Reliable Customers and Credible Fixed-Price Contracts for Software Development Projects: A Study of one Supplier's Contracts

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Abstract. A fundamental tenet of the information systems discipline holds that changing requirements in software development projects (SDP) are the main reason for failure; therefore, in case of such uncertainties, fixed-price contracts (FPC) are not suitable for success. Our empirical research, informed by economic theories, compellingly illustrates that the FPC is an appropriate contractual form. However, we claim that there is a need to optimize its use. With this paper, we show that reliable customers allow credible FPCs enhancing project success, whereas sophisticated contract provisions do not have this effect. Customer reliability reflects whether the customer uses stable methods and regulations for information processing regarding goal definition, belief generation, and decision-making. Our findings offer managers important insights into how they can design and enact FPCs to manage SDPs successfully. Further, we show how economic theories can enhance understanding of SDP success.

Keywords: Customer Reliability, Credible Contract, Software Development Project, Failure Reasons

1 Introduction

For decades, the information systems (IS) discipline holds that changing requirements in software development projects (SDP) are the main reason for failure [1, 2, 3, 4, 5]. The central argument posits that changing requirements of the information system generate uncertainty for the concerned customer and supplier in terms of budget and time; the goal of the SDP shifts by changing requirements. Researchers claim that in this situation a predetermined price for the software system - defined in a fixed-price contract (FPC) - is not suitable for completion of the SDP in line with the expectations of the contracting parties [6, 7]. Indeed, the contract influences the success or failure of SDPs [8]. However, the budget of the organization is limited. In addition, the legislator forces public authorities to carry out a Request for Proposals to find the supplier with the best price. Consequently, the parties mostly sign an FPC for the SDP. Therefore, the central challenge is to govern a project with an inevitably

incomplete contract (in terms of specification of tasks and outcomes), which however has a fixed price.

We claim that the customer's reliability and the credibility of the contract with its provisions influence the effectiveness of the contract and thus the project success. We argue that researchers need to consider the settings of the contracting parties themselves when the effect of the contract on the SDP is the focus of the investigation. It is widely accepted that customer and supplier pursue at the transaction level different economic targets and outcome goals [9]. Savolainen [9] elaborated after a comprehensive literature review that the customer's attention is on cost, time, and quality, whereas the supplier's attention is on customer satisfaction, short-term business success for the supplier, and long-term success for the supplier. Ultimately, an SDP is not an anonymous or unassisted transaction in the market [10, 11].

In this paper, we study one supplier's contracts regarding (a) the contract provisions of the FPCs, (b) the customers' properties and (c) the SDPs characteristics. We show that reliable customers allow credible FPCs enhancing project success, whereas sophisticated contract provisions do not have this effect. Economic theory can improve our understanding of reasons for failure of SDPs. However, there is a paucity of research on how the contracting parties can improve SDP's performance or outcome by the use of a credible FPC.

We develop our argument, in particular our understanding on reliable customers and credible contracts, in section 2 of this paper. In section 3, we review the theoretical background of our empirical investigation. After a description of our results, we discuss some findings in section 4. In section 5, we summarize our results. We end up with the limits of our paper and with suggestions for further research.

2 Credible Contracts and Reliable Customers

A first typology of the contracts under uncertainty found its way into economic theory in the late 1970s [10]. Transactions with asset specificity and uncertainty need assistance by contractual control [11]. Such relational contracts provide long-term relationships more than short-term projects. Relational contracts are designed for the continuation of the relationship between the contractual parties. The researchers suggested for long time to carry out transactions with asset specificity and uncertainty internally or under customers' hierarchical control. However, the contracting parties of software development outsourcing (SDO) projects need contracts for short-term projects. Therefore, Williamson took up this topic again in 2008 [12]. Hybrid contracts for transactions not feasible in the market or in hierarchy need a mediating style. He argued the three leading styles are (1) muscular, (2) benign, and (3) credible.

(1) Often large customers do business with smaller suppliers. The *muscular* customer asks the supplier only for the best price for the services. If for whatever reason the service fails, the customer will refuse payment. However, the supplier cannot easily redeploy the assets (customized code) if such unexpected developments arise. Therefore, suppliers will ask the customers to provide safeguards to mitigate the risks, or they will try to increase their price to consider the additional risk. This

exploitation is myopic and inefficient for a long-term relationship. For a short-term project, it is very risky for the supplier.

