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The Public Hand and IT Mega-Projects: Lessons from the German TollCollect Case

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ABSTRACT

In this research, we analyze in a longitudinal case study the German electronic toll collect system (TollCollect) for heavy trucks that is operating now since January 1st, 2005. With more than €3 billion of revenue stream per year and altogether €2 billion for development and installation of the system, the TollCollect project was not only the single-largest public-private partnership project ever rolled out in Germany, but also the largest IT development project in Europe in the years between 2002 and 2005. Through interviews, secondary data, and documentations, qualitative data will be gathered on commitment and escalation in large-scale public private partnership projects. The aimed at goal is the development of an inductively generated, grounded model of de-escalation process. The research objective can be subdivided into three sub-objectives which are (1) the building of grounded theory in project management with public hand interference, (2) provision of a process model for IT mega projects with failing course of action, escalation and de-escalation, and (3) development of normative recommendations for practitioners.

Keywords

Commitment, escalation, public private partnership, IT project management.

INTRODUCTION, RESEARCH OBJECTIVES AND QUESTIONS

Although countless information systems projects have been conducted in various industries for many decades so far, the successful in-time and in-budget management and development of innovative large-scale information systems have remained a difficult challenge. The Standish Group's 2004 chaos report states, that of 9,236 completed IT projects worldwide 18% failed and 53% where challenged (i.e. late or over budget and/or with less than the required features and functions). While the number of failed projects has decreased by nearly 42% in comparison to the first chaos report of 1994, infamous examples of failed or challenged information systems projects, e.g. the US Navy's effort to implement an ERP system (US $1 billion largely wasted on four non-interoperable pilot systems), the FBI's Virtual Case File project (US$ 170m), Taurus, the London Stock Exchange's paperless share settlement system (GBP 400m) and many more show, that we still lack the necessary managerial skills. Very often, over-commitment of project leaders to their projects leads to escalation of commitment, failing course of action and in consequence to inadequately delivered information systems that are over-time and over-budget.

The aforementioned cases illustrate how visible information systems have become and point to a continuing problem in businesses worldwide: how can large and innovative information systems be successfully developed?

In this research, we analyze in a longitudinal case study the German electronic toll collect system (TollCollect) for heavy trucks that is operating now since January 1st, 2005. With more than €3 billion of revenue stream per year and altogether €2 billion for development and installation of the system, the TollCollect project is not only the single-largest public-private partnership project ever rolled out in Germany, but also the largest IT development project in Europe in the years between 2002 and 2005.

