated approaches [9]. With the age of digitalization ascending upon the energy sector disruptive forces emerge as key shapers of the new energy paradigm. In this context, digitalization is the application of digitally-enabled solutions to provide new revenue streams and create added value for consumers. The digital revolution in progress does not simply affect established processes, but has a profound impact on the very mechanisms underpinning the entire market. As the rapid transformation progresses, electricity markets are reformed, market players’ business model reinvented, new technological solutions appear, multiple industry sectors converge and prosumers emerge. This overwhelming process of fundamental change is driven by several forces. It is not just a question of decarbonization (reduction of carbon dioxide emissions). It is about rewriting the entire modus operandi of the energy sector.

After decades of silence, data is now starting to flow between providers and consumers [10]. This is in many ways revolutionary, as it allows energy to flow between the two sides of the energy supply equation. Traditional one-way energy traffic is starting to be obsolete, while bi-directional flow of current is a thing of the future. Data is one of the key enablers of the implementation of distributed energy sources and a key enabler for consumers to start acting as prosumers on the electricity market. The increased complexity of electricity systems will no doubt have to rely on various machine learning algorithms that will predict when and where energy will be needed and how to optimize power flows in order to achieve maximum system efficiency [11]. Enhancing the predictability of variable renewables such as solar and wind will minimize the need for capital investments in
energy storage and grid infrastructure. This is a radical change of the existing top-down supply structure that characterized electricity systems for the past several decades [12]. Digital transformation in progress will provide a foundation for disruptive innovation necessary to enable these processes.

The paper is organized as follows. After the introduction to the subject, the concept of value co-creation is discussed and the importance of having an open business structure outlined. In section 3, the building blocks of digital platforms are described and key platform layers are identified. The section also provides a quick overview of the transactive multi-sided energy management system necessary to ensure optimal operation the future power system based on distributed energy sources (DER). Section 4 reveals a high-level overview of the digital ecosystem in power sector, while section 5 draws a final conclusion on the matter.

II. THE CONCEPT OF VALUE CO-CREATION

Creation of value is the core purpose of economic exchange. One of key rules in business-to-business marketing is that value should be created through constant interaction between consumers and providers [13]. Traditional models regarding value creation focus on a central company’s output and price. In this context, internal know-how is considered one of the key elements of a company’s survival on the market. However, new business models heavily oppose such a narrowly defined concept of value creation. Their main idea is that no matter how large the company is, it cannot compete with massive potential of the open, developers’ market. This is why an increasing number of companies started to focus on developing platforms upon which they gather external knowledge to be offered to the market. In this way, these companies open their organizations and share some of their know-how. Their goal is not to fully monetize on each developed idea, but rather to achieve two crucial things: (1) expand the market by creating added value for their consumers and (2) maintain their position as a market leader. In a recent study, it has been determined that in knowledge intensive services, value co-creation occurs through a dyadic problem-solving process encompassing five key activities: determining needs, designing and producing solutions, organizing the process and resources, managing value conflicts, and implementing solutions [14].

In order to enable a functional ecosystem, any platform must consist of four types of players, as illustrated in Figure 1. Apart from platform owners and infrastructure enablers, engaging external developers and consumers is crucial to ensuring overall success of the endeavor. In this context, value co-creation has become an umbrella term describing a string of complex ideas. As such, it appears in a considerable amount of literature, both business and science orientated [15]. With the evolution of information and communications technology (ICT), companies across the globe started using internet as a medium for multisided platforms. At present, 7 out of 10 most valuable companies by market capitalization are based on value co-creation. Observing the outlined concept, value co-creation can be described as a joint process of producing added value [17]. This implies a logic of creating services and/or products that are not unilaterally generated, but are co-created through a synergy between providers and consumers. This type of rationale coincides with service-dominant logic (SDL) where services (not goods) are the fundamental unity for value exchange [18].

In other words, web-enabled interaction facilitates the emergence of new business models that focus on the creation of value based on consumer needs and based on offering a premium service. These service-based systems mutually interact improving the quality of output for all participants engaged in the exchange. Value is, thus, fundamentally derived through the integration and application of resources, rather than embedded in firms output and captured by price [19]. This type of logic fuels business innovation, development of new products and services, improves consumer experience and creates long-lasting market relationships [20].