(2) In case of *benign contracts*, trust in reputation replaces the concept of power. However, if conflict arises, "defection from the spirit of the contract can be projected" (cf. [12]).

(3) This study builds on Williamsons pioneering work when adopting his call for *credible contracts*. This approach is hard-headed, but not mean-spirited. The parties look ahead and work out the mechanisms managing potential hazards. Credible according to a sentence form 1750 BC: „When you ask us for troops, we will not answer you with evasions, we shall brandish our maces and strike down your enemy. …" (cf. [12]). In earlier time, kings intermarried their children for this. However, this is not an option in context of an FPC for the SDP. Therefore, this study will look for conditions making the FPC credible to effect hazard mitigation. Being willing to agree upon such conditions, is a sign of the reliability of a contractual party. Thus, we want to assess the customer's reliability. We use the term reliability here not in a moral sense, but with a technical meaning [13]. A market partner is reliable, if he acts in a comprehensible way, if he makes rational decisions due to his transparent interests and earlier promises. Economic theories developed for the description and understanding of rational actors use this construct implicitly [14, 15, 16]. Therefore, being reliable is connected with rationality. Organizations have the ability to generate their own rationality through stable methods and regulations for information processing regarding goal definition, belief generation, and decision-making [17, 18, 19]. These characteristics determine the *customer reliability*.

For our empirical investigation, we are in need of measureable attributes, which we draw from existing studies. Numerous studies examined contract design choices and contracts. However, we must be careful when considering the interpretation of results of these studies. One example of contract research is the study by Fink and Lichtenstein [7], giving a suggestion for contract choice. Typically, two basic contract types are used in practice: FPC, and time and material (T&M) contract. The T&M contract requires that the customer pays the costs plus a profit to the supplier. The authors deemed FPCs incompatible with short-term SDPs under uncertainty. The study by Gopal et al. [17], cited by Fink and Lichtenstein [7], did not distinguish project types. The cited studies had all together in focus: development, re-engineering, and maintenance. However, the asset specificity and uncertainty of these project types are not comparable. Therefore, our focus is on development.

The second example is the study of Søderberg et al. [21]. The contracting parties establish a long-term business relationship. Mostly, researchers consider long-term business relationships between customer and supplier when considering SDO (e.g. [22], [17], [23]). In this paper, we refer to short-term development projects. Therefore, we hook up on two recent studies. First, the study of Eckhard and Mellewight [24], having contractual functions under investigation. Second, the study of Benaroch et al. [14] building on it. These researchers identified measurable attributes in the categories of contractual functions. We address these studies in the next section.

3 Research Methodology

We conducted our empirical analysis using an abductive approach [25, 26]. In the first stage, we referred to the contractual functions, identified in an extensive literature study by Eckhard and Mellewight [24]. The authors carried out a systematic analysis of 22 top-ranked management and economics journals to identify all articles dealing with the contractual form of inter-firm relationships between 1993 and 2005. As a result, they identified contractual functions, which they classified under one of the following three categories: safeguarding of parties investments, coordination of the exchange process and contingency adaptability to cope with future disturbances. *Safeguard provisions* should protect the investments of the contracting parties. In particular, intellectual investments require sensitivity and confidentiality. Furthermore, this includes the protection against performance risks for reaching the goal of the project as well as the risk of premature termination of the SDP after one party has achieved his own goal. Therefore, dispute resolutions belong to this category. In conclusion, safety risks are opportunism-driven relational risks. *Coordination provisions* include the definition of a project schedule and of roles and responsibilities for the time of project execution. In addition, reporting specifications and the assignment of specific personnel belong to this category. These provisions provide the subsequent collaboration and address performance risks stemming from the task itself. *Contingency adaptation provisions* concern future circumstances. The contracting parties need to map technical changes as well as changes in the business environment when they become known. Therefore, the contracting parties have to define price adjustments. These provisions address risks arising in the future.

From this preliminary work and after a comprehensive literature review, Benaroch et al. [14] carefully identified measurable attributes for these contractual categories. The authors studied pure SDO contracts to improve the understanding of contract design in SDO. As a result, they substantiated that SDO contracts require a different mix of contract provisions than other ITO arrangements. Fortunately, they studied the mix of provisions in two contract subsamples, FPCs, and T&M contracts. Therefore, we can hook on this research. However, we have only the FPCs under investigation.

