Evaluating transport demand management interventions

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EVALUATING TRANSPORT DEMAND MANAGEMENT INTERVENTIONS USING THEORETICAL EVALUATION

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ABSTRACT

Theoretical approaches to evaluating public policy initiatives seek to account for the effect of factors external to the initiative which could impact on the outcome of that initiative. The application of this approach within the transport sector is relatively new despite current government Department for Transport guidance advocating its use.

Nottingham is the first City in the UK to implement a Workplace Parking Levy (WPL) which places a levy on private non-domestic off street parking provided by employers. The scheme acts as a transport demand management measure with the revenue hypothecated for funding a package of transport improvements.

This paper analyses the application of a theoretical evaluation approach, using the example of the Nottingham WPL package as a case study. The analysis includes a logic map based on stakeholder consensus and literature, explaining how the package is expected to meet its stated objectives.

The paper concludes that a combination of two theoretical approaches, ‘Theory of Change approach strengthened by elements of ‘Realistic Evaluation, as an appropriate framework for evaluating transport interventions and that this has established a plausible model for change and expected outcomes and impacts for the Nottingham WPL Package. Additionally, it concludes that the available data supports the validity of the established Theory of Change for the Nottingham WPL package with regards to shorter term outcomes. This will be invaluable to any authority which chooses to pursue a similar approach.
INTRODUCTION

It is common for local authorities introducing new transport initiatives in the UK to monitor a set of indicators upon which the intervention is intended to cause change. Large or complex interventions however, which are implemented and assessed over a period of time may result in incorrect conclusions, since factors such as economic conditions may change over time. Thus monitoring must be considered against the overall background of change which is external to the intervention. This is generally referred to as the ‘context’ in evaluation literature (see 1 and 2). Thus ideally the aim is to research evidence in order to indicate that it is the intervention in question that is causing any observed change, anticipated or otherwise, rather other unrelated contextual factors. This is termed attribution (3). This wider consideration of context leading to attributing the medium and long term changes in indicators to the intervention being studied is termed evaluation (1).

In recent years UK government best practice guidance for evaluating major transport interventions has advocated Theoretical Evaluation approaches to address the issue of achieving attribution of affects to the scheme being evaluated. (3 and 4). Theoretical Evaluation is common in assessment of issues related to public health and social programs however there is little published on the use of such approaches in transport evaluation. The Nottingham Workplace Parking Levy (WPL) package is an example of a major transport intervention recently implemented in a medium sized UK City being used to manage transport demand and raise capital for public transport improvements. The effectiveness of the WPL package in meeting its stated objectives has to be evaluated and theory of change has been proposed for such evaluations.

This paper introduces the WPL and provides a literature review to explore the options for tailoring Theoretical Evaluation to evaluating a transport intervention. It then develops a theory of change for the Nottingham Workplace Parking Levy package which is a required component of a theoretical evaluation approach. This leads to the production of a logic model of how the WPL package can be expected to meet its key scheme objectives. The extent to which this theory is operating as expected is assessed against the latest available data. From this key elements required of such an approach are identified that can, in future, be applied to the planning stage of any similar intervention to aid scheme evaluation.

BACKGROUND TO THE WPL

In April 2012 Nottingham City Council introduced the WPL which uses the provisions of the Transport Act 2000 to levy a charge on occupied private non-domestic off street parking places that is Workplace Parking Places (WPP) occupied by employees, regular business visitors or students. It is the first charge of its type in the UK, and indeed in Europe. Currently the charge per WPP is £334 ($571) per year. Employers apply for a licence for each of their premises where such places are provided which states the number of WPP they wish to use and then pay the appropriate levy. Currently a third of Workplace Parking places have the charge passed onto employees via employer run workplace parking charging schemes.

The WPL therefore has a dual role to act as a transport demand management measure and also to raise hypothecated funds for transport improvements. The money raised
by the WPL is funding two new tram lines, improvements to Nottingham Railway
Station and additional bus services. The WPL scheme and the above mentioned public
transport improvements comprise the overall “WPL package” and are intended to
complement each other to enhance the transport demand management effect.

As part of the approval for the scheme a business case was prepared and submitted to
government in 2008 (5), within this 6 key objectives of the WPL were identified
(further discussed below) together with a commitment to evaluate these. For those
interested in further detail on the Nottingham WPL and its implementation, Dale et al
2014 (30) provide a detailed case study of the scheme which provides further
background information to support this paper.

