

Organizational development of renewable energy: the case of Wave Hub

Marfuga Iskandarova

University of Exeter Business School, Streatham Court, Rennes Drive, Exeter, EX4 4PU

United Kingdom

Keywords: actor-network theory, sociology of translation, generalized symmetry, case study/research, macro-actor, renewable energy.

This research addresses the organizational aspects of technological development in renewable energy sector in the UK. It presents a strategic research site for working out in detail the approaches put forward by STS and actor network theorists. Using a technological innovative project in the renewable energy sector as a case study, the emergence of organizational forms is examined in order to investigate the alliances and networks built up by heterogeneous actors, to explore the dynamics of technological systems in situations where interactions of the social, technological and political are regarded as particularly important, and present a construction of the actor-network. Evidence from the case research is used to exemplify aspects of the theoretical constructs.

This study is a PhD work in progress and aims to offer more than mere application of the previously presented concepts. The concepts applied in this research demonstrate that the development of new technology is not an inevitable process. This research facilitates the understanding of technological development of renewable energy technologies, considering the emergence of an actor-network as a unique and unrepeatable chain of events, a process that must be investigated according to its historical and contextual circumstances.

Methodology

The methodology is mainly informed by theorists who have contributed to STS and especially to actor-network theory (ANT). ANT is a variation of social constructionism in which non-human actors/ technical artefacts, etc. have a life of their own and can play an active role in the construction. It denies that purely technical or social relations are possible and makes no distinction in approach between the social, the natural and the technological.

A single-case design was chosen in line with the theoretical framework to address the research question. For this purpose, the case of the Wave Hub (WH) project in North Cornwall, UK, was considered. Wave Hub is a grid-connected shared offshore facility for the large scale testing and commercialisation of technologies that generate electricity from the power of the waves. It consists of an electrical hub on the seabed 16 kilometers off the north coast of Cornwall to which wave energy devices can be connected. The data collected about

the technical, social, economic, environmental and political aspects of the project allowed building a 'thick narrative' (Geertz 1973) behind WH.

Creating a macro-actor – WH as an evolving technological system

The notion of an actor is central to ANT. According to Callon and Latour (1981), an actor can be 'any element which bends space around itself, makes other elements dependent upon itself and translates their will into a language of its own'. This entity is not just a 'point object' (a thing or a substance) but an association of heterogeneous elements themselves constituting a network. Each actor is also a simplified network (Law 1992). An actor is often compared to a black-box that contains a network of elements which are black-boxes themselves.

To explore WH as an actor it is necessary to understand what 'Wave Hub' means as relevant social groups can attribute different meanings to it. As a physical object, is it a subsea cable with a socket and grid connection, or should it be understood in operational sense, i.e. with the devices attached rather than the hub or 'socket' on its own? Or is it an innovative idea that had been implemented as a project (includes processes and related activities such as design, construction, consenting process etc.), or is it an opportunity to get economic benefits (for the industry, contractors, fishermen), or an opportunity to implement ambitious and costly research projects and generate knowledge (for scientists and researchers), or may be a symbol of environmentally friendly South West Regional Development Agency (building a positive image of the South-West and other participants involved in the project)?

The application of an ANT approach often leads to anthropomorphization of objects and construction of macro-actors. Macro-actors are actor-networks that coalesce in such a way that the whole is seen as having projects (Feldman & Pentland 2005), acting as a single entity.

The notion of network allows dissolving the distinction between micro and macro as the whole metaphor of scale is replaced by a metaphor of connections: 'a network is never bigger than another one, it is simply longer or more intensely connected' (Latour 1997).

So what are the elements that WH places in the 'black box' to raise such a broad construction – modes of thoughts, forces, objects, and how to examine such a macro actor? Callon and Latour (1981) suggest directing attention towards the processes by which an actor creates lasting asymmetries not to the social. This means that 'only the differences between what can be put in black boxes and what remain open for future negotiations are now relevant for us' (Callon & Latour 1981, 286).

The question here is how WH as a macro-actor has been continually constructed, built up in practice; how a heterogeneous set of pieces has been turned into something that stands and

performs as a single entity. A macro-actor is a result of translation of multiple actors in a single will (Callon & Latour 1981), so the process of translation is another interesting aspect.

