

CONCEPTUAL MODEL FOR EFFICIENT AND ENVIRONMENTALLY FRIENDLY URBAN FREIGHT MOVEMENTS

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ABSTRACT

The relationship between sustainability and urban freight transport has gained the attention of urban freight researchers in the past decade. One of the successful approaches is the formation of Freight Quality Partnerships, a public private partnership (PPP). This paper presents a conceptual approach to employing a PPP of a different kind: a Design and Monitoring Framework (DMF) to address sustainable urban freight. The paper explains how DMF methodology was developed from logical framework analysis and how it was deployed, in a novel fashion, in a developed setting, addressing city logistics issues in a British city and on a leading British university campus.

Keywords: urban freight, public private partnership, design and monitoring framework, city logistics, soft operations research

INTRODUCTION

The relationship between sustainability and urban freight transport has gained the attention of urban freight researchers in the past decade (see for example: Browne, Allen, Tanner, Anderson, Christodoulou, & Jones, 2003; Zunder & Ibanez, 2004; Dablanc, 2007). The agenda, set following the Rio Earth summit in 1992 and the Kyoto protocol agreement in 1994, was initially aimed at addressing the negative environmental impacts of transport,

European policy on urban freight transport has also been established, in the European Commission's 2011 Transport White Paper. A number of scenarios were set around the urban freight transport vision that aim to achieve - both economically and environmentally - transport operation efficiency in order to reduce emissions and to minimise generalised costs for urban freight operators and their customers (MDS Transmodal & Centro di ricerca per il Trasporto e la logistica (CTL), 2012). Some of the scenarios envisaged for a sustainable urban freight environment include: minimising the number of freight movements and the distances required to carry them out; using low emission urban trucks to carry out deliveries; making maximum use of intelligent transport systems (ITS) to increase the efficiency of deliveries; and reducing noise pollution from freight movements, so that road infrastructure can be used more efficiently at different times of the day.

Public Private Partnership (PPP) is one of the recent transport policies being promoted to address urban freight transport issues (see for example: Stathopoulos, Valeri, & Marcucci, 2012; Lindholm, 2012). The main feature of such policy is the cooperation between urban freight stakeholders – be it public or private entities – to achieve sustainable urban freight. Additionally, PPP is meant to include consultation and dialogue in public decision making (Browne, Nemoto, Visser, & Whiteing, 2003). Urban freight transport involves many different stakeholders, both those within the urban area who are not directly involved in freight transport movements (including city authorities, residents and visitors) and the actors in the supply chain. The interaction between these different stakeholders produces complexity in addressing the sustainability issue. This is especially true because logistics decisions are usually taken on the basis of commercial and operational factors, rather than considering the wider sustainability issues that are the concern of city authorities acting on behalf of residents and visitors.

One of the successful PPP approaches is the formation of Freight Quality Partnerships (FQP), as evidenced in a number of British city regions (see for example: London; Tyne and Wear). Freight Quality Partnership is a partnership between the freight industry, local government, local businesses, the local community, environmental groups and others with an interest in freight, aimed at developing an understanding of freight transport issues and finding constructive solutions (<http://www.londonsfqs.co.uk/>). In Tyne and Wear, the FQP comprises 5 local authorities, including Newcastle Upon Tyne, and the promotion of the Local Transport Plan (LTP) - which in practice embraces a regular meeting among freight stakeholders who aim to address freight issues in Tyne and Wear - has been on the agenda since 2005. A number of FQP outputs are evident, including lorry parking and traffic information, best practice, multi-modal carbon calculator, and Fleet Operator Recognition Schemes (FORS) (<http://www.tyneandwearfreight.info/index.aspx>). Apart from the FQP, Low Emission Zones, and Urban Consolidation Centre are other transport policies aimed at addressing freight issues in the metropolitan area.

This paper presents a conceptual approach to employing a PPP of a different kind - the so - called Design and Monitoring Framework (DMF), addressing sustainable urban freight. The next section discusses DMF (Design and Monitoring Framework) and is followed by a

description of the Newcastle case study. The final part of the paper reports the initial findings from the DMF application in Newcastle.