Benaroch et al. [14] focused on drivers of contract complexity and on "how the transaction attributes and the effect of learning to contract impact the complexity of specific contract functions". The researchers analyzed 270 SDO contracts of a leading international bank. In detail, they analyzed 181 FPCs. The remaining 89 contracts were T&M contracts. Some results they found are: (a) Asset specificity generally lowers reliance on safeguards in SDO contracts. (b) Asset specificity increases reliance on contingency adaption provisions, at least in FPCs. (c) Transaction uncertainty does not increase reliance on contingency adaption provisions in FPCs. (d) In standard contracts, safeguard provisions are more standardized than coordination and contingency adaption provisions. This holds most notably for contingency adaption provisions in FPCs. The authors believe that the contract manager perceive these provisions as less important. We will come back to these results when discussing our findings in section 4.

Benaroch et al. [14] investigated the contracts of a customer. We could observe opportunely the opposite side, one supplier working for different customers in Germany such as a bank, insurance companies, public authorities, a wholesaler, a

machine manufacturer, and others. In total, we identified 49 different customers. This German software development company has been developing software systems since 1994, based on the individual requirements of their customers. The supplier employs 10 software developers.

For our empirical analysis, we used the written contracts from the last twenty years. All associated contracts were stored in a database we could use. Additionally, many contracts were available in email form. We used the 152 FPCs for software system development. Their values range from 550 € to 270,000 €, with an average of 17,011.40 €. Their durations range from 1 to 491 days, with an average of 30.9 days.

3.1 The Measurement Model

We started our empirical investigation with the identified and just discussed attributes of the contractual categories. After a first iteration step, we decided to adjust the attributes of our investigation. In particular, we were in need of further details about the customers and their processes. Therefore, we defined three sections: customer constructs, contract constructs, and project constructs (Table 1).

For the first *customer construct*, we wanted to know the market segment (construct 1). Private companies have business goals, whereas public authorities have to solve administrative tasks. We assumed that different types of goals results in different behavior and contractual provisions. Furthermore, we wanted to know the company size (construct 2). We assumed that different sized companies work differently. Since we classified the observed supplier as a small company, we wanted to examine if there are differences in SDPs with customers of different sizes. With the last customer construct item customer reliability, we could measure to which extend the customers follow clear and comprehensive rules during the negotiation phase and the project phase (construct 3), so that he can be seen as a reliable customer. We asked whether the customer has standardized processes, whether he follows them and whether he cannot bypass them during the contract negotiation. For the project phase, we asked whether the customer has standardized processes, and whether little changes in requirements result typically in little changes in the goals and the behavior. We asked whether the customer communicated the business objectives in the contracting phase as well as in the project phase. For the measurement of reliability, we counted all fulfilled attributes. Therefore, we classified customer reliability in the range from 0 up to 7. For the collection of the attributes, we interviewed the supplier's chief negotiator.

The *contract constructs* we draw from Benaroch et al. [14]. In detail we draw the safeguard, coordination, and contingency adaptation provision (construct 5-7). Furthermore, we added a question about the contract type, as we assumed customers and suppliers have their own standard contract (construct 4). We wanted to find out who determines the contractual provisions.

For the *project constructs*, we draw from Benaroch et al. [14] the constructs project size, prior interaction, and transaction uncertainty (construct 8-10). Furthermore, we added some questions about project failure, customer satisfaction, and supplier satisfaction. We consider an SDP as being definitely failed if the parties are not able to come to an amicable agreement regarding arising problems without a third party

and so it comes to the court (construct 11). Furthermore, a project is not completely successful, if one of the parties is not satisfied with the result.

