REGULATORY REFORMS IN PUBLIC TRANSPORT WITH RESPECT TO INNOVATIVE CAPABILITY

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Abstract

It is believed that regulatory reforms of public transport could bring about a better quality of service. The expectations are that the regulatory reforms would lead to more innovation in the industry. This study focuses on the role of innovation in the public transport market, and how it is developed. The paper examines different effects of regulatory regimes with respect to innovative capabilities of the public transport services, both in the public and private sectors. Innovative capabilities include the implication of both technological and organisational innovations. Innovation is classified into three areas, namely: technical innovation, competence development and service innovation. In accordance with this classification, this study analyses the relationship between regulation and innovation along with the connection between public authority and private operator. This paper first elaborates the theoretical framework derived from the innovation perspective. The paper then compares the innovative capabilities that occurred in both the Netherlands and Great Britain.

Keywords: Public transport; Innovation; Regulatory reforms; Bus
Topic Area: H5 Innovation in Transport Policy

1. Introduction

Public transport is important for the societal mobility. Traffic congestion in an urban area due to the excessive use of private automobiles creates problems in many European countries. In this situation, public transport must play a major role in improving the mobility in the city. However, the government policy has not yet achieved the goal of promoting the use of public transport. The foremost barrier is a limited budget of government to support the public transport mode. Lack of funding has always been an issue with which the public sector has tackled by introducing the private sector involvement via privatisation and regulatory reforms.

The public transport sector in Europe is rapidly changing. This change is the result of the trend toward regulatory reform which, by default, affects the market structure. European countries suffered from the decline of public transport use in 1980s. What is more, the level of subsidy was significantly increased during that period which left the government in a predicament. The social provision toward public transport planning and policy, which has seen to be an inefficient approach, has been replaced by a market approach (Banister et al. 1992). The reasons for this fundamental change are partly ideological and partly financial (Andersen 1992).

Two important processes of the regulatory reforms are; first, to assign the public transport operation and planning to a private operator; and second, to introduce competition to the sector. By turning the operation and planning over to a private operator, the policy maker hopes for greater managerial efficiency than there would be in a publicly owned company. This would also

induce more investment boot from the private sector. In addition, the policy maker anticipates that the competition will sustain efficiency improvement. Furthermore, the competition would also influence the public transport firm to be more innovative in order to maintain its position in the market.

Many researches have studied the effects of regulatory reforms in an economic aspect. Yet there is a lack of interest in the issue of innovation in the public transport sector. It is important to realise that research in innovation is also important. Most research in public transport concentrates on outcomes, especially from an economic sense. For example, the productivity study focuses on the efficiency of the firm where it allows a little to the variation of the input and output variables (Ongkittikul 2002a). The implementation of the reforms is also an important facet. This paper seeks to understand the effects of regulatory reforms by studying the process of innovation in public transport through the concept of innovative capability.

The term '*innovation*' has come into popular use in public sector areas such as the housing association sector (Walker & Jeanes 2001), public health sector (Mohr 1969; Kimberly & Evanisko 1981; King 1992), and transport sector (van Zuylen & Weber 2002; Geerlings 1999). However, one unique aspect of innovation studies is that the meaning of the term '*innovation*' can be interpreted in various dimensions, dependent on the objective and theoretical background of such studies. This paper, thus, tries to bring together the useful aspects from a variety of literatures to construct a hypothesis for innovation in the public transport service. Generally, public transport planning has employed an economic theory, a welfare approach in particular. This paper introduces other perspectives, namely innovation studies, to develop the theoretical framework for analysing the innovation in public transport in this transition period.

The objectives of this paper are twofold: (1) to develop the theoretical framework for analysing innovation in the public transport sector; and (2) to identify innovative capability of public transport service using the developed theoretical framework. This paper first examines the relationship between regulatory changes and innovation in transport sector. It then introduces the economics of innovation theory to study the concept of innovation in public transport. Additionally, this paper employs the *twin characteristics approach* to classify innovation in public transport. With this classification, the paper defines the innovative capabilities of public transport. Moreover, case studies are carried out to show the developments of the innovation in public transport. The case studies are Dutch and British cases. The paper compares and analyses the innovative capabilities in various dimensions.

The organisation of this paper is as follows: Section 2 presents the relationship between regulatory changes and innovation in transport. It also gives a general observation on innovation theory related to public transport. Section 3 introduces the *twin characteristics approach* to classify innovation in public transport. Section 4 then defines the innovative capabilities, based on the classification in Section 3, and analyses the cases. Section 5 gives conclusion and recommendations for further research studies.