THEORETICAL APPROACHES TO EVALUATION

Theoretical approaches to evaluation have evolved to address acknowledged
weaknesses of experimental design fully accounting for context and attribution.
Pawson and Tilley (1997) (2) introduced Realistic Evaluation, while in 1998 work
carried out by the Aspen Institute put forward an alternative theory based approach;
the Theory of Change (6). These approaches take into account contextual changes, as
and when, they occur by incorporating them into a theory which describes the process
of change the intervention is intended to achieve (7). Additionally theory based
techniques, where a lack of data mitigates against experimental proof, are intended to
have the ability to fall back on the underlying theory so as to make credible
attributions in the absence of experimental evidence (8). It is important to stress that
the term ‘theoretical’ is used to articulate that the evaluation uses a theory based on
previous experience and is tested by collecting evidence prior to any conclusions
being provided, rather being purely theoretical in that it is untested or unreal.

Theory of Change Approach

A Theory of Change Approach (ToC) describes the causal relationships between the
events linked to an intervention which aim to meet a set of stated scheme objectives,
in doing so it seeks to take into account context and any likely changes to this that can
be foreseen. These events are commonly identified as follows (9 and 4):

- Context/setting – this describes the problem the action will attempt to mitigate
  and also any relevant contextual factors, Thus it could also be seen as setting
  the scene;
- Inputs – This describes the nature of the intervention and the resources
  required to implement it;
- Outputs – This describes what those resources deliver on the ground e.g. a
  new tram line;
- Outcomes – This refers to the immediate effect of the intervention in the short
  and medium term;
- Impacts - this is longer term strategic changes which the intervention has
effectuated or contributed to.
A distinctive aspect of a ToC evaluation is that it relies on this causality being developed based on existing evidence from stakeholders, good practice elsewhere, previous evaluations, and academic studies leading to a consensus on the theory of change. Where knowledge gaps are identified bespoke research may be necessary. Modern applications of this approach have used logic maps to articulate and understand the theory (6, 9 and 3). Thus the theory proposes that if, given setting X, resources are committed then Y will be delivered. Given that Y is now in place this will result in Z outcomes which in turn will achieve W impacts. While clearly the larger the evidence base in terms of previous experience the better, this form of evaluation is effective in dealing with complex or innovative schemes due to the flexibility of evidence gathering in developing the theory.

Literature on how a ToC approach achieves attribution is somewhat general in nature. Connell and Kubisch (1998) (10) while recognizing that there is no guarantee that observed change is due to factors other than the intervention, argue that often, if the observed change is commensurate with the theory then stakeholders may be willing to accept that it is attributable to that intervention. They identify four points which they believe could be sufficient to demonstrate attribution when adopting a ToC approach, namely that the:

- theory is plausible;
- intervention was implemented as expected;
- magnitude of the outcomes following the above was as predicted by the theory;
- absence of any contextual shift that could account for the above outcomes.

**Realistic Evaluation**

Realistic Evaluation (RE) is a theoretical evaluation approach which is rooted in the realist philosophy of science and views the world as a series of open systems subject to causal factors that vary over time (2) i.e. they recognise that if intervention A has previously lead to outcome B it may not necessarily be the case in the future or in a different location because external causal factors may not be the same. In other words they embrace the concept that the outcomes to actions will depend on the wider context (11). RE can therefore be said to have a base formula for exploring this explanatory aim:

Mechanism + Context = Outcome

These 3 elements are explained as follows (12):

1. Mechanisms (M): That evaluators need to explore the mechanism that is intended to operate to make the programme effect the intended change. A mechanism is, therefore, a mini theory which says how an intervention will achieve change, e.g. a WPL, where it is passed on will raise the cost of travelling to work by private car thus utilising basic economic theory to reduce the percentage of people choosing that mode.

2. Context (C): It’s important to explore the context in which it is intended to operate and identify what factors will impact on the intended mechanisms.
3. Outcome Patterns (O): This is a postulation as to what outcomes will occur to whom and where. It includes an appreciation that the mechanisms and therefore the outcomes may not operate in a uniform fashion due to differences between contextual factors.

A realist theory therefore comprises a series of postulated Context-Mechanism-Outcome Theories (CMOs) and the output of the evaluation is refined and tested CMOs. Pawson and Tilley (2004) (12) provide a straightforward account of how realist evaluators approach attribution by identifying mechanisms and proceeding to test them empirically. They recognize that in complex programs potential mechanisms may be almost infinite and that the evaluator can only go so far. While the two approaches outlined above developed independently it is debateable if they are distinct and mutually exclusive. Pawson and Tilley (2004) (12) give a number of examples of the applications of RE to real life evaluations. It is important to that these were applied to a relatively narrow area of study with easily definable consequences, a far cry from a major transport intervention which can, arguably pervade many policy areas. Laws (2009) (11) used RE to evaluate Publicly Funded Demand Responsive Travel (DRT) Schemes in the UK. Laws (11) concluded that although the approach generated a reasonable level of knowledge the approach was extremely time consuming and the findings could lack precision. She recommended that such evaluation methods be limited to key areas of the scheme rather than adopted as an overall evaluation approach. Blamey and Mackenzie (2007) (7) conclude that it may be desirable to include an element of RE within an overall ToC evaluation framework in order to examine the cause of change in more detail.

