

Investing in urban underground space – maximising the social benefits

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ABSTRACT: With increasing pressure on space in cities, we are seeing greater development underground. Despite the multiple benefits of underground space, its social value is underappreciated and no market for underground space utilisation exists. The result is that underground space is not planned, engineered or managed in a way to realise its potential value. This paper presents findings from a Think Deep UK initiative which explored the social value of underground space and evaluated the UK's Social Value Act which embraces social, economic and environmental benefits. It was found that the main drivers to evaluate social value for infrastructure projects are cost and risk which are intimately linked with the scheme's design life. As such, only tractable, evidence-based benefits are easily accounted for. It is suggested that social value frameworks should be flexible and incorporate qualitative measures of value across different timescales so that long-term benefits for future generations are planned.

1 INTRODUCTION

Social value is the contribution that projects and investments make to society and which results in a positive impact to people's lives. In theory social value frameworks were introduced to capture a broader measure of value, to consider not only market forces and financial performance but to evaluate the wider societal impact (both positive and negative) to demonstrate increased 'value for money' (SORI Network 2011). In practical terms there are many different definitions and interpretations of social value represented in a wide range of assessment frameworks.

The Public Services (Social Value) Act (2012) was introduced in the UK to evaluate the social value of new public services. The act requires the social, economic and environmental benefits of the public services to be considered at the commissioning (pre-development) stage in order to design better services and find innovative solutions to maximise the potential benefits (DCMS, 2018). Large government projects in the UK will often adopt a 'Benefits management' framework to fulfil this new requirement. Whilst the act only applies to public services "social value" as a concept is increasingly being applied by both public and private bodies across the infrastructure sector and wider built environment (ARUP, 2017). However, there is a perception that the rigidity of the social value assessment frameworks can inhibit the concept of social value being harnessed to enhance collective community benefits. There is also an acknowledgment that environmental considerations are not always well accounted for when social value assessments are applied in their narrowest definition. Failure to fully account for all the wider benefits within the options appraisal and business case can lead to a 'value gap' where the development doesn't deliver its potential value and the return on investment is lowered (ARUP, 2017), or an

‘opportunity cost’ where an alternative development or design option might have yielded enhanced benefits or reduced societal impact.

The balance between initial investment and societal benefits is particularly pertinent for underground development and subsurface utilisation, where a number of subsurface developments are necessary to support public services e.g. transport tunnels, waste facilities, public utilities. Underground development is often viewed as problematic and while the short-term costs and impact of the development are often higher than comparable development at surface, this is often outweighed by the longer-term societal benefits. In consideration of the social value of urban underground development there are a number of questions to investigate, i) Is investment in underground development preferable to development at surface? ii) If space limitations in our cities necessitates underground development, how do we maximise societal benefits?, and iii) Where the impacts of underground development are dynamic and felt across multiple temporal and spatial scales, how do we best balance individual preferences, community benefits and national interests?

This paper discusses how the social benefits of underground development may be enhanced based on a review of social value assessment frameworks, evaluation of the social value of different subsurface uses and elicitation from domain experts during a workshop facilitated by Think Deep UK. For social value frameworks to be effective for underground space developments they have to incorporate different time scales and invite stakeholder engagement early on in the development process.

2 WHY SHOULD WE VALUE THE SUBSURFACE?

There is increased pressure on underground space in our cities. Cities are growing, and with increasing pressure on space, higher land prices and a drive for compact, resource efficient cities, the use of urban underground space is broadly increasing in line with population growth (Bobylev, 2016).

The urban subsurface space is used for a wide variety of applications that deliver social benefits (Figure 1). In the UK, cities and towns have evolved to use and exploit the urban subsurface in a multitude of different ways, for example for water supply, transport infrastructure, buried utilities, and waste disposal. These different services and functions can, for example, be classified as follows (de Mulder et al., 2012):

- source of natural resources
- storage of materials (solid, liquid, gas)
- space for public and commercial use
- space for infrastructure
- medium for foundation for construction
- archive of historical and geological heritage

Over and above these traditional uses of urban underground space, there is increased recognition that the ground is an important component of life-support systems and delivers a range of ecosystem services, e.g. water and heat storage and conductance, such that more effective use of the subsurface can contribute to climate resilience, a low-carbon economy and sustainable living (Rawlings, 2015; Vermooten, 2015).