III. DIGITAL PLATFORM BUILDING BLOCKS

The upsurge of platforms is driven by technological innovation [21]. New solutions regarding cloud-based solutions, social networks and mobile phone technology are enabling everyone to get connected and contribute to
creating content at a worldwide stage. Simply because there are plenty of successful platform-based companies surviving and thriving on the market, does not necessarily mean that constructing a feasible platform business is easy. In all truth, constructing a platform is an arduous task, both time-consuming and capital-intensive. Pursing a platform strategy in no way improves the chances for success. Like any other business venture, platforms fail more often than they succeed [22]. This is why it is important to bear in mind all the headwinds these endeavors face. Platform strategy is not about selling a good or a service online. It is about engaging supply and demand side actors and creating an environment that enables innovation and value creation through a synergistic effect. In recent years, digital platforms based on artificial intelligence, Big Data and machine learning have overridden established laws and redefined business models around the world.

Looking at the energy sector, competition is composed mostly of conventional businesses [23]. It should be noted here that this does not mean the energy industry is easy to enter. Competition is fierce, margins are slim, the sector is based on a behemoth of a system, government regulation is strict and the demand for continuous supply is of paramount importance [24]. A new entrant does not only have to fit within this frame, but has to be able to thrive within a highly constricting environment. It has to achieve financial viability whilst operating a complex system. It has to keep providing a reliable and affordable source of energy whilst under constant regulatory scrutiny. Changing government policies, social pressures, debt obligations towards investors and all sorts of different competition make things even harder [25]. What makes developing a platform-based utility even more difficult is the fact that the energy sector is highly regulated, but digital platforms (as a relatively new area for lawmakers) are not [26]. This imbalance has the potential to cause considerable issues during the next few decades as digital will enter all pores of the energy industry.

Synergetic effects of various market forces such as policy measures, technological innovation and customer evolution facilitate new forms of competition and the emergence of disruptive players. These occurrences are happening at rapid pace and at a global scale fundamentally transforming the energy sector. Digitalization, decentralization (referring to the transition towards distributed energy sources) and decarbonization do depend on policy support and economic circumstances. However, it is only a matter of time until they reach every single country and every single home with an electrical connection. The future of utilities already present on the market heavily relies on what they are doing to enhance their digital capabilities at this very moment. In this context, numerous utilities have already started to engage themselves in digitalizing their operations. Given the many restraints typical of the energy industry, this is an arduous, time-consuming process. In general, despite the fact that utilities are increasingly aware of the changes their business models require in order to stay competitive on the new market, their revelations are often not translated into practical actions [27]. When difficulties associated with digitalization efforts will be surpassed, technical constraints resolved and when regulation will no longer present an unsurmountable obstacle, utilities (energy suppliers) will start operating as platforms. If a utility can function only as a commodity procurator and a service provider, without owning energy related assets, having a platform would be essential in differentiating among other suppliers. Especially considering the slim cost margins that are a trademark of the energy sector. A platform can: provide a better service for clients, enable easier and more transparent monitoring of consumption, optimize energy management models and simplify bill handling processes [28]. In addition, since it is always the same type of commodity being sold, the major distinction between different energy suppliers will be the service they offer. Platform that entails an open innovation model procures capabilities from outside incumbent firms. These capabilities raise the platforms’ level of service and unequivocally provide a source of added value for end consumers and the entire ecosystem.