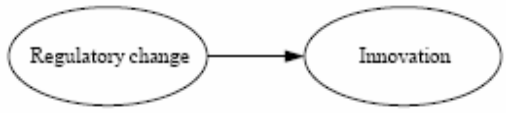
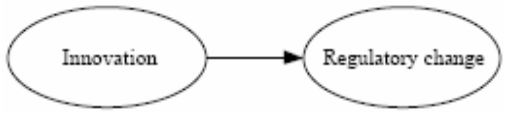
2. Innovation and regulatory reforms in public transport

2.1. Innovation and regulatory reforms in transport

The relationship between innovation and regulatory change in transport is not new. There are a number of examples that show the interaction between these two aspects. The importance of both regulation and innovation have been experienced in many transport sectors. For example, Gallamore (1999) shows the relationship between innovation and regulation in the American railroad industry. He finds that the Interstate Commerce Commission (ICC) regulation could delay or thwart innovation and change whereas deregulation could foster it.

To illustrate the relationship between innovation and regulatory reforms, let us consider a simple linear correlation of this kind. Table 1 shows patterns of developments of innovation and regulatory change. Note that these examples are simplified linear relationships; and the real-world situation may be much more complex and have an interaction (feed back loop) between regulatory change and innovation.

Table 1 Patterns of developments of innovation and regulatory change

Pattern of development	Examples
	Pattern *First the regulation was changed *Then the innovation occurred Examples *The use of mini-van (Technological innovation) *Multinational operator (Organisational innovation)
	Pattern *Innovation is first developed *Then the change in regulation booted the diffusion of innovation Examples *Unleaded gasoline (Technological innovation) *Low-floor buses (Technological innovation)

There are a number of examples that show the patterns of development where regulatory change leads to innovation. For instance, the bus deregulation in Great Britain affected the system in that the size of vehicle decreased (minibus effect). Furthermore, deregulation also affects the organisational reforms of the industry. After years of deregulation, there were several mergers and acquisitions which lead to the creation of multinational public transport operators in recent years.

Another pattern of development that occurs is when innovation leads to a change in regulation. In this case, innovation is first realised to be a benefit to the society, but there may not be any incentive to the users. Regulatory tools accelerate the diffusion of innovation which may come in forms of fiscal incentive or regulation. For example, the case of unleaded gasoline in the UK shows that regulations have been an effective instrument in stimulating the desired shift from leaded to unleaded gasoline (Stoneman 2002).

2.2. Defining and understanding innovation

In terms of literature focusing on innovation, one of the contributions of the Schumpeter's work (Schumpeter 1939) that is often cited concerns his distinction between invention, innovation, and diffusion. According to his definition, invention concerns the first development of a new artefact or process. Innovation entails its economic application. Diffusion describes its introduction by buyer or competitor. It is a rough and 'heroic' conceptual distinction, which can hardly be found in practice, since the empirical processes are usually never quite like this (Dosi 1991). The invention is often introduced from the start as an innovation by economically-minded research establishments. Diffusion entails further innovation on the part of both developers and

users. All three activities are often associated with changes in the characteristics of, and incentives for, potential innovators/adapters.

An important process is diffusion which is characterised by increases over time in both the number of firms using or owning a technology (inter firm diffusion) and more incentive use of technology by the firm (intra firm diffusion) (Stoneman 2002). Technological diffusion time, with the period from the date of first use a technology to the date of use, or ownership, of a technology by (say) 90 per cent of potential users possibly extending from five to fifty years (Manfield 1968).

Considering the diffusion of innovation, there was a debate among economists, sociologists, and historians about theories of "science (or technology)-push" and "demandpull" (Freeman 1996). The role of demand in driving innovation is undoubtedly important and there have been numerous examples of inventions and innovations that were initiated and driven largely in response to pressing social demands. However, Mowery and Rosenberg (1979) show that empirical studies of innovation that were often cited in support of "demand-pull" did not justify these conclusions. They further state, in the literature, the difference between "needs" and "demand" and between "potential demand" and "effective demand". Because human "needs" are extremely varied and often unsatisfied for long periods, they cannot alone explain the emergence of particular innovations at a particular time. Thus innovation should not be viewed as a linear process, whether led by demand or by technology, but as a complex interaction between potential users and new developments in science and technology.

Public transport is regarded as a service sector. It is important to point out that users (i.e. passengers) take part in the production process in the public transport system. This process consists of two main functions: the production of the service and its utilisation (Costa 1997). Those functions are performed by different agents: the producers of the service are the operators and the users are a subset of potential passengers.

Concerning the service sector, innovations have contributed to its growth in a number of service firms and to the scale of their operations, which in turn has increased their economic benefits (van der Aa & Elfring 2002). Innovations provide opportunities to increase the efficiency and quality of the service delivery process.