While these subsurface services and functions deliver a range of economic, environmental, social, cultural and political benefits they are not well evidenced and as such underground space remains under-valued. Strategic utilisation of underground space can be an enabler of city functions (e.g. buried utilities, water supply) but uncoordinated or fragmented planning of the subsurface can also be an inhibitor of city development and services, where subsurface space becomes sterilised for future uses or where subsurface uses impact negatively on other functions. To derive enhanced value from urban underground space assessment of the interactions of subsurface uses and greater coordination of underground development through the planning framework is needed.

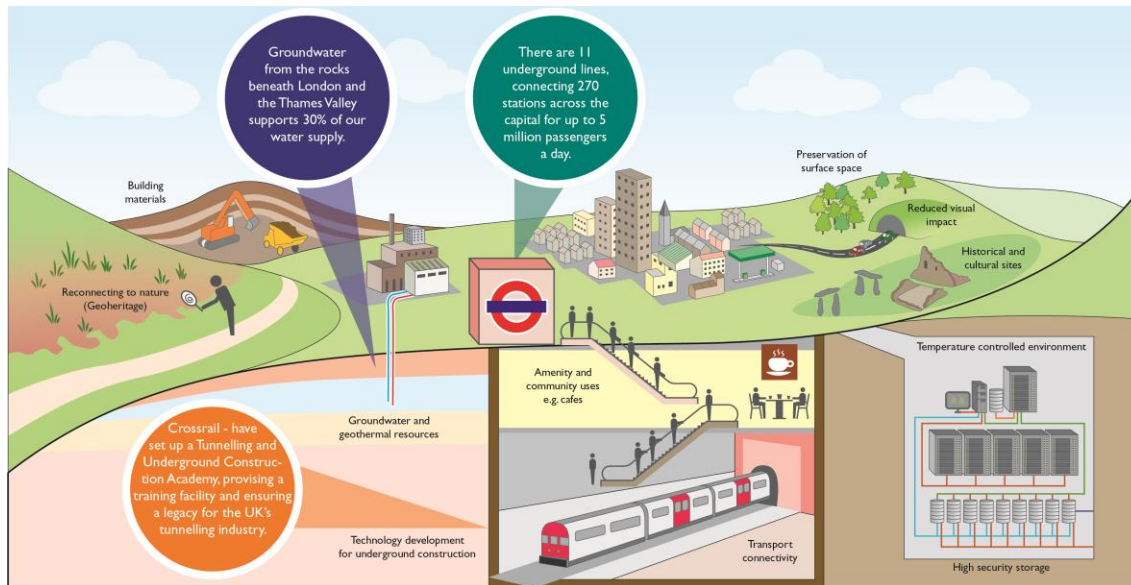


Figure 1. Illustrative example of the social value delivered by underground space.

3 MEASURING SOCIAL VALUE

To evaluate the application of social value measures to urban underground space, Think Deep UK, a group of built-environment experts, used an exploratory approach to consider how to determine the multiple benefits provided by the ground and how to measure the social value delivered by underground space. A review of social value assessment frameworks was complemented by a workshop facilitated by Think Deep UK, a group of build environment experts, in which the social value of different subsurface uses was evaluated. During the workshop, participants were asked to apply principles of social value assessments to outline the social value or benefits delivered by underground space, whether existing means of evaluating social value are adequate for underground development projects, and whether public and private works should be dealt with differently. Participants were further asked to consider both the challenges and opportunities of embedding social value in business cases for underground development and subsurface utilisation.

The varied interpretation of social value gives rise to a multitude of frameworks, guides and policy documents for social value assessments, while this provides flexibility in the application of social value it can also introduce ambiguity and inconsistency in the measurement of social value. Social value may be defined in its narrowest sense where only societal impact is considered while other definitions are broader and embrace environmental and economic benefits more akin to sustainability appraisal or Natural Capital assessment. Some frameworks encourage economic valuation and monetary indicators to measure social value such as the UK's HM Treasury Green Book Guidance (HM Treasury 2018) which is used for the procurement of government projects. The Green Book is built on the principle of a social cost-benefit analysis calculated over the design life of the development, which accounts for economic, financial social and environmental impacts, comparing options to the baseline or 'status quo' along with a five-point business case – strategic, economic, commercial, financial and management - where social value case is incorporated in the economic case.