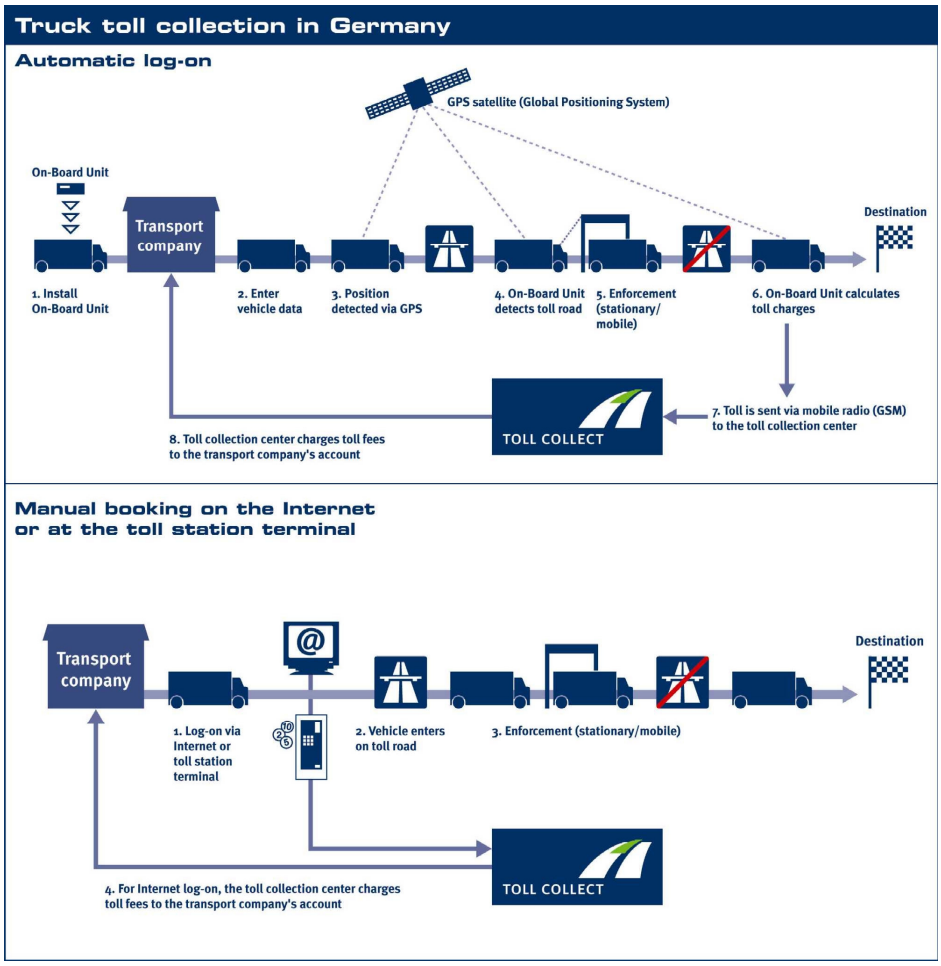

Figure 1: Automatic and manual toll collect system in Germany (Source: TollCollect)

From the very beginning, the project attracted a lot of public attention, not only due to the innovative and never done before approach of the toll collect project itself, but also due to the initial, overambitious development and installation schedule. Several delays occurred that increased the public pressure on both the contractors DaimlerChrysler, Deutsche Telekom and Cofiroute, as well as the politicians responsible for the project in the federal government. Originally, the federal government intended a toll system that starts operation at January 1st 2003. Due to delays in the public tender procedure the starting date had to be delayed to August 31st, 2003, which still meant an ambiguous deadline for the winning TollCollect consortium. Soon it became obvious that it was impossible to meet the deadline. What followed was a painful chain of further failed deadlines and promises that negatively affected the reputation of all participants in the public opinion. Eventually, the TollCollect systems started successfully but with a significant delay on January 1st, 2005. A schematic illustration of how the truck toll collect system operates is provided in figure 1.

The realized, technologically demanding center of the automatic system is the so-called on-board unit (OBU) which uses a combination of GSM-based mobile communication solution and GPS-based solution for positioning. In more than 500,000 trucks, the OBU localizes the current position, identifies if the current route is a toll route, calculates the toll fee according to the driven distance, the number of axils and emission class of the truck, and sends this information in defined intervals via the GSM mobile phone network to TollCollect for invoicing. With 500,000 OBU installations in European trucks, this system is probably the largest decentralized mobile system with independent clients on earth. Currently the toll road network comprises 12,000 km of motorways. The overall toll fee is defined by the driven kilometers, the number of axles and the emission class for trucks with a total weight of more than 12 tons. On average, 12.4 Euro Cents have been charged per km in 2005 summing up to more than €3 billion alone in 2005.

In contrast to, e.g., private operations where a certain percentage of fraud can be tolerated, a federal fee has to meet higher standards: from a legal point of view, a fee must be paid by all users, equivalent to 100% of all trucks on the motorways. It is

obvious that it is—from an economic perspective—rather inefficient to enforce a fee payment level of 99.9% since the control costs easily exceed any additional income, but in a public private partnership project the economic concept of efficiency is sometimes ruled out by law. Therefore, approximately 300 enforcement bridges had to be built spanning over the German Autobahn system in addition to mobile enforcement units who control the flowing traffic by reading the OBUs when passing a truck in their van. In addition to the automatic system there is a redundant back-up system in place in form of an online manual booking system on the Internet and 3,500 terminals in petrol stations and near the border of Germany to allow trucks without an OBU to book the route. Both manual systems are designed and established as redundant system for the unlikely case of a GPS or GSM breakdown. Then, the manual system has also to handle all the truck traffic that normally would use the OBUs. This was another requirement the federal government has asked for.

