Roles of Private-Sector Partners in Transportation Public-Private Partnership Failures

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Abstract: Public-private partnership (PPP) models for public infrastructure delivery are becoming popular among government institutions around the world, due to their embedded potential value for money (VFM) to the public and governments themselves. The experience with infrastructure PPPs internationally have demonstrated many problems and partnership failures, where both the public and private sectors suffered huge losses. Motivated by a number of these failures, this study investigates the actions and decisions of private-sector partners by evaluating 35 failed transportation PPPs around the world. This paper identifies a set of drivers responsible for the failures of transportation PPPs, discusses the causal relationships between them, and finally evaluates a set of failure mechanisms initiated by the private-sector partners. It sheds light on the role of private-sector partners in terms of triggering failure mechanisms in transportation PPP failures. The identification of failure mechanisms discloses the fact that inappropriate decisions and actions of private-sector partners (i.e., failure drivers) have created problems for other project partners, which ultimately caused the PPP failures. The failure mechanism model suggested here provides insight into the existing failure trends associated with private-sector partners in transportation PPPs. These findings will help private-sector partners to safeguard partnerships more effectively and provide public-sector PPP practitioners with a better understanding of their partners' actions and decisions and their influence on project success. **DOI: 10.1061/(ASCE)ME.1943-5479.0000263.**

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Introduction

Providing basic transportation infrastructure has long been considered a responsibility of public-sector organizations. The perception of public ownership is rooted deeply in the concept of the welfare state, where in return for taxes paid to the government, citizens have access to a variety of basic services to safeguard their well-being. The basic services include housing, health care, education, and access to basic infrastructure (e.g., transportation, electricity, and potable drinking water), among many others.

The increasing population has put stresses on countries' limited resources, and governments are compelled to move resources to more basic needs like health care and education rather than spending on the development of new and enhanced transportation infrastructures and other development sectors. The situation in developing countries is even worse, as many of these governments can hardly provide for the basic needs of their citizens. Therefore, government spending on the development of new transportation networks is almost out of the question in many developing nations. The situations of tight financial and other material resources leave governments with no other choice than to adopt the principles of a free-market economy to use private capital for public works and services. The public-private partnership (PPP) is a trend associated with the free-market economy in which private parties are invited to finance, construct, own, and operate a public facility and then transfer it to the public-sector authorities after a fixed period of concessions. PPPs remain an attractive alternative to the public sector, as historically they have provided value for money (VFM) and delivered high-quality outcomes on time and on budget (Yuan et al. 2012).

PPPs represent a principal-agent maximization problem (Zhang 2009), and any solution to such a principal-agent maximization problem has to satisfy two constraints (Laffont and Martimort 2001). The two constraints are associated with satisfaction of the principal and agent; i.e., the public and the private partner, respectively. In a typical PPP project, the two partners are involved with opposite motivations but a common goal (i.e., successful completion of the project). The public sector aims at welfare maximization, while the private partners are motivated by the potential profit-making capacity of the project. Therefore, it is highly probable that the profit-making motivation of the private partner may jeopardize the social welfare associated with the project. Alternatively, the public-sector partner may feel that private-sector partner is attempting to maximize its profit (Papajohn et al. 2011). Consequently, the embedded VFM to the taxpayers is always at stake unless the energies of the partners are aligned to achieve the project goals for both; and synergizing the two partners requires developing optimized project goals that meet the objectives of both partners.

The optimized project goals in transportation PPPs are always subject to market uncertainties, which may eradicate the optimization factors and create conflicts of interest between the public- and private-sector partners. For example, in the wake of national economic down times, the public-sector partner would like to enforce tolls based on the social value of time to achieve welfare maximization, but if the traffic volumes on project corridors are somehow getting low, then the private partner may wish to increase the toll rate in order to meet the requirements of debt repayment. However,

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the increased rate may not be acceptable to the public-sector partner, triggering a conflict of interest between the partners. Apart from market uncertainties, the transportation PPP projects are vulnerable to a variety of risks; and large parts of such risks are inherent in the organizational setup of PPP projects and in the people involved. Other risk sources in PPPs include construction delays, operation cost overruns, politics and policies, cooperation credibility, and economic environment (Chan et al. 2011).

Past experience with transportation PPPs has revealed numerous problems illustrating complex interrelationships among market uncertainties, sociopolitical risks, and human error (i.e., the risk inherent with the main project partners). In addition, experience has shown that the majority of problems were not caused by a single factor; rather, they entailed a complex relationship of many actions by different project partners or events associated with the sociopolitical situations in project-hosting countries. However, for many failed transportation PPP projects, as documented in the literature, a single factor was reflected as a reason for the failure; but exploring the situation further reveals multiple small actions that, when combined, results in that single factor ultimately causing the failure. This research attempts to evaluate similar scenarios of complex interrelationships among different factors that caused transportation PPP failures. More specifically, this paper looks at the actions and decisions of the private-sector partners, as well as their interrelationships with factors associated with other project partners that caused partnership failure. Therefore, previous experiences in failed transportation projects are evaluated in order to identify factors responsible for project failures and the interrelationships, among which were failure drivers and failure mechanisms, respectively.

Research Methodology

This research is based on the case studies of failed transportation PPP projects witnessed in the last two decades all over the world. The research methodology can be divided into three main parts: (1) selection of failed transportation PPP cases, (2) event sequence mapping (ESM), and (3) identification of failure drivers and failure mechanisms. The following sections explain each part of the research methodology in detail.

Selection of Failure Cases

The search for transportation PPP failure cases from the World Bank's database for private participation for infrastructure (PPI) returned 66 canceled transportation PPP projects. The PPI database has certain limitations, in that it keeps records only for PPPs in developing countries and does not have any records for projects that do not yield VFM to the public. The PPI database also does not contain any details on how exactly a particular project failed or succeeded. Therefore, the search for transportation PPP failure cases is extended to all available literature on the Internet tagged with "transportation Public Private Partnerships," which returned thousands of documents citing a variety of failed transportation PPP projects in both developed and developing countries. Among these documents are research papers, evaluation studies made by public-sector organizations, and other international financial institutes, audit reports, and reports by nonprofit organizations.

All the failure cases identified through the PPI database and Internet search then are checked systematically in three consecutive phases to ensure the failure status of projects and assess their suitability for case studies. The three phases are as follows:

1. Projects must satisfy the failure criteria given in Table 1.
2. Reliable documents citing project events must be available.
3. The validity of the available documents must be confirmed.

The third phase is applied only to failure cases that are categorized as not delivering VFM. The reason is that numerous documents prepared by nongovernment organizations (NGOs), especially some antiprivatization organizations, described many projects as not delivering VFM at all; however, the public-sector officials involved in these projects were satisfied that VFM was achieved. For example, Mehra (2005) characterized the PPP project of the rapid-transit by Vancouver Transit Authority Canada as a flawed deal because of the high cost bids and associated improper risk allocation proposals received at that time. However, the annual reports issued by the concessionaire and regional transport commissioner showed that the project was achieving the planned goals and delivering the anticipated value (Brodie 2006). Therefore, cases illustrating the "not delivered VFM" failure type are not considered for further analysis unless supported by more reliable evidence, like audit reports or official project evaluation reports and articles published by reputable research journals.

