

# Chapter 13

## Actors in the Emerging Internet of Things Ecosystems

**Seppo Leminen**

*Laurea University of Applied Sciences, Finland & Aalto University, Finland*

**Mervi Rajahonka**

*Aalto University, Finland*

**Mika Westerlund**

*Carleton University, Canada*

### ABSTRACT

*This study investigates actors in the ecosystems of the Internet of Things (IoT). Previous research suggests that unstructured ecosystems make one of the greatest challenges for creating business models for the IoT. The present study concludes four contributions. First, the study reviews literature to develop a framework for role mechanisms in ecosystems and applies the framework to analyse data from fifteen interviews in six cases. Second, it identifies four diverse actor roles in IoT ecosystems: butterfly, ant and greenfly, spider, and the swarm of bees. Third, the study shows how actors take and make different roles in four emerging IoT ecosystems; product-, company-, industry-, and peer to peer ecosystems, which are structured in accordance with the identified actors' role behavior. Fourth, it suggests a new role pattern, role replication, where companies replicate their value designs and networks to other contexts.*

### 1. INTRODUCTION

Diverse everyday objects from cars to toothbrushes and buildings to baby monitors will be connected to the Internet and with each other. This Internet of Things (IoT) can be defined as a world where physical objects are seamlessly connected to the information network, and where these objects can take actively part in business processes (Haller et al., 2009). It integrates diverse technologies and systems (Fleisch et al., 2009) and creates a significant potential for companies, their customers and other stakeholders to produce, co-create and get better services cost-effectively. The networked infrastructure of the IoT enables incremental and radical innovation and business development (Bucherer & Uckelmann, 2011). Despite

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the vast potential the IoT holds, the business promise has not yet been realised (Bucherer & Uckelmann, 2011). New business models will be needed for this emerging highly-connected world. However, the diversity of objects, the immaturity of innovation, and the unstructured ecosystems are proposed to be primary challenges for developing business models for the IoT (Westerlund et al., 2014). Thus, more research is needed on how the technological opportunities can be realised from the business perspective (Haller et al., 2009; Leminen et al., 2012; Leminen et al., 2014).

In addition to calling for more research on the emerging IoT ecosystems from the business perspective (Leminen et al., 2012), recent studies argue that research on IoT business models should be widened from a single company point of view to an ecosystem perspective (Westerlund et al., 2014). Previous literature on innovation networks reveals different roles organizations may take or make (cf. Gemünden, 1985; Gemünden & Walter, 1998; Walter & Gemünden, 2000; Herrmann et al., 2006; Gemünden et al., 2007). Similarly to many innovation networks, especially open innovation networks, emerging ecosystems consist of diverse stakeholders looking for new business opportunities (cf. Rohrbeck et al., 2009; Nyström et al., 2014). Furthermore, roles are coupled to structures and positions in networks (cf. Heikkinen et al., 2008; Leminen et al., forthcoming). Nonetheless, extant literature is focused on documenting existing and institutionalised ecosystems and organisational roles in them, rather than revealing emerging ecosystems (Iansiti & Levien, 2004a, b; Ballon, 2009). Therefore, it is particularly interesting to study actor roles in emerging ecosystems. Emerging IoT ecosystems offer up-to-date context for this. This study investigates actor roles, and adjacent business models, in emerging IoT ecosystems. Our research questions include: i) which roles can actors take and make in emerging IoT ecosystems?, ii) how are these ecosystems built?, and iii) how are the role options linked to the emergence of IoT ecosystems?

The paper is organised as follows. After this introduction, we review previous theories on ecosystems and roles, particularly the IoT ecosystem, and actor roles. Thereafter, we explain the methodology and present key findings. Finally, we conclude by discussing the key implications of our research both to practice and the theory, and provide avenues for future research.

## **2. LITERATURE REVIEW**

Studying ecosystems and actor roles in them will become more and more important, because in the future, actors are increasingly interdependent through technical and business ties. In the future, a large number of small and specialised “things” (devices and sensors) will be connected to each other and to the Internet, expanding existing Internet applications and services and enabling new ones (Leminen et al., 2012). The IoT increases complexity, as network structures are transforming from centralised structures towards decentralised and distributed structures. As a consequence, businesses become participants of complex business ecosystems (Barabasi, 2002; Möller et al., 2005). Tarkoma and Katasonov (2011) argue that an IoT ecosystem is a community of interacting companies and individuals where the companies use a common pool of core assets, based on linkages of physical world of things with virtual world of the Internet.

Next, we briefly review literature on IoT ecosystems, particularly related to IoT ecosystems and their business models, as well as actor roles in those ecosystems.

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