However, relatively few studies have focused on innovations in services (van der Aa & Elfring 2002). Innovative developments in service industries seem to be difficult to explain in terms of traditional innovation theories and typologies (Damanpour 1991). The main emphasis of innovation research is on new products and production processes, especially in manufacturing. For example, the product and process innovations (Utterback 1994) do not necessarily provide any deeper understanding of the factors responsible for the successful development of service innovations. Furthermore, although it is known that a service firm may innovate more or less in the same way as do industrial firms, Sundbo et al. (2001) emphasise that innovations seem to be much less technologically driven and most of them are organisational or social in nature. Service firms have also been found to have very few research and development (R&D) activities. Moreover, such innovations, if found, are usually somewhat unsystematic work of individuals in the firms. In other words, the innovation process is more informal in service than manufacturing. Innovations in service firms also tend to be more driven by the market and by consumers.

3. Innovation in public transport: a characteristics-based approach

3.1. Concept of characteristics approach

The characteristics approach allows us to understand the process of innovation in any given system. The notion, developed by Saviotti and Metcalfe (1984), of the product (goods) as a

combination of technical and service characteristics is now familiar in the economics of innovation and technical change (Gallouj 2002). This approach bases on the evolutionary theory of economic change (Nelson & Winter 1982).

The twin characteristics approach (Saviotti & Metcalfe 1984; Saviotti 1996) is represented by a description of the characteristics of a given technology. At any point in time this set of characteristics defines the current state of technology, each characteristic having variable levels. In this approach, a product could be described as the combination of two sets of characteristics, called technical (X) and service (Y) characteristics respectively. The two sets of characteristics are related by a mapping pattern, because the purpose of technical characteristics is to provide services. Moreover, the two sets of characteristics can be conceptualised as the inner structure (technical characteristics) and the interface (service characteristics) of the technological system and the interface or boundary of the system.

In this approach, technical characteristics are components which produce the final services. In public transport services, the technical characteristics can be divided into three categories: basic inputs, technological compositions, and managerial and operational compositions. Basic inputs represent the general production requirements of the industry. To produce transport services, like any other businesses, capital and labour are norms. Technological compositions represent the variety of transport technology used presently. This component will be useful when we explore the technological innovation as it will help us to identify differences and varieties of technological developments in a systematic way. Finally, managerial and operational compositions bring together the elements that are involved in the production of services in an indirect way. This is referred to as the competence (Gallouj & Weinstein 1997), which represents the utilisation of basic inputs and technological compositions.

It is also possible to advance this framework to characterise public transport service in more detail. The proposed framework is to divide the technical characteristics into two groups, namely technical and competence characteristics. This framework is more appropriate to the service sector which was originally proposed by Gallouj and Weinstein (1997). By introducing 'competence,' the provision of a service is generally the result of a combination of the following two mechanisms: the utilisation of (tangible or intangible) technical characteristics that are themselves based on competences and the direct mobilisation of competences (Gallouj 2002). Figure 1 shows the service characteristics (Yi) as a combination of technical characteristics (Ti) and competences (Ci).

In this notion, a product (goods or service) is represented by a set of service characteristics (*Yi*). These service characteristics are obtained by a certain subset of the technical characteristics (*Tj*), with each *Yi* being obtained by a certain subset of the *Tj*. Similarly, each technical characteristic mobilises the competence *Ck* (certain competences may involve the ability to combine different technologies); in certain situations, those same competences may be mobilised directly to produce the product (Gallouj 2002). These competences are derived from various sources: initial education, continuing training, organisational learning, and experiences.

For public transport sector, Ongkittikul (2002b) elaborates the twin characteristics approach to characterise the public transport. It originally uses the simple twin characteristics framework which consists of technical and service characteristics only. In this approach, technical characteristics are components which produce the final services. In public transport services, the technical characteristics can be divided into three categories: basic inputs, technological compositions, and managerial and operational compositions.

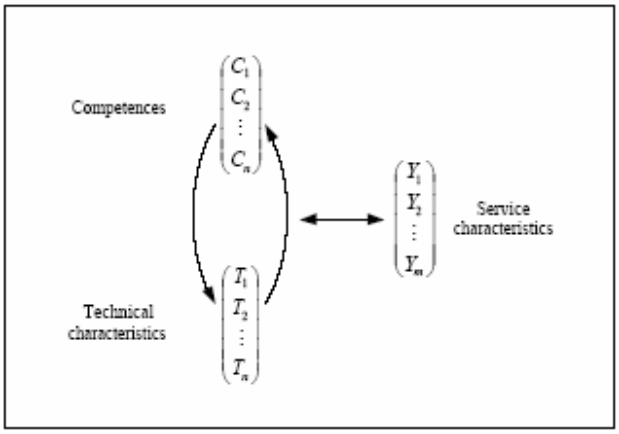


Figure 1 A representation of a product or service as a system of characteristics and competences
Source: Gallouj and Weinstein (1997)