THEORETICAL EVALUATION APPLIED TO TRANSPORT

To date there are very few published examples of how these approaches have been applied to the evaluation of transport projects. In general, as suggested by the literature it is considered that the basic methodologies for ToC or RE can be directly applied to transport interventions without major modification, however there are some points specific to transport interventions that should considered:

1. Scale of the intervention - Theoretical approaches lend themselves to schemes or packages that are complex and innovative as these approaches, while stronger for an existing evidence base, do not rely on this and are capable of generating conclusions from incomplete or sparse base and monitoring data. This is relevant to large scale transport initiatives as they are likely to influence whole conurbations with unique characteristics making traditional experimental comparative approaches difficult to design and implement.

2. Utility of a logic map - The current guidance on evaluating major transport interventions from the UK Department for Transport (3) strongly advocates the use of a logic map to express the theory of change, in doing so they are nudging evaluators towards a ToC approach.

3. Combining ToC and RE approaches - Given the discussion above it can be seen that an element of realistic evaluation can be used to strengthen the ToC approach. If the evaluator chooses this option then it will be important to limit the number of CMO theories or limit themselves to identifying key mechanisms and contextual factors.
The above issues are expanded in the discussion on the chosen approach to evaluate the WPL package in the following section.

A THEORETICAL EVALUATION APPROACH APPLIED TO THE WPL PACKAGE

Considering the above discussion, it is possible to make key statements about the characteristics of the WPL package relevant to the choice of evaluation approach:

1. The WPL package will be implemented over a 4 year time span during which both local and national context is liable to change.

2. The WPL package is unique in a European context and even the Australian schemes have significant differences to the Nottingham Package. It can therefore be considered to be an innovative and untested intervention.

3. The WPL and the schemes which it funds is a package, as it is a number of complementary interventions designed to act and interact to attain common objectives.

4. The presence of competitor cities within the region and other Core Cities of a similar size and socio-economic profile facilitates the identification of a comparator group for many indicators. It is not possible to identify a random control group as the WPL is area wide.

The above statements will be true for many large scale transport initiatives which incorporate innovative or new approaches where the existing evidence for their effectiveness is limited. Clearly because of the area wide nature of the package which mitigates against the availability of a random control group a true experimental approach is not possible. While other similar cities provide an acceptable comparator group only some of the chosen indicator monitoring data is available for those cities. This means that a quasi-experimental approach is feasible for some objectives but cannot be the complete answer.

Another consideration is that the WPL is an innovative measure that is untested in a UK or indeed European context, thus it is desirable not merely to report that change has occurred relative to the comparator cities but to understand why and how rendering information as to how specific context has contributed to that change. From the above it can be seen this kind of knowledge generation is only possible by adopting a theoretical evaluation approach. Neither before and after monitoring nor quasi-experimental evaluation approaches provide an understanding of how change is achieved and are not able to take into account changing contextual factors over time.

Additionally the formulation of a theory based on logic mapping would also be useful where no comparable data is available, for example bespoke business investment research, as attribution can be achieved by answering the questions. Based on (10):

- Is the theory is plausible?
- Was the intervention implemented as expected?
- Is the magnitude of the observed changes to the indicator as predicted by the theory?
- The absence of any contextual shift that could account for the above outcomes or if there was, has this been taken into account.
The above discussion clearly points to the desirability of an approach whereby a Theory of Change is articulated by producing a logic map based on the knowledge of stakeholders and key documentary evidence. Where feasible a quasi-experimental component to the evaluation will strengthen this.

Six objectives have been identified by stakeholders based on the WPL Business Case (see 13). In this paper the evaluation of the three most important objectives in terms of the packages long term aims and transferability are considered:

- O1 - Constrain congestion in the AM and PM peak periods.
- O2 - Encourage sustainable travel and mode choice.
- O3 - Enhance the attractiveness of Nottingham as a location for business investment.