Table 1. Items in the measurement model

Customer Constructs*	Item
(1) Market segment	-Private company or public authority
(2) Company size	-Small (<50 employees) , medium (>=50 and <500 employees) or large (>500 employees)
(3) Customer reliability	-Customer has standardized processes in contracting phase (yes/ no) -Customer follows his standardized processes in contracting phase (yes/ no) -This process cannot be bypassed in contracting phase (yes/ no) -Business objectives communicated in contracting phase (yes/ no) -Customer has standardized processes in project phase (yes/ no) -Little requirement change results in little project change in project phase (yes/ no) -Business objectives communicated in project phase (yes/ no)
Contract Constructs	**Item**
(4) Contract type	-Follows the whose standard contract: customers' standard contract [CSC], supplier's standard contract [SSC], supplier's standard contract changed by the customer [SSC+], or not formal [-]
(5) Safeguards	-Penalty amount payment defined for a breach of confidentiality, data protection, or employment of staff (yes/ no) [P] -Customer acceptance test specified (yes/ no) [CAT] -Warranty: period of post project completion defined (yes/ no) [W] -Intellectual Property Rights protection specified (yes or no) [IP]
(6) Coordination	-Delivery milestones, identified points of delivery (number), Payment milestones, identified points of payment (number), Additional milestones without payment defined (yes/ no) [MS] -Meetings or reports frequency specified (yes/ no) [MR]
(7) Contingency adaptation	-Contingency adaptation changes clause specified (yes/ no) [CA]
Project Constructs	**Item**
(8) Project size	-Duration in days -Price in €
(9) Prior interaction	-Prior SDP (yes/ no)
(10) Transaction uncertainty	-Business objectives specified and functional and technical outcomes provided (yes/ no)
(11) Failure	-Came the project to court (yes/ no)
(12) Customer dissatisfaction	-Was the customer dissatisfied with the SDPs' outcome (yes/ no)
(13) Supplier dissatisfaction	-Was the supplier dissatisfied with the SDPs' outcome (yes/ no)
(14) Start date	-Contract signing date

*recorded by interview

As already mentioned, the customers and the suppliers have different economic targets and outcome goals with an SDP. The supplier observes the customer because he is interested in customer satisfaction. Therefore, we could ask him for both, customer dissatisfaction and his own dissatisfaction with an SDP (construct 12-13). For the sake of completeness, we added the start date of the SDP (construct 14).

3.2 Hypotheses

We ordered the constructs in a way that we could study the dependencies between these constructs (marked with X) in a systematic way (Table 2). Dependencies, from which we derived our hypotheses, are marked with a reference to the hypotheses.

Table 2. Examined dependencies.

Customer Constructs	(3)	(4)	(5)-(7)	(8)-(10)	(11)-(13)
(1) Market segment	H1a	X	X	X	X
(2) Company size	H1b	H2a	X	X	X
(3) Customer reliability		H2b	H3a	X	H4a
Contract Constructs					
(4) Contract type			H3b, H3c	X	H4b
(5) Safeguards				X	H4c
(6) Coordination				X	H4c
(7) Contingency adaptation				X	H4c
Project Constructs					
(8) Project size					X
(9) Prior interaction					X
(10) Transaction uncertainty					X
(11) Failure					
(12) Customer dissatisfaction					
(13) Supplier dissatisfaction					
(14) Start date					

We expected a connection between market segment and customer reliability as well as between customer size and customer reliability. Public authorities do not depend from short-term changes in a market environment, they can make planes for a longer time, and they have by law stronger rules for their decisions as private companies have. Furthermore, bigger-sized organizations develop more internal rules for decision-making then smaller ones. Therefore, we hypothesized that:

Hypothesis H1a. Public authorities act more reliable than private companies do.
Hypothesis H1b. Customer reliability is positively associated with customer size.

We expected that big-sized customers have the power to enforce the usage of own standard contracts. Furthermore, we assume that a customer with high reliability has developed own standard contracts. In addition, he should have rules that demand the enforcement of the usage of these contracts. Therefore, we hypothesized that:

Hypothesis H2a. Large customers mostly enforce the use of their standard contracts.
Hypothesis H2b. Customers with a higher reliability mostly enforce the use of their standard contracts.

We assumed that the customer reliability affects the provisions of its standard contract. Therefore, we hypothesized that:

Hypothesis H3a. Customer reliability is positively associated with the contract's provision number.
Hypothesis H3b. Customers' standard contracts include more safeguard provisions than supplier's standard contracts do.
Hypothesis H3c. Supplier's standard contracts include more contingency adaption provisions than customers' standard contracts do.