This framework can be expressed in more detail. The modified framework reclassifies the technical characteristics (*Xi*) into two new groups: technical characteristic (*T*) and competence (*C*). For public transport service, the technical characteristic is a hardware component such as vehicle, infrastructure or propulsion systems. Competences refer to the managerial skills of operators who manage the public transport system. These skills include labour, organisational structure, and contractual arrangement. The public transport sector is a labour-intensive sector. As a result, the division of labour plays an important role in this sector. The competence for the labour component is to utilise the staff's activity to achieve high performance. Further, marketing and ticketing activities can also be considered as essential operator's competences. In recent years, it is realised that the operation of public transport is not only a matter of moving people, but also reaching and encouraging people to use the system. To do this, many activities are required such as advertising and marketing campaigns. Finally, public transport operators normally face contractual arrangement with public authority with their main concentration on subsidisation level. This is the norm for public transport operations for the intervention of public authority in various aspects such as subsidy, level of service requirement, and ownerships. Note that the service characteristics are similar to those described in previous section. Figure 2 shows the new characteristics-based approach of public transport service.

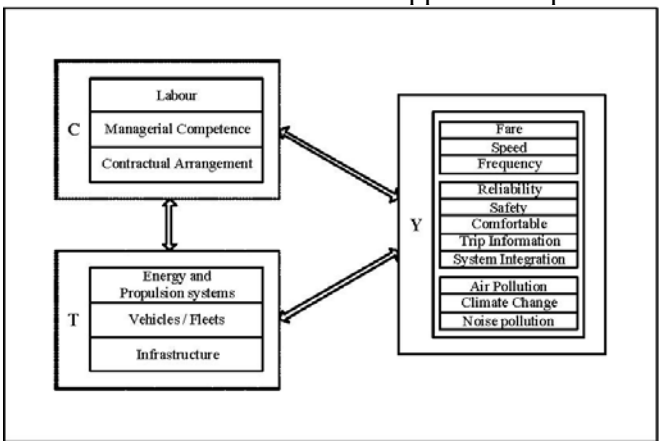


Figure 2 The characteristics-based approach of public transport service.
Source: developed from Gallouj and Weinstein (1997) and Ongkittikul (2002b)

It is also useful to divide the production activity of public transport service into two main categories: core and supplementary activities. The core activity is the essential part of the service which the operator must carry out to fulfil the basic passenger needs. In this term, the core activity is the task of transporting people from an origin to a destination. This involves the coordination between vehicle, infrastructure, and driver. Supplementary activities are the other tasks to make the public transport more attractive to the users. This may include travel information service, marketing, and the ticketing system.

3.2. Classification of innovation in public transport

Using the characteristics-based approach described above, innovation can be defined as any change affecting one or more terms of one or more vectors of characteristics (of whatever kind – service, technical or competence). Originally, Saviotti and Metcalfe (1984) identify five types of technological change namely:

a) change in absolute values of Xi;
b) change in the mixture or balance of Xi (changes in weights);
c) change in the pattern of mapping (Xi) ? (Yj);
d) change in the mixture or balance of Yj; and
e) change in absolute values of Yj.

However, as noted by Gallouj (2002), we are concerned by not only technological changes, but also organisational innovations in all their tangible and intangible aspects. This notion can be adopted here to exploit the process of innovation in public transport service. Gallouj (2002) identifies six models of innovation, namely: radial innovation, ameliorative innovation, incremental innovation, ad hoc innovation, recombination innovation, and objectifying or formulisation innovation.

- *Radical innovation*. It is the creation of a totally new product, i.e. one defined in terms of a system of characteristics and competences unconnected with those of an old product.
- *Improvement innovation*. According to the strictest definition, this type of innovation consists simply of improving certain characteristics, without any change to the structure of the system.
- *Incremental innovation (innovation by substitution or addition of characteristics)*. The general structure of the system remains the same, but the system is changed marginally through the addition of new elements to [T] and/or [Y] or through the substitution of elements.
- *Ad hoc innovation*. Ad hoc innovation can be defined, in general terms, as the interactive (social) construction of a solution to a particular problem posed by a given client.
- *Recombinative innovation*. Innovation of this kind exploits the possibilities opened up by new combinations of various final and technical characteristics, derived from an established stock of knowledge and a given technological trajectory.
- *Formalisation innovation*. This model consists of putting service characteristics 'into order', specifying them, making them less hazy, making them concrete, giving them a shape.

For innovation in public transport service, it is not necessary to employ all six models of innovation mentioned above. Rather, this study proposes the systematic classification of innovation as follows.

Service innovation

Service characteristics play a central role in classifying innovation. Most innovations aim to improve (or, at least, not decrease) service characteristics. As a result, any change in service characteristics could be considered as innovation in this category. Thus, the two sub-categories

suggested are endogenous service innovation and exogenous service innovation. The endogenous service innovation comes from any change in competences and/or technical characteristics whereas the exogenous service innovation relates to any external force or constraint. In the endogenous category, two groups of innovation can be distinguished: (pure technical) innovation and competence development. These categories are described in more detail below. Secondly, the exogenous type includes the change caused by external factors. For instance, if the intervention of public authority forces every operator to provide standard travel information, this could also be considered a service innovation in this category. Figure 3 shows the classification of innovation in public transport.