All the failed transportation PPP cases not fulfilling the requirements of the three phases were ignored for the purposes of this study. Finally, 35 projects representing both developed and developing countries were chosen for further analysis. Table 2 shows the list of failed transportation PPP projects considered for this research.

Event Sequence Mapping

It is rare that a single document can provide complete information on the events in a failed transportation PPP project. Therefore, to collect complete information on a project, multiple documents are relied on. The utilization of multiple documents from different authors and agencies raises issues like combining the information from the different documents, identifying missing information on and between events that had a negative impact on the project's progress, identifying the missing information defining the relationship between two independent project events, and choosing between contradictory information on the same event.

To overcome these issues, ESM is performed for each case study. This is a structured methodology developed to assimilate multiple sources of information and produce a complete story

Table 1. Types of Transportation PPP Failure

Number	Type of failure	Definition
1	VFM not achieved	The public sector is unable to achieve VFM, and taxpayers suffer losses
2	Concession cancelled	The concession contract is cancelled by the government, and a new tendering process is launched
3	Concession tender cancelled	The concession tender is called off at the initial stages (i.e., before signing agreement) due to poor financial viability of project or some other reason
4	Project nationalization	The government nationalizes the project (i.e., the project comes under public ownership)
5	Project halted	The project halts for a long time due to conflicts, legal proceedings, or technical issues
6	Contract suspension	The government temporarily suspends the concession rights of the concessionaire

Table 2. Projects Considered for Case Studies and Their Types of Failure

Number	Project name and country of origin	Type of failure
1	Blegrade Novisad Motorway, Czech Republic	Concession cancelled
2	D47 Motorway, Czech Republic	Concession cancelled
3	Horgos-Pozega Highway, Serbia	Concession cancelled
4	M9 Motorway, Pakistan	Concession cancelled
5	Mexican toll road program, Mexico	Concession cancelled
6	Mumbasa container terminal, Kenya	Concession cancelled
7	Trakia Motorway Project, Bulgaria	Concession cancelled
8	Transgabonais, Gabon	Concession cancelled
9	Jakarta Outer Ring Road, Indonesia	Concession cancelled and Project nationalization
10	BERTS, Thailand	Concession cancelled
11	D5 Motorway, Czech Republic	Concession tender cancelled
12	M3/M30 toll road, Hungary	Concession tender cancelled
13	M7 toll road, Hungary	Concession tender cancelled
14	M9 Danube toll bridge, Szekszárd, Hungary	Concession tender cancelled
15	Pitesti-Bucharest-Lehliu (140 km), First Phase, Romania	Concession tender cancelled
16	Argentina toll road program (first generation), Argentina	Contract suspension
17	Beiras Litoral/Alta Shadow Toll Road, Portugal	Project halted
18	91 Express Lanes, California, United States of America	Project nationalization
19	Camino Colombia toll road, United States of America	Project nationalization
20	London Underground—Metronet, United Kingdom	Project nationalization
21	London Underground—Tubelines, United Kingdom	Project nationalization
22	M1/M15 toll road, Hungary	Project nationalization
23	Railtrack, United Kingdom	Project nationalization
24	Siza Rail, Democratic Republic of Congo	Project nationalization
25	Skye Bridge, Scotland, United Kingdom	Project nationalization
26	Tha Ngone Bridge project, Laos	Project nationalization
27	Zagreb-Gorican Motorway, Croatia	Project nationalization
28	Channel Tunnel, England, United Kingdom	VFM not achieved
29	Channel Tunnel Rail Line (CTRL), United Kingdom	VFM not achieved
30	Confederation Bridge, Prince Edward Island and New Brunswick, Canada	VFM not achieved
31	Highway 407, Ontario, Canada	VFM not achieved
32	Railfreight Distribution, England, United Kingdom	VFM not achieved
33	Rolling Stock Leasing Companies (ROSCO), United Kingdom	VFM not achieved
34	Royal Dockyards (at Davenport and Rosyth), United Kingdom	VFM not achieved
35	Wijker Tunnel, Randstad, Netherlands	VFM not achieved

depicting failure events. The *name event sequence mapping* is derived from the fact that it attempts to map project events based on information found in documents from multiple sources. ESM is performed individually for all 35 projects, and this process is detailed in the next sections. Fig. 1 represents the ESM methodology.

Define the List of Failed Transportation Projects

Defining the list of failed transportation projects for which ESM is to be performed, as well as ensuring their failure status, are primary tasks in ESM. As this task (i.e., selecting failure cases) has been performed in the previous stage, this part of ESM is considered as a check to verify that this was done properly.

Develop Document Reliability Hierarchy

Numerous documents are collected during the search for failed transportation PPP projects. Therefore, development of a document reliability hierarchy is important in order to choose between different documents for resolving contradictory information about project events that had negative impacts on project progress. The reliability hierarchy is established based on the source of the document. Research papers published by renowned journals and reports prepared by the government bodies and international financial institutes are placed at the top of the hierarchy of reliability; newspaper and magazine articles come second in the hierarchy of reliability; and articles and information produced by the independent NGOs and other associations place third in terms of reliability, and the information furnished is always cross-checked with other sources of information wherever possible. One of the interviews conducted for this research is not placed in the hierarchy, as it represents only one project in Pakistan and has not showed any contradiction with other available information about the same project.

Identify Project Events

The project information is collected in terms of project events (e.g., type of tendering performed, type of concessionaire selection procedures and the different actions of project partners, and other elements). The collected information includes events that were undertaken in the context of the PPP framework and had no ill effects on the partnerships and events that had negative impacts on project progress. The identification of events that had a negative impact on project progress is a primary task in evaluating the scenarios in a failed transportation PPP project; however, information other than that about negative events is also collected. It is necessary to identify negative events correctly; marking events as negative that in reality had no negative impact may lead to flawed conclusions about the project failure. As citations of negative events are not always available in the literature, it is necessary to evaluate each event individually.

