Shift
Sustainable Horizons in Future Transport

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The role of business models in the transition to Electric Road Systems

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Electric road systems (ERS) are road transportation systems based on technologies that support electric power transfer from roads to vehicles in motion. ERS has in the recent decade emerged as a sustainable solution for the long-haul freight sector, which is one of the most difficult sectors to decarbonize and is projected to grow drastically in coming years.

Compared with other alternative technologies, ERS reduces the need for batteries, relies on well-established electricity infrastructure, and has potential to preserve flexibility in the freight sector.

There are various ongoing projects around the world to evaluate the viability of different ERS technologies such as overhead lines, in-road conductive, and wireless inductive technology.

The development of ERS has primarily been driven by societal needs rather than market demand, and most activities have been initiated, supported, and subsidized by public funding. This constitutes a typical technological niche in which technology development is temporarily shielded from the commercial market to become competitive.

However, while the purpose of these actions is to prepare ERS for commercial takeoff, technologies that contest the established technological paradigm typically fail at market. This challenge is often described as the ”valley of death,” where firms risk stalling between pre-commercial invention and basic research, on one hand, and product development for the commercial market, on the other.

Empirically, this study has concentrated on the potential transition toward ERS by studying different activities (e.g. technical pilot, demonstration, and deployment projects) that have been (partially) funded by policy makers and that have formed the ERS trajectory over the 2010–2017 period.

Key findings

- The relationship between business models and socio-technical change is not homogenous in the early phases of transition and differs depending on what type of niche activity is analyzed.
- Business model concept could be used as a perspective to understand the evolutionary processes that take place during the early phases of transition.
- For systemic innovations, which suffer from the chicken-and-egg dilemma, business models are needed for alternative infrastructure with long investment horizons as well as for alternative products and services with shorter investment horizons.
- Deployment projects, such as an infrastructure transformation project, might be a suitable policy mechanism for creating a test bed for suppliers and future market demand.

Nordic Energy Research

Background

Will electric road systems take off?

Policy makers, practitioners and scholars have argued that sustainable technologies are insufficient in themselves to bridge the valley of death. It is often said that new business models are needed to realize their potential on the mass market.

New business models could translate the beneficial qualities of new products to end users, thereby creating user acceptance, firm profitability and facilitating the transition. Several studies have identified and analyzed new types of business models that firms deploy for sustainable technologies. However, these studies have not taken into consideration that many of these technologies require socio-technical change e.g. regarding infrastructure, user practices, institutions, actor network etc. Business models are analyzed from a product or service perspective and treated as static models that transforms a focal firm's strategy.

This study addresses this research gap by analyzing the relationship between business models and socio-technical change in the early phases of a potential transition.

Few studies have focused on the processes during the early phases of transition. This study contributes to more nuanced views of how technological niches are shaped, the interactions between actors in different contexts, the strategies that firms use to manage potential technology shifts, and different empowerment strategies used by niche advocates to commercialize sustainable technologies in different contexts.

Findings

Business models in the early phases of potential transition

The first finding is that the relationship between business models and socio-technical change is not homogenous in the early phases of transition and differs depending on what type of niche activity is analyzed.

In the studied pilot projects, development of new business models was not part of the technological niche, as the focus was on developing radical innovations without any interactions with potential users. These projects illustrated how the new technology did not fit with incumbent business models.

In the demonstration projects, which focused on developing a socio-technical experiment that involved interaction with users, new business models were developed for commercializing the new technology. However, they were neither implemented or tested in these projects (or on the market).

In the deployment projects, which focused on evaluating wider socio-technical change, business models were tested by evaluating the economic feasibility of different types of technological niches and the willingness to pay for and use the new infrastructure. Figure 1 summarizes this finding and illustrates the relationship between business models and socio-technical change in the early phases of transition.

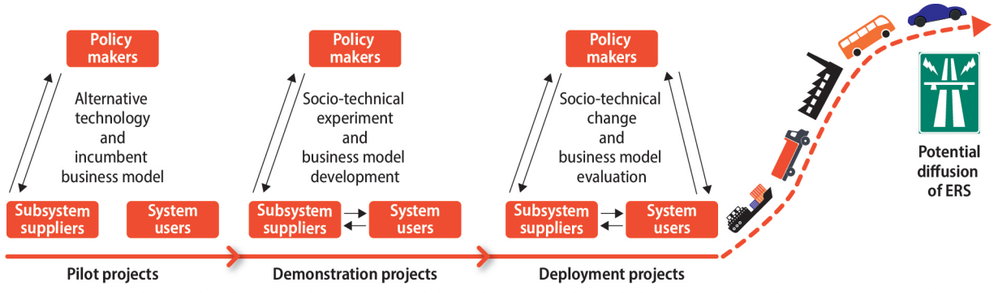

Figure 1. The relationship between business models and socio-technical change in pilot, demonstration and deployment projects. (Tongur, 2018.)