We expected a connection between customer reliability and project failure. In addition, we assumed that it is relevant, which standard contract is used. Therefore, we hypothesized that:

Hypothesis H4a. Customer reliability is negatively associated with project failure.
Hypothesis H4b. Customers' standard contracts rarer result in project failure than supplier's standard contracts do.
Hypothesis H4c. The number of contract provisions is negatively associated with project failure.

We collected all contract information in a database for further analysis and interpretation, which we discuss in the next section.

4 Data Analysis and Interpretation

Our sample consists of 152 data sets with the constant FPC. For our statistical analysis, we calculated for each hypothesis the proportion of data sets with the respective value of the dependent variable for each value of the leading variable. We present one analysis for each hypothesis followed by an interpretation.

4.1 Dependencies between customer constructs

Our sample consists of 22 contracts with public authorities and 130 contracts with private companies. There are 78 contracts with large customers, 60 contracts with medium customers, and 14 contracts with small customers.

There is no significant difference between the reliability of public authorities and private companies (Our sample consists of 22 contracts with public authorities and 130 contracts with private companies. There are 78 contracts with large customers, 60 contracts with medium customers, and 14 contracts with small customers. Table 3) Most of the customers have an intermediate or high reliability level.

Table 3. Market segment and customer reliability (H1a)

Market segment	0	1	2	3	4	5	6	7
Public authorities	0%	0%	0%	36%	14%	50%	0%	0%
Private companies	5%	5%	5%	32%	19%	32%	0%	0%
In total	5%	5%	6%	35%	21%	38%	0%	0%

Table 4. Customer size and customer reliability (H1b)

Customer size	0	1	2	3	4	5	6	7
Large	1%	0%	1%	12%	18%	**68%**	0%	0%
Medium	0%	12%	3%	**62%**	23%	0%	0%	0%
Small	**43%**	0%	29%	29%	0%	0%	0%	0%
In total	5%	5%	6%	35%	21%	38%	0%	0%

We found a strong dependency between reliability and customer size (Table 4). Most of the big customers are highly reliable. Nearly half of the small customers show a reliability level of Zero.

Hence, hypothesis H1b is supported in the entire sample, but not H1a.

4.2 Dependencies regarding contract constructs

Table 5. Customer size and contract type (H2a)

Customer size	[-]	[SSC]	[SSC+]	[CSC]
Large	3%	**45%**	10%	**42%**
Medium	10%	50%	10%	30%
Small	14%	79%	0%	7%
In total	7%	50%	9%	34%

Table 6. Customer reliability and contract type (H2b)

Customer reliability	[-]	[SSC]	[SSC+]	[CSC]
0	43%	57%	0%	0%
1	0%	57%	43%	0%
2	0%	**86%**	0%	14%
3	12%	**74%**	6%	8%
4	0%	32%	0%	**68%**
5	2%	30%	15%	**53%**
6	0%	0%	0%	0%
7	0%	0%	0%	0%
In total	7%	50%	9%	34%

In the case of small customers, mostly the supplier's standard contract is used. However, for medium and large customers, the chosen contract type does not depend

on customer size (Table 5). For large customers, the quota of supplier's standard contract is nearly the same as of customers' standard contracts.

For the interpretation of dependencies from the customer reliability, it is remarkable that the sample is not evenly distributed over the reliability levels. There are only seven contracts with a customer reliability of 0, 1, or 2, respectively. There is no contract with a customer reliability of 6 or 7.

If the customer's reliability is high, he mostly provides his own standard contract (Table 6). At first glance, one can assume that this is only an implicit dependency from the connection between customer size and reliability. On the other hand, only 42% of the contracts with large customers base on their own standard contract, although in 80% of contracts with large customers the customer reliability is high (4 or 5). For medium-sized customers the situation is similar (cf. Table 4 and Table 5). Therefore, using the customers' standard contract is not a matter of size (of pressure from the customer as the stronger party). Consequently, the connection between customer's reliability and the provision of customer's standard contracts is independent from the customer size.

Hence, hypothesis H2b is supported in the entire sample, but not H2a.