The remainder of this research in progress paper is organized as follows: In the next section, the research motivation will be illustrated, followed by the research objectives in the next section. Then, the theoretical foundations will be briefly discussed before the current research status is provided. The paper concludes with a forecast on possible topics we will present at the workshop under the condition that we get the opportunity to present our work.

MOTIVATION

Challenged by the importance of the still unsolved problem of how to manage innovative and large-scale information systems projects, the proposed research projects will investigate the historical and current development path of the single largest information systems project in Europe. The TollCollect case provides us with the opportunity to analyse the class of mega-projects, which are characterized by "innovation on demand" and commitment and escalation effects, often in the context of public private partnerships (PPP). Since the infrastructure of the future will be based on intelligent IT solutions rather than brick and mortar infrastructure and furthermore, since the public hand is urgently looking for new financing alternatives due to their declining budgets, PPP IT mega-projects will become more popular in the future.

Although the TollCollect project struggled tremendously in the beginning, contrary to most of the aforementioned examples, it finally succeeded and still exists. Motivated by this promising outcome, we will analyze the project in order to investigate the differences in comparison to unsuccessful projects. In doing so, the different stakeholders, their decisions, development phases, technical problems and developed solutions etc. will be considered.

Managing innovative and large scale IT projects is inherently risky since the nature of large-scale systems and software development projects is on the cutting edge of known. Furthermore, they are not only risky from a monetary but also from a reputation point of view. In contrast to regular projects, where other implementations or projects in the same area already exist, innovative projects have never been done or tried before. Managing such projects seems to be more like permanent crisis management rather than organized, well-structured project management. Furthermore, it seems to be obvious that such projects have to be managed in a different way compared to "simple" projects. These assumptions seem to be intuitively true since different outcomes of such projects are possible and since the most likely one is not necessarily the successful completion: apart from reaching the preferred goal of technological leadership catapulting a firm or project into premier position, the more likely result are project delays, failures or a complete financial and reputation disaster.

Since reputation and money are at stake, only few very large IT projects are known that were not subsidized or part of a PPP project. In this respect, national governments and agencies are not seldom the largest contractor of multi-million IT projects not only in the defense and military sector, e.g., for developing the Arpanet as predecessor of the Internet but also in the area of new administration support or workflow management systems in the public sector. Most of these cutting-edge IT projects have in common that they are by nature more risky and that their successful completion is more unlikely then comparably complex but significantly smaller or less innovative projects in the private sector. Managers of private companies tend to be more risk averse—with regard to their shareholders—than public agencies when it comes to bear solely the risk.

With regard to social welfare and investments into the future, it seems that the politicians leading those public agencies are less risk averse although they also have to consider the interests of their clientele, namely of voters and tax payers. This difference between managers and politicians already demonstrates that highly risky but possibly groundbreaking investments in fundamental research or IT projects are more likely in public private partnerships rather than in private co-operations alone. However, this also illustrates that decision-making processes, return on investment issues, or project management patterns commonly used in the private sector are not simply applicable to private public partnerships. The special relationship and the commitment of politicians and stakeholders to a project have certain implications for the project development and goals that have to be analyzed in more detail.

Therefore, we analyze relations in large scale public private partnership IT projects, where administrative or governmental institutions are involved as customers or project partners. Our research seeks to understand the process of IT project

escalation and de-escalation and to establish a model of crisis management for turning around troubled public private partnership projects. This has a theoretical as well as practical significance. Through a longitudinal case study of the IT-based German Autobahn toll collect system, qualitative data is gathered on commitment and escalation by supporters of the project to a failing course of action in the first place, followed by qualitative data describing the de-escalation and opponent sight of view in the critical phases of the project. The aimed at goal is the development of an inductively generated, grounded model of de-escalation process as it unfolded at TollCollect. The research objective can be subdivided into three sub-objectives which are the:

building of grounded theory in project management with public hand interference,

provision of a process model for IT mega projects with failing course of action, escalation and de-escalation, and

development of normative recommendations for practitioners.