DESIGN AND MONITORING FRAMEWORK (DMF)

Design and Monitoring Framework (DMF) is a methodology designed and adopted by the Asian Development Bank (ADB). This methodology has elements of the Project Performance Management System and outlines a systematic way of designing and implementing projects. The DMF is a results-based tool for analysing, conceptualizing, designing, implementing, monitoring and evaluating projects (Asian Development Bank, 2007). This methodology has been widely used by non-government organisations and by finance institutions - including the World Bank and the Asian Development Bank - to reach consensus and create support for selected solutions through intensive stakeholder consultation. The central idea of DMF is that these systems are developed, with the mutual support of all stakeholders, to find creative solutions based on a logical framework approach (LFA). The main barriers for successful implementation are learned through stakeholder consultation. The main outputs of the DMF are a problem tree, an objectives tree and a DMF matrix. Also produced is a detailed design and specification of demonstrators, including the innovations tested; the supply chain; the technology used; who is responsible for the different components; etc.

Based on the LFA concept, DMF can be defined as an analytical, presentational and management tool, intended to help planners and managers to:

- analyse the existing situation during project preparation, to establish a logical hierarchy of means by which objectives will be reached;
- identify some of the potential risks;
- establish how outputs and outcomes might best be monitored and evaluated; and
- finally present a summary of the project in a standard format.

Logic Models, Logical Frameworks, and Results Frameworks

Logic models, logical frameworks and results frameworks are all tools for programme planning and management with a wide application. They have been developed and used extensively by planners and evaluators for more than 30 years. The logical framework approach (LFA) was originally devised in the 1970s as a methodology for improving the systematic planning of development projects. The first logical framework matrix (logframe) was developed by the United States Agency for International Development, for improving its accountability to Congress (Toffolon-Weiss, Bertrand, & Terrell, 1999). Over time, LFA has evolved from a simple framework for structuring project objectives, to more sophisticated, process-orientated approach for involving stakeholders in project design and management.

A number of definitions have emerged from the literature to represent an evaluation framework, or programme of some kind, for various reasons and applications (see for example: Rush & Osborne, 1991; Framst, 1995; Torvatn, 1999), but there is little distinction

between the diagrams for inputs, outputs and outcomes that are used as tools to illustrate the logical progression of a programme. UNICEF (2002) has used a simple graphic or schematic representation model of the logical sequence and intended relationships between inputs, activities and results. A logical framework, or logframe, includes the same information as a logic model, but is organized in a matrix table.

The ADB (2007) defines the logical framework that is the basis of DMF as:

“a simple but powerful design and management tool [Which] helps build consensus with stakeholders and create ownership of the proposed project. It organises thinking and relates activities to expected results”

The ADB model provides a structure for monitoring and evaluation where planned and actual results can be compared. Therefore, logical frameworks tend to be more specific than program logic models. Logical frameworks follow the same reasoning as logic models, but they extend further - to the identification of indicators for each component, their means of verification (or sources of data), and their assumptions. The DMF structures the project planning process and helps communicate essential information about the project to stakeholders in an efficient, easy-to-read format.

A drawn summary of strengths and weaknesses of a logical framework, based on the review of the logical framework literature, is tabulated in Table 1. There is an ongoing debate about the use of such an approach by a large global institution such as the World Bank, but the evidence to date is that ADB is still regularly using the DMF approach to monitor its funded projects.

