Engaging stakeholders in digital infrastructure projects

Stakeholder engagement review

Richmond Ehwi

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Richmond Ehwi
Cambridge Centre for Housing & Planning Research
Department of Land Economy
University of Cambridge
19 Silver Street
Cambridge
CB3 9EP

rje52@cam.ac.uk

Tel 01223 337128

www.cchpr.landecon.cam.ac.uk
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1. **Summary of recommendations**

This report was commissioned in order to review the literature on stakeholder engagement with a particular focus on Smart City initiatives and digital infrastructure projects. The aim was to provide recommendations that will guide stakeholder engagement for the development of a Digital Twin (DT) project at the West Cambridge site. This document forms the first step towards an Engagement Plan for the West Cambridge Digital Twin project.

The main finding is that stakeholder engagement in most Smart City initiatives only takes place after the specific Smart City technology or initiatives have been developed by the three main bodies driving the digital agenda – universities, industry and local authorities/government. Therefore, in most Smart City initiatives, the contribution of stakeholders is limited to providing data and feedback, which at best leads to tweaking the preconceived plans, ideas and ideals that underpin Smart City initiatives.

Our initial recommendations recognise the time sensitivity of the project and the need to begin setting up data collection.

Based on the review of the literature to date, our recommendations regarding the West Cambridge Digital Twin Project are as follows.

### 1.1. Stakeholder identification and analysis

Our key recommendation is to consider all the identified individuals, groups and institutions as key stakeholders, i.e. take an inclusive approach in identifying potential stakeholders, and assume that they all potentially have ideas that can shape how the Digital Twin project can be implemented in ways that are sensitive to their concerns. Adopting such an approach would eliminate the likelihood of excluding some stakeholders, or assuming at this stage that some are more significant than others to the project’s success. As such, it would be helpful to gather some basic information about the stakeholders, namely how and where they can be located.

<table>
<thead>
<tr>
<th>Preliminary list of stakeholders</th>
<th>Their stake in the Digital Twin project</th>
</tr>
</thead>
<tbody>
<tr>
<td>The University and its ethics and GDPR committees</td>
<td>(1) institutional reputation; (2) usage of university facilities; (3) ethical, legal and data protection implications; and (4) welfare of staff and students.</td>
</tr>
<tr>
<td>Stakeholders and Responsibilities</td>
<td>Considered Issues</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>The Schools and Department ethics communities</td>
<td>(1) institutional reputation; (2) usage of university facilities; (3) ethical, legal and data protection implications; and (4) welfare of staff and students.</td>
</tr>
<tr>
<td>Estate management department</td>
<td>(1) usage of university facilities and assets; and (2) safety of users of university buildings and facilities.</td>
</tr>
<tr>
<td>University Accommodation</td>
<td>(1) usage of university facilities and assets.</td>
</tr>
<tr>
<td>Students and staff working in the specific building</td>
<td>(1) privacy; (2) data protection; and (3) user safety.</td>
</tr>
<tr>
<td>Residents</td>
<td>(1) privacy; (2) data protection; and (3) residents’ safety.</td>
</tr>
<tr>
<td>University Nursery</td>
<td>(1) institutional reputation; (2) privacy; (3) child safety; and (4) data protection.</td>
</tr>
<tr>
<td>Parents whose children use the nursery</td>
<td>(1) privacy; (2) child safety; and (3) data protection.</td>
</tr>
<tr>
<td>Businesses</td>
<td>(1) institutional reputation; (2) privacy; (3) child safety; and (4) data protection.</td>
</tr>
<tr>
<td>Construction companies</td>
<td>(1) institutional reputation; (2) privacy; (3) child safety; and (4) data protection.</td>
</tr>
<tr>
<td>Pedestrians, cyclists, drivers of cars, buses and vans</td>
<td>(1) personal safety; (2) privacy; and (3) data protection.</td>
</tr>
</tbody>
</table>

### 1.2. Information to convey to stakeholders

As the majority of the identified stakeholders were not involved in the conception, refinement or adoption of the specific digital infrastructure for the Digital Twin, it is important to adopt forms of stakeholder engagement that provide adequate information about the project. Such information should include but is not necessarily limited to:

- An explanation of what a Digital Twin is, using a variety of forms, including text and infographics;
- Why the Digital Twin project might be relevant and important for the stakeholder in question, set within a broader context, its usefulness at the specific site, and at city and national levels;
- Where the Digital Twin project sits within the UK’s wider national Digital Twin agenda, along with information about the CDBB;
- Who is implementing the Digital Twin project;
- What kinds of smart technologies will be used for the project;
- What kinds of data the smart technologies will collect;
- Where and when the data will be collected;
• Assurances that personal data will not be collected;
• Highlight the importance the project attaches to ethical and general data protection standards;
• Details of how long the data collection period will last;
• An explanation of how the data will be used;
• How people can find out about the decommissioning of the project;
• Contact details of the person to contact in case someone has other concerns or needs further information about the project.

Furthermore, because the general public was not involved in generating ideas for the Digital Twin project, it would be also be helpful during the information stage to find stakeholders who would be willing to attend a workshop or a short information session where the nature of the project or the data collected so far is presented in an accessible, less technical way. Such an occasion could be used to gather more ideas from stakeholders regarding the use of the data collected.

1.3. Forms of stakeholder engagement

The initial set up of the Digital Twin project is time sensitive. Therefore we recommend that information-oriented forms of engagement be initially implemented before any infrastructure is installed. These could include:

• Creating a website that provides the public with all the information listed above.
• Posters and flyers which provide abridged information about the Digital Twin project. Such materials can be left at vantage points, preferably areas with heavy footfall, including but not limited to: streets leading to the West Cambridge site, common areas and receptions in specific buildings, College Porter’s lodges, and the Estate Management Office at Eddington.
• Face to face meetings with relevant Heads of Departments and Departmental Administrators to explain the project, and to secure overall consent within buildings and offices.
• Email communications to building users using departmental lists. This needs to give a clear route for raising questions and concerns, and a mechanism for dealing with them.
• Bespoke emails to individuals whose personal offices may be used for data collection, with an agreed means of securing informed consent. Follow up emails,
phone calls and personal visits may be required to achieve consent. Consent could be given by return of email, but depending on the ethics application it may be appropriate to go further and use a form that office users sign to indicate consent.

- Hold drop in sessions in communal areas of buildings, advertised to building users via email and poster, to allow discussion and raising of queries.
- Face to face meetings with Estate Management/Security to secure consent for the installation of data collection points across the West Cambridge site.
- Face to face meeting with the University Nursery manager to discuss the project and to give them an opportunity to highlight any concerns.

Over the medium term, we recommend forms of stakeholder engagement that strive to bring the identified stakeholders together to share their perspectives on the project. In line with this, we recommend the following, which will have the further benefit of moving from information provision only to a more co-productive approach to engagement:

- Focus group discussions to gather varied perspectives;
- A workshop or short training session to provide some insights into the use of the data collected or to encourage other forms of co-production;
- An interactive video display mounted at strategic locations, e.g. the West Café, which can provide 3D visualisation of what a Digital Twin using the accompanying data collection might achieve;
- Develop an ongoing plan to further engage stakeholders and to evaluate the success of the engagement.

Further thoughts and recommendations will be provided when the case studies of other digital infrastructure projects have been completed.