Pure technical innovation

This type of innovation includes the changes in technical characteristics, for instance, change of propulsion, vehicle or infrastructure systems. This innovation may or may not require and/or affect any change in other characteristic groups. This could be the case for incremental or radical innovation of the systems. Thus, three sub-groups can be identified as follows:

. *Incremental innovation*: This innovation does not require any change in competence and service characteristics. For example, the use of new propulsion systems (e.g. natural gas) does not require a change of driver skill and the services provided are nearly the same.

. *Componential innovation*: This innovation does require a development of new competence to acquire a new component. For example, a trolley bus may need a driver to develop his/her skill to operate. However, the service characteristics mostly remain unchanged.

. *System shift or radical innovation*: An introduction of a new system required the operator to develop new competences to handle such a new system, and it consequently brings about new service characteristics.

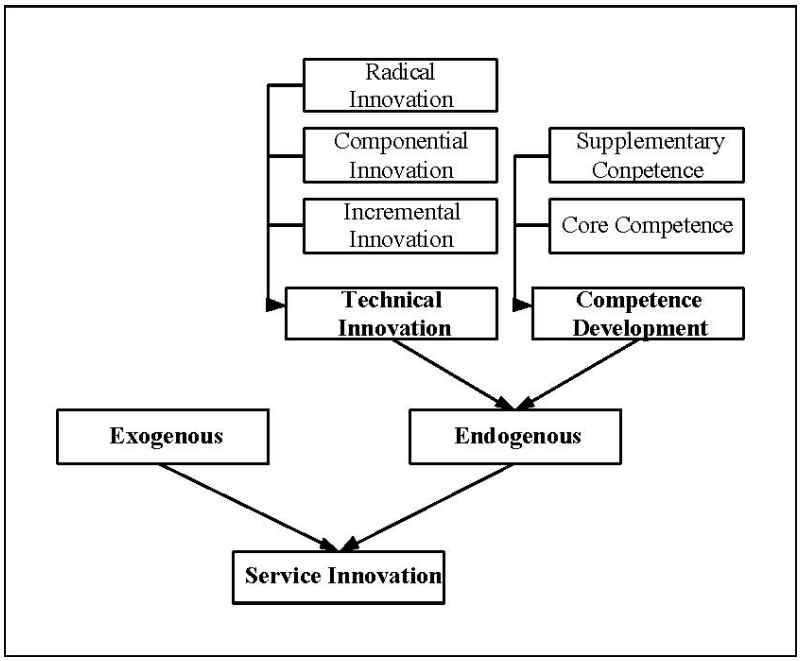


Figure 3 Classifying innovation in public transport

Competence development

At the firm level, there is a learning process. This learning process can be the result of competitive pressure or constraint from the industrial environment. Thus, innovation is required

to maintain the position of the firm. This category entails both endogenous and exogenous forces on innovative activities. The development of competences could occur endogenously, such as managerial skills in the division of labour. A contractual arrangement is also an essential part of public transport service nowadays. The company's competence dealing with different kinds of contracts in different environments is also beneficial in this industry. The move toward regulatory reforms, such as liberalisation, deregulation or tendering, makes this competence more important. Further, a firm could be forced to develop new competences due to an exogenous constraint such as a new regulatory framework or new technology. New technology in the competence development differs from the one used in pure technical innovation which focuses mainly on the improvement of main service characteristics, such as fare, speed, and frequency. New technology in competence development refers to other supplementary technology that can marginally improve the service characteristics. For instance, relaying travel information is a new technology that public transport firms have to develop. This innovation may or may not affect service characteristics.

Technical innovation aims to improve technological elements toward better performance. In other words, given constraints in other dimensions, an improvement can be made through technical characteristics. The competences can be seen as organisational learning tasks. This mainly deals within the organisation of public transport operators. Finally, the service exogenous innovation may overlap both technical innovation and competence development. However, the real aim of innovation is presented through service innovation which lead to the improvement of service attributes.

4. An analysis of innovative capabilities

4.1. Innovative capabilities: definitions

In section 3, the classification of innovation is presented. In this section, the paper introduces the criteria to investigate the innovative capabilities of bus systems in two countries namely, Great Britain and the Netherlands. The development of regulatory reforms in these two countries in the past twenty years has evoked interesting comparisons. Great Britain had a break-through reform, i.e. deregulation in 1985, whereas the Netherlands opted a rather gradual reform, though no less divergent, in the past fifteen years.

The classification given in section 2 can be translated to more operational categories. This paper classifies the innovative capabilities of the bus system into three categories, namely, innovative capabilities related to 1) infrastructure, 2) vehicle, and 3) service operation. Figure 4 shows this classification of innovative capabilities.

