

Institution: The Open University		
Unit of Assessment: D32 Art and Design: History, Practice and Theory		
Title of case study: Designing sustainable urban innovations in Milton Keynes		
Period when the underpinning research was undertaken: 2009-2017		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Prof Matthew Cook Prof Stephen Potter	Professor of Innovation Professor of Transport Strategy	2009 - present 2000 -13: Full time 2014 - present: Emeritus
Dr Alan Miguel Valdez	Lecturer in Technology and Innovation Management	2014 - present
Period when the claimed impact occurred: 1 August 2013 - 31 December 2020		
Is this case study continued from a case study submitted in 2014? N		
1. Summary of the impact		
<p>Cook, Potter and Valdez' research has been central to a series of practical application trials in Milton Keynes to design sustainable urban transport and energy infrastructures. Their contribution to these projects has been to work in partnership with technical designers and engineers to providing design inputs through engaging with users and to produce inputs to policy development. Their work with a coalition of academic, public and private sector partners has:</p> <ul style="list-style-type: none"> • Contributed to the creation of a UK-leading electric vehicle charging network in Milton Keynes • Supported the development of demand side response measures for smart grid to meet increased demand from the electrification of transport in the Midlands • Facilitated user participation in designing a travel information app to augment urban transport infrastructures in Milton Keynes. <p>Overall, participation in these innovation trails has resulted in enhanced take-up of sustainable designs and technologies and input to practices and policies at a national and international level.</p>		
2. Underpinning research		
<p>Since 2009, Professors Matthew Cook, Stephen Potter and Dr Alan-Miguel Valdez have led three interlinked research projects to trial the practical application of sustainable urban transport infrastructures, processes and policies in Milton Keynes, as part of a coalition of academic, public and private sector partners. In each of these projects, The Open University researchers spearheaded a research approach to understand user behaviours and practices and the institutional relationships needed to support innovative projects, which most practitioner-led projects viewed as a subsidiary research issue to technical design, development and roll out. Today, addressing socio-behavioural factors and feeding these at an early stage into the design process has come to be seen as central to such projects.</p> <p>Plugged in Places (2009-2014). This UK Government Office for Low Emission Vehicles and the South Eastern England Development Agency-funded project focused on identifying the needs of lead electric vehicle users (innovators). It also addressed the design and implementation of the infrastructure to effectively meet these needs. This project was led by Milton Keynes Council in partnership with Potter, Valdez and Cook. The GBP5.1 million programme engaged influential corporate users, such as transport fleet managers, through interviews and experiential workshops, to illustrate the socio-technical practices of electric vehicle drivers. Research outputs from the project revealed a preference for charging infrastructure in city-centre locations, the need for complementary transport policy measures of free electricity and parking and peer-to-peer exchanges of experience [O1].</p> <p>Project Falcon (2012-2015). Building on <i>Plugged in Places</i>, Cook, Potter and Valdez led the Open University's contribution to this GBP16 million project funded by the UK Government Low Carbon Network Innovation Fund. This was led by Western Power Distribution (WPD) in collaboration with the OU, the universities of Bath and Aston, Cranfield University and industry partners CISCO, Logica and Alstom. The project explored how 'smart grids', which proact and</p>		

react to changes in electricity usage, can address the infrastructure challenges associated with the significant regional energy demands, including the widespread adoption of electric vehicles. The smart grid trial in Milton Keynes aimed to increase the flexibility of the local electricity network to respond to new demands, such as those from electrified transport. **Cook, Potter** and **Valdez's** research contribution to *Project Falcon* focused on the design of demand-side response (DSR) measures. These measures encourage critical power users, such as businesses who use a lot of electricity, to consume energy more flexibly. Typically, this involves incentivising these users to reduce energy use during times of peak demand. The researchers identified and engaged with suitable industrial and commercial businesses to assess their willingness to participate in DSR. They then worked with Western Power Distribution to design and trial a DSR scheme with appropriate policies, management methods and contracts to encourage these 'flexibility providers' to participate [O2]. The trials took place over the winter of 2013-14 with a second trial later in 2014.

MK:Smart (2014-2017). **Potter, Cook** and **Valdez** led the OU's transport workpackage in this GBP16 million Higher Education Funding Council for England (HEFCE)-funded smart city project. The overall project was led by the Open University and also involved the Universities of Cambridge, Bedfordshire and industrial partners from BT, Anglian Water, HR Wallingford, Milton Keynes Council, Community Action MK, Fronesys, Graymatter, Satellite Catapult, Transport Systems Catapult and Playground Energy. The transport workpackage was to develop a new mobile application to provide real-time smart information about transport options and conditions in Milton Keynes. The Open University researchers' work explored how to engage users in early-stage conceptual design through prototyping and gamification, which supported the creation of the MotionMap application and an associated travel sensor network for Milton Keynes [O3 - O5].