To develop an evaluation framework, a logic map (Figure 1) has been developed which represents, a theory of change for the WPL package against these objectives. This logic map is based on the 5 events inherent in a theory of change approach as described earlier. It is thus chronological in nature and identifies the stages and linkages flowing from the initial context to the inputs outputs, outcomes and eventual longer term impacts. It also shows which outcomes and impacts contribute towards which objectives. An element of a realistic evaluation approach has been used to add further explanatory detail to the theory presented in the logic map by identifying individual mechanisms of change and where within the logic flow each mechanism is anticipated to operate.

The mechanisms that have been identified try to balance the need for them to be defined and discrete with, a recognition, that if they were broken down into the smallest unit there could be double or triple the number. Thus individual mechanisms occur at more than one place within the logic map. Contextual factors that are relevant at the schemes inception are identified within the background and context box in Figure 1. Table 1 identifies a series of discrete contextual factors which are anticipated to impact on the effectiveness of the WPL package. Table 2 details the individual mechanisms which are anticipated to operate.
### TABLE 1 Context of the WPL Package

<table>
<thead>
<tr>
<th>Context</th>
<th>Evidence base to support context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socio-economic characteristics</td>
<td>Nottingham is a medium sized English city with a population of 308,000 (645,000 in the primary urban area). It ranks 20th out of 326 Local Authority areas for deprivation and should, therefore, be considered deprived. 90% of its GVA is accounted for by the service sector.</td>
</tr>
<tr>
<td>Relevant Transport Policies</td>
<td>The Local Transport Policy background features extensive bus priority measures, activities to encourage green modes of travel including workplace travel planning, Park and Ride, 1 existing Tram Line and a general presumption against catering for growth in travel via road improvements.</td>
</tr>
<tr>
<td>National Economic Conditions</td>
<td>The WPL package is being implemented in a period when the national economy is emerging from recession with associated improving economic growth figures.</td>
</tr>
<tr>
<td>Cost of fuel</td>
<td>Standard unleaded fuel prices rose by 17% between January 2010 and December 2013 while diesel prices rose by 22% in the same period. (14)</td>
</tr>
<tr>
<td>The Nottingham Offer</td>
<td>Key operational costs are lower in Nottingham than other comparable cities in the UK, with office costs at £19.00 per sq. ft. for Grade A office space (compared to £35–400 in Birmingham and Manchester, £30.00 in Leeds, £25 in Milton Keynes and £25 in Cardiff) – (15) and salary costs on average 10% lower than the national average (16). These are the main costs that a business will focus on when deciding on a new location and are key in terms of what Nottingham has to offer as a location.</td>
</tr>
<tr>
<td>Existing Congestion Problem</td>
<td>Nottingham City Council estimates that congestion, mainly in the AM and PM peak period, costs the City’s economy £160m pa (5), this will manifest itself as a cost to business in lost time, increased transport costs, difficulties in access for qualified workforce etc.</td>
</tr>
<tr>
<td>Presumption of Growth</td>
<td>Population projected to grow by 9% 2011-2026 (17)</td>
</tr>
<tr>
<td>Short term disruption to network by construction phase of WPL Package, Ring Rd Improvement scheme and Improvements to A453</td>
<td>Journey Time per Vehicle mile on Radial Routes into the City in the AM peak period affected by these road works rose by 31% between 2010/11 and 2013/14 while those isolated from them rose by 5.4%, less growth than in 3 out of 4 of the comparator cities</td>
</tr>
<tr>
<td>Mechanism</td>
<td>Evidence base to support mechanism</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>M1</strong> WPL funds Improved public transport (PT) options.</td>
<td>The parking space schemes in the Australian deliver stable hypothecated revenue for transport (5). The Nottingham WPL scheme has raised approx. £14 million to date (13)</td>
</tr>
<tr>
<td><strong>M2</strong> Improved PT options result in increased capacity, this will encourage new trips generated by growth to choose PT rather than the car.</td>
<td>In Nottingham the introduction a tram increased PT trips from 68,000 in 2003/4 to 74,000 in 2005/6. (18).</td>
</tr>
<tr>
<td><strong>M3</strong> Improved PT options result in better connectivity, image and convenience when using PT, encouraging modal switch from the car to PT.</td>
<td></td>
</tr>
<tr>
<td><strong>M4</strong> WPL funds business support measures to encourage workplace travel plans, car park management and cycle infrastructure improvements which encourage employees to switch from car to PT, cycling or walking.</td>
<td>Studies show that Travel Planning is effective in encouraging mode shift (19 and 20). Concern for WPL is imposing a cost on business discouraging inward investment (21 and 22). Passing cost to employees via parking charges may address this concern and there is evidence that this is taking place (13).</td>
</tr>
<tr>
<td><strong>M5</strong> Direct increase in cost in commuting to work by car due to Workplace Parking Charges. Some employers choose to pass on the cost of the provision of these places to their employees, thus effectively increasing the cost of commuting to work by car. According to basic economic theory this should decrease the demand for this mode of travel.</td>