Identify Relative Timings of Each Identified Event

The identification of the relative timing of each event in a project is another vital element in ESM, as the timing of an event is used for

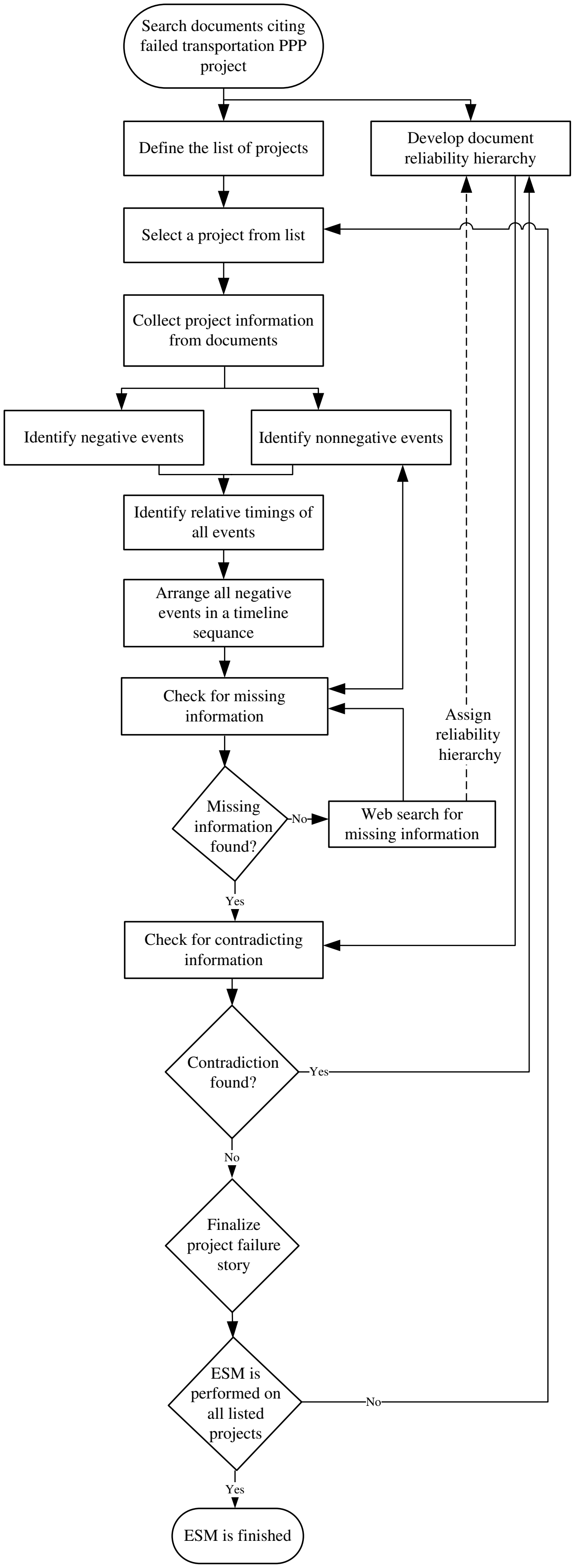

Fig. 1. ESM

indexing the event and placing it in a timeline sequence with other project events. Therefore, identification of the approximate timing of each event is necessary to distinguish between simultaneous, consequent, and overlapping events in a project. Identifying the approximate timing of events is also helpful in defining the interrelationships between different events of a project.

Arrange All Identified Events of a Project in a Timeline Sequence

After segregating project information in negative and nonnegative events, all negative events are arranged in a timeline sequence. The arrangement of events refers to the placement of all identified information from a single document or multiple documents in order based on the time of their occurrence; i.e., placing the earliest event information first, then the next, and so on. as a result, all the identified data are placed in ascending order. This way, all the collected data from a single document or multiple documents on a project provide a complete story of the project failure.

Check for Missing and Contradictory Information

The last part of ESM is to check the project failure story. The first step in this process is to look for any missing or incomplete information about any event cited in the project failure story. In order to find the missing information, reference is made to the information collected on nonnegative events, and in this way, nonnegative events are reevaluated to confirm their status regarding any negative impact on project progress. If missing information is not found from the nonnegative events of a project, the web search is performed. The new documents found through this search are also assigned to the document reliability hierarchy. The majority of the project failure stories prepared through ESM are found to be complete and provide sufficient information to assess failure scenarios in the respective failed transportation PPPs.

The second check is to look for any contradicting information. Wherever contradiction in event information is found, reliance is placed upon the source of information; and the document with a higher ranking in the document hierarchy takes priority over the contradictory information.

These checks are performed on all the case studies to make sure that all the cited project events illustrate complete information in order to comprehend the failure scenario.

Identification of Failure Drivers and Failure Mechanisms in Transportation PPPs

Failure Drivers in Transportation PPPs

The identified negative events are reassessed, as the availability of more structured information now allows assessment of the project events in the context of other surrounding events; i.e., previous, simultaneous, and consequent events. Reassessment of the identified negative events has helped in refining and consolidating them to represent specific failure domains. For example, the "no competition rights (unconditional) of bidder" and "concessionaire's right to collect tolls from existing facilities prior to performing improvement works" items are consolidated under the domain of "unfair rights and privileges to the bidder." The finalized negative events are then named "failure drivers," and these include improper actions and decisions by the project partners, socioeconomic factors, factors associated with political and national situations, and other associated events responsible for the failure of transportation PPP projects. Table 3 shows the identified failure drivers and the parties responsible to deal with them.

Table 3. Identified Failure Drivers in Transportation PPP Projects

Party responsible for dealing with failure driver	Failure drivers
Public-sector establishment	Selection of an unsuitable concessionaire
Private-sector partners	Concessionaire's insolvency
	Financial problems with the concessionaire at early stages of project
	High-interest debt
	Improper due diligence by the lenders
	Lack of coordination with parallel projects
	Lack of financing capacity of the lenders
	Loss of customer trust
	Ineffective commercial/business strategies
	Poor governance by concessionaire
	Poor quality of work by concessionaire
Mutual responsibility of public- and private-sector partners	Cost overruns
	Demand of higher subsidies/guarantees by the concessionaire
	Improper demand forecasting
	Inaccurate cost estimation
	Legal proceedings due to conflicts between partners
	Less revenue generation
	Low traffic demand
	Project's inability of market competition
	Slow and hindered project construction progress

This study shows that failure drivers are distributed throughout the PPP project life cycle, and this identification reflects the notion that transportation PPP projects entail failure risk throughout their lifetimes. It is also seen that failure drivers have a tendency to lead to other failure drivers that may create new problems for the other project partners. Based on the identification of their tendency to set off new failure drivers, the failure drivers in transportation PPPs can be categorized as primary (i.e., initiating failure drivers) and secondary failure drivers. The primary failure drivers have the great potential to trigger a chain of new failure drivers, which not only may cause problems in the current and simultaneous project stages, but also may have impacts that remain to the very final stage of a project. The primary failure drivers are independent factors attributed as decisions and actions by project partners and tend to cause secondary failure drivers throughout the PPP project stages. The secondary failure drivers are the consequences of the initial failure drivers. The secondary failure drivers also tend to lead to new failure drivers; however, they are not considered as initiating new failure chains, but as a part of a failure chain initiated by primary failure drivers. This study has found that secondary failure drivers are also caused by multiple primary failure drivers and thus share multiple failure paths.

Failure Mechanisms in Transportation PPPs

The analysis of the case studies of failed transportation PPPs revealed that a single driver does not drive any PPP project toward failure or success. Instead, it is always a series of simultaneous and/or consequential failure drivers that causes PPP failure, and this series is termed a *failure mechanism.* In a failure mechanism, failure drivers transmit their impacts across the whole project life, and as a consequence, new failure drivers emerge in simultaneous and later project stages. Therefore, a failure mechanism defines a failure path that initiates with the occurrence of a single failure driver, which in turn causes other multiple failure drivers in simultaneous and later project stages and ultimately leads to PPP failure.

The next section elaborates on the evaluation of failure mechanisms from transportation PPP failure stories prepared through ESM.