Other frameworks adopt more qualitative measures for example, the Total Impact Measurement and Management tool (PwC, 2017), the Total Value Capture tool (Arup 2018) and the Five Capitals Model for sustainable development (ref), all of which embrace the concept of total impact measurement across financial, social, human and natural capital.

There are four main stages of a social value assessment (table 1). These stages facilitate the identification of the investment and effects of a project, evaluation and quantification of the impacts and outcomes and finally options appraisal and optimisation to enhance the benefits and

‘value for money’. Whilst these are described in a linear fashion, an iterative process that embeds public engagement at multiple stages was the preferred engagement method highlighted during the workshop, as evaluation of long term and wide-ranging societal benefits and impacts is complex and difficult to communicate. Experts commented that public consultation throughout the planning and evaluation process is proven to be highly effective, it helps to resolve conflicting priorities at an early stage, identify innovative design solutions, and helps balance functional elements with more creative, community development options.

Table 1. Stages of a social value assessment*

Stage	Assessment
1. Total assessment of the environmental, economic and social factors	The big picture: The initial assessment considers the investment or ‘input’ to the project and the ‘outputs’ that are generated from the investment. What is changing as a result of the project? All the economic, environmental and social factors that contribute to the project are identified.
2. What are the impacts and outcomes?	Ask the right questions: It’s important to look beyond the inputs and outputs: What are the outcomes from the project? An outcome is a change that occurs over the longer-term. What impact will it have? What would have happened anyway? Consider who will be affected and at what scale will the impact be felt.
3. Can these outcomes and impact be quantified?	What gets measured gets valued: An evidence base to monitor and evaluate the change that occurs as a result of development allows the outcomes and impacts to be measured, and then valued. Not all indicators of change are monetary, e.g. number of jobs, and area of land protected, are other metrics that could be used.
4. Can the options be adjusted to optimise social value?	Value is in the eye of the stakeholder: Social value considers the impact on society and people’s lives. It’s important to consider the priorities of the project and the stakeholders, consult with them, and identify shared priorities and potential conflicts to deliver a solution that maximises the benefits.

*Adapted from PwC 2017; London Business School 2004.

4 EVALUATING AND COMMUNICATING THE SOCIAL VALUE OF URBAN UNDERGROUND SPACE

The review suggests that urban underground space is not routinely considered as a development option and is often viewed as an abstract concept. At the workshop, participants emphasized the perception that underground development is expensive and disruptive; this perception inhibits a more holistic evaluation of options and consequently means that potential benefits are not being realised. However, the sector has seen an increase in innovation and advanced technology to facilitate improved underground utilisation for example, boring technology for tunnel construction and aquifer storage and recovery for public water supply. If smart use of underground space is designed at the outset, as a result of more complete options appraisal which embraces new innovations, the social return on investment can be enhanced. From an urban planning perspective, greater utilisation of underground space, compared to development at surface, can provide more flexibility in urban planning and allow the surface of cities to be prioritised for higher value land uses and needs.

At present cost-benefit analysis remains the predominant tool to evaluate and compare project proposal. However cost-benefit analysis for underground development often fails to identify the broader and long-term societal benefits of subsurface utilisation. These benefits are delivered at a range of different spatial and temporal scales - the initial costs, which are often high, may be

borne by a private investor but the social value that is delivered by underground space utilisation is often greater than the capital expenditure, and it is delivered over longer timescales and at multiple spatial scales. In such cases, a cost-benefit analysis based on financial metrics will conclude a low financial return on investment, since broader social value is neglected. Given that underground development occurs at the intersection of the natural (the ground), built (physical infrastructure) and social (public services) sphere, a broader social value assessment framework which captures the social, environmental and economic impacts is expected to be more effective.

A more sophisticated life cycle and cost benefit analysis will allow the intrinsic values, environmental services, and competing demands on underground space and resources to be evaluated and the 'value gap' and 'opportunity cost' to be reduced. This requires a robust evidence base including information about existing subsurface utilisation, what functions might be displaced or impacted as well as visions for future uses. Underground space is finite resource and should be managed effectively. Development of the evidence base would support better informed planning policy and more effective selection of development or use options.