This innovative capability is considered as a tool kit to examine innovation in the bus industry. It is based on the classification in section 3 in the sense that the innovation classification presents several overlaps in terms of the responsibility between the actors involved in bus transport. This innovative capability attempts to cluster the technological fields of each actor involved and elaborate the characteristic approach in a practical and operational manner.

The authority and operator have different innovative capabilities in each aspect presented in Figure 4. It is remarkable to see how these responsibilities (which imply innovative capabilities of actors) change during the course of regulatory reforms. The comparison of these innovative capabilities' changes would enable us to analyse the effects of regulatory reforms with respect to innovation. This paper distinguishes between potential and practical innovative capabilities. Potential innovative capabilities are the (ideal) capabilities that should happen whereas practical innovative capabilities are, generally, what actually happened. Thus the gap between the potential

and practical capabilities can be identified and this will set some guidelines as to which actions or incentives are needed in order to reduce this gap.

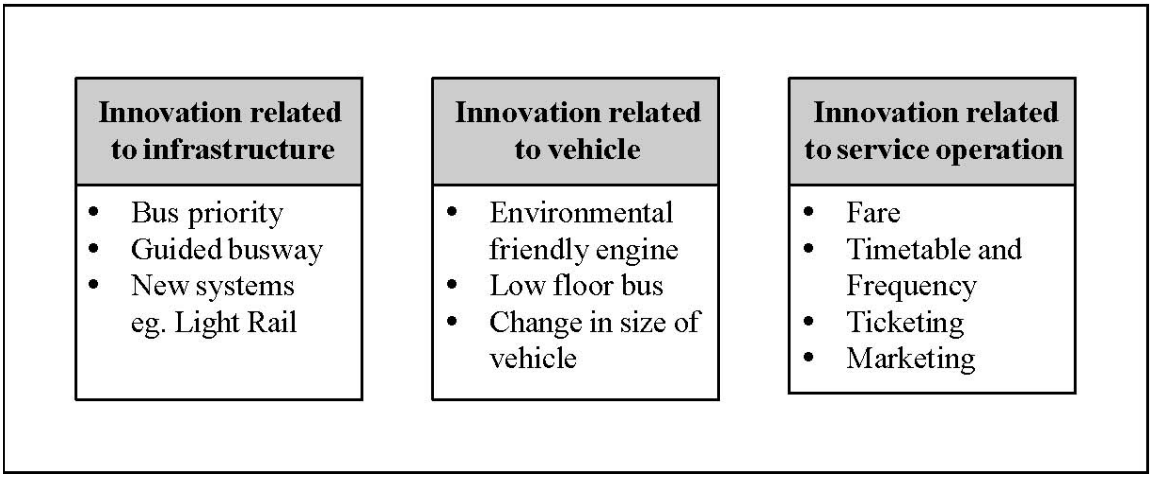


Figure 4 Innovative capabilities in bus industry

4.2. Innovative capacities: empirical evidences

In this section, the concept of innovative capabilities described in previous section, is applied to empirical cases. These cases are the British and Dutch cases which are depicted in section 4.2.1 and 4.2.2 respectively. Note that the information used for both cases is gathered from various publications, as noted in table and text, and general information available to the observers. In the Dutch case, some information was also obtained from interviews with authorities and practitioners in the Dutch public transport sector.

4.2.1. The British case

The breakthrough of public transport regulatory reforms is the British deregulation case. It came from the Transport Act of 1985 which set the local bus service in Great Britain: to abolish quantity controls (road service licensing) on local bus services outside London; to restrict subsidy payments in support of public transport for local services to unprofitable routes required to meet social need; and to make fundamental structural changes to public sector bus ownership (McGuinness et al. 1994).

It was anticipated that deregulation would have a number of consequences. It was contended that through a process of deregulation, new operators would able to enter the market and incumbent bus understandings would be transformed into more innovative, market-oriented and commercial companies (McGuinness et al. 1994). With respect to innovation, Mackie et al. (1995) reveal that established firms have been quite willing to develop new service patterns, and to switch from big bus to mini or midibus operations. They conclude that a large well-managed incumbent has sufficient sources of competitive advantage to deter entry successfully, or at least to restrict to the competitive fringe.

The main effects of the deregulation were the excessive capacity and the decreased quality of bus services which resulted in the shapely decrease of bus ridership (White 1995). It is realised that there are several service dimensions, not only the subsidiary service, but also infrastructure and vehicle investment, that both operators and local authorities have to take a responsibility (Mackie 1999). Investment in bus infrastructure dropped dramatically after the

year of deregulation as a result of both *the effective '**divorce**' of bas operation and social planning and reforms of funding mechanisms by Government* (Huntley 2001). Thus, there was an effort to stimulate the investment in this gap. After years several trail projects had been introduced and the Quality Bus Partnerships scheme emerged.