Work Out Relationships between Negative Events

After evaluating the failure drivers, the next task is to identify the cause-and-effect relationships. The transportation PPP failure stories prepared through ESM provide the descriptive indicators of causal relationships that include both implicit and explicit indicators. The main reason for the implicit indication of the cause-and-effect relationship among failure drivers is reliance upon multiple documents, as two events of a project cited in two different documents lack any explicit indication of any cause-and-effect relationship. Therefore, to draw a clearer picture of the existing causal relationships among failure drivers, *cause-and-effect diagrams* are prepared for each failed project; and both the implicit and explicit indicators of causal relationships are considered.

A cause-and-effect diagram is a tool that helps with identifying, sorting, and displaying the possible causes of a specific problem. It graphically illustrates the cause-and-effect relationship between two or more factors or variables. There are multiple types of cause-and-effect diagrams; the type adopted for this study is known as the *path diagram*. The path diagram is chosen from a variety of available cause-and-effect diagrams because it depicts the cause-and-effect linkages between multiple factors and illustrates the chain of events and factors caused by the initiating event or factor. Therefore, it is a good tool to illustrate the failure mechanism.

The following example illustrates the use of the path diagram to illustrate the causes and effects among a set of variables (i.e., failure drivers). An empirical study has identified the causal relationship among five variables; i.e., *a*, *b*, *c*, *d* and, *e*. According to the empirical study, variable *a* causes the occurrence of variable *b*; variable *b* causes the occurrence of variables *c*, *d*, and *e*; and variables *c* and *d* work together to cause the occurrence of variable *e*. In a typical path diagram, a horizontal line is drawn between two variables to demonstrate a causal relationship between them; correspondingly, Fig. 2(a) shows the identified causal relationships among the five variables in terms of causal paths.

Two types of path diagrams are used in this paper: First, path diagrams that illustrate individual causal paths in a failure

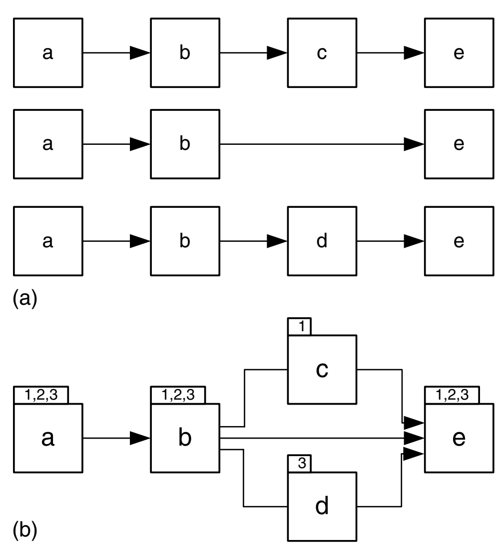

Fig. 2. Path diagram example: (a) individual causal paths; (b) integrated causal paths

model, similar to Fig. 2(a); second, path diagrams that illustrate the integrated causal paths in a failure model. The path diagram of integrated causal paths reflects the role of each variable (i.e., failure driver) to cause or be affected by all the other possible variables in a failure model; and therefore, the characteristics of each variable are demonstrated in the context of a complete failure model. Three causal paths are featured in this example, and Fig. 2(b) shows the integrated path model for all five variables. A small rectangular box on the upper-left corner of each variable shows the number of causal paths that variable is part of.

Similarly, the causal relationships are defined for all failure drivers in a failed project. Then, failure drivers are categorized in vertical columns with respect to the project stages to illustrate the flow of the failure mechanisms across the project stages. The path diagram clearly portrays the impacts of failure drivers and the complete scenarios in each failed project are revealed. Later, all the individual failure mechanisms are consolidated to show the overall trend of failure mechanisms emerging from private-sector partners. In a path diagram representing the consolidated failure model, the nodes are modified to illustrate the party responsible for the failure driver and to show the flow of the failure mechanisms across the project partners.

Merging Failure Scenarios in Different Projects

By looking individually at cause-and-effect diagrams in each failed project, it is found that the consequences of some failure drivers vary in different projects, and similarly, some failure drivers are found to be caused by different failure drivers in various projects. For example, in the failure case of the Skye Bridge in Scotland in the United Kingdom, the public protests were caused by high tolls (Wikipedia 2011), while in the failure project of the Trakia Motorway in Croatia, the public protests were caused by the direct award of projects (i.e., they were protests against alleged corruption). Therefore, it becomes necessary to consolidate the multiple causes and effects of each failure driver to develop a complete failure model.

The following process is applied to all individual failure drivers exhibiting different consequences or causes:

1. Merging based on similar failure drivers caused by different failure drivers.
   a. Identify failure drivers that are similar, but caused by different failure drivers in different projects.
   b. Pick a failure driver and identify all the causes, as illustrated by the failure mechanisms in each failed project.
   c. Attach all causes to that selected failure driver. For example, public protests in the failure cases of the M1/M15 toll road in Hungary and the Skye Bridge in Scotland were caused by unfair toll pricing by the concessionaire; but the failure case of the D47 motorway in the Czech Republic demonstrates public protests caused by noncompetitive tendering. Now, attaching all consequences observed in different cases will reflect that public protests can be caused by both unfair toll prices and direct awarding of a contract.
   d. Steps b and c are repeated for all failure drivers caused by different failure drivers in different projects.
2. Merging based on different consequences by failure drivers in different projects.
   a. Identify failure drivers that are similar, but exhibiting different consequences in different projects.
   b. Pick one failure driver and list all the consequences, as illustrated by the failure mechanisms in each failed project.
   c. Attach all the consequences to the selected failure driver. For example, in the case of the Skye Bridge, the public protests caused users' unwillingness to pay. In the failure case of the camino colombia toll road in the United States, public protests lead to political pressure to lease back the infrastructures. Now, attaching all consequences observed in different cases will reflect that public protests can result in users' unwillingness to pay, as well as political demands to lease back the infrastructure.
   d. Steps 2 and 3 are repeated for all failure drivers exhibiting different consequent failure drivers in different project.

The failure mechanisms explained in this paper illustrate the possible outcomes of inappropriate decisions and actions of private-sector partners in typical transportation PPPs. Therefore, secondary failure drivers, illustrated in failure mechanisms initiated by the private-sector partners, may be caused by other factors associated with other project partners or socioeconomic issues. For example, this paper states that the selection of unsuitable concessionaires is systematically caused by lack of financing capacity of lenders and improper due diligence; nevertheless, the selection of unsuitable concessionaires also may be caused by the adoption of weak scrutiny and concessionaire selection procedures, a failure driver primarily associated with public-sector partners. However, the scope of this paper is limited to the failure mechanisms initiated by private-sector partners, so the intervening factors associated with other project partners are not discussed here.

Validating Identified Failure Mechanisms

Silverman (2006) suggested that the "constant comparison method" could be an approach to validating the qualitative research. In the constant comparison method, the researcher utilizes existing findings, data, and cases to validate the hypothesized concepts (Parry 2004). The validation method used by this research is similar to the constant comparison method, where hypothesized failure mechanisms are broken down into causal relationships, and then each causal relationship is compared with specific events from case studies of failed transportation PPPs.