Suggested types of stakeholder engagement, targeted stakeholders, and the primary purpose of the engagement:

<table>
<thead>
<tr>
<th>Type(s) of engagement</th>
<th>Targeted stakeholders</th>
<th>Primary purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short term forms of engagement</td>
<td>A website linked to social media platforms (Twitter, Facebook YouTube &amp; Instagram)</td>
<td>All stakeholders</td>
</tr>
<tr>
<td>Method</td>
<td>Audience</td>
<td>Goal</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>---------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Posters at places with heavy footfall and flyers at left at receptions of businesses and departments at West Cambridge site and nearby colleges</td>
<td>All stakeholders</td>
<td>To provide salient information about the DT project with URLs and QR codes linking to the project website.</td>
</tr>
<tr>
<td>Face to face meetings</td>
<td>Representatives of University Ethics Committee, Information Compliance, Estate Management, University Accommodation Service and Heads of Departments</td>
<td>To provide information about the DT project and gather initial reactions.</td>
</tr>
<tr>
<td>Bespoke emails</td>
<td>Departmental Administrators, staff, students and residents of premises at West Cambridge Site</td>
<td>To provide information about the DT project and gather initial reactions.</td>
</tr>
<tr>
<td>Drop in sessions</td>
<td>All stakeholders</td>
<td>To provide information about the DT project and gather initial reactions.</td>
</tr>
</tbody>
</table>

**Medium term forms of engagement**

<table>
<thead>
<tr>
<th>Method</th>
<th>Audience</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interactive video display located at places with heavy footfall</td>
<td>All stakeholders, chiefly pedestrians</td>
<td>To provide information about the DT project and gather ideas and suggestions.</td>
</tr>
<tr>
<td>Focus group discussion</td>
<td>All stakeholders</td>
<td>To bring together the different perspectives in order to fully understand the range of concerns different stakeholders have about the DT project, how such concerns are connected and suggestions on other use of the data collected.</td>
</tr>
<tr>
<td>Workshop and charrette</td>
<td>All stakeholders</td>
<td>To bring all the stakeholders together and provide them with a hands on illustration of the DT project using the DT of the IfM. Also, to crowdsource suggestions about other uses of the data collected.</td>
</tr>
</tbody>
</table>

**Source:** Author, with insights from the Workbook of the Department of Environment Land Water and Planning in Victoria, Australia (2015, p.25-27).
2. Introduction

There is consensus within government, industry, academia and the civil service ‘that the UK has a clear opportunity to demonstrate global leadership in Digital Twin technology’ (National Infrastructure Commission, 2017). A Digital Twin is a representation of a system which mimics its real world-world behaviour (and, in some cases, the surrounding environment). ‘Surrounding environment‘ relates to the transport, energy, water, telecommunications, waste, social infrastructure, residential, commercial, industrial and natural environments within which human activities take place (Enzer, 2019). A Digital Twin draws on real-time updated data collection, models, algorithms and analysis (ibid, p.68). It has the potential to (1) help the UK optimise the use of resources such as energy and water; (2) reduce disruption and delay for transport and ease traffic flow; (3) increase resilience in the face of terrorist attacks; and (4) boost quality of life for UK citizens (National Infrastructure Commission, 2017 p.61).

At the heart of the potential benefits mentioned above are the people whose taxes support the provision of the physical infrastructure found in the built environment, and whose daily experiences of this infrastructure generates rich data that help to improve our understanding of the built environment. This centrality of people or more formally, stakeholders, has been widely acknowledged in both the academic literature on Smart City initiatives (Draetta & Labarthe, 2016; Fernandez-Anez, Fernández-Güell, & Giffinger, 2018) and also from government and public sector standpoints. For example, in a blog post on the vision of a Digital Twin Hub¹, the Chairperson of the National Infrastructure Commission, Sarah Hayes, acknowledged that while government funding, support and skills are for the Digital Twin Hub, it is ‘the people behind the technology’ who are more crucial. Also, in an address on public engagement for infrastructure delivery², Sir John Armitt, the then deputy chairman of the National Infrastructure Commission, remarked that ‘across the sector, we all need to do more to consult and listen to a wide range of views to ensure we identify where the needs are and to secure the support of the public as one of the country’s biggest infrastructure investors’.

Within the context of digital infrastructure projects like Smart Cities and Digital Twins, the above assertions invite critical questions regarding who stakeholders are and how can they be effectively engaged. Indeed, while stakeholder engagement has been well documented in business and strategic management (Clarkson, 1994; Freeman, 1984), urban planning (Arnstein, 1969; Lindenau & Böhler-Baedeker, 2014) and in natural resource management

and governance (Reed et al., 2009), it is less discussed in the growing literature on Smart Cities. Thus, this report reviews two sets of literature on stakeholder engagement. The first focuses on stakeholder engagement in the relatively well established disciplines of business and organisational management and urban planning to lay down the theoretical and conceptual underpinning of stakeholders. This is followed by a review of more recent literature on stakeholder engagement in Smart Cities and other digital infrastructure projects, to ascertain points of convergence with and divergence from the established literature.

It is hoped that insights from these two sets of literature will assist the CDBB to design and execute an effective stakeholder engagement plan as part of efforts to develop a Digital Twin for the West Cambridge Site. Based on the project brief, the report offers some insights into:

- who the stakeholders of the DT West Cambridge project are likely to be;
- what issues are likely to be significant to them; and
- how best to engage them such that there is productive two-way learning among both groups, so that, as a very minimum, the DT project encounters minimal opposition.

Going forward, developing insights and establishing principles of best practice in stakeholder engagement in digital infrastructure projects would be of use to the sector and would help to avoid the criticisms of placation, stewardship, civic paternalism, and a neoliberal conception of citizenship that has plagued stakeholder engagements in both urban planning (Arnstein, 1969) and in early Smart City initiatives (Cardullo & Kitchin, 2019).

### 2.1. Who are stakeholders and why do they matter?

In his much-cited work, Freeman (1984) observed that the general management approach and business models were both incapable of accommodating the rapidly changing business environment, particularly in the area of stakeholders. Hart and Sharma (2004), added that most companies still focused management attention on known, powerful or salient stakeholders who can directly impact their organisation. In challenging this received wisdom, Freeman (1984 p.46) clarified that ‘a stakeholder in an organisation is (by definition) any group or individual who can affect or is affected by the achievement of the organisation’s objectives’.

Mitchell and Wood (1997, p.856), emphasised that Freeman’s definition is quite broad and ‘leaves the notion of ‘stake’ and the field of possible stakeholders unambiguously open to include virtually anyone’. Thus, adopting a narrow view, Clarkson (1994), cited in Mitchell et
al. (1997) observed that a stakeholder might include those who bear some risk as a result of investing human or financial, or something else of value, in a firm (voluntary stakeholders) and those who are placed at risk due to a firm’s activities (involuntary stakeholders).

Notwithstanding the scope, stakeholders are generally classified as belonging to two groups. These include primary, or internal, stakeholders and secondary, or external, stakeholders (Ayuso, Rodríguez, García-Castro, & Ariño, 2011; Freeman, 1984; Hall & Vredenburg, 2005). Primary stakeholders include business owners, managers, employees, customers and suppliers directly involved with the business, while secondary stakeholders include those who indirectly affect and/or are affected by the business. These include governments, local communities, competitors, special interest groups, quasi-agencies, consumer advocates, environmentalists and the media. According to Mitchell and Wood (1997, p.855), stakeholder theory attempts to answer the question ‘which groups are stakeholders deserving or requiring management attention, and which groups are not’.

This question is salient because there is consensus across several disciplines that stakeholders are important for the success of organisations and indeed for any undertaking that involves humans and non-humans (Le Pira, Ignaccolo, Inturri, Pluchino, & Rapisarda, 2016; Reed et al., 2009). Stakeholder benefits are often discussed from three theoretical perspectives. These are the descriptive rationale, the instrumental rationale and the normative rationale (Donaldson & Preston, 1995; Reed et al., 2009).

According to Donaldson and Preston (1995), the central thesis of the descriptive strand of stakeholder theory is to describe the firm as a panoply of competitive interests possessing intrinsic values. More specifically, the descriptive perspective illuminates issues such as the nature of the firm, the way managers think about managing, how board members think about the interest of corporate constituencies, and how some corporations are actually managed (Donaldson & Preston, 1995, p.70).

The instrumental perspective posits a framework for examining the connections between practising stakeholder engagement and achievement of corporate performance goals such as profitability, stability and growth (ibid, p.67).

The normative perspective stresses that stakeholders are persons or groups with interest in the substantive and procedural aspects of corporate activity. These interests carry subjective intrinsic value and hence warrant consideration (Donaldson & Preston, 1995 p.67). Donaldson and Preston (1995) go on to assert that these three theoretical perspectives are not necessarily mutually exclusive and that normative rationales implicitly underlie both descriptive and instrumental rationales.
It therefore follows that the growing interdisciplinary literature on the importance of stakeholder engagement is underpinned by either one or a combination of these three theoretical rationales.