Table 7. Customer reliability and contract provisions (H3a)

Customer reliability	(1) [P]	(1) [CAT]	(1) [W]	(1) [IP]	(2) [MS]	(2) [MR]	(3) [CP]
0	0%	0%	0%	0%	14%	0%	14%
1	14%	0%	14%	29%	14%	0%	14%
2	14%	14%	14%	14%	0%	0%	0%
3	4%	0%	0%	4%	10%	0%	4%
4	7%	4%	4%	4%	4%	0%	4%
5	**49%**	**47%**	**51%**	**49%**	13%	47%	2%
6	0%	0%	0%	0%	0%	0%	0%
7	0%	0%	0%	0%	0%	0%	0%
In total	21%	18%	20%	20%	10%	16%	4%

Table 8. Contract type and contract provisions (H3b, H3c)

Contract type	(1) [P]	(1) [CAT]	(1) [W]	(1) [IP]	(2) [MS]	(2) [MR]	(3) [CP]
[-]	10%	10%	10%	10%	0%	10%	0%
[SSC]	4%	0%	1%	0%	7%	0%	5%
[SSC+]	0%	0%	7%	29%	7%	0%	0%
[CSC]	**54%**	**50%**	**52%**	**50%**	17%	**46%**	4%
In total	21%	18%	20%	20%	10%	16%	4%

Only if the reliability of the customer is high, we found a high proportion of contracts with safeguard provisions (about 50%, Table 7). We found additionally in mostly all of these cases, the customer enforced the use of his standard contract. This means: If a high-reliable customer enforced the use of his standard contract, it contained mostly always safeguard provisions. However, independently of the contract type, the

customers with high reliability do not accept change provisions. We did not find a continuous growth of the contract's provision number with customer reliability, but a singularity for high-reliable customers.

With few exceptions, only standard contracts delivered by customers define safeguard provisions (Table 8). About 50% of them include such provisions. The situation regarding coordination provisions is ambiguous. For provisions regarding meetings and reporting the quota is as high as for safeguard provisions, whereas the quota for milestones is lower.

Only 5% of the supplier's standard contract and 4% of the customers' standard contracts contain change provisions.

Hence, hypothesis H3b is supported for in the entire sample, but not H3a and H3c.

4.3 Dependencies regarding project failure

Table 9. Customer reliability and project failure (H4a)

Customer reliability	Failure	No Customer satisfaction	No Supplier satisfaction
0	12%	0%	14%
1	29%	29%	43%
2	43%	14%	43%
3	2%	2%	2%
4	0%	0%	4%
5	0%	2%	8%
6	0%	0%	0%
7	0%	0%	0%
In total	5%	3%	9%

Table 10. Contract type and project failure (H4b)

Contract type	Failure	Customer dissatisfaction	Supplier dissatisfaction
[-]	0%	0%	10%
[SSC]	7%	4%	7%
[SSC+]	**14%**	0%	**14%**
[CSC]	0%	4%	10%
In total	5%	3%	9%

If the customer reliability was high, no project completely failed (Table 9). In addition, both the customers and the supplier are more satisfied with the result if the customer reliability is high. There is a small sign in the figures that there is a higher risk for supplier satisfaction if the customer reliability is extreme high.

There is a weak indication in the figures that supports the hypothesis H4b (Table 10). The highest quota of failing or not satisfying projects we found when supplier's standard contract with changes by the customer [SSC+] is used.

Table 11. Contract provisions and project failure (H4c)

Contract provisions	Failure	Customer dissatisfaction	Supplier dissatisfaction
(1) [P]	0%	9%	19%
(1) [CAT]	0%	7%	15%
(1) [W]	0%	10%	20%
(1) [IP]	3%	6%	13%
(2) [MS]	0%	20%	27%
(2) [MR]	0%	4%	12%
(3) [CP]	17%	0%	0%
In total	5%	3%	9%

We can confirm that the risk of a complete failure is low in projects with contracts containing safeguard provisions (Table 11). On the other hand, the quota of projects that finish without success for the supplier is higher than the overall quota of 9%. However, because of the low number of contracts with contingency adaptions and milestones provisions, the figures for these provision types are not significant.

Hence, hypothesis H4a and H4c are supported for in the entire sample, hypothesis H4b is weakly supported.