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Pilot projects with different ERS technologies.
① Overhead lines. Scania's and Siemens' project outside Gävle, Sweden. (Picture: Scania)

② In-road conduction. Volvo's and Alstom's project in Hällered, Sweden. (Picture: Volvo)

③ Wireless induction. Electreon's test in Israel. (Picture: Electreon)

The second finding is that the business model concept could be used as a perspective from which to understand the evolutionary processes during the early phases of transition. When it comes to niche activities, the right business model solutions are apparent only after the innovation has taken off and reoriented the existing socio-technical system. By adopting a business model perspective to understand processes of socio-technical change, attention is concentrated on the value added by the new technology from multiple actor perspectives, rather than only from the perspective of the firm – user relationship. In this way, the business model perspective is useful, as it integrates both environmental and sustainable value for policy makers, subsystem suppliers, and users.

A third finding is that the challenges of commercializing and deploying systemic innovations, such as ERS, are complex. Most studies focus on the potential benefits or drawbacks of new sustainable technologies but tend to neglect the fact that the commercialization of them is dependent on investments in alternative infrastructure.

For systemic innovations, which suffer from the chicken-and-egg dilemma, business models are needed for alternative infrastructure with long investment horizons as well as for alternative products and services with shorter investment horizons. The various actors must find their roles and ensure that they complement one another to produce a functioning business model that allows investments in both sustainable transportation infrastructure and the related vehicles.

Deployment projects, such as an infrastructure transformation project, might be a suitable mechanism for facilitating a window of opportunity for such systemic innovation. It creates a test bed for suppliers and future market demand, attracting support from policy makers for necessary infrastructure investments.

Practical implications:
Are the electric road systems to be or not to be?

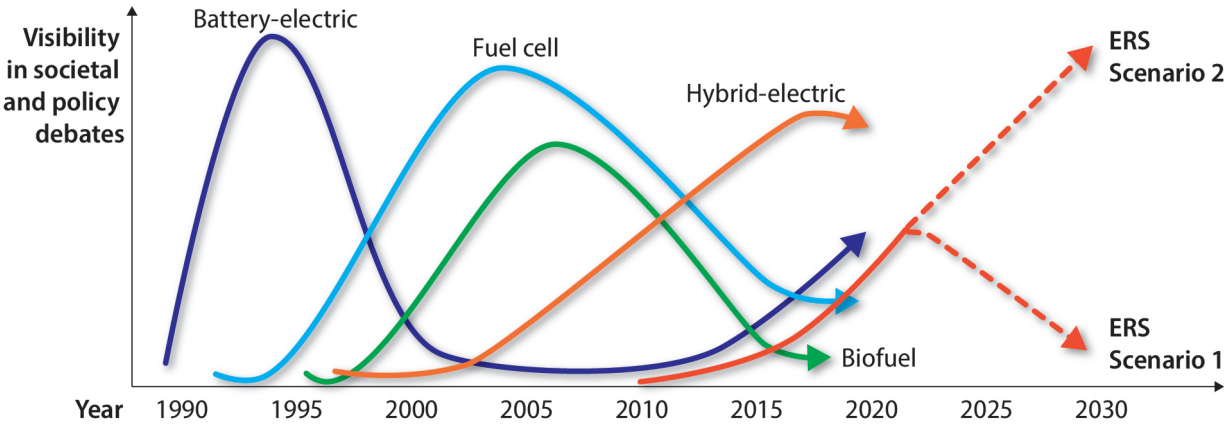

Figure 2. The cycles of hype and disappointment of different technologies. (Tongur, 2018, based on Geel, 2016.)

ERS is competing with other solutions such as battery-electric, fuel cell, natural-gas, and biofuel technologies. Figure 2 illustrates the cycles of hype and disappointment of several technologies in recent years.

So, will ERS will take off or not? To answer that question, we are assuming two future scenarios for heavy trucks in 2028. For each scenario, the technical, political, and economic conditions are discussed, using Sweden as a point of departure.

Why ERS will not takeoff

- **Technical perspective:** Solutions were promoted that where closer to the existing system interfaces.
- **Economic perspective:** Uncertainties deterred potential users and investors from committing to ERS.
- **Political perspective:** The costs of transition failure was not high enough.

Why ERS will takeoff

- **Technical perspective:** ERS new dominant design with other technologies as complements.
- **Economic perspective:** Relative low capital cost, new public-private arrangement, and ERS as competitive advantage for users.
- **Political perspective:** All solutions were needed due to urgency, open standards made ERS procurable, and Sweden was positioned as the global ERS knowledge and export hub.

Policy recommendations

- Policy has an important role in development of new business models – laying down the conditions of business models and transitions.
- Engage with business model development early on, not only technology development.
- Stimulate cooperation between different types of actors that can build the future together.
- Standardization between interfaces to allow for competition and business model innovation.

References

Tongur, S. (2018). Preparing for takeoff: Analyzing the development of electric road systems from a business model perspective (Doctoral dissertation, KTH Royal Institute of Technology)

Contact

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