All the identified failure mechanisms are also shared with the PPP experts from academia and industry to validate the research findings. All consulted PPP experts in general agreed upon the identified failure drivers and their causal behavior to form failure mechanisms.

Failure Mechanisms Initiated by the Private-Sector Partner

Whether or not they have a high level of experience and skill, private-sector companies are not invulnerable to mistakes and making wrong decisions because PPPs are complex institutional arrangements, and their typical structure varies from project to project depending upon the legal and regulatory systems of the project's host territory. International private consortiums involved in transportation PPPs in foreign lands are more prone to failure risks unless they are partnered with local companies or having strong business relationships with public-sector partners. Following the notion of vulnerability in private-sector partners, this study identifies 15 failure mechanisms initiated by the private-sector partners. As was elaborated previously, a failure mechanism defines a series of failure drivers with causal relationships; therefore, the phrase *failure mechanisms initiated by private-sector partners* refers to the series of failure drivers set off by the private-sector partners or a series that was initiated with a failure driver caused by the private-sector partners.

Fig. 3 illustrate the failure mechanisms initiated by private-sector partners. The primary and secondary failure drivers are

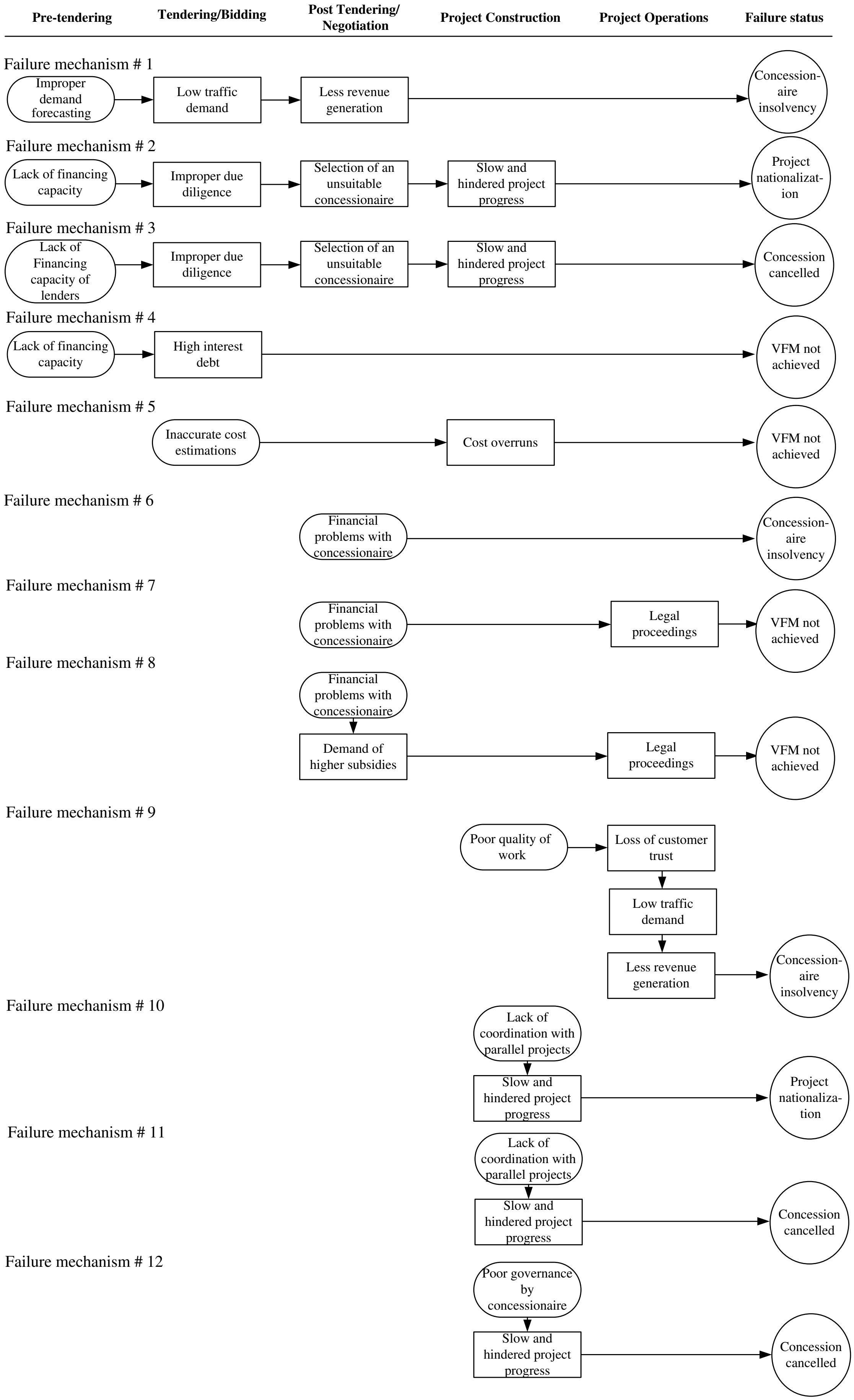

Fig. 3. Failure mechanisms initiated by failure private-sector partners

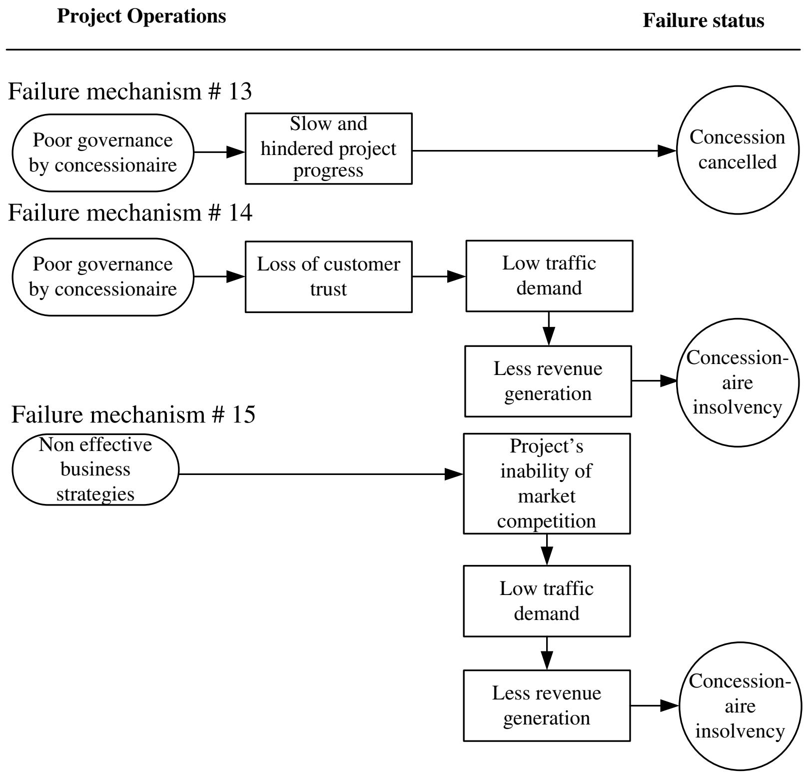

Fig. 3. (*Continued.*)

illustrated in rectangular boxes with rounded corners and rectangular boxes with square corners, respectively; and the final failure status statements are in circular boxes. Failure mechanisms are illustrated with respect to the project life cycle phases.