THEORETICAL FOUNDATIONS

From a research point of view, different empirical approaches have been used to understand the pivotal factors driving or inhibiting a successful information system project accomplishment. In this context, structural equation models are used to link independent and dependent variables in a statistical analysis of multiple IT projects in a diversity of organizations where the projects are often at different stages of progress. Because of the use of multiple projects over multiple sites, statistical analyses are intrinsically historical and lacking context. The aim of such cross-sectional studies is to find significant associations between measures of success and their determinants. In contrast, process models depict sequences of events and decisions in one or a few organizations in order to investigate IT projects in a historical and contemporary context over an extended period. Grounded on institutional economics and agency theory the essences of such case study research approaches is to identify key decisions responsible for success or failure of IT projects in an explanatory way. By revealing those pivotal past decisions certain path dependencies emerge defining the current and future problem solution space of an ongoing IT project. The successful completion of an IT project is consequentially only one of several likely results.

Project Risk Management

The approaches and recommendations for successful management of information systems projects from a risk perspective can be roughly divided into factor (or variance) models and process models. The factor model research approach identifies dependencies between predictors (or independent variables) and outcomes (or dependent variables). Both independent and dependent variables can be measured along some scale and their dependencies are empirically tested, e.g. by means of statistical analysis like regression testing. Typical risk factors affecting the overall project performance and success found in the literature are e.g. technological newness, application size, lack of expertise, application complexity (Barki et al. 2001), personnel shortfalls, unrealistic schedules and budgets and continuous stream of requirements changes (Boehm 1988). For a comprehensive overview and categorization of project risk factors refer to (Alter et al. 2004).

Although a great deal of effort has been spend to put forward sophisticated factor models of all aspects of information systems development and project management, the variance theory approach doesn't seem adequate to explain project success or failure. Recent research (Montealegre et al. 2000) has shown, that the social dynamics of information system projects have considerable influence on the overall project performance. The social relationships between the different stakeholders are complex and develop and vary over time. This seems to be especially valid in large-scale and/or public-private-partnership projects, where the number of different stakeholders is high and their interests are diverse and influenced by off-topic considerations like power-politics, impression management, self-justification, etc.

While factor models explain, how variations in the identified independent variables affect their corresponding dependent variables, process models in contrast deal with sequences of discrete states and events in order to explain how and why certain outcomes are reached (Mohr 1982). Thus process models provide evidence of the states, events, actions, etc. that link the independent variables to the dependant variables.

Therefore, studies that examine social factors influencing information system development projects commonly employ process models. Some examples are: Montealegre and Keil (Montealegre et al. 2000), who conducted a longitudinal case study of the seriously troubled automated baggage handling system project at Denver International Airport and developed a process model of de-escalation. Newman and Robey (Newman et al. 1992) developed a social process model for information systems development. In this context, the Toll Collect case with its multi-national, multi-vendor consortium, cutting edge technology and public private partnership setup seems ideal to derive a process model of risk management in information systems development projects. Although the project struggled tremendously during its course, it was turned around and finally succeeded.

Escalation & De-Escalation of Commitment

In general, commitment is defined as a psychological relation between a person and another individual or institution and plays an important role within private relations as well as within professional business relations. The phenomenon of commitment has been originally discussed in sociology and psychology, but has made its inroads into the information systems discipline in the area of IT project management research. A useful, behavioral-oriented commitment approach has been developed by social-psychologist, a sub-discipline of psychology. Here, the environment is used as exogenous variable which influences the individual preferences of commitment to one or another action alternative or course of action. Bounded to a once made commitment, later decisions are non-ergodic, i.e. path-dependent (Meyer et al. 1997). Another, more popular approach is attitude-oriented commitment, which has its origins in social science and is, e.g., part of the organizational theory or investment theory in economics. In an attitude-oriented commitment approach, one is focusing on the specific circumstances for the development of attitudes towards commitment.