3. References to the research

- O1. Valdez, A., Potter, S., and Cook, M.** (2019) The imagined electric vehicle user: Insights from pioneering and prospective buyers in Milton Keynes, United Kingdom. *Transportation Research Part D: Transport and Environment*, 71 pp. 85–95. DOI: <https://doi.org/10.1016/j.trd.2019.01.010>. [A refereed paper in this internationally renowned transport research journal. Drawn upon in a paper on a [Swedish study](#) on the impact of electric vehicles on the distribution network.]
- O2. Langendahl, P., Roby, H., Potter, S., and Cook, M.** (2019) Smoothing peaks and troughs: Intermediary practices to promote demand side response in smart grids. *Energy Research and Social Science*, 58, article no. 101277. DOI: <https://doi.org/10.1016/j.erss.2019.101277>. [A refereed paper in an internationally renowned journal that provides social sciences insights on energy studies. Cited in a paper on a related [Chinese study](#) on smart grids.]
- O3. Valdez, A., Cook, M., Langendahl, P., Roby, H., and Potter, S.** (2018) Prototyping sustainable mobility practices: user-generated data in the smart city. *Technology Analysis & Strategic Management*, 30(2) pp. 144–157. DOI: <https://doi.org/10.1080/09537325.2017.1297399>. [A refereed paper in an influential innovation studies journal.]
- O4. Valdez, A., Cook, M., and Potter, S.** (2018) Roadmaps to Utopia: Tales of the Smart City. *Urban Studies*, 55(15) pp. 3385–3403. DOI: <https://doi.org/10.1177/0042098017747857>. [A refereed paper in a leading journal.]
- O5. Wolff, A., Valdez, A., Barker, M., Potter, S., Gooch, D., Giles, E., and Miles, J.** (2017) Engaging with the Smart City Through Urban Data Games. In: Nijholt, A. ed. *Playable Cities: The City as a Digital Playground*. Gaming Media and Social Effects (1). Springer. DOI: https://doi.org/10.1007/978-981-10-1962-3_3. [A key chapter in this major book.]

4. Details of the impact

The research on these three projects was conducted with public sector and industrial partner practitioners. Although the projects were located in Milton Keynes, it was intended that this would represent a trial 'test-bed' area. Thus, the socio-technical understandings achieved would not only produce an impact in Milton Keynes, but also diffuse to influence design and development practices across both the UK and internationally.

Enabling the creation of a UK-leading electric vehicle charging network in Milton Keynes

Cook, Potter and Valdez' Plugged in Places (PiP) research [O1] has supported the uptake of electric vehicles in Milton Keynes. In an October 2020 letter to **Potter**, Milton Keynes Council's Director of Strategy & Futures described how the OU research work resulted in Milton Keynes currently having "one of the highest densities of charging infrastructure" in the UK. He also wrote that Milton Keynes now "records above twice the average number of new electric vehicle registrations per month" to achieve the UK's "national target four years in advance of other locations" [C1]. The PiP programme also included providing charging points outside Milton Keynes, which led to the regional rapid charger 'Crosslinks' programme. In the same letter, Milton Keynes Council's Director of Strategy & Futures explains that the overall success of the programme has decarbonised "transport in Milton Keynes and has helped provide the council with the confidence to commit to becoming carbon neutral by 2030" [C1]. The user engagement methods employed by The Open University researchers during PiP encouraged and validated Milton Keynes Council's decision to develop "a new approach, unique to the UK (and possibly Europe) of providing an independent 'experience centre'" [C1]. Located in Milton Keynes city centre, people can visit the Electric Vehicles Experience Centre seven days a week to speak with an 'EV Guru' and test drive one of the council's fleet of electric vehicles [C2]. The UK Government's 2018 national strategy for cleaner road transport, 'Road to Zero', specifically cites this centre as an exemplar of public engagement with electric vehicles [C3].

Supporting the development of demand side response measures for smart grids to meet increased demand from the electrification of transport in the Midlands

The substitution of EVs for petrol and diesel cars can significantly reduce greenhouse gases and toxic particulate matter emissions. However, the widespread adoption of EVs will place significant new demands for electricity on regional power supply networks. The OU's work in Milton Keynes on PiP led to participation in Project Falcon on the design of a trial smart grid in Milton Keynes.

Cook, Potter and Valdez work on Project Falcon [O2] directly contributed to the success of Western Power Distribution's two commercial demand side response (DSR) trials, which took place over the winter of 2013-14 and later in 2014. In a November 2019 letter, WPD's Systems and Innovation Manager explained how the OU team's "interviews and their analysis directly contributed to the success of the commercial DSR trials by providing emerging learning. This was used to adjust the trials to reflect the requirements of the flexibility providers. This had the effect of improving the reliability of dispatch from 50.5% in the first trial to 96.3% in the second trial" [C4, pp. 2-3]. WPD's Network Strategy Manager noted that "The contribution from OU towards strengthening the business case and improving the efficiency of these techniques provided a strong foundation to ensure the project's outputs were successful" [C4, pp. 4-5].