Failure Mechanisms Initiating at Feasibility Study Stage

The first failure mechanism, such as the first series of failure drivers, is initiated at the very first stage of project feasibility study when incorrect demand forecasting is made. Improper demand forecasting at the feasibility stage is highly likely to cause low traffic demand during project operations, which further influences the revenue-generation capability of the project, thus increasing the chances for concessionaire insolvency. Such failure mechanisms are seen in the M1/M15 toll road in Hungary, the Ngone Bridge in the Laos Republic, the Channel Tunnel and its rail link in the United Kingdom, and in the first generation of Mexico's toll road program.

This study identifies three types of errors in demand forecasting: (1) forecasting based on improper or limited data, (2) exaggerated forecasting due to optimism bias, and (3) neglecting the business strategies of competitors. The case of the M1/M15 toll road in Hungary illustrates the first two types of improper demand forecasting, where the bases for traffic forecasting were made upon pre-1990s traffic data that was limited and inaccurate (Joosten 1999). Because Hungary was a part of the Communist bloc, the traffic between it and other western European countries was very much restricted prior to the 1990s. Thus, after the fall of the Soviet Union in 1989, the borders between eastern and western European countries were opened and an increase in traffic increase resulted. The data representing the traffic increase was utilized to forecast the future traffic flows of the newly proposed M1/M15 toll road. However, the traffic increase on the M1/M15 corridors was caused by two time-dependent factors; first, many local Hungarians traveled to Vienna to buy cheaper goods; second, there was a good deal of holiday traffic from Germany, attracted by the cheaper tourist destinations in Hungary (Joosten 1999). The local traffic to Vienna decreased as economic conditions improved and goods became less expensive in Hungary; and the economic upsurge in Germany made other European destinations affordable to the German public. The evaluation of the M1/M15 toll road case confirms that economic and political situations at the origins and destinations of cross-border or long-route traffic have strong potential influences on trip generation patterns.

The second type of forecasting error (i.e., exaggerated demand forecasting caused by optimism bias) reflects the tendency of forecasting planners to be overly optimistic about the outcomes of planned actions. Optimism bias is a prejudice that causes planers to become more certain about the available information and consequently believe there is less risk of experiencing negative outcomes (Shepperd et al. 2002). In terms of forecasting future traffic flows, this study identifies that excess optimism in transportation projects is usually caused by neglecting reality on the ground and in overestimating the likelihood of time savings and key economic factors responsible for generating traffic flows. The failure case of the Mexican toll road program is a good example of optimism bias in forecasting future traffic flows. In this case, the forecasting planners were certain that trucks (i.e., the highest toll-paying vehicles) would account for 20–40% of future traffic; however, in reality, the trucks contributed less than 5% of the total traffic. As a result, the total revenue collection was much lower than originally expected (Ruster 1997). Ruster (1997) also found that forecasting planners underestimated the congestion relief caused by introducing toll roads and overestimated the actual time savings, which also contributed to lower traffic. In establishing a new transportation PPP project, it is necessary to understand existing economic conditions in the project's host territory and evaluate the government's future plans affecting existing economic trends.

Neglecting or not taking account of the business strategies of competitors in traffic forecasting is also a cause of lower traffic on project corridors. The case study of the Channel Tunnel and its rail link in the United Kingdom shows that it suffered low traffic demand only because their appointed consultants were unable to understand the existing market competition and the competitors' business strategies. The reviews of the consultants and the commercial department of the concessionaire tended to concentrate on issues like prospects for economic growth and the size of the total market, rather than the project's likely share of the current market and the effect of competition from ferries on prices (Castles 2003).

The second, third, and fourth failure mechanisms are associated with the financiers of private-sector partners. These three failure mechanisms are initiated through a single failure driver; i.e., lack of the financing capacity of financiers or financing institutions. In the usual case, the financing institutions from international markets have theoretically unlimited financing capacity, but sometimes due to the existing laws and regulations in the PPP project's host country, the financing market is limited to the national or local financial institutions. Based on the case study analysis, this research has identified that local financial institutions having no or little prior experience of project financing lack the knowledge of rigorous due diligence practices. Due diligence assesses the bidder's financial and technical standing and the proposed business plans' commercial viability and profitability, and it also assures that the concessionaire is capable of delivering anticipated or claimed returns on the requested financing investments. Therefore, the financing personnel's failure to perform proper due diligence increases the probability of selecting an unsuitable concessionaire, which is likely to cause slow and hindered project progress. The second and third failure mechanism follow the same failure path until the failure driver causes slow and hindered project progress, after which the second failure mechanism finally causes the nationalization of project and the third failure mechanism results in cancelation of the contract.

The fourth failure mechanism illustrates the impact of low financing capacity of financial institutions in terms of high-interest loans that damage the VFM associated with the PPP project. The case of the Mexican toll road program also depicted this failure mechanism, where the legal and regulatory system decreased the pool of financiers to the national financial markets only. Poor macroeconomic situations at the national level reduced the capacity of local financial companies to provide long-term, fixed rate financing; thus, the main financing streams were based on short-term maturities rarely extending beyond five years, with interest rates often 1,000 to 1,500 basis points (Ruster 1997). The short-term, expensive debt had a bad effect on the financial viability of the projects in the Mexican toll road program; and consequently, the majority of the concessionaires were unable to repay their debt.

Failure Mechanisms Initiating at Bidding and Negotiations Stage

The fifth failure mechanism starts with inaccurate cost estimation during bid preparation and eventually leads to cost overruns during project construction, which ultimately results in loss of VFM. This cause-and-effect relationship is simple and most evident in almost any construction project. The cost overrun ultimately affects the VFM associated with a PPP model. Such causal relationships are witnessed in the failure cases of Channel Tunnel and the Mexican toll road program.

The sixth, seventh, and eighth failure mechanisms are initiated when the concessionaire encounters financial problems. The case study analyses performed for this research have shown that such problems can be observed at two stages of transportation PPPs; first, at the early stages of the project, when the concessionaire is unable to acquire the promised financing from financing institutes; and second, during the project operations stage, which is usually caused by low revenue generation. However, the sixth, seventh, and eighth failure mechanisms explain the phenomena associated with the early stages of the project; the financial problems of the concessionaire during the operations stage are covered by the first, ninth, fourteenth, and fifteenth failure mechanisms. The sixth failure mechanism elaborates that the concessionaire's failure to acquire financing through reliable financiers at the early stages may result directly in the concessionaire's insolvency. The seventh failure mechanism shows the other possible situation: a legal battle between the concessionaire and the public-sector clients if the concessionaire is unable to meet the agreed investments or fails to achieve financial closure in due time. This failure mechanism is witnessed in the case of the Gorican Highway in Zagreb, Croatia, where the concessionaire was unable to reach financial closure and the project went under arbitration. Consequently, the concession was cancelled (Carpintero 2010; Cuttaree et al. 2009). The eighth failure mechanism shows that sometimes, due to financial problems, the concessionaire tends to demand higher subsidies or financial support from the public sector, and refusal to approve such requests may cause conflicts between the partners, which could lead them into a legal battle and consequent loss of VFM.