Unfortunately, unlike other sectors, where platform companies can often act simply as matchmakers between supply and demand, the story in the energy sector is quite different. And much more complicated. This is because of the specificities of electricity as a commodity and the gravity of the energy system itself. In order to be successful, a platform operating in the energy arena needs to be able to draw real time data from countless physical components of the system. It then needs to utilize this data to optimize system’s operation (again in real time) without endangering the reliability of supply. When numerous consumers, regulatory restrictions and technical issues are added to the equation, we are presented with an enormous task of reconciling these constraints with needs and desires put in front of a platform [29]. As one can assume, there is no magic formula or a singular path towards achieving a satisfactory functionality of such a platform. However, there are certain factors that have a significant impact on the effectiveness of one’s digital efforts. In broad terms, a utility needs to foster an environment that can offer a continuous engagement of various actors all aligned towards ensuring an agile, open ecosystem that facilitates the development and application of new concepts and technological solutions. A platform firm is structured around an organizational platform and an operating system. It bases its operation on cloud services, external connectors and identity management protocols. At the heart of a platform lies a hardware and software architecture that functions as a hub used for facilitating connections, resources and transactions. By doing so, a successful platform represents an ecosystem enabling a synergy of various participants all with the goal of creating value. In a truly platform-orientated firm there are no borders for value creation. Assets and outputs are created and developed outside the mother organization. Figure 2 shows the key layers of a platform-based
operating model. Business, infrastructure and physical layers are further decomposed into six interoperability layers [30].

![Incorporation layers](image)

Figure 2. Platform layers built upon a smart grid architecture

Physical layer contains the components of the power supply chain. This is where power flows between households, producers and prosumers occur through the distribution/transmission grid. Optimal flows of injections and withdrawals must be established in real-time respecting the physical constraints of the system. Solving the Optimal Power Flow (OPF) problem is the most common way optimizing operation and minimizing costs. Physical layer and the infrastructure layer exchange data. This communication facilitates a trading mechanism which is utilized for monetary compensations regarding power withdrawals and injections to the grid [31]. In the economic layer, two types of markets can be distinguished. First, there is collective market run through a centralized entity. Second option is the peer-to-peer (P2P) market, where trades are facilitated bilaterally with no central authority to supervise the transactions. The increasingly distributed nature of the power network requires the application of a transactive energy management system [32]. This refers to direct energy exchanges responding to market-based energy injections/withdrawals. These types of systems allow individual prosumers to execute P2P transactions within their microgrid communities. Microgrids can be defined as an aggregation of consumers, prosumers and producers. New technological solutions and the emergence of prosumers are causing a wider adoption of microgrid-based concepts in the power grid [33]. In order need to apply transactive principles in the retail market. This is of particular importance for prosumers, distributed generators and the future applications of demand response techniques. While still in its early stages of development, P2P market seems to be a necessity for the power system of the future. In this context, blockchain is hailed as a potential solution that can enable not only a decentralized transaction system, but that can also enhance the cyber-security of these very transactions [34][35]. Figure 3 shows the basic principle of a transactive energy management model where each physical asset has a corresponding virtual counterpart. These digital twins can transact in the digital space and track power flows that occur between different players on the market.

Transactive systems usually focus either on economic or engineering layer of the system. However, the development of practical applications in the power sector demands for an integrated approach to the issue [36]. Upon physical and infrastructural layers, the business layer is built. This layer is the potential gatekeeper to the value co-creation ecosystem. Transactive energy management enables individual users and interconnected microgrids to collaborate according to real-time market signals. For the system to be functional, a considerable amount of dynamic data needs to be collected and analyzed [37]. The true value of this data lies not in the potential benefits for the optimization of the system, but rather the data’s potential to refine services for end-consumers.

IV. DIGITALLY-ENABLED ECOSYSTEMS

During the past decade there has been a surge of interest directed towards the concept of ecosystems as new modus of the competitive environment. The term is borrowed from biology and signifies a group of interacting firms that are mutually dependent on each other [38]. Observing available literature suggest that ecosystems can be considered as business, innovation or platform orientated. Business ecosystems center on an individual company around which other firms, organizations, institutions, etc. are aligned. Innovation to close the gap between retail and wholesale electricity prices, distribution system operators (DSOs) and utilities.
ecosystem focuses on a particular innovation, a set of innovations or a new value proposition. Platform-orientated ecosystems focus on creating an environment of open collaboration regarding a certain area of interest. These ecosystems comprise of a platform sponsor and their complementors that bring added value to consumers. In practice, borders between different types of ecosystems often get blurred as companies mix different strategies in an effort to extract maximum value out of the system. Figure 4 reveals a high-level illustration of different market arrangements, including the ecosystem value proposition model.