### 2.2. Identification of stakeholders

While it may seem obvious, identifying stakeholders is not a straightforward exercise. According to Hart and Sharma (2004 p.8), ‘firms do not often know which stakeholders are salient and important for generating the knowledge required for innovation’. Indeed, while some stakeholders can quite easily be identified owing to their position within some production, exchange and consumption processes, for example, producers, marketers and consumers in a production firm, some are more nuanced. Consequently, several analysts have advanced arguments as to what counts when identifying or selecting stakeholders. This section discusses some of these suggestions and how the insights can be applied to the Digital Twin West Cambridge Project.

Mitchell et al. (1997) have observed that, at the centre of stakeholder identification is what constitutes a ‘stake’. A stake is commonly understood as a material interest which can be affected by the activities of an entity or which can affect an entity’s activities (Mitchell et al., 1997). A ‘stake’ is often equated to risks that result from the (in)actions of a business entity (Freeman & Evan, 1990). Being predisposed to these risks or actually suffering from such risks, it is argued, accords legitimacy (ibid). Mitchell et al. (1997) argue that equating ‘a stake’ to the risk and the legitimacy that derives thereof best serves the interest of scholars who adopt a narrow definition of stakeholders. In their view, a good understanding of what constitutes a ‘stake’ requires a distinction between (1) claimants versus influencers, (2) people with actual or potential relationship, and (3) the nature of power, dependence and reciprocity in the relationship between stakeholders and organisations. Each distinction is elaborated as follows.

Regarding the distinction between claimants and influencers, Mitchell et al. (1997) argue that influencers have power over firms but whether they have valid claims or any claims at all and whether they wish to press their claim is another issue. Claimants may have legitimate or illegitimate claims but may not have the power to influence the firm. Similarly, regarding the relationship with a firm, Mitchell et al. (1997) ask whether ‘an entity can claim to be stakeholder without having a relationship with the firm’.

‘Potential stakeholders’ or what Hart and Sharma’s (2004) call ‘fringe stakeholders’, include: the poor, weak, isolated, non-legitimate and even non-humans’ who cannot be readily
identified, but who can self-organise and acquire an important voice to influence disruptive changes. These fringe stakeholders often hold knowledge and perspectives that are essential to anticipating potential future sources of problems as well as finding innovative solutions. Hence Mitchell et al.’s (1997) response to their question about whether one qualifies to be a stakeholder even when no direct relationship exists between them and an entity is affirmative: they argue that ‘potential relationships’ can be as relevant as actual relationships and their ‘identification, at a minimum, can help organisations avoid problems and perhaps even enhance effectiveness’ (p.859).

However, Hart and Sharma (2004) also concede that it is practically impossible to involve every stakeholder potentially affected by the decision of a corporation (p.8). Their advice is for firms to adopt what they call ‘radical transactiveness’ (RT) which involves ‘fanning out’ (extending the scope of the firm) and ‘fanning in’ (integrating diverse and disconfirming information).

Fanning out aims to identify stakeholders and issues that can help firms to understand stakeholder concerns better and to prevent the formation of adversarial forms. Some of the fanning out process entails: (1) training people to carry out ‘boundary spanning’ in terms of, for example, marketing, procurement, communication, new business development, etc.; (2) charging boundary spanners to engage with fringe stakeholders and those in their network; (3) setting up corporate departments to coordinate information from boundary spanners to develop the list of fringe stakeholders; (4) initiating a task force to develop strategies for good communication with stakeholders; and (5) implementing strategies formulated in collaboration with fringe stakeholders for local buy-in. According to Hart and Sharma (ibid), fanning out preserves a business’s reputation, accords legitimacy and affords operational freedom.

Fanning in becomes necessary after expanding the firm’s boundaries to new thinking, new concerns and new opportunities for the future. Here, a business entity builds bridges, often by engaging first with fringe stakeholders. Also, at this stage, a business would usually reframe their dominant logic substantially to build complex interactions. The objective for fanning in entails generating new product ideas and innovations, and transferring tacit knowledge. The process pays attention to the following issues: (1) training managers on cultural sensitivities in boundary areas; and (2) encouraging managers to personally visit or temporarily stay at places occupied by fringe stakeholders, in order to generate competitive imagination for the future growth of a business.

Also, regarding power, dependence and reciprocal relationship, Mitchell et al. (1997) sort the arguments in the literature into six inter-related scenarios. On relationships, it should be
ascertained whether the firm and the stakeholder are in a relationship, be it contractual, moral, ethical or fiduciary. The existence of such a relationship would form the basis for stakeholder legitimacy. In terms of power dependencies, attention is drawn to whether it is the stakeholder or the firm who dominates the power relationship. This means it is important to establish whether (a) the firm is dependent on the stakeholder or the stakeholder has power over the firm, as in stakeholder-dominant power relationship, or the reverse in a firm-dominant model. Finally, attention focuses on whether the stakeholder has an interest in the firm for which legitimacy is not implied.

Following their comprehensive review of the literature on stakeholder identification, Mitchell et al. (1997) proposed that, beyond having a ‘stake’, a combination of stakeholder attributes can help identify different types of stakeholders. These attributes include power, legitimacy and urgency. Mitchell et al. (1997) link power to being in a position to carry out one’s own will despite resistance. This power can be exercised in different ways, including in a coercive manner, such as using force, violence or restraint. Power can also be exercised using financial or material wealth. Finally, power can be exercised normatively, using symbolic resources such as love and prestige.

Legitimacy relates to socially accepted and expected structures of behaviour (Scott, 2005) and having legitimacy is often presumed to confer power, although this is not always the case. This is because some powerful stakeholders are not necessarily legitimate, and some legitimate stakeholders may lack the power and urgency to make managers respond to their needs (Mitchell et al., 1997; Powell & Colyvas, 2008).

Urgency, according to Mitchell et al. (1997), relates to the time-sensitivities of an issue that is important to a given stakeholder. Urgency conveys to management that delays in responding to stakeholder concerns may lead to perverse outcomes for an organisation. Combining these three attributes in a Venn diagram, Mitchell et al. (1997) identify seven distinct stakeholders. In their concept, three of the stakeholders would possess only one attribute: power, legitimacy or urgency. Another three would possess two attributes, while only one possesses all three attributes. They termed those with no attributes as non-stakeholders. Mitchell et al.’s (1997) seven stakeholders are illustrated in Figure 1 below, and a description regarding their characteristics and salience to managers is elaborated in Table 1 below:
Table 1 Stakeholders, their attributes and salience to managers

<table>
<thead>
<tr>
<th>Type of stakeholder</th>
<th>Relevant attributes</th>
<th>Level of salience to managers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latent Stakeholders</td>
<td>These are stakeholders having only one attribute.</td>
<td>Likely to have low salience</td>
</tr>
<tr>
<td>1 Dormant stakeholders</td>
<td>Possess the power to impose their will but lack legitimacy and an urgent claim. Have little interaction with the firm. Can become more salient if they acquire either legitimacy or urgency. Example include a fired employee.</td>
<td>Managers should be cognisant of them.</td>
</tr>
<tr>
<td>2 Discretionary stakeholders</td>
<td>Possess legitimacy but lack the power to influence the firm and press no urgent claims. Example include people or groups who usually benefit from corporate social responsibility.</td>
<td>There is no pressure on managers to engage them.</td>
</tr>
<tr>
<td>3 Demanding stakeholders</td>
<td>Possess only urgent claims but lacks both power and legitimacy. They are bothersome but not worrying. Examples include a lone picketer.</td>
<td>Do not warrant managers’ attention.</td>
</tr>
<tr>
<td>Expectant stakeholders</td>
<td>These are stakeholders with two attributes. The combination of attributes leads to active versus a passive stance.</td>
<td>Stakeholder salience would be moderate to managers.</td>
</tr>
<tr>
<td>4 Dominant stakeholders</td>
<td>Possess both power and legitimacy and can easily form a dominant coalition. They have formal mechanisms in place that acknowledge their relationship with the firm. They expect and receive manger’s attention. Examples include stockholders in a firm.</td>
<td>They would matter to managers.</td>
</tr>
<tr>
<td>5</td>
<td>Dangerous stakeholders</td>
<td>Possess urgency and power but lacks legitimacy. They are likely to be coercive and possibly violent. Examples include employee sabotage or political terrorist using kidnappings to demand attention.</td>
</tr>
<tr>
<td>---</td>
<td>------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>6</td>
<td>Dependent stakeholders</td>
<td>Possess legitimacy and urgency but lack power and hence depend on others (stakeholders or the firm) for power to carry their will. Example include local residents suffering air pollution from a nearby firm but who needs some advocacy groups to help them fight their cause.</td>
</tr>
<tr>
<td></td>
<td>Definitive stakeholder</td>
<td>Possess all three types of attributes, namely, legitimacy, power and urgency and hence, managers have a clear and immediate mandate to attend to and give priority to that stakeholder’s claim.</td>
</tr>
<tr>
<td>7</td>
<td>Non-stakeholder or Potential stakeholder</td>
<td>They have no direct relationship with the firm.</td>
</tr>
</tbody>
</table>