Table 1 LFA strengths and weaknesses

Strengths	Weaknesses
<ul style="list-style-type: none"> LFA can be used to test project ideas and concepts for relevance and usefulness; 	<ul style="list-style-type: none"> Focussing too much on problems rather than opportunities;
<ul style="list-style-type: none"> LFA can form the basis of key performance indicators (KPI's) with explicit statements of what will be delivered; 	<ul style="list-style-type: none"> LFA used too rigidly - the framework needs to have a degree of flexibility;
<ul style="list-style-type: none"> LFA provides indicators against which the project progress and achievements can be assessed 	<ul style="list-style-type: none"> Limited attention to the problem of uncertainty where a learning or adaptive approach to project design and management is required
	<ul style="list-style-type: none"> There is often a general lack of focus on mechanisms and pathways

DMF Matrix

As can be seen in Figure 1, the ADB's DMF matrix comprises 14 frames with 4 major headings/columns. The design summary outlines the main elements of the project and shows the vertical logic of the DMF - explaining the means-ends relationship, also referred to as the results chain. The vertical logic tests the soundness of the results chain, by checking if the inputs are sufficient to carry out the activities, which have to be sufficient to produce the outputs. In turn, outputs, also referred to as deliverables or project scope, are expected to achieve the desired outcome at the completion of the project. The outcome contributes to achieving the impact. The results chain is derived from the objectives tree, as can be seen in Figure 2. The centre frame of the tree table is a statement, aimed at addressing the issue in question. The sub-frames below the main frame are various issues that have to be addressed via a number of stakeholders.

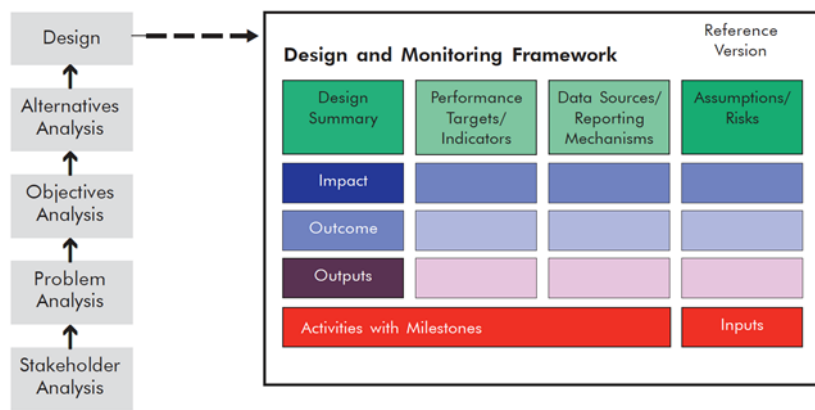


Figure 1: Design and Monitoring Framework (Source:(Asian Development Bank, 2007)

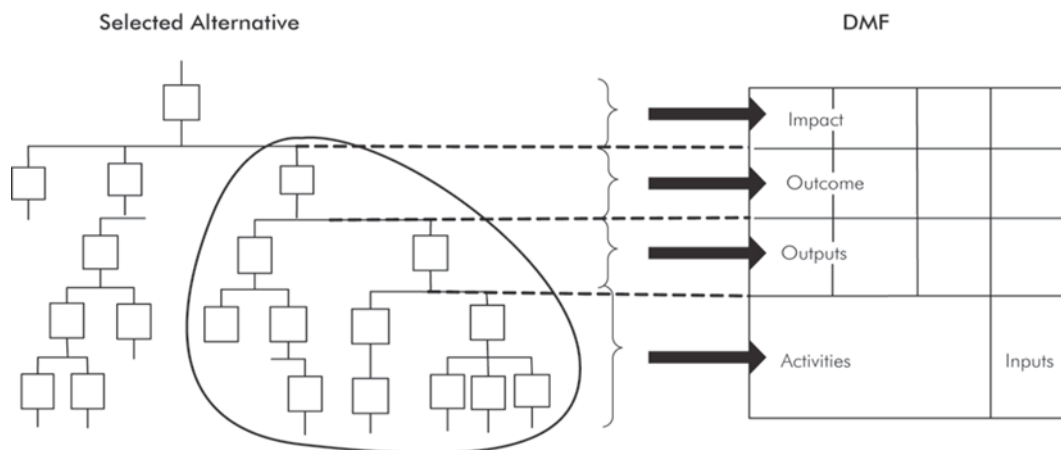


Figure 2: Linkage between the objective tree and the DMF (Source: (Asian Development Bank, 2007)

Application of the LFA approach is discussed next, using the case of a medium sized British city that is aiming to address the challenges of meeting the sustainable urban freight environment.