Failure Mechanisms Initiating at Project Construction and Operations Stage

The ninth failure mechanism is initiated through poor quality of work during project construction that damages the confidence of customers in the services provided by the concessionaire. Poor quality of work increases uncertainty in the project operations and give rise to safety issues. The resulting loss of customer and market confidence in the concessionaire has a direct impact on the revenue-generation capability of the project, as transportation projects are mostly demand driven; therefore, reduced confidence causes failure to achieve the targeted demand, and the consequent generation of less revenue increases the probability of the concessionaire's insolvency. The causal relationships among this failure mechanism are confirmed via the case study of the Channel Tunnel and privatization of Railtrack in the United Kingdom. The Channel Tunnel had fewer issues rated as poor quality of work, but those issues were highlighted at the start of project operation and were directly associated with passenger operations, which decreased confidence in the services provided by the Channel Tunnel operators. The Channel Tunnel had problems with its environment due to dust, salinity, humidity, water seepage, and high temperatures, which caused failures of the signaling system and electrical supplies (Castles 2003). All these issues affected the targeted traffic demand, but they were coupled with other issues as well, which are discussed in the fifteenth failure mechanism. The Railtrack company had more serious incidents due to poor quality of work that caused a fatal rail crash at Hatfield, England, on October 17, 2000, which left four people dead and many injured (BBC 2000). The incident was found to stem from broken rails, which caused the train to derail. Following the heavy compensation paid to the victims of the Hatfield train crash, Railtrack announced great financial losses and approached the government for funding (Osborne 2001). However, the continued bad performance and the dissatisfaction of users and the government itself put Railtrack into *administration* (a British legal term for the initial phases of bankruptcy). At last, Network Rail, a nonprofit, government-owned company, bought Railtrack. Railtrack didn't suffer from low traffic demand because of its monopolistic business nature, but the consequences of its poor quality of work brought financial disaster to the company, and it was renationalized.

The tenth and eleventh failure mechanisms, due to lack of coordination with parallel projects, lead to slow and hindered project progress, which potentially causes either nationalization of a transportation PPP project or in cancelation of the concession agreement. Lack of coordination between parallel projects is a fairly uncommon failure driver, and it can transpire only if other parallel infrastructure development projects exist along transportation PPP project corridors. The existence of parallel projects may cause difficulties for a transportation PPP project to proceed further if proper coordination plans are not prepared in advance and agreed upon by the managing authorities of all the existing parallel projects.

Of all the case studies performed for this research, only the Bangkok Elevated Road and Train System (BERTS) in Thailand depicted this failure driver. In the case of BERTS, another concession for a greenfield project of the Don Muang tollway was awarded to a different concessionaire at almost the same time as BERTS. The Don Muang tollway had site-interfacing issues with BERTS, as larger parts of both projects were running in parallel. The construction of the Don Muang tollway was completed before BERTS, and flyovers were constructed for cross-street intersections in such a way that BERTS found it difficult to proceed further (2bangkok.com 2005). Besides the Don Mung tollway project, BERTS also had site-interfacing and handover issues with the Bangkok Skytrain project, which had many stations positioned directly across the BERTS main route (World Bank 2000). Lack of coordination among parallel projects created site handover and cross-interfacing problems and affected the progress of the BERTS project so badly hat only 10–13% of work was completed by the end of the stipulated construction time (World Bank 1999). Consequently, the project was canceled by the Thai government.

The twelfth, thirteenth, and fourteenth failure mechanisms are initiated through poor governance by the concessionaire. The good governance of a project company is critical to achieving project goals, and lack of it jeopardizes the project's success and the value attached to the PPP model. The twelfth and thirteenth failure mechanisms cause slow and hindered project progress that further increases the probability of project nationalization and the cancelation of the concession agreement, respectively. The examples of such failure mechanisms are Metronet in the United Kingdom (NAO 2009) and the Mexican toll road program. The fourteenth failure mechanism is initiated via poor governance by the concessionaire, which damages customer trust in the concessionaire's services, causes reduced traffic demand and revenue generation, and increases the risk of the concessionaire's insolvency. This failure mechanism is observed in the case of the Railtrack privatization in the United Kingdom. Railtrack was criticized for its continuing bad performance and safety record. Only after two years of privatization, the company began receiving warning notices from the government for not performing at the required standards; but train crashes continued to occur despite the government's attempts to goad Railtrack into improving rail safety (Funding Universe 2011). The continued failure to address the governance issues finally led to Railtrack's renationalization.

The fifteenth failure mechanism is initiated due to the adoption of ineffective business strategies during the operational stage of the transportation PPP project, which affects the project's ability to compete in the existing market. The project's inability to compete efficiently further causes low traffic demand, and consequently, less revenue generation and the concessionaire's insolvency. The case of the Channel Tunnel is a good example of this failure mechanism, though the problem was solved by the government bailing out the concessionaire instead of nationalizing the Channel Tunnel or canceling the rights of the concessionaire. The Channel Tunnel serves traffic between the United Kingdom and France, and excluding freight transport, it mostly serves the leisure passenger market, which is driven by promotions and attractive offers rather than need. The Channel Tunnel administrators did not realize this fact earlier (Castles 2003), which affected their business strategy during the operational phase. During the construction of the tunnel, the ferry operators invested heavily in new vessels and offered attractive promotions for different categories of passengers. A later analysis by Castles (2003) found that ferries were able to break even on half the available capacity of their vessels. All these market situations left very little space for the Channel Tunnel and its rail link to compete in the market. The situation of low traffic persisted for a long time, until the high-speed rail link was completed in 2007; and since then, continuous increase in traffic has been observed (Eurotunnel 2011).

Discussion

Fig. 3 shows all 15 failure mechanisms, consolidated to illustrate the overall trend of the identified failure mechanisms and failure drivers sharing multiple mechanisms. In Fig. 4, all failure drivers and the failure status are presented in three boxed rectangles: the upper-left rectangular box contains the numbers of failure mechanisms passing through each failure driver; the center box contains the name of the failure driver; and the lower-right box contains the party responsible for dealing with the failure driver.

It is interesting to see that failure drivers caused by private-sector partners create problems for their counterparts; however, many of them lead to the failure drivers being rated as mutually shared. All failure drivers also are the inherent characteristics of potential risks, and therefore, the responsibility of such mutually shared failure is defined in the concession agreement. However, it should not be disregarded that any risk not dealt with by other partners ultimately falls upon the public sector, and therefore, such failure drivers are considered to have mutual responsibility.