**Source:** Mitchell et al. (1997)

Eden & Ackerman (1998), cited in Reed et al. (2009), suggest that an interest-influence matrix can also help to identify stakeholders. This entails mapping interest and influence (or power) of stakeholders, along two separate axes marked as low and high (see Figure 2 below). Four stakeholders are commonly identified from the matrix: key players, context setters, subjects and the crowd. Key players are stakeholders who should be actively engaged because they have high interest and influence. Context setters are highly influential but have little interest, and hence they should be monitored and managed. Subjects have high interest but often lack the capacity for impact. However, they can become influential through alliance formation. Crowds are stakeholders who have little interest and low power, and hence, there is little need to consider them in greater detail or to engage with them.
Identifying stakeholders often starts with the generation of a preliminary list of stakeholders (Yang, Shen, Ho, Drew, & Xue, 2011). This would usually comprise primary or internal stakeholders who are easily identifiable. However, there are some stakeholders who are difficult to identify without some secondary information (Hall & Vredenburg, 2005) and hence risk being excluded from the engagement process altogether. Hence, in addition to the preliminary list, other stakeholders are added to the list usually through some empirical approach. Commonly, a snowballing technique is set in operation by contacting the preliminary stakeholders for more information on other potential stakeholders. Reed et al. (2009), also suggest semi-structured interviews, focus group discussions, and snowballing as being helpful approaches to stakeholder identification.

In a study examining stakeholder engagement in an urban renewal project in Chongqing, China, Yang et al. (2011) relied on their experience of other urban renewal projects and local knowledge to first generate a preliminary list of 23 stakeholders. They further conducted interviews with the preliminary stakeholders to achieve five goals, namely to (1) verify their preliminary stakeholder lists; (2) clarify stakeholder roles; (3) summarise the interest stakeholders represented; (4) illustrate the cooperation and conflict between them; and (5) answer open-ended questions about current problems or barriers related to urban renewal decision-making. This eventually increased their list of stakeholders to 36, representing 8 different groups. It was only after these interviews that questionnaire surveys were administered to understand the knowledge, power and level of interest that the stakeholders

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3 http://projectizing.co.uk/stakeholders-analysis-powerinfluence-interest-matrix/
had in the urban renewal project. This suggests that the identification of stakeholders is an iterative process which requires time.

It should be stressed that each method has its strengths and weaknesses, and these should be taken into account when making a decision. For example, while focus groups make it possible to solicit different perspectives at the same time, they are susceptible to some voices becoming more dominant than others. Likewise, using a snowballing technique can be time-consuming. Ultimately, the choice of which method to use for stakeholder identification depends on several factors, including the ease of identifying primary stakeholders, the scale of the project, the project timeline and resource availability.

2.3. Stakeholder relationships

While different people or groups are likely to stake different claims, some stakeholders can express common concerns. Such common concerns often form the basis for the formation of coalitions within stakeholder groups (Jelile, Olevsky, & Safiulins, 2016; Zhuang, Qian, Visscher, Elsinga, & Wu, 2019). Thus, as part of stakeholder identification, it is important to pay attention to the relationships that exist, or that could potentially develop, between different stakeholders. Such awareness is useful because some of the concerns around which the stakeholders coalesce could form a critical mass to reach consensus swiftly, or stifle the engagement by uniting dissidents. Commonly, scholars employ social network analysis (SNA) to understand stakeholder relationships within a stakeholder ecosystem (Cascetta, Carteni, Pagliara, & Montanino, 2015; Hanneman & Riddle, 2014). This is usually a graphical representation for identifying and comparing the relationship between individuals, groups and systems in order to model real-world interactions (Zhuang et al., 2019). It also shows the interdependencies between stakeholder and stakeholder groups (ibid).

The graphical representation is usually preceded by a survey that asks the different stakeholders of a project to subjectively rank either their influence or perceived importance within a given stakeholder ecosystem (Yang et al., 2011). Yang et al. (ibid) used SNA to test the study the importance of stakeholders in the construction of new classrooms and facilities for a theological school in Australia. The graphical representation of their survey results validated their underlying conceptual thinking of different stakeholder influences and their importance. Chevalier and Buckles (2008) further suggest three things when analysing the relationship between actors. Firstly, they advise that it is important to carry out an assessment of what the actors expect of each other and what their approximated satisfaction is likely to be. Secondly, they caution that it is crucial to look at the networks of influence, trust and information that can potentially flow within and across the relationships. Thirdly, it is helpful to assess how the stakeholders or their respective activities influence each other.
2.4. Conducting the stakeholder engagement

Having identified stakeholders and the possible relationships that can develop between and among them, the stakeholder engagement process can then begin. Like most activities, every stakeholder engagement should have an engagement plan. This plan should comprise a strategic engagement plan and an operational engagement plan (Department of Environment, Land, Water and Planning, 2015). The strategic engagement plan takes a high-level view of the engagement process, while the operational engagement plan is used to record specific activities to be carried out during the engagement process. The strategic engagement plan is made up of two key components, namely: (1) a clarification of the purpose for the stakeholder engagement; and (2) a clear idea of what would constitute a successful engagement.

2.2.1. Purpose of stakeholder engagement

In a much-cited work in planning literature, the urban planner, Sherry Arnstein (1969) relates citizen engagement in planning decision-making to eight rungs on a ladder. Each rung represented different levels of citizen involvement and power over the final decision making. Arnstein calls the two bottom rungs, manipulation and therapy, as non-participation. She argues that the ‘real purpose of these two rungs is not to enable people to participate in the planning or conducting of programmes but to enable powerholders to educate or cure the participants’. She calls the next three rungs on the ladder, informing, consultation and placation, tokenism, arguing that although powerholders allow ‘the have-nots’ to hear the deliberations and make a contribution, they have no power to influence the power holder to change the status quo.

Further up the ladder are the three rungs which constitute what Arnstein terms ‘citizen power’: partnership, delegated power and citizen control. At this level, citizens, including the ‘have-nots’, gain a higher degree of decision-making clout, and can negotiate and engage in trade-offs with power holders. Also at this point, notably, in terms of citizen control, the less influential acquire majority decision-making and managerial powers.
Arnstein’s (ibid) ladder of participation is a simplified abstraction of a rather complex reality. Moreover, there is no guarantee that access to power would lead to upward movement on the ladder. However, for decades, Arnstein’s work has served as an essential reference for most studies on stakeholder engagement.

In their guidance on citizen engagement, the Department of Land, Water and Planning in Victoria, Australia (Department of Environment, Land, Water and Planning, 2015) summarised the purpose of stakeholder engagement into five parts:

- to inform - to provide stakeholders with balanced and objective information to assist them to gain a better understanding of a situation or a project goal. For such engagement, project developers promise to keep stakeholders informed of all developments (Ibid, 2015).

- to consult - to consult stakeholders means to solicit input and feedback on analysis of a situation, alternative and decisions. Here, project developers promise to keep stakeholders informed, in addition to listening to and acknowledging their concerns, and providing feedback on how their input has influenced the final decision or product (ibid).
to involve - project developers work directly with the stakeholders throughout the process to ensure that their concerns and aspirations are systematically understood and considered (ibid). Project developers promise to work with stakeholders to ensure that their concerns and aspirations are adequately captured in the alternatives developed, and feedback on how their input would influence the final decision.

to collaborate - the goal for collaborative stakeholder engagement is to partner with stakeholders in each aspect of the decision-making process, including developing alternatives and finding the ideal solution. Here developers promise to look to stakeholders for direct advice and innovation in formulating solutions, as well as incorporating their advice and recommendations into decision making.