To analyse the innovative capability of the bus service, this paper divides the period of the regulatory changes in the British bus industry into three periods: before deregulation, after deregulation and the quality bus partnership/contract period. The period before deregulation occurred before the Transport Act 1985 had been implemented. At that time, the local bus industry was a heavily regulated public service. It was owned mostly by local or central government, regulated by the Traffic Commissioners (Mackie & Preston 1996). The second period, after deregulation, is the period where the industry was shaping into a more commercial-oriented manner. This period started in 1986 when the Transport Act of 1985 had been implemented. Finally, the third period represents the period where Quality Bus Partnerships scheme was implemented. Table 2 shows an analysis of the innovative capabilities of the British case.

Table 2 The innovative capabilities of the British case

		Prior to Deregulation (before 1985)				Period after Deregulation (1986-1996)				Quality Bus Partnerships/Contracts Period (From 1996)			
		Authority		Operator [1]		Authority		Operator		Authority		Operator	
		Potentially	Practically	Potentially	Practically	Potentially	Practically	Potentially	Practically	Potentially	Practically	Potentially	Practically
Innovative Capabilities	Related to infrastructure	Very High If there are budget available, the Authority could potentially introduce a new (innovate) infrastructure	Low Most budget spent on subsidiary the service Little incentives for authority to innovate in infrastructure	None	None	Remain High Authority still has the right to introduce a new and/or charge infrastructure systems	Not used Not much have been use mostly due to a limited budget	None	None	High The QBPs allow the authority to involved in co-investing the infrastructure		High The QBPs allow the operator to participate in the infrastructure investment	
	Related to vehicle	High Authority could require a new type of vehicle to use in the operation	Not used	None	None	None The authority have no right to intervene the (commercial) service		High The operator has options for size of vehicle and can potentially improve a quality of service by using new buses	High The use of minibus is increasing. But, on a negative side, the average age of vehicle dropped dramatically.	Higher Local authority can propose the QBPs to subsidy the operator to improve the vehicle quality		High Beside the options of vehicles that operator can choose, a QBPs option is also available	
	Related to service operation	High The authority (through Traffic Commissioner) controls fares, frequency, and other service characteristics		None Most services were designed by the authority		Low Only social services have been required		High The operators decide the routes, timetables, and fares for any service that they choose to run commercially		Low Only social services have been required. But in exchange to the infrastructure improvement made by local authority, the higher level of service may be required.		High Still, in profitable routes, the operator have right to initiate a service	

Note: [1] Most operators in this period are public-owned companies.
Sources: Mackie et al (1995), White (1995), Mackie et al (1996), Mackie (1999), Huntley (2002)

4.2.2. The Dutch case

Prior to the year 2000, local and regional public transport in the Netherlands was historically based upon the principle of market initiative but moved de facto gradually away from that principle, giving a great degree of stability to incumbent operators, which were mostly authority-owned (van de Velde & Leijenaar 2001). Although it was legally possible for the new entry from private operators, it hardly took place in practice. Nevertheless, there was a reform discussion in the period from 1992 to 2000 and two experiences with competitive tendering (with mixed results) took place in 1994 (van de Velde 2003).

The major development of Dutch public transport in recent years was the introduction of the new Passenger Transport Act 2000. This reform's aim was twofold: more attractive public transport services (especially in areas worst hit by congestion) and an improvement in cost recovery ratios (van de Velde 2003). This act decentralised the powers to provincial and regional authorities, and competitive tendering of public transport services for concessions was introduced gradually. Additionally, authority-owned local transport companies were put at arm's length or

privatised. The process of reform was set to be complete by the year 2006. However, there will be a 'go/no go' decision to move 100% in 2006 after a Parliamentary evaluation (based on passengers, quality, and costs) by the end of 2004. In an early assessment of this reform, Hermans & Stoelinga (2003) studied potential impacts of the reform in three aspects: service level, patronage, and cost efficiency. The results were positive, yielding an increase in service level, patronage, and cost efficiency while some barriers still remained.

To present the analysis of the innovative capability of the Dutch public transport system, this paper divides the regulatory changes into the following three periods: market initiative period (before 1991), experimental period (1992-1999), and transitional period (after 2000). The market initiative period presents the initiative to provide public transport services in a certain area coming from one of the operators. The operator submits a plan to the authorities to be authorised. In practice there was no competition in this system (Hermans & Stoelinga 2003). During the experimental period, the government carried out trial reforms in several areas. Finally, the transitional period reflects the changes of the regulatory regimes with response to the new Passenger Transport Act 2000. Table 3 shows an analysis of the innovative capabilities of the Dutch case.