<td>Evidence from long standing parking space levy schemes in Australia suggests that they can contribute towards modal shift (23 and 24). The London Congestion charge prompted an initial drop in congestion, although it did later rebound, possibly due to external economic factors (25). A report on the economic and business impact of the WPL produced by Price Waterhouse Cooper on behalf of Nottingham City Council (21) predicted that a significant number of employers would choose to pass the charge onto their employees.</td>
</tr>
<tr>
<td><strong>M6</strong> Indirect increase in cost of commuting to work by car. WPL causes a contraction in the supply of workplace parking resulting in an additional cost to commuting by car as paid for non-workplace parking is used thus decreasing the demand for this mode of travel.</td>
<td>There is evidence that the introduction of the Nottingham WPL has prompted a contraction in the supply of workplace parking places. (13).</td>
</tr>
<tr>
<td><strong>M7</strong> Decrease the supply of Workplace Parking. The WPL prompts employers to ‘ration’ the workplace parking places (WPP) they provide to employees causing a contraction in the supply of WPP in places where there is no alternative supply other modes will need to be utilised.</td>
<td></td>
</tr>
<tr>
<td>M8</td>
<td><strong>Enhanced effect of WPL package.</strong> The combined effect of the WPL Package: The WPL, NET Phase 2, the refurbishment of Nottingham Station and provision of Linkbus Services act as a combined package to greater effect than the individual schemes to encourage mode shift.</td>
</tr>
<tr>
<td>M9</td>
<td><strong>Congestion Constraint.</strong> The improved PT quality and capacity combines with the increase in cost of commuting by car to prompt modal shift away from the car and thus reduces or constrains traffic congestion.</td>
</tr>
<tr>
<td>M10</td>
<td><strong>Transport demand management effect of the WPL package reduces cost of congestion</strong> to businesses making Nottingham more attractive as a business location.</td>
</tr>
<tr>
<td>M11</td>
<td><strong>Increased PT capacity and efficiency makes Nottingham more attractive as a business location due to workforce mobility.</strong></td>
</tr>
<tr>
<td>M12</td>
<td><strong>Employers choose to pass on the cost of the WPL to their employees via parking management thus mitigating the WPL as a cost to business.</strong></td>
</tr>
<tr>
<td>M13</td>
<td><strong>Increase in cost of operating a business in Nottingham.</strong> The WPL charge is absorbed by employers thus placing an additional cost burden on local businesses which risks a reduction in inward investment.</td>
</tr>
<tr>
<td>M14</td>
<td><strong>Suppressed demand for travel by private car.</strong> As congestion decreases demand suppressed by the capacity of the network is released thus no real congestion benefit is derived.</td>
</tr>
</tbody>
</table>
While Table 2 describes each mechanism it is important to understand how the contextual factors itemised in Table 1 are likely to impact on these mechanisms. The ability of the WPL to deliver the required revenue stream (M1) relative to commuters opting to switch mode due to an increase in costs/reduction in WPP supply (M5, M6 and M7) will be dependent primarily on C3, the National economic situation and on local economic factors, C1, determining to what extent employers and employees are prepared to bear the cost of the WPL and also how buoyant the economy is delivering growth to offset, M7, the reduction in Workplace Parking supply. Additionally the availability of PT alternatives is also a factor affecting these mechanisms, C2. Mechanisms 2, 3 and 4 will interact with C1, socioeconomic factors. As this will affect the propensity for use of different modes, it is likely that the more deprived the area the greater the propensity to use PT. C3 economic conditions, including C4, fuel prices will also play a part in perceived attraction of different modal choices. In general historic trends from Nottingham show that the less favourable the economic conditions and the higher the cost of fuel the greater the propensity for the use of PT.

As M8 is a secondary mechanism, recognising the combined effects of M1 to M7 the contextual factors affecting this mechanism are the same as the individual mechanisms. Mechanisms 10 through to 13 which describe how the benefits of reduced congestion and less car use encourage inward investment will be heavily influenced by C5 the Nottingham Offer and its competitiveness with other locations. An additional factor will be the national and local labour market C2, and how the better PT acts as a positive for recruitment. It is anticipated that C6 and C7 are pre-existing conditions that are unlikely to vary sufficiently in the evaluation period to impact on the mechanisms.
Develop and implement a WPL scheme through powers provided in the UK Transport Act 2000. The aim of this scheme is to act as a Transport Demand Management measure and to raise hypothecated revenue for PT improvements. The main inputs are:

- £3m scheme development
- Implementation Team
- External legal advice
- Specialist project management consultancy
- Specialist transport/economic consultancy
- Public consultation exercise
- Evaluation exercise

PT improvements implemented as a result of WPL funding:

- Net Phase 2 (2 new tram lines)
- Link bus services
- Nottingham Station Refurbished

Raise revenue for PT improvements: Funding for:

- Linkbuses
- NET Phase Two
- Nottingham Station
- Future PT improvements
- Funding for business support

Support businesses wishing to develop workplace travel plans

Support businesses to developing parking management schemes

Liable organisations license and pay for the Workplace Parking Places they provide.