(5) to empower - in order to empower stakeholders, project developers place final decision-making in the hands of the stakeholders, and promise to implement what the stakeholders decide.

2.2.2. Clarifying what counts as success

The second component of an engagement plan is to provide clarity as to what counts as success. Here, the general observation is that most project developers often enter stakeholder engagement with a rigid or pre-determined view of what should count as a successful stakeholder engagement process. This clarity of goal is important to avoid unnecessary distractions during the exercise and to guard against dissipation of resources, including time, money and energy. A pre-conceived view of success can sometimes stifle communication and lead to misbranding of individuals who express contrary opinions and outcomes as dissidents and rebels. Thus, while, project developers are encouraged to be clear about what they want from stakeholder engagements, they should be flexible enough to welcome suggestions and criticisms that could help refine project ideas and unlock citizen buy-ins. Hence, it is incumbent on them to maintain a disposition such that that their insights and ideas are not immensely immutable and that they can be enriched with insights from diverse stakeholders (Gould, 2012).

2.5. Operational stakeholder plan

The operational stakeholder plan of the stakeholder engagement process focuses on a wide range of issues regarding the types of the engagement process, the medium of communication, and the protocols that guide the engagement, among others. There are different forms of stakeholder engagement, and the type that is selected will often depend on a range of factors: including the age group, sexual orientation, disability, educational attainment, digital literacy of, and accessibility for, the different stakeholder groups. Insights into the profile of the stakeholders often goes a long way towards influencing the selection
of engagement venues and the types of media used for communication. Whilst the selection of venues and the media for communication may be seen as non-contentious, recent empirical studies on the use of communication media in urban infrastructure projects in Hong Kong by Vivien and Leiringer (2014) reveal that stakeholder engagement can easily be thwarted by using communication media which the public find either unbelievable or which they cannot make sense of. Another critical factor is the anticipated reach of the engagement process and how easily the different stakeholder groups can be accessed.

The spatiality of an intervention is another key component to consider as part of the operational plan for stakeholder engagement. For example, if an intervention would impact a handful of people in a small building, it might be possible and more cost-effective to engage with them verbally or to physically circulate information regarding the intervention.

However, if the intervention would span a wider spatial extent (a street, or multiple sites) then other forms of engagements tailored to suit the commuting patterns of different stakeholders might be more useful. In the extant literature on stakeholder engagement, the common types often discussed include: face-to-face interviews, focus group discussions, town hall meetings, workshops, charrettes\(^4\), websites, posters and letters. Each of these forms of engagement has its strengths and weaknesses. Similarly, each one or a combination of some might be more useful for a particular type of stakeholder engagement than others. In line with the above, below are some suggestions regarding engagement tools and forms of engagement for some and all the five purposes of stakeholder engagement discussed earlier.

\(^4\) A charrette is an intensive workshop in which various stakeholders and experts are brought together to address a particular design issue. It starts the communication process among key stakeholders and concludes with participants being able to identify and understand project performance goals and needs (Lindsey, Todd, Hayter, & Ellis, 2009).
Table 2. Table showing Tools and forms of Engagement versus the purpose of Stakeholder Engagement

<table>
<thead>
<tr>
<th>Tools and forms of engagement</th>
<th>Inform</th>
<th>Consult</th>
<th>Involve</th>
<th>Collaborate</th>
<th>Empower</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Key stakeholder interview</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Video interactive display</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Printed information</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Public involvement volunteers</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>5 Simulation (electronically generated)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>6 Surveys</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Websites</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>8 Workshops</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>9 Media releases</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. **Stakeholder engagement, or citizen participation in Smart City and Digital Initiatives**

3.1. **Overview**

This section of the report reviews the literature on stakeholder engagement, or citizen participation, in Smart City initiatives. The aim is to show the form of and how stakeholder engagement takes place in Smart City initiatives of which a Digital Twin is a key component.

‘Smart City’ now seems to be a buzz word, and its ubiquity can be found in most big cities of the world. However, no consensus exists on what a Smart City is (AlAwadhi & Scholl, 2013), how it should be conceptualised (Fernandez-Anez et al., 2018) and how its initiatives and performance can be assessed (Albino, Berardi, & Dangelico, 2015). As an example, Albino et al. (2015 p.6-7) recently sampled 21 distinct definitions of Smart Cities from the literature published from 2000 to 2013 and found remarkable differences in term of functionality, technology, and beneficiaries. Holland (2008) points out that four things have conflated the Smart City discourse.

Firstly, there is a difficulty in separating terms such as ‘smart’, ‘intelligent’, ‘innovative’, and ‘creative’. Secondly, there is a problem with separating the hype for place marketing purposes from actual infrastructure change or evidence of workable and effective policy. Thirdly, the meaning of smartness is overly embedded in information and communication technology, and fourthly, a focus on spaces that bring ICTs and people together to enhance innovation, learning and problem-solving (p.305). Despite this lack of consensus, most scholars, when defining a Smart City, tend emphasise the use of networked computers, the internet, sensors, machine learning and publicly-sourced data to solve contemporary urban challenges such as transportation, education, healthcare governance (Paskaleva, Cooper, Linde, Peterson, & Gotz, 2015; Shelton & Lodato, 2019). Kouritin et al. (2014) note that a city can be considered smart ‘when investments in human and social capital, and traditional (transport) and modern (ICT) communication infrastructure, fuel sustainable economic growth and high quality of life, with a wise management of natural resources, through participatory governance’.

Kitchin et al. (2019) contend that literature on Smart Cities is broadly organised around two main perspectives. On the one hand are those who seek to develop and implement Smart City technologies and initiatives but pay scant attention to how they would reproduce a particular form of political economy and wider consequences beyond desired effects like efficiency, productivity, competitiveness, sustainability, security. This group comprises scientists, technologies and technocrats working in universities, companies and government. They claim that they only create technologies that solve instrumental problems. The other
group critique such instrumental logics of Smart City technologies or initiatives from political, ethical, and ideological grounds, arguing that such technologies are designed with little or no regard for wider and deep-seated societal issues of power, capital, equality, participation and citizenship. This group commonly includes geographers and scholars from urban study backgrounds. They maintain that Smart City initiatives ‘facilitate and produce instrumental, functionalist, technocratic, top-down forms of governance, and reflect ‘an ethos of stewardship and civic paternalism’ (Kitchin et al., 2019 p.3). This group are, however, criticised for not offering any pragmatic or technical solutions for societal problems (ibid).

There is a consensus that Smart City initiatives are initiated and sustained by the investments made and the benefits accruing to the three main entities which form the (advanced) Triple Helix Model (Alawadhi et al., 2012; Kourtit et al., 2014; Leydesdorff & Deakin, 2010). These three entities include (1) universities and their research centres, (2) industry and big corporations, and (3) national and local governments. Within this model, universities and research centres are responsible for knowledge production and industries corporatise intellectual capital from universities and their research centres. The government provides the regulative standards, policies and governance required for universities to create patents and customise their intellectual capital (Deakin, 2014).

3.2. Stakeholder engagement in Smart City initiatives

Many scholars have called into question claims that Smart City initiatives are citizen-centric (Cardullo & Kitchin, 2019; Paskaleva et al., 2015). This is because in most cases, when citizens, people or stakeholders are mentioned in Smart City discourse, emphasis is placed on the entities in the Triple Helix Model. Sarah Hayes, the author of the Data for Public Good report (2017), made the following comment about the importance of people in a Digital Twin:

More crucially, it requires people to make it [digital twin] work. It’s not so much about the technology but the people behind the technology – the data scientists and the AI specialists and the enablers who want to make it work because they see what the benefits of a National Digital Twin might be (Italics for emphasis).

Broadly speaking, stakeholder engagement in Smart Cities can be viewed as two stages: the concept design stage and the end-user stage. The concept design stage often includes idea generation, idea refinement, idea adoption and the translation of the idea into a Smart City initiative. Stakeholder engagement at this stage is restricted to the insights and experts of computer and data scientists, programmers, engineers and some bureaucrats. In the literature, people lacking this expertise are rarely engaged. However, there is some evidence
of co-production and co-design taking place in Smart City initiatives such as the EU funded EAR-IT\(^5\) living lab project (Ståhlbrööst, Bergvall-Kåreborn, & Eriksson, 2015). However, as Cardullo and Kitchin (2019) observe, while citizens who attend such events are free to produce whatever application they desire, the event is very much owned and run by the sponsors, who frame the event's aims and provide space, mentors and guidance (p.9).

