Appendix

The analysis of the innovation system of smart cities in Japan is based on the data about 22 projects and two consortia, the Japan Smart Community Alliance (JSCA) (https://www.smart-japan.org/) and the Energy Conservation and Homecare Network (ECHONET) (https://echonet.jp/english/). When multiple organizations join the same joint project, they are connected with one another in the network. The software UCINET used for the network analysis is available at https://sites.google.com/site/ucinetsoftware/. A social network was modelled in which each joint project was treated as a connection, and organization membership was treated as one connection to the organization vertex, and the two organization vertices were removed after calculation. For every pair of vertices in a connected network, there exists at least one shortest path between the vertices such that the number of edges that the path passes through is minimized. The betweenness centrality for each vertex is the number of these shortest paths that pass through the vertex and hence illustrates how important the location of an organization is for the other organizations connected with each other in the network. Further details about network analysis can be found in Stephen P Borgatti, Martin G. Everett, and Jeffrey C. Johnson, *Analyzing Social Networks*, SAGE Publications (2013).

The projects on smart cities are listed as follows:

Project	Participants
Yokohama Smart City	City of Yokohama, Tokyo Institute of Technology, Urban Renaissance Agency, Marubeni, Accenture, NTT, ORIX, Sharp, JX Nippon Oil & Energy, Sumitomo Electric Industries, Sekisui House, Sony, DAIKYO ASTAGE, Taisei, Tokyo Gas, TEPCO, Toshiba, Nissan, JGC, NEC, Nomura, Panasonic, Hitachi, Misawa Homes, Mitsui Fudosan, Meidensha
Toyota City Smart City	Toyota City, Aichi Prefecture, Nagoya University, Aisin Seiki, ENERES, KDDI, Sunkus, Sharp, Shinmei Industry, Sumitomo Electric Industries, SECOM, Systems Engineering Consultants, Chubu Electric Power Co, Denso, Toshiba, Toho Gas, Toyota Motor, Toyota Industries, Dream Incubator, Central Nippon Expressway,, Nagoya Railroad, Development Bank of Japan, Hewlett- Packard, Hitachi, Fujitsu, Mitsubishi, Yazaki, Yamato Transport, Yamaha
Keihanna Smart City	Kyoto Prefecture, Kizugawa City, Kyotanabe City, Seika Town, Kansai Research Institute, Kansai Economic Federation, Kyoto Center for Climate Actions, Urban Renaissance Agency, Enegates, i-Energy, Osaka Gas, OMRON, Kansai Electric Power Co, Sharp, Nihon Unisys, Mitsubishi Motors, Mitsubishi, Mitsubishi Heavy Industries, Mitsubishi Electric, Fuji Electric, Furukawa Electric, Furukawa Battery, Renesas Electronics

Kitakyushu Smart City	Human Media Creation Center, Azbil, Iwatani, UCHIDA YOKO, ORIX, Saibugasu, JX Nippon Oil & Energy, Sharp, Nippon Steel, NS Solutions, Softbank, Daiwa House, DENSO, TOTO, TOPPAN Printing, Toyota Motor, Toyota Industries, Toyoda Gosei, Nittetsu ELEX, IBM, Japan Telecom Information Service, FamilyMart, Fuji Electric, Furukawa Electric, Furukawa Battery, Hohkohsya, Mitsubishi Heavy Industries, Yaskawa Electric, Yaskawa Information Systems
Fujisawa Sustainable Smart Town	Fujisawa Town, Panasonic
Teriha Smart Town	Sekisui House
Kashiwanoha Campus City	Chiba Prefecture, Kashiwa City, University of Tokyo, Chiba University, Mitsui Fudosan
Kesen Region Eco- future City	Tohoku Electric Power Co, Hitachi, NEC, Yokogawa Electric, Meidensha, ORIX, University of Tokyo, NTT
Ishinomaki City	Toshiba, Ishinomaki City
Japan US Island Grid	NEDO, DBEDT, HNEI, Hawaiian Electric Co, Maui Electric Co, medb, Mizuho, Hitachi, Sandia National Laboratories, NREL
AES Center	Tokyo Institute of Technology, ENEOS, NTT, Tokyo Gas, Mitsubishi,
NEDO Lyon	NEDO, Grand Lyon Community, Toshiba, Bouyges, Veolia Transdev
NEDO Malaga	NEDO, Mitsubishi, Mitsubishi Heavy Industries, Hitachi, Endesa, Unipersonal, Sadiel Technologias de la Informacion
Java Feasibility Study	NEDO, Sumitomo Electric Industries, Mitsubishi Electric, NTT, Meidensha
Global Development of Urban Smart Transportation System (Electric Vehicles, Electric Buses, Charging Systems)	NEDO, Mitsubishi
Smart Community Development in Advanced Industrial Cluster Cities	Japan Research Institute, Toshiba, NTT, Itochu, NEDO
Chinese Development of Energy Optimizing Businesses with Cogeneration and Building Energy Management Systems	Toshiba, Mizuho, Cubic S Consulting, NEDO
Operation of Smart Grids with Renewable Energy	Japan Research Institute, Hitachi, Mitsubishi Heavy Industries, SMBC, NEDO

Demonstration of Large-Scale Photovoltaic Systems for Industrial Parks	Hitachi, Itochu, NEDO
Microgrid of Combined Power and Heat in Japanese Industrial Parks	NEDO, Toshiba, Tokyo Gas
Delhi-Mumbai Industrial Corridor Initiative	JGC, Mitsubishi, Fuji Electric, Panasonic, City of Yokohama, Nikken, Ebara
Development of Smart Environmental Protection Systems in Industrial Parks	Fuji Electric, NEDO