In his letter, the Systems and Innovation Manager explains how this DRS work in Project Falcon provided the company "with the necessary confidence to launch Flexible Power". This new partnership between four energy network operators aims to create a new path for 'flexibility providers' to participate flexibly in multiple energy networks with DSR now becoming part of the industry's normal business model [C5]. WPD's Network Strategy Manager notes that "WPD now operates a portfolio of around 440MW of demand side flexibility to manage constraints on the network and has agreed for the Flexible Power toolkit to be rolled out across three other DNOs, covering 11 of the 14 licenced network areas in the UK" [C4, pp. 3-4]. Thus, the lessons from Project Falcon have been built upon to be applied across the UK as a whole and disseminated through WPD's international practitioner networks.

Encouraging user participation in designing a travel information app to augment urban transport infrastructures in Milton Keynes

The Open University's work to prototype and gamify a big data-enabled real time travel information app [O3, O4, O5], contributed to the successful development of a proof of concept model of MotionMap when the MK:Smart project was completed in June 2017 [detailed in the 'MotionMap section in O4]. The Greater Cambridge Partnership implemented a variant of MotionMap, which was launched by Smart Cambridge in June 2018 [C6].

MK:Smart partner Vivacity has deployed the network of innovative sensors to monitor vehicle and pedestrian traffic it developed in its work with The Open University researchers in several subsequent projects. Subsequent to the end of MK Smart in June 2017, Vivacity employed the technology for Transport for London at London Bridge Underground Station to optimise pedestrian flows and Highways England has also deployed the sensors for the automatic detection of stopped vehicles in tunnels since [C7]. Vivacity is now using the sensors at a European level as a partner in the 2018-20 Horizon 2020 *Synchronicity* project to support active mobility in Antwerp, Eindhoven, Helsinki and Manchester [C8].

Championing a Socio-Technical perspective

As in the Plugged in Places project and Project FALCON, MK:Smart adopted a research approach that sought an understanding of user behaviours and practices and the institutional relationships needed to support important innovative projects. When **Potter, Cook and Valdez** started doing this as part of technical demonstration projects, this was viewed as a subsidiary research issue to technical design, development and roll out. Today addressing socio-behavioural factors and feeding these into the design process is seen as central to such projects. For example, the PiP report on lessons learnt from the programme [C9] included *"Understand user/ customer requirements, including how they access chargepoints and other services they receive. Consider what is needed to communicate with potential customers"* This is exactly what the OU team did, but which was excluded from receiving PiP funding (and so they secured SEEDA resources for this work). The stance of funding bodies has changed over the last decade, so for example, current *Innovate UK* calls now require a consideration of socio-behavioural factors and expect researchers with this expertise to be a central part of any application. The OU team have continued to develop their work by providing their socio-behavioural expertise for further low carbon energy and transport projects and in 2019 were partners in a successful GBP3.1 million *Innovate UK* bid for trials of an innovative design for wireless on street charging of EVs. These trials are due to commence in London, Buckinghamshire and Milton Keynes in spring 2021.

In a March 2020 letter, the Associate Director of Arup, who have been partners in Plugged in Places, MK:Smart and other collaborations with the OU research team, wrote of the Open University researchers' *"significant contribution to the city of Milton Keynes achieving international recognition in the field of low-emissions transport systems (both private and public)"* [C10]. *"Members of the Council"* he also explained *"now regularly receive invitations to speak about local sustainable transport developments at events all around the world. The impact of that work is therefore considerable. It has encouraged (and continues to encourage) the Local Authority to take bolder steps along the path to a low-carbon future, and it has engaged with the public to raise awareness of those new transport solutions which might lead to a cleaner and brighter future"* [C10].

5. Sources to corroborate the impact

- C1.** Letter from Director of Strategy & Futures at Milton Keynes Council. 5th October 2020.
- C2.** Milton Keynes Electric Vehicle Experience Centre website.
- C3.** The UK Government's 2018 national strategy for cleaner road transport, Road to Zero.
- C4.** Testimonial Letters:
 - DSO Systems and Innovation Manager (pp. 2-3).
 - Network Strategy Manager, Western Power Distribution (pp. 4-5).

- C5.** Flexible Power website, explaining what the initiative does.
- C6.** Smart Cambridge (2020): Smart Journey Planning.
- C7.** Highways England (2019): Vivacity Tunnel Testbed Trial.
- C8.** SynchroniCity (2019): A Guide to SynchroniCity.
- C9.** Office for Low Emission Vehicles (2013), *Lessons Learnt from the Plugged-in Places Projects*, OLEV, July.
- C10.** Testimonial Letter from Associate Director, Arup.