It is also evident from the literature that stakeholder or citizen engagement in Smart City initiatives predominantly takes place at the end-user stage. This is the stage where the technology or smart initiative has already been developed and is being operationalised. Thus, at this stage, citizen engagement serves as a testbed for project initiators to try the technologies and other smart initiatives: the public is invited to learn about or experience something they had no input in the conception and design. As Cardullo and Kitchin (2019) note, the public is reduced to data points or feedback to refine top-down ideas and initiatives.

Similarly, in a recent review of how publicness and the role of the public is imagined and positioned in Smart City policy documents of six UK cities, namely, Glasgow, Bristol, Manchester, London, Milton Keynes and Peterborough, Cowley et al. (2018) proposed four identified four modalities of publicness, namely: (1) service-user publicness; (2) entrepreneurial publicness; (3) political publicness; and (4) civic publicness. Their analysis revealed that service-user and entrepreneurial publicness were the two dominant imaginaries in Smart City initiatives. In the former, the public is positioned as part of the city’s routine functionality rather than assigned co-creation agency. In entrepreneurial publicness, public involvement is valued and incentivised by commercial possibilities which the project initiators stand to gain without making any clear conceptual distinction between the public sphere and the market. They concluded that the citizen-centric claim of Smart City initiatives in UK cities is questionable. This is because it lacks public interest or enthusiasm, and such initiatives tend not to constitute mainstream local government policy. Following from the above, stakeholder engagement for Smart Cities or digital innovations might be visually summarised in Figure 4 below.

\(^5\) This was an EU FP7 funded project which sought to develop a high societal value applications and deliver of innovative services and applications targeting smart buildings. The technology in question was a large-scale real-life experimentation of intelligent acoustics in smart buildings.
Figure 4 Stakeholder engagement

- SE is dominated by experts
- Public participation may be allowed
- No meaningful change can be made to concept design

Source: Author
4. Digital Twin Project at the West Cambridge Site

This section explores how the insights above can inform good stakeholder engagement for the West Cambridge Digital Twin Project. It discusses the following key aspects of the engagement process which we feel it is important to pay attention to:

- Stakeholder identification and their stake in the DT Project
- Contacting the stakeholders – approaches and timing
- The purpose and forms of engagement
- Key protocols to observe

4.1. Stakeholder identification and their stakes in the DT project

Given the specific and wider context of where the project is taking place, we envisage the institutions, people and groups summarised in Table 2 below would constitute the preliminary list of stakeholders to be engaged. Following Yang et al. (2011), this would mean that other empirical approaches would be required to validate the stakes attributed to these preliminary stakeholders and to help identify other stakeholders. Also, given that a social network analysis is yet to be conducted to establish the centrality or salience of the preliminary stakeholders, we think it is prudent in the short-term to assume that the preliminary stakeholders are all key stakeholders. This would help avoid the temptation of trivialising the salience of some stakeholders.

<table>
<thead>
<tr>
<th>Preliminary list of stakeholders</th>
<th>Their stake in the Digital Twin Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>The University and its ethics and GDPR committees</td>
<td>(1) institutional reputation; (2) usage of university facilities; (3) ethical, legal and data protection implications; and (4) welfare of staff and students.</td>
</tr>
<tr>
<td>The schools and department ethics communities</td>
<td>(1) institutional reputation; (2) usage of university facilities; (3) ethical, legal and data protection implications; (4) welfare of staff and students.</td>
</tr>
<tr>
<td>Estate management department</td>
<td>(1) usage of university facilities and assets; and (2) safety of users of university buildings and facilities.</td>
</tr>
<tr>
<td>University Accommodation</td>
<td>(1) usage of university facilities and assets.</td>
</tr>
<tr>
<td>Students and staff working in the specific building</td>
<td>(1) privacy; (2) data protection; and (3) user safety.</td>
</tr>
<tr>
<td>Residents</td>
<td>(1) privacy; (2) data protection; and (3) residents' safety.</td>
</tr>
<tr>
<td>University Nursery</td>
<td>(1) institutional reputation; (2) privacy; (3) child safety; and (4) data protection.</td>
</tr>
</tbody>
</table>
Parents whose children use the nursery | (1) privacy; (2) child safety; and (3) data protection.
---|---
Businesses | (1) institutional reputation; (2) privacy; (3) child safety; and (4) data protection.
Construction companies | (1) institutional reputation; (2) privacy; (3) child safety; and (4) data protection.
Pedestrians, cyclists, drivers of cars, buses and vans | (1) personal safety; (2) privacy; and (3) data protection.

**Source:** Author

### 4.1.1. Preliminary stakeholder relationships

While each of the identified stakeholders may have unique concerns about the Digital Twin project, there may be some concerns shared between and among the stakeholders. Such concerns can easily lead to the formation of stakeholder groups or pairs which can facilitate or hinder reaching a consensus. It is important to pay attention to such pairings, the common issues they coalesce around and the basis of their relationship. Table 4 below summarises the stakeholder pairs, common stakes and basis of their relationship.
### Table 4. Stakeholder coalitions, their common issues and basis of their relationship

<table>
<thead>
<tr>
<th>Stakeholder pairs</th>
<th>Common stakes or issues</th>
<th>Basis and nature of the relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 The university, schools and departmental ethics committee and GDPR</td>
<td>Ethical implications of the project, implications of the project on institutional reputation, and on the welfare of staff and students.</td>
<td>Established protocol is likely to exist and may be binding. Relationship can be mutually advantageous and enduring.</td>
</tr>
<tr>
<td>2 University Estate Management and Accommodation services</td>
<td>Safety and functionality of university assets, including buildings.</td>
<td>Established protocols might exist, but may not be binding. Relationship may be mutually advantageous and potentially enduring.</td>
</tr>
<tr>
<td>3 Students and staff</td>
<td>Privacy, safety, security and data protection.</td>
<td>Established protocols may not exist but the relationship may be mutually advantageous and enduring due to proximity and frequent interaction.</td>
</tr>
<tr>
<td>4 University Nursery staff and parents who use the nursery</td>
<td>Privacy, safety and data protection of nursery staff members, parents and children in the Nursery.</td>
<td>Contractual relationship may encourage this coalition which may be mutually beneficial but not necessarily enduring.</td>
</tr>
<tr>
<td>5 Residents, businesses and construction companies</td>
<td>Changes in the character of neighbourhood, privacy, security and data protection.</td>
<td>Mutually beneficial interests and less enduring relationship.</td>
</tr>
</tbody>
</table>

**Source:** Author

### 4.2. Establishing initial contact with stakeholders – approaches and timing

It is important to bear in mind that different stakeholders may require different approaches when establishing initial contact. Some may have very strict rules regarding this (often relating to data protection) whilst others tolerate conventional approaches, involving sending an official letter either by post or via email. Thus, it is important to first check these whether there are any strict set of initial approaches. If not, then suggestions below may be used to contact the stakeholders identified above.
### Table 5. Suggestions for establishing initial contact with stakeholders and timing