There are plenty of examples where the dynamic ecosystem model created partners from competing companies. BWM and Toyota work in synergy trying to develop some of the key technologies that they implement in new vehicles—such as batteries. Apple, Fitbit and Garmin together created an ecosystem focused on apps regarding fitness. Perhaps the most well-known example of ecosystem application are smartphones. Apps are the ones that make smartphones smart. This is the reason why smartphone producers thrive to enable open-source platforms that attract developers which create added value for consumers. Recently, the largest open-source platform that enables hosting for software development—GitHub was purchased by Microsoft. In 2020, there were 28,000 projects being developed by millions of developers on the GitHub platform. As large as a single company might be, it cannot compete with such massive development capacity. There are several dimensions to an ecosystem. Every larger company exists in several business ecosystems. The key is to understand the role that it can play in these arenas. One of the key aspects of defining an ecosystem strategy is determining a degree of openness within the ecosystem. This degree should be set according to the potential of new entrants to create added value for consumers and defines the nature of relationships between various players in the ecosystem. In this context, increasing connectivity in order to engage diverse participants is crucial. In the fast-paced digital world, organizations that do not work towards understanding their ecosystems, the nature of their competitors and the tendencies of their consumers risk slipping into a participatory role. This scenario is playing out in incumbent energy companies around the world. Although energy is at the heart of every process in the world, numerous energy providers find themselves in the background. This is not because we don't need electricity. It’s because the majority of companies are still operating within an old paradigm. They simply offer a commodity, not a service. A recent cross-sector analysis by McKinsey reveals exactly that (Figure 5).

![Figure 4. Types of value systems](image)

V. CONCLUSION

New technologies, new market players and a brand-new approach to energy planning force utilities to evolve their business models and adapt to new circumstances. Some utilities recorded progress. However, a number of
them is yet to catch this wind of change and still lurk in the shadows of business arenas. In truth, the energy sector is a difficult one for implementing changes. This is in large part to its bond with the extensive infrastructure that ensures the interrupted energy supply. However, despite the fact that today’s utilities are less agile than most technology companies, things are changing. As digitalization is swiftly entering the pores of our entire society it only remains a matter of time when the entire energy supply chain is digitalized. Utilities are slowly moving towards this direction. Worth saying is that having a large number of companies stuck in a traditional way of operating is not necessarily a bad thing. Sure, it is a negative trait of a sector, but it enables opportunities for those companies that open themselves new innovative technological solutions and new ways of doing business. Terms like artificial intelligence, blockchain and big data will soon become much more to the energy industry than just buzzwords. In the meantime, the industry’s rules will be rewritten, new players will emerge whilst a number of old ones will fade. As any transformation, this one offers a platform for new opportunities. To be able to predict only a part of the future one must be perfectly aware of both the past and the present. This is particularly true in a world more interconnected and more complex than ever before. As new technologies evolve, they bridge the gaps between different areas of the economy. Over time, they gently creep into our daily lives, making it unimaginable for any of us to go through our day without some form of technology. The same technology that probably wasn’t available a few years ago.

The energy sector sits on the cusp of a dramatic and fundamental transformation. Different utilities will find different modes to respond to this change. These responses depend on a number of various factors such as their respective infrastructure portfolios, regulatory frameworks, customers’ structure, level of agility and technological evolution. Looking at a longer time horizon, we envision a utility acting as an adhesive between a whole array of market participants. The electricity system of the future will resemble a living organism optimizing its demand and production schedules, reporting operational issues and determining maintenance needs. Communication will be crucial to this system, raising the importance of reliable security protocols. Data flows are to be transparent and timely, circulating from large scale power units, smaller scale distributed sources, grid operators, microgrids, battery storages and consumers. In this brand-new world, more interconnected than ever before, utilities will have to evolve into active service providers. This will require serious changes to existing operating habits and the application of new business models. The entire company culture will have to be changed from bottom up to accommodate a new way of thinking about the company’s role in the provision of energy.

REFERENCES


[29] W.P. Zarakas, “Two-sided markets and the utility of the future: how services and transactions can shape the utility platform,” The Electricity Journal 30(7), 43-46