NEWCASTLE URBAN FREIGHT DMF: A CASE STUDY

A series of workshops were held in Newcastle to follow the process of completing the DMF matrix discussed in the previous section. A number of key urban freight stakeholders were identified, using the Freight Quality Partnership network, and invited to a workshop held in November 2012. The stakeholders included: Newcastle City Council (NCC); Tyne and Wear transport planners; an urban consolidation centre operator; Newcastle University Estates and Purchasing departments; the Freight Transport Association (FTA); a logistics operator; a stationery supplier; a transport consultancy; an electric vehicle manufacturer; a transport software provider; Newcastle University Students' Union; Gateshead College; and the authors. In total 14 different stakeholders joined the workshop.

At the first workshop the stakeholders were introduced to the DMF process stage by stage. First a stakeholder analysis was completed using blank cards to record such information as name, interest(s), problem(s) and the resources and mandates the person could deploy¹. After the cards were completed and returned, groups were formed, maintaining heterogeneity amongst stakeholders. Three groups - eventually merged into two large groups - worked to create a problem analysis tree. The groups were given a development problem based on previous knowledge: 'freight in Newcastle could be more sustainable'. New cards were distributed, on which individuals recorded 'causes' (with the related data), and 'effects' (with the related data). Next, in an interactive 'hands-on' process, the group "built a tree" by placing the cards on a wall, with the problem in the centre and the causes as the 'roots' of the tree and the effects as its 'branches and leaves'. This process can be seen, for both groups, in Figure 3 and Figure 4 respectively.