<table>
<thead>
<tr>
<th>Category of stakeholder</th>
<th>Establishing initial contact</th>
<th>When to engage them</th>
</tr>
</thead>
<tbody>
<tr>
<td>The University and its ethics and GDPR committees</td>
<td>Face to face meetings with the University representatives for ethics and general data protection regulations to explain the aim of the project, the type of data required and to seek their consent.</td>
<td>In the short term (before project commencement)</td>
</tr>
<tr>
<td>Schools and Departments ethics committees</td>
<td>Face to face meetings with the Schools and Departmental representatives for ethics to explain the aim of the project, the type of data required and to seek their consent.</td>
<td>In the short term (before project commencement)</td>
</tr>
<tr>
<td>Estate Management Department</td>
<td>Face to face meeting with Estate management to secure consent for installation of data collection points across the West Cambridge Site.</td>
<td>In the short term (before project commencement)</td>
</tr>
<tr>
<td>University Accommodation Service</td>
<td>Face to face meeting with University Accommodation Service to secure consent for installation of data collection points across the West Cambridge Site.</td>
<td>In the short term (before project commencement)</td>
</tr>
<tr>
<td>Students and staff working in the specific buildings</td>
<td>Bespoke emails to individuals whose personal offices may be used for data collection, with an agreed means of securing informed consent. Follow up emails, phone calls and personal visits may be required to achieve consent. Consent could be given by return of email, but in the ethics application it may be more robust to go further and use a form that office users sign to indicate consent.</td>
<td>In the short term (before project commencement)</td>
</tr>
<tr>
<td>Residents</td>
<td>Bespoke emails to individual residents through the University Accommodation Office. Consent could be given by return of email, but in the ethics application it may be more robust to go further and use a form that residents sign to indicate consent.</td>
<td>In the short term (before project commencement)</td>
</tr>
<tr>
<td>University Nursery</td>
<td>Face to face meeting with the University Nursery Manager.</td>
<td>In the short term (before project commencement)</td>
</tr>
<tr>
<td>Stakeholder Group</td>
<td>Engagement Method</td>
<td>Timeline</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>Parents whose children use the</td>
<td>Bespoke emails to parents/guardians whose children attend the nursery, through</td>
<td>In the short term (before</td>
</tr>
<tr>
<td>University Nursery</td>
<td>the University Childcare Office. Consent could be given by return of email, but</td>
<td>project commencement)</td>
</tr>
<tr>
<td></td>
<td>in the ethics application it may be more robust to go further and use a form that</td>
<td></td>
</tr>
<tr>
<td></td>
<td>parents sign to indicate consent.</td>
<td></td>
</tr>
<tr>
<td>Businesses</td>
<td>Bespoke emails to managers of and staff working in businesses operating at the</td>
<td>In the short term (before</td>
</tr>
<tr>
<td></td>
<td>West Cambridge site. Consent could be given by return of email, but in the ethics</td>
<td>project commencement)</td>
</tr>
<tr>
<td></td>
<td>application it may be more robust to use a form that representatives sign to</td>
<td></td>
</tr>
<tr>
<td></td>
<td>indicate consent.</td>
<td></td>
</tr>
<tr>
<td>Construction companies</td>
<td>Face to face meetings with project managers, to be followed up with bespoke</td>
<td>In the short term (before</td>
</tr>
<tr>
<td></td>
<td>emails to construction workers and subcontractors</td>
<td>project commencement)</td>
</tr>
<tr>
<td>Pedestrians, cyclists, drivers, other</td>
<td>Posters, flyers, personal contact. QR codes linked to an online consent form</td>
<td>In the short term (before</td>
</tr>
<tr>
<td>visitors</td>
<td>should feature on posters and flyers.</td>
<td>project commencement)</td>
</tr>
<tr>
<td>All stakeholders</td>
<td>Drop in sessions in designated communal places, advertised via emails and posters.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Project website.</td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Author

### 4.3. The purpose of stakeholder engagement

As discussed earlier, most Smart City initiatives engage stakeholders after the project idea has been conceptualised, refined and adopted, giving stakeholders outside the Triple Helix Model virtually no influence over what is finally developed as Smart City infrastructure. At the moment, the Digital Twin project at the West Cambridge site is perhaps in this category, since the stage of the project at which stakeholder engagement is being sought might be described in Arnstein’s (1969) ladder of participation as tokenism, i.e. it is focused on informing and consulting, and potentially placating. Indeed, apart from stakeholders with institutional clout like the University Information Compliance Office and Ethics Committees, who can authorise or stall the project, the intended form of engagement with the other stakeholders could perhaps be described as tokenism (See Figure 5 below).
4.4.1. Remedial strategies: moving towards co-production

Whilst it may be true that the dumb sensors and other smart technologies involved do not collect personal information and would only be used for the Digital Twin project, there has been no input from non-expert stakeholders to date. It would be prudent to anticipate and plan for such concerns coming up in any stakeholder forum.

Over the medium term, we propose that the project team explore ways in which they can solicit suggestions and ideas from stakeholders regarding what they (stakeholders) would also like to know, create, or focus on using the data collected from them. For example, some stakeholders might like to receive regular updates, or have a display monitor, to tell them about the level of air pollution in their locale, or how many cyclists, vehicles have used a particular road on any one day. Such minimal engagement may lead to more significant local buy-ins, empower stakeholders and make them more welcoming of future Smart City initiatives from the project design team. Whilst the initial focus is on informing stakeholders, we recommend developing a more co-productive approach over the more medium term.
4.4. Type of stakeholder engagement

Given the time and location sensitivities of the project, any type of stakeholder engagement adopted should reflect such sensitivities. Thus, in terms of time, it important to think about the stakeholder engagement in the short and medium term.

4.5.1. Short term engagement

The short term engagement types should be oriented primarily towards providing detailed information about the Digital Twin project, as far as it is practicable. This should include but not necessarily be limited to:

1. A website where the public can access detailed information regarding the following issues:
   - An explanation of what a Digital Twin is using a variety of forms, including texts and infographics
   - Why it might be relevant and important for the stakeholder in question and also for the broader context, its usefulness at the specific site, the city and national level
   - Where the Digital Twin project sits within the UK’s wider national Digital Twin agenda, and information about CDBB
   - Who is implementing the Digital Twin project
   - What kinds of smart technologies will be used for the project
   - What kinds of data the smart technologies will collect
   - Where and when the data will be collected
   - Assuring people that their personal data are not being collected
   - Highlight the importance the project attaches to ethical and general data protection standards
   - Detailing how long the data collection period will last
   - Explaining how the data will be used
   - How people can find out about the decommissioning of the project
   - Who is the person to contact in case someone has other concerns or needs further information about the project
   - Links to social media platforms, including Twitter, Facebook, YouTube and Instagram, where people can leave their comments and start a conversation
2. Posters and flyers which provide the public with most or all of the information listed above. These should be displayed or left at places with heavy footfall, namely; reception areas of buildings in the West Cambridge site, College Porter's lodges, the cloakroom in the University Library, and the Estate Management Office in Eddington.

3. Face to face meetings with relevant Heads of Department and Departmental Administrators to explain the project and secure overall consent within the buildings and offices.

4. Email communications to building users using departmental lists. These need to give a clear route for raising questions and concerns, and set out a mechanism for dealing with them.

5. Bespoke emails to individuals whose personal offices may be used for data collection, with an agreed means of securing informed consent. Follow-up emails, phone calls and personal visits may be required to achieve consent.

6. Organise drop in sessions in communal areas of buildings, advertised to building users via email and posters, to allow discussion and the raising of queries.

7. A face to face meeting with the University Nursery manager to discuss the project and give them an opportunity to highlight any concerns.

4.5.2. Medium term engagement
The medium term stakeholder engagement should be oriented towards engaging, consulting and empowering stakeholders, with the ultimate goal of leveraging stakeholder insights for ideas generation and co-production of smart technologies. Such engagement could include the following:

- A focus group discussion involving the preliminary list of stakeholders and other stakeholders identifiable through empirical data collection approaches;
- A workshop or charrette designed to provide stakeholders with less technical insights into the use of the data collected, and to allow them to articulate any concerns. This could also potentially be an opportunity to gather suggestions of other uses for the data collected.
• An interactive video display mounted in strategic locations on the project site. The interactive video could, for example, display a representation of the Digital Twin of the IfM building to give the public a sense of what a Digital Twin looks like and what it can achieve. These interactive video displays could be mounted in areas with heavy footfall, which could include: dining rooms in the William Gates Building, the Lucy Cavendish Laboratory and the West Café, at the bus stops along JJ Thompson Avenue, Charles Babbage Road and at the intersection between Wilberforce Road and Adams Road.

• A survey administered to validate the list of stakeholders and to also gauge public sentiments regarding data collection.

