**Innovating for smart cities: a firm-centric perspective on exploring and exploiting smart city technologies**

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**ABSTRACT** [Please write your abstract here. Abstract should be no more than 750 words in length and does not have to contain bibliographic references]

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| On a global scale, ‘smart cities’ are increasingly becoming a widespread phenomenon. Across a broad range of definitions that have been adopted to characterize this smart cities, the use of information and communication technologies (ICT) to enable cities to address a wide range of urban sustainability challenges in fields such as energy efficiency, urban mobility, and water and waste management, is identified an integral part. Many city administrations have initiated local-level collaborations with other urban stakeholders in pilot projects, aimed at developing, testing, and implementing innovative technological solutions to address these challenges. Simultaneously, many firms from a variety of industries have increasingly started to move into the market for smart city technologies, which is reflected in the expected market value of approximately US$1.5 trillion in 2020. As a result, (multi)national firms are increasingly becoming a key stakeholder in addressing urban sustainability challenges. The role of these firms in developing and marketing technological solutions for smart cities has very sparsely been researched in studies to date. Hence, insight in how (multi)national firms, as a key stakeholder in smart cities, develop innovative solutions that enable cities to actually become ‘smarter’, would be a valuable addition to the existing work on smart cities. In addition, scaling up solutions beyond smart city pilot projects has also been identified as a key issue that needs to be addressed (Van Winden & Van den Buuse, 2017). Multinational firms are often more capable in scaling up solutions beyond pilot projects than other urban stakeholders. Therefore, insight in how (multi)national firms market solutions beyond a pilot phase could bring lessons to other urban stakeholders faced with problems in upscaling processes. This paper aims to shed more light on these issues, based on two interrelated research questions: *how do (multi)national firms develop innovate solutions for smart cities?*; *And how do firms scale up these solutions and bring them to the market?*.  We conduct an actor-centric analysis of how firms develop and market technological solutions for smart cities, building on the literature on organizational ambidexterity to distinguish between exploration and exploitation activities. Managing ambidexterity effectively, i.e. managing exploration and exploitation activities in a balanced way, is perceived as a key factor in firm performance. March (1991, 71) identifies that exploration includes “search, variation, risk taking, experimentation, play, flexibility, discovery, innovation”, while exploitation includes “refinement, choice, production, efficiency, selection, implementation, execution”. In the context of smart cities, both developing innovative solutions to address urban sustainability issues (i.e. exploration), as well as scaling up beyond a pilot or demonstration phase towards larger-scale diffusion (i.e. exploitation), are part of the role firms play in enabling cities to become ‘smarter’. Exploration can occur both internally via research and development (R&D) activities within the boundaries company, as well as externally, though collaborations with city administrations and other urban stakeholders in smart city pilot projects. Such external contexts can be particularly valuable as part of exploration activities, given that smart city pilot projects provide an opportunity to develop, test, or experiment with new technological solutions in a real-life urban setting. The concept of open innovation, defined as "the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation" (Chesbrough 2006, 1), identifies that collaborative innovation processes through collaborations with other stakeholders is essential for more radical, breakthrough innovations. External contexts as spaces for exploration as part of exploration activities, which can be complementary to the internal R&D activities of firms in developing smart city solutions, are therefore included as an integral part of the exploration activities of firms in this market. Exploitation activities, i.e. scaling up smart city solutions from the development phase as part of internal or external exploration activities, and thereby bringing them to the market, can follow various pathways depending on the type of smart city solution that is developed. A recent typology for scaling up smart city solutions (Van Winden & Van den Buuse, 2017) has identified three dominant manifestations based on empirical research on smart city pilot projects: roll-out, expansion, and replication. While the typology has originally been developed from a project-centric perspective on how solutions can be scaled u beyond pilot projects, we extend the typology in this study to include an actor-centric perspective on how solutions can be scaled up as part of a firm’s exploitation activities. From this perspective, exploitation through roll-out is the most simple form of upscaling, and applies to manufactured smart city products or service innovations: a firm scales up the developed product or service once it comes out of exploration activities, by introducing it to existing or new markets. When exploitation occurs through expansion, a firm scales up a smart city solution (such as digital platforms and networks) by refining it and adding functionalities or enlarging the geographical area, thereby increasing the (economic and social) value of the solution. In exploitation via replication, smart city solution that has been developed as part of exploration activities in one specific context is replicated in another context (another organization or another city) by the firm. These three dominant manifestations of upscaling will provide the foundation for the analysis of exploitation activities of firms’ smart city activities. The conceptual model bellow summarizes the dynamic process of exploration and exploitation, and the ways these can occur for developing and marketing smart city technologies. The empirical section of this study is focused on a set of six (multi)national firms with exploration and exploitation activities in products and services aimed at smart cities, and which are part of the Amsterdam Smart City network. Through a combination of a documentation study combined with semi-structured interviews, we explore how each of these firms engage in exploration activities, either internally via R&D activities and/or designated business units for smart cities, as well as externally, via participation in multi-stakeholder pilot projects developed as part of the Amsterdam Smart City network. In addition, we aim to explore how smart city solutions coming out of this exploration process are scaled up in the exploitation phase, and via which of the dominant manifestations of scaling processes (roll-out, expansion, replication) this process occurs. The firms in our sample include IBM, Cisco, Accenture, Philips, KPN, and Alliander, which are all actively developing and marketing smart city solutions, and participate in one or more pilot projects developed as part of the Amsterdam Smart City network. All interviews were *conducted between 2015 and 2017,* and are part on a *broader study on organising smart city pilot projects* (for details, see Van Winden et al., 2016). *Early findings suggest* that firms are engaging both in internal exploration activities, through designated programs for smart cities, while simultaneously being engaged with external exploration activities through networks such as Amsterdam Smart City.The aim of our study is twofold. First, we aim to identify how private actors are increasingly becoming involved at addressing sustainable development challenges at the city-level, though developing innovative smart city solutions (i.e. exploration) and scale them up to bring them to the market (i.e. exploration). This will contribute to a better understanding of the role of private actors in smart cities, given that private actors (including small- and medium-sized enterprises (SMEs) and start-ups) are increasingly becoming more important in facilitating cities to become ‘smarter’. Second, we aim to learn why some firms tend to be more successful in upscaling than others, so we can identify lessons learned for other (private) actors on how to develop and scale up solutions in a more impactful way. |

**KEYWORDS** [List 3 to 5 keywords]

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| Keyword 1 | Smart Cities |
| Keyword 2 | Business Strategies |
| Keyword 3 | Open Innovation |
| Keyword 4 | Exploration  |
| Keyword 5 | Exploitation |

**SUBJECT CATEGORIES** [Select 3 to 5 WoS Subject Categories that the paper covers. Wos Subject Categories can be found in the first column of Table 1]

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| WoS Subject Category 1 | Business |
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