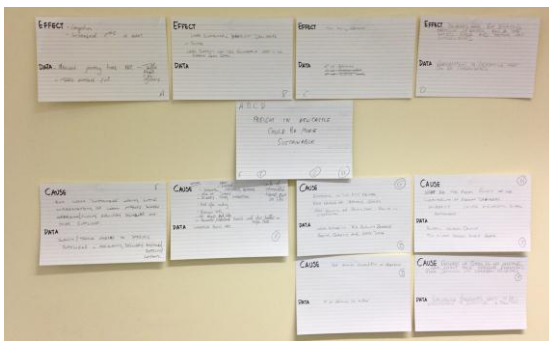


Figure 3: First group problem tree

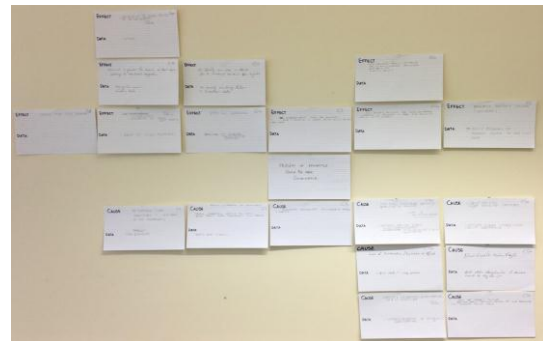
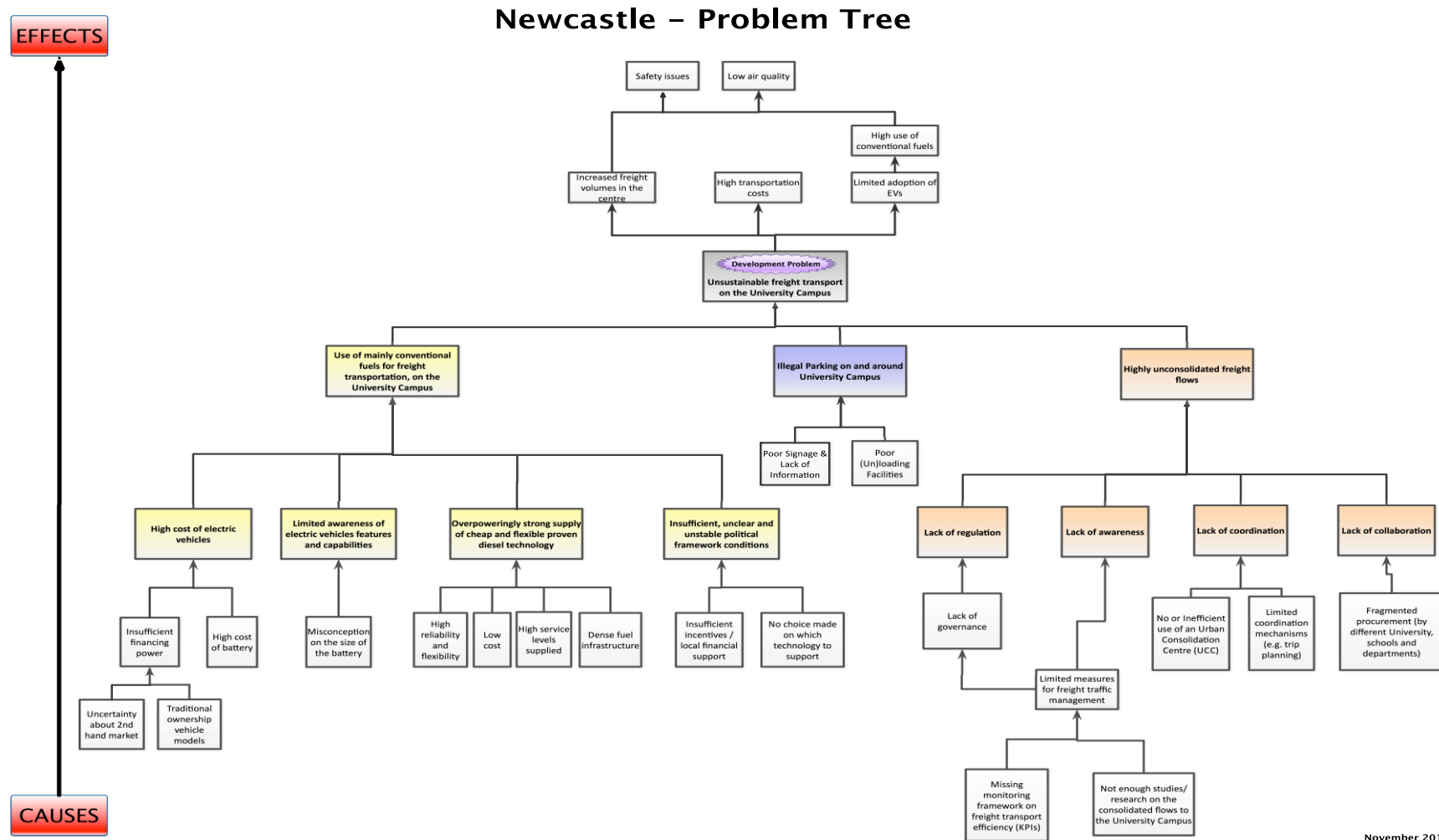


Figure 4: Second group problem tree

From the first workshop a single, synthesised problem tree was formulated, as can be seen in Figure 5. This was used to inform both the process and the stakeholder membership of the second and third workshops. The synthesised cause and effect statements in the single problem tree suggested three main causes for unsustainable freight:

1. Use of mainly conventional fuels for freight transportation;
2. Illegal parking on and around the university campus;
3. Highly unconsolidated freight flows.

¹ mandate is a term used in DMF to represent authority and power to initiate or change actions.



November 2012

Figure 5: Synthesised Problem Tree

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From these key causes, secondary and tertiary causes were traced, for example:

1. Use of mainly conventional fuels for freight transportation;
 - a. Lack of awareness;
 - b. Lack of collaboration;
 - c. Lack of regulation;
 - d. Lack of co-operation

and so on, down through the ‘roots’ of the tree.