4.4 Answers to Benaroch et. al.

In direct comparison to Benaroch et al. [14] and their results (section 2), our empirical analysis delivers the following results:

(a) The first finding is that the supplier invests in each SDP specifically. From the suppliers' point of view, the asset specificity is high. We could detect only two projects for different customers based upon the same software code. Moreover, both these customers are public authorities and expressly agreed. Both these public authorities perform the same function. Aggravating this situation, we could detect safeguard provisions only unilaterally in the interest of the customer. Therefore, we cannot notice any reliance between suppliers' asset specificity and safeguards in the FPCs.

(b) We did not find any sustainable contingency adaption provision. At the most, the supplier might have been able to incorporate a payment provision for additional, unforeseen requirements. Only in 6 contracts (4%) we found a clause regarding payments for change requests. However, there were now rules for detecting change requests. Therefore, we cannot notice any reliance between suppliers' asset specificity and contingency adaptions in FPCs.

(c) Mostly the customer gives a general overview about his business objectives. In 95% of the contracts, the customers communicated their economic goals clearly and stable before the parties signed the contract. We could not detect a significant dependency from customer type, customer size, or contract type. However, the supplier has to develop the detailed specification on functional and technical outcomes during the SDP. Therefore, uncertainties exist about projects outcome. However, as mentioned, we did not find contingency adaption provisions covering these suppliers' risks.

(d) We can confirm that customers' own standard contract often include standardized safeguard provisions. For contracts based on customers' standard contracts, we found in about 50% such provisions. On the other hand, in contracts based on suppliers' standard contracts, we found these provisions only in less than 10%. However, for coordination and contingency provisions we found another situation. Only 12% of the contracts based on customers' standard contracts contain milestone definitions unless the delivery of the final software system. Although 46% of these contracts contain clauses regarding meetings and reporting, in fact they all contain only the suppliers' obligation to deliver weekly status reports. None of the contracts based on suppliers standard contracts contain such a clause. Benaroch et al. [14] believe the contract managers perceive both types of provisions as less important. We discovered that customers' legal departments generate the standard contract. However, they cannot (yet) standardize project-dependent coordination or contingency provisions in detail.

5 Conclusion

Our empirical analysis shows first, that the project's failure risk for SDPs with FPCs significantly decreases if the customer reliability increases. Customer reliability reflects whether the customer uses stable methods and regulations for information processing regarding goal definition, belief generation, and decision-making. In particular, if the customer reliability is high, the risk of failure is low. Therefore, a high customer reliability is an important success factor for SDPs with FPCs. As a first result, a reliable customer makes the FPC credible.

Second, reliable customers tend to bring safeguard and coordination provisions into the contract. However, only the half of contracts bases on customers' standard contracts (in line with Benaroch et al. [14]). Therefore, for the project's success these provisions are obviously in this case not necessary, because this holds even if the supplier's standard contract is chosen and the customer has a high customer reliability. However, if a customer's standard contract with a high number of safeguard provisions is agreed, the risk of supplier's dissatisfaction increases. Furthermore, we investigated the contracts of only one supplier. For two decades, this supplier has signed contracts with customers very different in size, structure, age, and market area. The overall failure quota is low in comparison with the results of the cited studies [2, 3, 4]. Most of the projects this supplier has carried out were SDPs under FPCs. The overall success of this supplier allows us to state, that contracts as signed by this supplier do not hinder the project's success in general. Not the FPC itself is the challenge but if the customer influences the suppliers' safeguard provisions. In this case, the customer's reliability is low. Our interpretation is that the customer demonstrates his low reliability by tightening the authoritarian FPC. The FPC itself is an authoritarian contract; in addition, the customer stresses his authoritarian position. Therefore, such a contract is muscular in the sense of Williamson. As a second result, safeguard provisions have more coordinating role and should not be too clever (as discussed already by Axelrod [27]), the fixed-price itself is the customer's best safeguard. The customer assets are obviously not in danger.

Third, contingency provisions are not in use. As a third result, a fixed-price project has a budget limit, which the customer is encouraged not to weaken.

At this point, we recognize the limits of our investigation. We used the contracts only from one supplier. Furthermore, we did not find credible contract provisions in the sense of Williamson [12]. Customers can suspense the payment. In addition, the supplier has the risk of repayment if for whatever reason the project fails. However, he invests in each SDP specifically. Further research can start here. We expect that regardless of customers' reliability non-repayable deposits can make a contract itself credible.

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