Multi-agent Based Simulation for the Smart Energy Solutions

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Background

The failure rate to launch new product/solution to the market is high, and the smart energy solutions usually require large investment [1, 2], and the market adoption rate and growth speed is slow and depends on different market segment and business models that companies apply [2, 3].
Therefore, to avoid the risk (especially the value chain risk) and predict the market reaction, this research applies agent-based simulation to find the adoption rate and growth of smart energy solutions and by that investigating the business opportunities for smart energy ecosystem. This is necessary due to the ambitious climate goals from countries like Denmark [4] and with the Paris Agreement in 2015 which involves 181 parties [5] in keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius [6].
This PhD research will give the smart energy ecosystem tools and understanding on how to positively affect the adoption and growth in smart energy solutions by e.g. overcome the adoption barriers by turning their solutions/innovations into adoption triggers [3].

Objectives

The aim of this research is *to investigate the customer adoption rate and market growth speed of the smart energy solutions with a cross-national comparison.*

The following objectives will be used to find the main objectives.

1. *Multi-agent based simulation and modelling of the smart energy ecosystem.*
2. *Investigating business model innovation for smart energy solutions.*
3. *Global energy market analysis.*

Methodology

Agent Based Models (ABM) are used to model a complex system by decomposing it in small entities (agents) and by focusing on the relations between agents and with the environment. The tool used to perform the multi-agent based simulation is called “AnyLogic”. AnyLogic is the unique simulation software tool that supports three simulation modelling methods: system dynamics, discrete event, and agent based modelling and allows you to create multi-method models [7].
The qualitative and quantitative research methods will be applied to investigate the stakeholders, their inter-relationships. Furthermore, the qualitative and quantitative research methods will be used to identify adoption barriers, drivers, and triggers.
The findings of the agent based simulation will be treated as either qualitative or quantitative as seen in [8]. Qualitative findings mean that the author only draws qualitative conclusions from the model. Quantitative findings indicate that the author states that particular outputs will vary with determined factor/percentage [8].

References

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