Key: O1, n (See Page x) = Output/Impact contributes to wards this WPL Package objective, M1-n = Mechanism (see Table 2), C1 - n = Contextual factor (see Table 1)
Having developed a logic map and a theory of change this needs to be measured against the key metrics to assess its effectiveness as an evaluation tool. Dale et al 2013 (13) presented a table (Table 3 in Dale et al 2013 (13)) which describes the indicators that had been earmarked for tracking the WPL package’s progress towards its stated objectives which have been linked to the original WPL business case. Monitoring these indicators, benchmarking them against other cities where possible and assessing if the direction of change and magnitude is commensurate with the theory of change will be an important part of the scheme’s evaluation. Four UK Cities have been selected as comparator areas based on their similarity to Nottingham with respect to size, socio-economic and transport characteristics. These cities are:

- Leicester
- Liverpool
- Newcastle
- Sheffield

However comparative data from these Cities is only available for some of the relevant indicators which limits this approach. Where comparative data is not available, the evaluation must rely on comparison with the direction and magnitude of change predicted by the ToC for indicators.

However, in order to understand why change has occurred in more detail, these indicators must be used to assess if the mechanisms are activating as predicted by the theory and to what extent they are impacted by changes to the contextual factors.

Table 3 outlines how each mechanism can be evaluated, the available data to date (2013/14) and to what extent that indicates each mechanism is activated as predicted by the theory. Most of the contextual factors identified in Table 3 are currently static, however where this is not the case they are highlighted. With regard to current assessment of progress it has to be considered that the WPL has only been in place a short while and the PT improvements are currently being implemented many of the medium and longer term aspirations of the scheme will be difficult to evaluate at the moment. However assessment of short term aims can be made.
<table>
<thead>
<tr>
<th>Summary of Mechanism</th>
<th>Indicator</th>
<th>Evidence for Attribution</th>
<th>Evidence suggesting mechanism is active including relevant contextual changes</th>
<th>Active as predicted</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1 Improved PT options funded.</td>
<td>Provision of planned PT improvements. Annual WPL net revenue.</td>
<td>None required</td>
<td>Linkbus services and the refurbishment to Nottingham Station have been implemented. NET Phase 2 is under construction and is due to open in 2015. WPL raised over £7 million in its first full year of operation.</td>
<td>YES</td>
</tr>
<tr>
<td>M2 Increased PT capacity</td>
<td>PT Satisfaction Surveys. PT mode share at Inner Traffic Area cordon</td>
<td>None required</td>
<td>No PT satisfaction surveys yet planned. Direct interview surveys of commuters planned for 2015/16.</td>
<td>?</td>
</tr>
<tr>
<td>M3 Improved PT options result better connectivity and convenience an image</td>
<td>PT Patronage Number of employees/WPP covered by parking management or workplace travel plans.</td>
<td>Direct interview surveys of commuters asking if they have switched mode and why</td>
<td>Linkbus services and the refurbishment to Nottingham Station have been implemented. NET phase 2 is under construction and is due to open late 2014.</td>
<td>?</td>
</tr>
<tr>
<td>M4 WPL funds workplace travel plans, car park management and cycle infrastructure improvements</td>
<td></td>
<td></td>
<td>Both PT mode share and patronage have declined slightly since 2010. However the main PT improvements are not yet complete. In 2010 25% of employees in Nottingham were covered by workplace travel plans, this has risen by 2013 to 33% almost certainly as a result of the WPL package</td>
<td>YES</td>
</tr>
<tr>
<td>M5 Direct increase in cost in commuting to work by car</td>
<td>% of WPP where the employer passes on the WPL charge to the employee.</td>
<td>Direct interview surveys of commuters asking if they have switched mode and why</td>
<td>There was no data prior to 2012/13 however at present for 38.9% of WPP are covered by parking management or workplace travel plans.</td>
<td>YES</td>
</tr>
<tr>
<td>M6 Indirect increase in cost of commuting to work by car.</td>
<td>Commuter parking in NCC public car parks.</td>
<td></td>
<td>A weekday average of approximately 426 vehicles are parked using the “Early Bird” parking deal for a Council City Centre car park, this deal is aimed at commuter parking and, when considered in the context of a reduction in the number of Workplace Parking Places, demonstrates that this mechanism is active.</td>
<td>YES</td>
</tr>
<tr>
<td>M7 Decrease the supply of Workplace Parking.</td>
<td>Number of licenced WPP</td>
<td>Comparison with comparator cities</td>
<td>The number of WPP fell by 18% from a pre implementation estimate of 32225 to 26464 following the introduction of the WPL and by a further 4% between 2012 and 2013 to 25320.</td>