Table 3 The innovative capabilities of the Dutch case

		Market Initiative Period (before 1991)				Experimental Period (1992-2000)				Transitional Period (After Passenger Transport Act 2000)			
		Authority		Operator		Authority		Operator		Authority		Operator	
		Potentially	Practically	Potentially	Practically	Potentially	Practically	Potentially	Practically	Potentially	Practically	Potentially	Practically
Innovative Capabilities	Related to infrastructure	Very High If there are budget available, the Authority could potentially introduce a new (innovate) infrastructure	Low Most budget spent on subsidiary the service Little incentives for authority to innovate in infrastructure	None	None	Very High If there are budget available, the Authority could potentially introduce a new (innovate) infrastructure	Low (but increasing) Several municipalities have introduced tram or light rail	None	None	Very High If there are budget available, the Authority could potentially introduce a new (innovate) infrastructure	Low Still low due to a budget constraint	None	None
	Related to vehicle	High Authority could require a new type of vehicle to use in the operation	Not used	None	None	High Authority could require a new type of vehicle to use in the operation	High There were several trial projects where different vehicle types were implemented	None	None	High Authority could still require a new type of vehicle to use in the operation	Mostly low Most authorities hesitate to require a new investment in vehicle due to the budget constraint	Varied Some authorities request a specific type of vehicle, while some do not.	Mostly low When the specific vehicle is requested, the cost of subsidies will be higher. Most authorities prefer a lower subsidies.
	Related to service operation	None The service had been in the operator decision.		High This is a market initiative model where the operator had a right to design the operation		Low The idea was that the authority should not interfere the market initiative	High The authority increased its role in design the service.	High The market initiative model where the operator had a right to design the operation still employed	Low As the authority increased its role in design the service.	Varied The new Act requires the services to be tendered but the authority still have a right to decide which kind of tender they adopt. Thus some authorities chooses to design service themselves while some choose to let the operator design.		Varied As the tender designed by the authorities, operators have to follow what authorities proposed.	
Sources: van de Velde (1998), van de Velde & Leijenaar (2001), van de Velde & Pruijmboom (2003), Hermans & Stoelinga (2003)													

4.3. Discussion

Table 2 and Table 3 show the analyses of innovative capabilities of the cases. In both cases, generally, authorities and operators in different regulatory regimes have different levels of innovative capabilities. Although these cases cannot be directly compared due to the difference in time scales and industry environment, it might be possible to obtain experiences from the process of changes.

The British case seems to present a radical movement of the innovative capabilities. The deregulation affected all three innovative capabilities, i.e. infrastructure, vehicle and service operation. The innovation in infrastructure and vehicle seems to have had negative effects, such as the lag of investment in infrastructure and the decrease of the average vehicle age. This led to the government's introduction of the Quality Bus Partnerships to improve the infrastructure and vehicle qualities.

In contrast to the British case, the Dutch case seems to be less radical. Generally, the innovative capabilities in infrastructure and vehicle are invariable. Much of the innovation lied in the authorities' hand or authorities' initiative. The development mostly occurred in the service operation aspect. The movement from the first period to the second period is seen to have a negative effect. However, one must note that the clear boundary for each period may not be a good representation as the development is gradually changing (see van de Velde & Pruijmboom (2003) for more in-depth discussion in this aspect). As noted earlier, the Dutch case has gradually changed and any significant indication may hardly be identified.

In sum, the British case, in the deregulation scheme, shows the changes in innovative capabilities in all aspects (both negative and positive) where as the Dutch case shows mainly the changes in the service operation aspect. Although White (1995) suggests that the imitation of the deregulation would be unwise and he recommends the competitive tendering within a coordinated network model, the British case shows, in long term, that the radical change brings more innovation to the systems, not only the service operation, but also the development of the innovation in infrastructure and vehicle.

5. Conclusions

The public transport industry has radically changed during the last decade. This significant development is the result of a move toward more private-involvement in the sector. It is believed that the reforms would bring about better efficiency, cost reduction, and better use of innovation. However, there is a lack of interest in the issue of innovation in public transport sector. Most research in public transportation systems does not take innovation studies into consideration. The common assumption that most researchers presupposed is that the regulatory reforms will lead to a positive innovation. This is rarely the case. This paper attempts to explain how the innovation in public transport takes place and what the important factors are.

This paper analyses innovation in public transport using the *characteristics approach*. The conceptual framework is proposed to define the characteristics of the public transport service. With this conceptual framework, the classification of innovation in public transport is introduced. Then, the innovative capability is defined, using the developed classification, namely innovation in infrastructure, vehicle, and service operation. The British and Dutch cases are introduced to analyse the innovative capabilities of the different regulatory reforms.

In conclusion, comparing regulatory regimes gives a different outlook on innovation capabilities. The British case shows a greater degree of innovation (both positive and negative) than the Dutch case which suggests that, in long run, radical reform (deregulation) is likely to create innovation more than moderate reform.

Further research is needed to apply the theory of innovation in greater detail. Both technological and organisational innovations are important for public transport service development. Another interesting aspect would be the effect of market concentration through the multinational transport operator companies working on the innovation. It is remarkable to discover that big companies are more innovative than smaller ones, and this should be extended to the public transport companies that operate in different modes, i.e. bus and railway.

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