Although a certain degree of personal commitment to a project or enterprise is regarded as necessary and healthy precondition for business success in management science, too much or over-commitment may also hold additional business risks. If stakeholders are over-committed to failing-course-of-action projects, then they might support it although it makes economically no sense any more. Such an escalation of commitment is therefore dangerous and asks for a strict project controlling and revision in order to prevent unfavourable developments. Unfortunately, although most enterprises deploy IT project risk management tools and controlling instruments, especially large mega projects develop regularly a life of their own and escalate because warning signs are ignored or wrongly interpreted. If this is the case, then de-escalation strategies and instruments are needed bringing back the project on track or, in last consequence, exit strategies as most extreme form of de-escalation are necessary to terminate such projects.

In management sciences, the strong ties and relations to an organization or project are defined as commitment, independent from the origin of personal or organizational commitment (Brockner 1992; Rubin et al. 1980). In research on project management, commitment and especially over-commitment is regarded as main reason for project escalation and failing course of action (Ross et al. 1993; Staw 1981; Staw et al. 1978). Therefore, the reduction of commitment can be crucial in order to de-escalate a critical project. Determinants influencing excessive commitment are also discussed in theories of psychology, mostly dealing with the individual cognitive ability to process information.

One of the most demanding decision situations for project officials is to decide whether a critical project should be continued or terminated. After all, according to (Ewusi-Mensah 1997; Ewusi-Mensah et al. 1991), more than one third of all problematic projects made it into the final project implementation phase and were then terminated. Such a long-lasting commitment and escalation of commitment asks for suitable explanation schemas for the behaviour of the responsible project officials. The literature on project commitment states several social sciences theories which can describe certain phenomena such as self justification theory (Brockner 1992; Festinger 1978; Keil 1995; Keil et al. 2000; Newman et al. 1996), expectancy theory (Brockner 1992; Newman et al. 1996; Staw et al. 1978), prospect theory (Garland 1990; Kahnemann et al. 1979; Whyte 1986), decision dilemma theory (Bowen 1987; Brockner 1992), and self presentation theory (Brockner 1992). Nevertheless, a unified set of theories describing all phenomena that occur within projects is still missing, wherefore a grounded theory research approach seems to be promising. Especially when it comes to describing unintended dynamics within projects where the public hand is involved, political determinants are not considered in already existing models that contain only social, psychological, project-related, and enterprise-specific determinants.

RESEARCH METHODOLOGY

Methodologically, apart from collecting secondary data for data triangulation, we started to conduct interviews with members of the project, with the manager in charge from the industry consortia, and with officials from the government. Furthermore, related consultants and auditors will be interviewed by using a semi-structured questionnaire. We use the case study and interview guidelines provided by Yin to conduct our case study (Yin 2003) and follow the recommendation of Glaser and Strauss to derive our grounded theory later in the research progress (Eisenhardt 1989; Glaser et al. 1967). The embedded single case study interviews are taped using a digital recorder and stored together with the transcripts within a qualitative database. During the interviews, the second interviewer is writing personal notes to complement the interview data with these first, subjective interpretations. Based on the findings of the first interview round which will include approx. 40 interviews, a second and probably a third interview round will be conducted which will focus on certain critical project issues as investigated during the first interviews. Apart from the inductive grounded theory approach to develop generalized insights into public private partnership project dynamics, another main goal will be to improve our understanding of IT project risk management for cutting-edge, never-done before IT projects.

CURRENT STATUS

This research project under progress has started with the collection and analysis of secondary data collections from daily newspapers and economic and financial periodicals (altogether approx. 2,300 newspaper articles) from the last 5 years. In addition, we started to conduct interviews with all participants and stakeholders involved in the project from Daimler Chrysler, Deutsche Telekom, TollCollect itself, the Federal Ministry of Transport and related auditors and consulting companies. In this case study we use these two sources together with the publicly available TollCollect documentation from the Internet to develop grounded theory and two answer our two primary research questions:

- What are the specific dynamics (drivers and inhibitors) of IT mega-projects when the public hand is involved and should a PPP project be managed differently from "regular" IT projects?
- Are existing risk management approaches developed for "regular" IT projects sufficient in large-scale and highly innovative mega-projects with complex socio-technical phenomena or do we need adapted or even new approaches for mega-projects with strong commitment, escalation and resulting pure incident management?