The second stakeholder workshop extended the invitation to a wider audience, including Newcastle City Council Procurement department; an urban consolidation centre operator; Newcastle University Planning Management, Procurement and Estate Services and local National Health Service (NHS) hospitals. The workshop was held in December 2012 and attended by 18 attendees representing the aforementioned stakeholders. It was clear from the second workshop that Newcastle University itself has a strong interest in addressing urban freight issues on campus, in line with a sustainability agenda entitled “Coherent Campus”. The second workshop was largely informative and was followed by one-to-one meetings with University management that drew the process closer to focusing on campus issues. By now, the low involvement of retail operations, freight operators and shippers in the city (despite good links between the researchers and the members of the freight partnership) suggested that city’s urban freight issues may well be focused on the large organisational campuses, and that the research should focus on the University, where there were clear and identifiable problems and also actors with both data and a mandate to proceed.

A third workshop was held in February 2013 with selected Newcastle University stakeholders from the Procurement department and the Estates department, University researchers and local government transport planners. The process was to first identify potential interventions and, after a round table discussion of potential actions, attendees filled in cards, both singly and jointly, with:

- the nature of an intervention;
- who can do it;
- the effects of intervention, and
- the monitoring data.

The synthesised problem tree from the first workshop (Figure 5) was presented and used to map the completed cards onto the new problem tree. This output can be seen in Figure 6.

Following the third workshop an objective analysis tree was created, using an adaptation of the problem tree. As the DMF guideline described, objective analysis and alternative analysis are analytical tools to specify the desired future situation. In practice the identified problems in the tree (as concluded from the first and second workshops) and the interventions raised to address the problems (as obtained from the third workshop) are transformed into objectives and this can be seen in Figure 7. Alternatives can then be identified and analysed further.

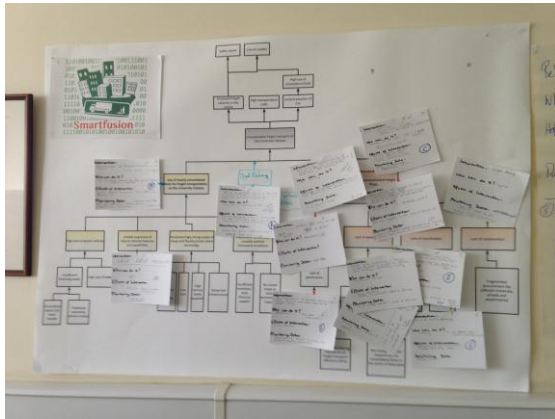


Figure 6: Adapted problem tree analysis

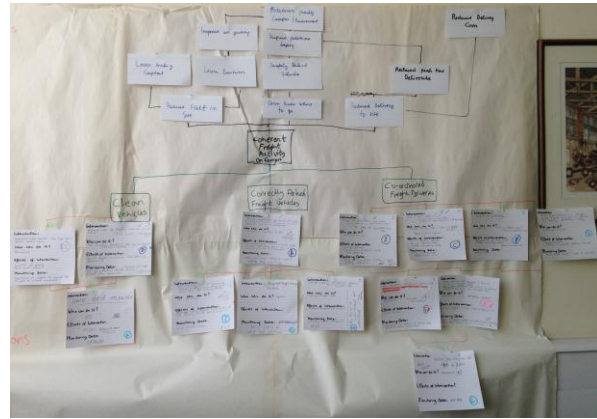


Figure 7: Objective tree

Completing the Newcastle DMF Matrix

Using the finalised objectives tree, the 14 frames of the DMF Matrix (Figure 1) can be completed. The main impact of the objectives tree is a coherent freight activity on the University campus. The performance target / indicators to demonstrate the impact of such strategy can be measured by a traffic count and procurement data as reported in (Zunder, Aditjandra, & Carnaby, 2012). A further traffic count and on-going procurement data analysis are planned and will allow monitoring of the interventions being carried out. The selected alternatives can be divided across three different core outcomes: clean vehicles, correctly parked freight vehicles and co-ordinated freight deliveries.