Applying generalized symmetry and free association

The most provocative aspect of ANT – its symmetrical treatment of humans and non-humans and its special focus on artefacts, is based on the principles of generalized symmetry and free association (Callon 1986). Under those principles, ANT attempts impartiality towards all actors in consideration, whether human or non-human, and makes no distinction in approach between the social, the natural and the technological (Tantal & Gilding 1999).

SWRDA's vision of the project was rooted in a trajectory predicting the growth of renewable energy sector, an implied growth in investments, and the prediction of a significant demand for WH. They identified the potential users, the constructors, research institutions, funding bodies, interested public bodies/groups likely to have an interest in this project. But once the principle of generalized symmetry is adopted, waves, marine habitats, the physical components of the facility, etc cannot be excluded. In other words, the actual ingredients of WH as a macro-actor are the devices that transmit the energy of waves into electricity in the power grid and which design and efficiency are being constantly improved, the elements of infrastructure such as subsea cable, substation, grid connection, the consumers that need this electricity, the companies – device developers, contractors, the managing company, the local businesses in the area, fishermen, general public that accept the project and have generally positive perception of it, the government and EU that fund it, the public and governmental bodies that impose regulations and grant the consent, the researchers that support WH with the latest set of scientific data and evidences of its safety, survivability and ability to be fulfilled. Natural phenomena also have an impact on the final shape of the project as wave climate restricts some devices to be tested in this location; the fact of the existence of waves and their energy makes the idea of building WH viable.

The idea of simplification and juxtaposition suggested by Callon (1989) allows reducing an infinitely complex world to associated entities which are linked and associated with others; the removal of one of the elements leads to changes in the whole structure (Callon 1989). So in our case the fishing industry, for example, was reduced to the fishermen-that-want-to-preserve-their-fishing-site or devices – 'black boxes' whose operation had been reduced to a few well-defined parameters.

The question of energy policy and regulation as an element of the network was also examined. The analysis of the situation suggests that policy had certain impact, as all those moments also shaped the project – the decision of the Government and EU to provide the financial support for WH, the lack of supportive financial mechanisms that would encourage

developers to come to WH, the uncertainty in the sector regarding its future in the UK and the lack of regulation for consenting process. WH as a macro-actor is composed of associated entities, and although these entities 'are susceptible to being molded or shaped', they in turn can transform the actor network of which they form a part (Callon 1989). In this respect, energy policy and regulation can also be seen as an element of an actor-network, not merely a context. Moreover, the construction of this facility and, lately, its existence influenced the development of related policy and regulation. Relevant regulations have been produced by legislators and changes in existing laws have been made. It illustrates that between the actor-network and its more dynamic elements there is a constant mutual process of adjusting one's development to others', transforming each other.

Examining the process of translation

'Project developers' (SWRDA and Halcrow on their behalf) didn't leave anything uncovered, as they believed, elaborating the idea of WH. From the start SWRDA established itself as 'an obligatory passage point' (Callon 1986) in the network of relationships they were building, and began to translate the desires, technical knowledge and the needs of a large number of actors.

But the trajectory defined by SWRDA changed. The factors such as economic recession, lack of sufficiently developed technologies, technical re-evaluation of the project (the underwater transformer didn't exist as a proven technology), problems with procurement strategy and lack of in-house expertise caused not just delays but changed the shape of the project. It appeared that SWRDA simplified certain information, accepted it as granted and proven (e.g. the existence of underwater transformers as a proven technology or the level of technological development in wave energy sector and willingness of certain companies to install at WH).

So the developers of the project arrived at compromise solutions many times (e.g. in the case with technical design, construction, change of site location) progressively changing the shape of WH. For instance, the selection process of the site was determined to a large extent by a consenting process and controversy over it involving maritime stakeholders, local businesses, fishermen, tourism industry, etc. The solutions, finally reached at this stage, illustrated a process of translation which is understood as a process of negotiation by means of which certain actors assume the authority to act and speak on behalf of others and attempt to influence others to accept potential solutions as valid and legitimate. Consensus has been reached, allies were mobilized, and the project moved forward.

Conclusion

This research raises questions about how organizational forms emerge, examines the means by which organizational arrangements are achieved, and helps to develop an understanding of technological development in renewable energy sector. The case study raises more questions about what is micro and macro in this setting, examines the question of the change of scale, helps to answer the question how policy becomes an element of an actor-network and to investigate the process of building a macro-actor applying ANT as a main methodological approach.

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