Despite the opportunities in social value assessment of underground development, a number of complexities were highlighted by industry experts, which can act as a barrier to its implementation. There are multiple organisations and stakeholders, both public and private, that currently use and derive value from the urban subsurface space. For the social value of underground development to be fully embedded and mechanism to balance the tradeoffs between individual gains, community benefits and national interests needs to be in place.

Whilst a clear definition of the terms of social value and what this entails is needed, experts considered it more important to discuss the societal impact early in the project development and identify the 'value gap' and potentially missed opportunities. Individual successes where public consultation had led to enhancement of social value – with associated financial savings – were highlighted and early stage consultation with potential beneficiaries and community-led engagement are considered crucial for this success. With this type of approach, the full potential of underground development, which may have a higher initial cost but greater long-term benefits, could be realised.

Wider stakeholder engagement and the promotion of public-private partnerships would also facilitate 'impact investment' for underground development. Impact investment is a growing market, worth £150m, where investors and fund managers are committed to increasing the social return, as well as financial return on investment in the UK (ARUP 2018). Social impact investment products and reporting tools for non-financial outcomes are being developed to support this market. Adopting a broader framework to measure the social value of underground development can increase the opportunities to identify new investors and funding mechanisms, i.e. the social impact is more visible and those that benefit are more motivated to invest. Understanding the integrated value supply chain for underground development and subsurface utilisation is therefore critical.

5 RETHINKING SOCIAL VALUE FRAMEWORKS FOR UNDERGROUND DEVELOPMENT

Evaluation tools like CBA start to consider social value and wider society benefits but usually these assessment forms part of the business case and the according processes favour quantitative measures, are often domain-specific with projects considered in isolation and cost and risk for the specific domain are primary drivers for the evaluation process. As such, only tractable, evidence-based social benefits can be easily accounted for. The more qualitative impacts and considerations are difficult to capture in this style of assessment and framing a suitable process for social value assessment is challenging as different benefits occur at a multitude of levels, and may take a long time to be fully realised. Therefore, project development needs to be refocused from a purely economic endeavour to an inclusive process that embraces socio-economic indicators and appropriately weighs project proposals against other potential uses.

Communicating the social benefits and impacts is key to explaining the value of underground space utilisation and making the benefits more visible. Discussions about social values, benefits or impacts of underground activities cover a wide range of topics and will differ by project, lo-

cation, stakeholders and cultural setting. Context specific settings have to be considered as social value is often discussed in a particular and unique environment and people likely to be affected rather than with regards to a wider national or, potentially global discussion. Engaging in national and local politics, communicating with key stakeholders and the public, through multi-disciplinary approaches is therefore critical to a successful outcome.

In summary, to the apply the concept of social value in general and regulations like the Social Value Act effectively for underground space the following recommendations are made:

- The social benefits of underground space utilisation need to be better understood and articulated.
- An evidence base to help measure and evaluate the benefits and impacts of underground development needs to be developed. Identification of the integrated value supply chain for subsurface utilisation would support this.
- Those who commission and undertake assessments need to know the benefits that use of underground space brings, to consult potential beneficiaries and affected communities early on and to have the means to include the value of those benefits within their assessment.
- The benefits and limitations of underground space utilisation need to be considered fully at the pre-commissioning stage and in parallel with planning policy. Exploring governance options for underground space, such as ‘public commons’ use may help facilitate shared use of underground space and help protect high-value uses such as public groundwater supply and transport networks.
- A framework to assess social value should be developed that is flexible enough to incorporate qualitative measures of value, across different timescales such that long-term benefits and broader societal needs of future generations are planned for. Application of impact investment products for underground development should be explored.

6 CONCLUSION

This paper showed that integration of social value in cost-benefit analysis is enshrined in the Public Services (Social Value) Act and also embedded in number of other value frameworks. However, the applicability of these frameworks to assessing underground developments and utilisations is not straight forward and only tractable, evidence-based benefits can be easily accounted for in commonly applied tools like cost benefit analysis. To facilitate social value assessments for underground space uses, the benefits of underground development need to be better defined and the opportunities clearly articulated to decision-makers. A broad evidence base, assessment skills and flexible assessment tools that integrate long-term considerations are suggested as major aspects to be developed to enable efficient integration of social value in project appraisal schemes and a change of focus from purely economic endeavour to a more socially inclusive process.

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