This study confirms that stable and continuous demand is vital for any transportation PPP project. It is found that lower demand not only harms the financial and commercial viability of a PPP project, but also increases the probability of bankruptcy for the concessionaire and damages the expected VFM in the eyes of the public. As a matter of fact, transportation PPP projects are sunken investments; they cannot be realized until they reach full maturity and yield optimum revenue that should be sufficient to pay back the project debt and financial returns to the investors. In the case of government guarantees attached to the concession agreement, lower demand may require public-sector clients to provide additional financing, subsidies, or both to the concessionaire. In the worst case of low demand, the public-sector client also may be compelled to bail out the concessionaire to secure a partnership and retain the trust of the private capital market in government institutions.

This research finds domains of traffic demand forecasting where private-sector investors are prone to make mistakes. The demand forecasting planners also need to take note of political and economic changes, as traffic demand, especially in toll roads, is extremely sensitive to economic cycles (Vassallo et al. 2012).

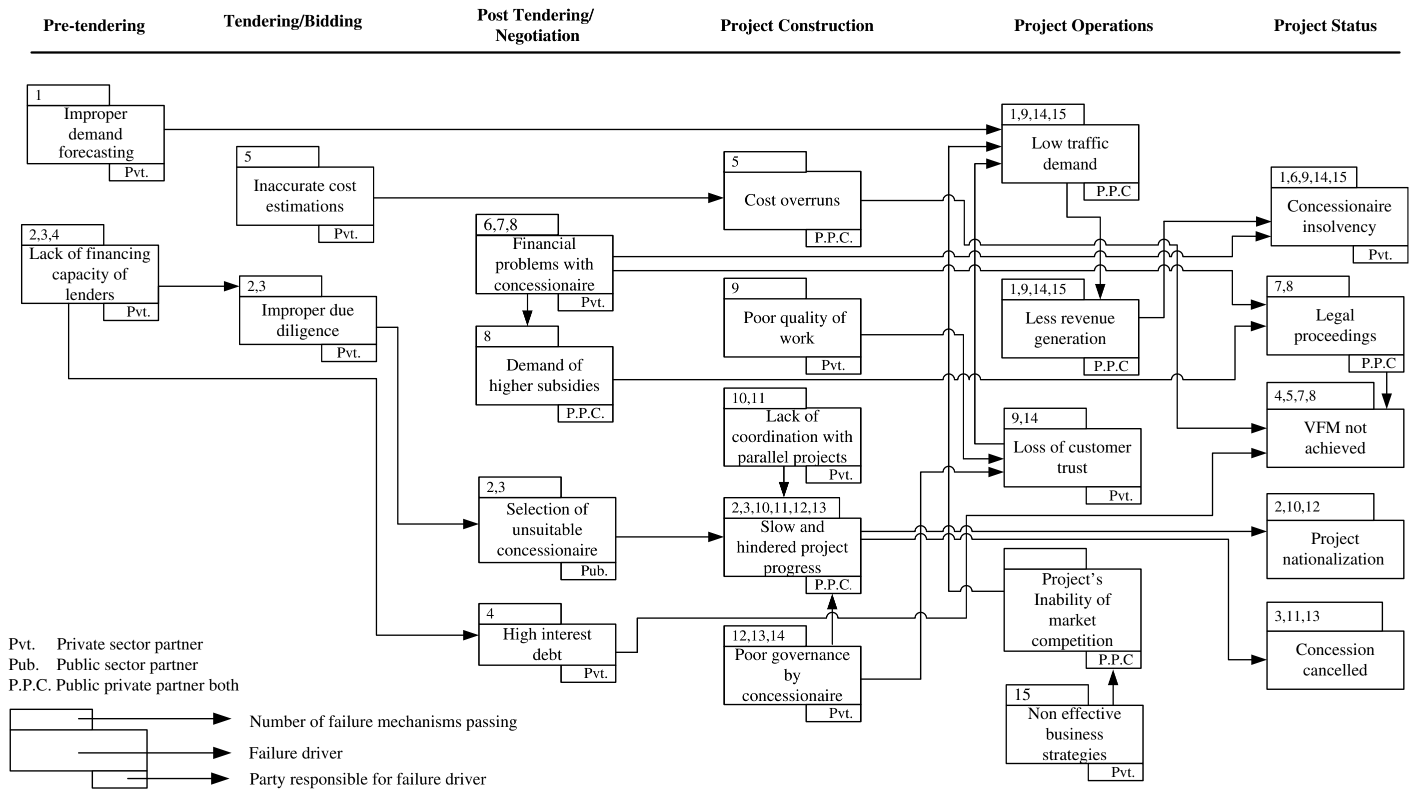

Fig. 4. Failure mechanisms (consolidated) initiated by private-sector partners

Therefore, the analysis should be extended to all origins and destinations of the anticipated long-route traffic. The demand forecasters also need to consider the nature of traffic streams attracted by the transportation PPP project. For instance, in the case of holiday traffic, the attraction factors should be considered as well as the political and economic factors. The incorporation of attraction factors includes evaluating the type and nature of tourist destinations, promotion offers by tour operators, and other factors.

These case studies have shown that good governance is vital to reaching the project goals, and enforcing good governance in any transportation PPP project requires the commitment of both partners. The establishment of a monitoring unit, comprising members of both public and private partners, is suggested for more efficient control. The absence of good governance is also found to have catastrophic effects on a partnership between public and private firms. Good governance is a program-level success factor for PPPs (Li et al. 2005). The identification of failure mechanisms has exposed some aspects of poor governance and their multidimensional consequences, which directly affect project progress. This research has identified that poor governance either by the private or the public partner affects project progress almost the same, although poor governance by the concessionaire can lead to more serious problems. For example, flawed quality control could cause poor quality of work, which increases the probability of accidents and damages customer trust, which is vital to achieving suitable demand for the project.

Conclusions

This paper focuses on the role played by private-sector partners in the failure of transportation PPP projects. The role of private-sector partners is examined in terms of how failure mechanisms are initiated. In this regard, the failure drivers and failure mechanisms in transportation PPPs are identified based on evaluating 35 failed transportation PPP projects around the world.

Among 15 failure mechanisms found to be initiated by the private-sector partners, 2 occurred before the formal tendering process was initiated, 4 occurred when the private-sector partner prepared bid documents and negotiated with public-sector clients after being selected as a preferred bidder, 6 occurred during the project construction, and only 1 was during project operations. By looking at the number of initiating failure mechanisms at each project stage, it can be concluded that the project construction stage is the most critical one in terms of triggering failure mechanisms.

Some of the identified failure drivers share multiple failure mechanisms. The number of failure mechanisms shared by each failure driver shows the level of complexity of the drivers; i.e., the more failure mechanisms there are, the higher the complexity of the failure driver. For example, slow and hindered project progress is a failure driver sharing 6 failure mechanisms, which reflects the fact that it is caused by six different failure paths initiated by the private-sector partners. Hence, preventing slow and hindered project progress would require controlling at least six failure paths. Similarly, in a typical failure mechanism, each failure driver may be considered as a control point to prevent the occurrence of the next failure driver, thus preventing total failure of the PPP project. Therefore, preventing the primary failure driver may outright terminate the whole failure mechanism; e.g., improved project governance can block three possible failure mechanisms that cause slow and hindered project progress.

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