<td>YES</td>
</tr>
<tr>
<td>M8 Enhanced effect of WPL package.</td>
<td>Decrease in the number of WPP</td>
<td></td>
<td>NET Phase 2 not yet complete so it is not yet possible to assess the combined effect of the package</td>
<td>?</td>
</tr>
<tr>
<td>M9 Congestion Constraint.</td>
<td>Modal shift Journey time per vehicle mile</td>
<td>Comparison to other core cities</td>
<td>NET Phase 2 not yet complete so it is not yet possible to assess the combined effect of the package. Journey time per Vehicle Mile has risen by 3.8% between 2010/11 and 2013/14.However this is also the case within some of the other medium sized cities i.e. Sheffield, and Leicester and may be due to the emergence of the national economy from recession (C3). Additionally, in Nottingham the disruption caused by the construction phases of the major transport improvements are also a factor. (C9)</td>
<td>?</td>
</tr>
<tr>
<td>M10 Reduced cost of congestion to businesses.</td>
<td>Journey time per Vehicle Mile</td>
<td></td>
<td>Investment enquiries and subsequent successes have increased in 2012/13 and 2013/14 when compared to the previous 4 years. The number of deals done by commercial estate agents has also increased which supports this data. Nottingham has fared better than the other 4 comparator cities with respect to employment and output (GVA). Although it needs to be accepted that this could be due to the emergence from recession (C3) as much as any effect of the WPL package. However, the comparison to the comparator cities as well as the magnitude of the increases suggests that this mechanism may be active. This, strongly suggests that the cost element of WPL is not having a detrimental effect and case study data demonstrates that the availability of good PT options especially towards the city centre are an attraction to inward investors. The above fits with the Theory of Change but more case study data is required to confirm attribution.</td>
<td>NO</td>
</tr>
<tr>
<td>M11 Increased PT capacity and efficiency makes Nottingham more attractive as a business location due to workforce mobility</td>
<td>Level of inquiries to NCC Inward Investment Team and subsequent successes. Volume of rental deals done by commercial estate agents Evidence from case studies of inward investors. Macroeconomic indicators</td>
<td>Case study based evidence from businesses. Indicators, when triangulated, move in the direction and magnitude commensurate with the theory of change.</td>
<td>Investment enquiries and subsequent successes have increased in 2012/13 and 2013/14 when compared to the previous 4 years. The number of deals done by commercial estate agents has also increased which supports this data. Nottingham has fared better than the other 4 comparator cities with respect to employment and output (GVA). Although it needs to be accepted that this could be due to the emergence from recession (C3) as much as any effect of the WPL package. However, the comparison to the comparator cities as well as the magnitude of the increases suggests that this mechanism may be active. This, strongly suggests that the cost element of WPL is not having a detrimental effect and case study data demonstrates that the availability of good PT options especially towards the city centre are an attraction to inward investors. The above fits with the Theory of Change but more case study data is required to confirm attribution.</td>
<td>NO</td>
</tr>
<tr>
<td>M12 Employers choose to pass on the cost of the WPL mitigating the impact on employers</td>
<td>% of WPP whereby the employer passes/absorbs the WPL charge to the employee.</td>
<td>NA</td>
<td>There was no data prior to 2012/13 however in 2013 39% of WPP were covered by parking management which passes on the cost to employees; anecdotal accounts from employers enables us to be certain that this is a recent development in response to the introduction of WPL.</td>
<td>?</td>
</tr>
<tr>
<td>M13 Increase in cost of operating a business in Nottingham.</td>
<td>Level of investment inquiries to NCC and subsequent successes.</td>
<td></td>
<td>Inward investment market buoyant, see M11, this suggests that overall business costs are not a barrier to business location in Nottingham.</td>
<td>YES</td>
</tr>
<tr>
<td>M14 Suppressed demand for travel by private car.</td>
<td>Enabling Mechanisms operate but congestion does not decrease, no. of trips on all modes increase</td>
<td>None required</td>
<td>None at this time</td>
<td>NO</td>
</tr>
</tbody>
</table>
Table 3 reveals that the mechanisms that facilitate the short term outcomes appear to be operating as predicted by the theory. There is strong evidence that the supply of WPP is reducing while the revenue remains stable due to the pre-planned increase to the WPL charge enabling the planned PT improvements to be implemented. Additionally employers are increasingly passing on the cost of the WPL to their employees and taking up workplace travel plans. Congestion and mode switch appears to be moving in a direction similar to other similar cities. However the following contextual factors must be considered:

- the national economy is emerging from recession and traffic volumes are increasing nationally
- the key PT improvement, the provision of two extra tramlines, are not yet open.
- the construction phase of the above and other non WPL package schemes have created considerable disruption on the network.

These factors will all mitigate against mode switch and a subsequent reduction in congestion and therefore it should be concluded that, given the current context external to the WPL package, it would not be expected to see progress towards the longer term scheme objectives as the important mechanisms cannot be activated at this point in time. The project to evaluate the WPL is due to conclude in Spring 2017 by which time these contextual issues should be resolved and travel patterns normalised given the new PT options.

LESSONS FOR FUTURE EVALUATIONS OF TRANSPORT INITIATIVES

The process of deriving a theory of change is extremely resource intensive due to the iterative process of formulating and refining the theory via stakeholder engagement. For many transport interventions however this is implicit in scheme justification and this was the case with the WPL because of its innovative nature. The bulk of this process occurred in formulating the business case (5) via an extensive public engagement culminating in a public examination. Thus for the WPL there was little additional expense involved in creating the theory of change over and above the scheme justification. This however may not be the case for all transport interventions depending on the statutory requirements for scheme appraisal.

Data availability is a key area of concern when carrying out a Theoretical Evaluation (12) Issues have been experienced with the following areas of data:

- Obtaining equivalent indicator data from other comparable cities can prove difficult, and where data is provided it may not be in a comparable format.
- The process of identifying contextual factors and key mechanisms has proved illuminating. It requires a more detailed thought process from the evaluators as to how and why change occurred by breaking down the broad logic into stages that are measurable. This will be of advantage to any evaluation project.

Originally the authors generated 23 mechanisms for the WPL Package and these could be subdivided further. If these were then cross referenced with contextual factors it would have generated large numbers of CMO theories, this issue was predicted by the literature but seems to be a particular problem for the WPL Package. This is likely to be equally true when evaluating any area wide transport intervention.
This is because transport impacts permeate many policy areas. For this reason it is suggested that a policy of identifying key mechanisms only is adopted when applying this evaluation approach, however evaluators need to accept that this may result in some loss of detail a balance must be struck depending on the audience and aims of the evaluation in question.

CONCLUSIONS

Theoretical Evaluation is being proposed as a tool to evaluate complex and innovative transport projects where there are many influences external to the scheme. The UK Department for Transport guidance advocates this approach, yet there is little published information as to how this has been applied to transport projects. The two main theoretical evaluation approaches, Theory of Change and Realistic Evaluation have been reviewed with their potential practical application to the transport sector in mind. This showed that:

- a full RE approach is likely to be impractical due to the complexity and resource requirements.
- a ToC approach is potentially more suitable due to its more generalised nature whereby an agreed theory of change can be derived.
- a ToC approach may not fully identify the mechanisms by which the desired impacts will be achieved. However, mechanisms that achieve the objectives to be evaluated together with influencing contextual factors can be used to strengthen a Theory of Change approach. This is therefore advocating including an element of RE.

It is concluded that a ToC Evaluation approach strengthened with elements of RE are an appropriate approach to evaluating major transport interventions. This is suggested for use to evaluate the Nottingham WPL Package and is presented as a practical example of the application of this approach. A review of relevant literature reveals that interventions of this nature require an evaluation approach which:

- takes into account changing context
- achieve causal attribution
- allows partial data

The above are seen a key features to be considered in any use of theoretical evaluation of transport projects. Using this approach a Logic Map summarising how the Nottingham WPL is intended to achieve its stated objectives has been produced. Such maps are seen as a vital element in developing theoretical evaluation of transport schemes. The logic maps should include -

- A model to explain how the intervention can contribute to any integrated transport demand management policy
- A framework in order to understand and evaluate any observed changes in key indicators relevant to the interventions main objectives.

The latest data from the WPL model reveals that whilst the mechanisms relevant to the shorter term outcomes for the scheme are operating as predicted by the Theory of
Change, however it is too early at this stage to assess whether this will follow through to the longer term intended impacts.

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REFERENCES