We collected 2,300 newspaper articles and at the moment conduct concordance analysis to identify important reasons discussed in public media responsible for the 15 months delay to load our public private partnership performance model. A first rather descriptive snapshot of our research is provided in figure 2, where a few examples for project escalation and de-escalation are illustrated. At the same time, we have conducted our first nine interviews with altogether 16 hours of taped answers to our questions, nearly one quarter is transcript so far and we are analyzing the raw material. Unfortunately, at the moment most of our preparatory work is in German (as, e.g., the questionnaire).

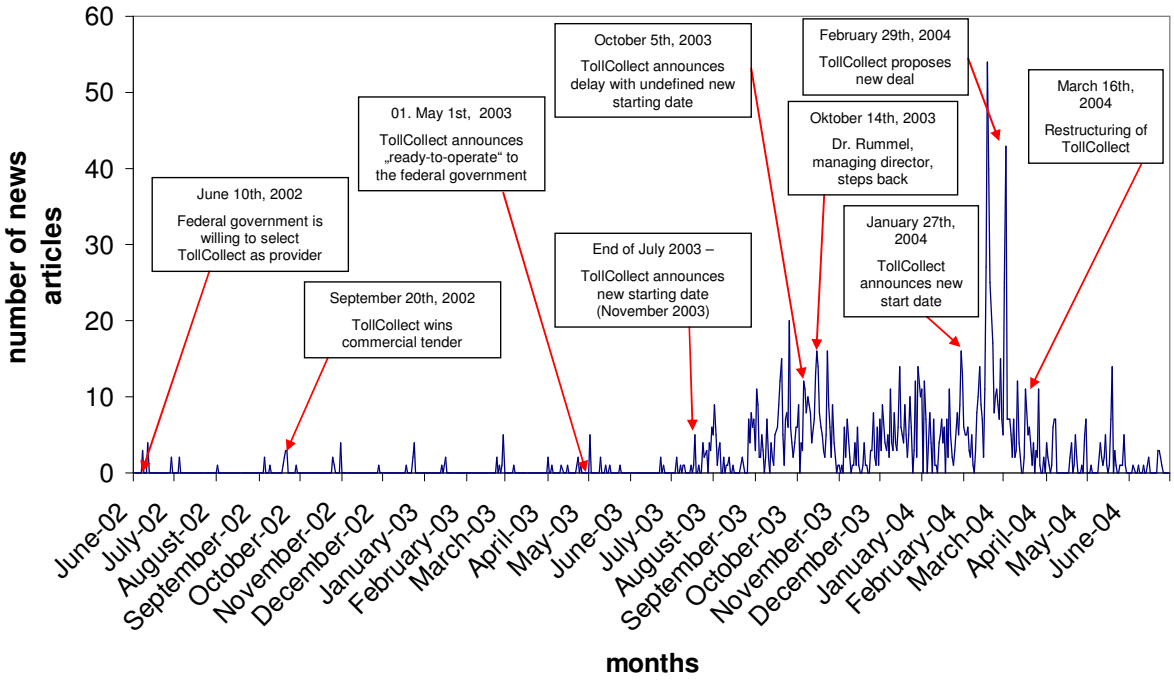

Figure 2: Escalation and de-escalation of the TollCollect project as discussed in the media

PRESENTATION PROPOSAL

We are more than confident that we can present first insights into the public private partnership project dynamics together with a longitudinal time line with the most critical decisions and phases which presumably are responsible for being over time over budget. What we cannot do is presenting any details based on the interviews since there is still a lawsuit pending. The federal government is asking Daimler Chrysler and Deutsche Telekom for compensations to cover the not cashed-in fees in 2004 of approx. €4 billion. Therefore, we cannot disclose sensitive insights as long as the lawsuit is not settled.

Nevertheless, we believe that there is so much to report on that we would be glad if we could discuss our research with experts from the IT project management area.

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