Clean Vehicles

The target for clean vehicle performance would be reduced emissions resulting from the decrease in number of freight vehicle entering University premises. Data on energy used by the University fleet vehicle has been logged (via fuel use data) and can be used to evaluate the promoted clean vehicle scenarios. The outputs of the clean vehicles strategy are the implementation of a clean vehicles requirement in the terms and conditions of high volume/value contracts, and the increased use of the University's fleet electric vehicle. One of the activities involved is the deployment of telematics to monitor the university's current fleet activity. The stakeholders involved in and committed to this strand of the strategy include the University's Energy department (which can monitor the impact of fuel consumption); the Procurement department (which can acquire the electric vehicle); and the vehicle supplier (who can lease the required vehicle, either for demonstration, or for long term University fleet operation).

Correctly Parked Freight Vehicles

This strategy was not captured in the first and second workshops, only being given special attention at the third. The performance target for this particular strategy is the decrease in illegal freight parking around the University campus that currently obstructs a busy, highly

pedestrianised environment. An expected output of vehicle routing and access maps for deliveries is important. A number of activities are being identified to support this strategy, including the introduction of a charge for freight vehicles to enter the campus, the design and planning of designated freight parking areas around the campus, and improving vehicle routing to site. The stakeholders committed to this strategy are the University Estate Service (who can enforce, promote and monitor the implementation of signage and supply a delivery map to the supplier); Newcastle City Council (who can advise how signage and maps are used at the city metropolitan level); and the supplier, who can commit to the new strategy and run the delivery to the designated sites.

Co-ordinated Freight Deliveries

This strategy attracted the most attention from the stakeholders at the third workshop, as can be seen in Figure 6. The idea is centred on a Delivery and Servicing Plan (DSP) with the help of a consolidation centre. The performance target for this strand of activities is the reduction in freight traffic around the University campus and the consequent reduction in emissions and noise, together with reduced obstruction by freight vehicles around the University sites. Four expected outputs were identified to be delivered: supplier self-consolidation; a university urban consolidation centre; out of hours deliveries; and time restricted access windows, or days, for vehicles. Supporting activities include the inclusion in procurement contracts of a supplier delivery plan, and the enforcement of Fleet Operators Recognition Scheme (FORS – see the introduction section) as promoted by the Tyne and Wear integrated transport authority. Additionally, improved data entry into the University procurement system with regard to storage location, and also the required date for deliveries, can be enforced. The stakeholders involved and committed to this strategy comprise the University Procurement department (who can enforce procurement contracts on suppliers, as well as improve the procurement system for buyers); the Catering department (who can turn the current delivery plan into an out of hours delivery plan); Newcastle City Council (who can introduce FORS, which has already been adopted at both the city and the Tyne and Wear metropolitan area level); the consolidation centre (city level or internal University) to organise regular delivery to the University campus sites; and the supplier, who can enforce the delivery plan by using the consolidation centre on the supply system to the University sites.

CONCLUSION

This paper presents the application of the Design and Monitoring Framework in addressing sustainable urban freight in a medium sized British city. It is a methodology used and promoted by the Asian Development Bank in aiding and improving effectiveness and that is consequently in prominent use in developing environments and countries. The application of DMF in the developed environment can be considered novel and this paper further extends this by its application to the promotion of sustainable urban freight. Although the full DMF process is yet to be completed, the level of understanding between stakeholders and the achievements in terms of how the strategy can be utilised and deployed, have been remarkable and encouraging.

The DMF application in Newcastle has demonstrated a process that has taken a number of steps towards the formation of a DMF Matrix. First was the stakeholder analysis, which included the identification of stakeholders; problems arising; the identification of interventions; and the mandate – which is basically a stakeholder who can make the change happen. Second was the development of problem analysis - via two stakeholder workshops - with the third step being the development of the objectives analysis via a further stakeholder workshop. The Fourth step will be the formulation of the analysis of alternative interventions and the final step, the completion of the DMF matrix.

At the later stage of the DMF process, an interview with each of the key stakeholders (who were involved in and committed to the three identified strategies) will be needed. The stakeholders' contribution will also be required to complete the input frame regarding the level of investment available (for example, from government subsidy; from the University) in order to promote the strategies (clean vehicles, regulated freight parking and co-ordinated freight deliveries) and to ensure that the associated activities are properly defined and undertaken.

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