Table 6 below summarises the suggested types of stakeholder engagement for the different periods and the purpose each can achieve.
Table 6. Suggested types of stakeholder engagement, targeted stakeholders, and the primary purpose of the engagement

<table>
<thead>
<tr>
<th>Type(s) of engagement</th>
<th>Targeted stakeholders</th>
<th>Primary purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short term forms of engagement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A website linked to social media platforms (Twitter, Facebook YouTube &amp; Instagram)</td>
<td>All stakeholders</td>
<td>To provide detailed information about the Digital Twin project and other related issues.</td>
</tr>
<tr>
<td>Posters at places with heavy footfall and flyers at left at receptions of businesses and departments at West Cambridge site and nearby colleges</td>
<td>All stakeholders</td>
<td>To provide salient information about the DT project with URLs and QR codes linking to the project website.</td>
</tr>
<tr>
<td>Face to face meetings</td>
<td>Representatives of University Ethics Committee, Information Compliance, Estate Management, University Accommodation Service and Heads of Departments</td>
<td>To provide information about the DT project and gather initial reactions.</td>
</tr>
<tr>
<td>Bespoke emails</td>
<td>Departmental Administrators, staff, students and residents of premises at West Cambridge Site</td>
<td>To provide information about the DT project and gather initial reactions.</td>
</tr>
<tr>
<td>Drop in sessions</td>
<td>All stakeholders</td>
<td>To provide information about the DT project and gather initial reactions.</td>
</tr>
<tr>
<td><strong>Medium term forms of engagement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interactive video display located at places with heavy footfall</td>
<td>All stakeholders, chiefly pedestrians</td>
<td>To provide information about the DT project and gather ideas and suggestions.</td>
</tr>
<tr>
<td>Focus group discussion</td>
<td>All stakeholders</td>
<td>To bring together the different perspectives in order to fully understand the range of concerns</td>
</tr>
</tbody>
</table>
different stakeholders have about the DT project, how such concerns are connected and suggestions on other use of the data collected.

| Workshop and charrette | All stakeholders | To bring all the stakeholders together and provide them with a hands on illustration of the DT project using the DT of the IfM. Also, to crowdsourced suggestions about other uses of the data collected. |

**Source:** Author, with insights from the Workbook of the Department of Environment Land Water and Planning in Victoria, Australia (2015, p.25-27).

### 4.5. Key things to keep in mind when arranging a stakeholder engagement

The focus here is how to get the message across to the stakeholders and to receive their feedback. Deciding whether to reach out individually to stakeholders or to bring them together in an open forum or focused group would require insight into the characteristics, or features, of the different stakeholders.

#### 4.6.1. Demographic profiles: chiefly, age, gender, educational attainment and disability

This would enhance stakeholder diversity and avoid potential criticisms regarding selection bias. Also, this consideration could ensure that venue and materials used for the engagement process do not privilege some stakeholders over others. Insight into stakeholders’ demographic profiles could guard against overlooking or trivialising matters that may be considered sensitive by stakeholders.

#### 4.6.2. Tech-savviness and digital literacy

A sense of how adept stakeholders are or may be adept with basic technological devices would help to select materials or boundary objects⁶ that do not exclude some stakeholders, nor prevent obstacles to communication and receiving feedback from stakeholders. Also, this insight could inform the level of technical expertise required for those to facilitate or coordinate the engagement process.

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⁶ These include both artefacts (e.g. ballot boxes, PowerPoint presentation, 3D Visualisation) and systems of communicating between parties, example, raising your hand to catch the attention of an event moderator (Chow & Leiringer, 2014). Boundary objects provide coherence by linking multiple social groups through the stabilisation of facts and artefacts (Harvey & Chrisman, 1998 p.1683).
4.6.3. Place of residence or work, nature of work and commuting patterns

An insight into where stakeholders work can inform the selection of venues for the engagement process. Similarly, an insight into their commuting patterns can be useful in deciding where to display communication materials regarding the proposed project. Also, some insights into the nature of stakeholders' work could inform the scheduling of the engagement process and how long it should last.

It is essential to keep in mind that these considerations are not exhaustive. Nevertheless, they point to some fundamental issues that may hamper good stakeholder engagement if they are not considered.

4.6. Key protocols to observe during stakeholder engagement

This section provides suggestions regarding key protocols to observe when conducting stakeholder engagement for the medium to long term, chiefly focus group discussions and workshops. It is organised into protocols for before, during and after the stakeholder engagement process.

4.7.1. General protocols to be observed before the engagement process

- Ensure that the reason(s) and goal(s) of the stakeholder engagement are clearly communicated to stakeholders;

- Ensure that there are materials available, e.g. flyers that provide succinct and easily digestible information about the project which stakeholders can easily access for quick reference;

- Ensure that communication materials chosen appeal to a wide array of stakeholders, and there are alternatives should the initially selected material fail. It is helpful to have materials in different formats. Printed materials should be complemented with visual materials like PowerPoints, 3D models and visualisations;

- Ensure that there are opportunities for stakeholders to engage with the process in addition to being given information about the project;

- Ensure that avenues exist for stakeholders to evaluate the engagement process at its conclusion;

- Consider how the final output of the project might reflect the different opinions or consensus reached.
4.7.2. Protocols to observe during the engagement process

- Maintain a disposition that reflects a genuine desire to listen to and understand what stakeholders have to say;
- Adopt the attitude that every stakeholder you have invited has something useful to offer or a legitimate concern to articulate;
- Consistently ensure that every stakeholder is given a chance to articulate their concerns;
- Maintain a disposition that reflects an unbiased moderator by not allowing the views of some stakeholders to overshadow others.

4.7.3. Protocols to observe at the end of the engagement process

- Ensure that appreciation is expressed to the stakeholders for both their time and valued contribution;
- Ensure that all stakeholders have received materials for their feedback and encourage them to provide feedback on the exercise;
- If further engagement will be required, communicate this clearly to stakeholders and where possible, provide them with provisional dates;
- If no further engagement is required, explain to stakeholders how their feedback will be integrated into the final decision making, and how they would be notified to that effect.

4.7.4. Post-engagement protocols

- An email to thank all stakeholders who participated in the engagement, acknowledging the usefulness of their insights, comments and suggestions;
- Use the occasion to also inform them of upcoming events at which their participation would be welcomed, if a firm date has been agreed.
Smart Cities and digital infrastructure projects are rapidly becoming important avenues for universities, governments, industry and, sometimes, the civil service, to find common solutions to contemporary urban challenges involving, for example, sustainable transport, housing quality, and efficient healthcare delivery. Whilst the intentions underlying Smart City initiatives are benign, the processes through which initiators of these Smart City initiatives engage stakeholders tend to prioritise inputs from entities who make up the Triple Helix over other stakeholders. Some scholars have even warned that such Smart City initiatives could exacerbate existing inequities, injustices and societal polarisation by engaging solely with a narrow sector of the public.

Identifying who stakeholders are, what their ‘stakes’ or ‘interests’ entail, and how they can be effectively engaged is far from straightforward. This report provides insights into such issues by drawing on relatively well-established literature on stakeholder engagement in business management and organisation studies, and also in urban planning, relating the insights from such disciplines to recent debates on stakeholder engagement in the Smart Cities literature. Consequently, the review was aimed at providing insights to inform good stakeholder engagement for the CDBB digital twin of the West Cambridge site.

The main finding from our review is that stakeholders comprise a wide range of people and groups whose stakes in a project vary and who also command different levels of influence. It was also found that, in most Smart City initiatives, the discussion about who constitutes a stakeholder is often limited to the three main entities driving the Smart City agenda, namely, universities, businesses and governments. Furthermore, it became evident that where other stakeholders have been engaged, their involvement has not usually gone beyond providing data, feedback and suggestions that barely influence the technocratic and instrumental conceptions of the Smart City and built environment more generally. It was apparent that most stakeholder engagement in Smart City initiatives is designed to inform stakeholders about the functionality and utility of a Smart City initiative without necessarily engaging or empowering stakeholders.

It is important to stress that the insights in the existing literature inform our findings and recommendations. Hence, to corroborate the validity of the claims regarding stakeholder engagement in Smart City initiatives, some empirical research on selected case study Smart City initiatives in both the UK and possibly in other European major cities is warranted.

The next stage of the research is to review stakeholder engagement in existing digital infrastructure projects in the UK and to carry out empirical work to validate the preliminary
list of stakeholders identified for the West Cambridge site and their stakes in the Digital Twin project.

Further information and recommendations will follow.
6. References


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