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Assessing the risk for opportunism in collective IT investment: a Principal-Agent based framework for use in inter-firm networks

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Abstract

When managing information technology (IT) infrastructure investments, companies traditionally try to evaluate the monetary costs and benefits of this information system (IS) or seek to implement prudent IT governance structures. However, when collective, cooperation-specific investments in interorganizational information system (IOS) are needed, these classic approaches are flawed as they do not account for central organization-theoretic specifics of investing in cooperation. There is a need for a more comprehensive instrument which includes economic network welfare as perceived individual utility inequalities will keep partners from joining, thereby diminishing network welfare and impeding a successful establishment of the cooperation. The central economic influence on individual utility in collective investments, as identified by Williamson (1985), is the risk for opportunism associated to an investment.

The risk for opportunism in collective IT investment is operationalized in three steps: model construction, structured qualitative analysis of relevant investment scenarios with the help of Principal-Agent theory and result aggregation. In the end a novel risk assessment framework is presented. The framework allows any potential IOS participant to quickly read off the risk for opportunism he faces with different IOS alternatives. The discussion shows that purposeful collective IT investments have the following characteristics: every partner actively invests into the IOS, IOS operation is outsourced and, if the IOS is nevertheless sourced from within the cooperation, a decentralized IOS architecture is chosen. A concluding real life case demonstrates the application of the easy-to-use framework.

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Abbreviations

EAI	Enterprise Application Integration
ebXML	Electronic Business eXtensible Markup Language
EDI	Electronic Data Interchange
ICT	Information and Communication Technology
IOS	Interorganizational System
IS	Information System
IT	Information Technology
PA	Principal-Agent
PR	Property-Rights
XML	eXtensible Markup Language

1 Introduction

1.1 The need for an extended investment analysis

In all, Information and Communication Technology (ICT) facilitates economic transactions. Surely, ICTs have enabled new work arrangements such as teleworking and lead to well-known business to consumer online stores or online auctions. But at the same time – a change far more substantial – modern data processing equipment has fundamentally changed the organization of business to business environments. One of the consequences is an increased economic advantageousness of cooperating with other firms both in regard to supplier-buyer and co-producer relationships. Examples can be found in all sectors and prominently include the automotive and airline industries.

Research has gone into great lengths at explaining this development. For example, Powell (1990), Clemons/Row (1992) and Picot/Rippberger/Wolff (1996) describe the formation of inter-firm networks drawing on Williamson's (1975) notable transaction cost considerations. But while academia has generally agreed that information technology does serve as an enabler of inter-firm networks, a simple yet fundamental business management issue remains: how can companies determine whether a relationship-specific IT investment (which often represents a constituting part of the cooperation) is favorable for them? This question is addressed from a particular angle, namely **the risk for opportunism associated to a collective investment**, as existing approaches do not account for this major inhibitor of collective ventures.

Traditionally, two starting points for handling IT investment decisions exist. (1) IT governance represents a holistical approach to managing a firm's IT infrastructure. (2) Specialized IT evaluation frameworks help assessing costs and benefits of investment options. Both approaches are problematic when applied in a collective setting.

(1) **IT governance** should typically include directing, controlling and coordinating IT projects (Sambamurthy/Zmud 1999), but must at the same time be placed into a corporate governance context if it was to create value (Weill/Ross 2004). In addition to the lack of research on collective IT governance, literature generally suggests that collective governance structures are barely existent, have not been implemented prudently or, as with Japanese keiretsu, are loosing their influence (see, for example, Casciaro 2003 or Ahmadjian/Lincoln 2001). However, there is an alternative to collective governance if companies are to invest collectively. Williamson (1985, p. 121-122) writes that even when relation-specific investments are needed, companies might choose to take

part in inter-firm networks **if the risk for opportunism is low** or safeguards against such behavior are in place. So if no safeguards (→ governance) are implemented, the partner companies will have to asses the degree of opportunism related to an investment.

(2) **Frameworks** for evaluating information systems have been hotly debated in IS research ever since the discipline was founded (Banker/Kaufmann 2004), typically include financial and strategic considerations, and were extensively refined in the past years (see, for example, Melville/Kraemer/Gurbaxani 2004). The foremost problem evaluation frameworks are confronted with is measuring the value IT brings to an organization (for a classification of approaches see Hitt/Brynjolfsson 1996). This is particularly true for collective investments, where researchers have so far focused on determining the value to 'main'/focal or to 'minor' partners (e.g. Subramani 2004, Mukhopadhyay/Kekre 2002). However, it is often only in the interplay of the partners based on the specialized infrastructure where competitive advantage can be realized (e.g. Dyer/Singh 1998). In addition, existing evaluation frameworks do not include economic factors such as the degree of specificity or the degree of potential opportunism associated to investment options.

These shortcomings show that there is a definitive need for an extended framework for assessing collective IT investment options. Apart from including comprehensive cost/benefit assessments of the value to the individual partners, a helpful framework must account for the specifics of the collective perspective as relative economic inefficiencies will keep potential partners from joining the network and will hence impede its formation. In this paper the one critical economic factor emphasized by Williamson (1985) is focused: the risk for opportunism. As Principal-Agent (PA) theory is primarily concerned with the analysis of contracting parties behaving opportunistically, it constitutes the theory of choice for this paper.

1.2 Objective and method

In summary, this thesis' **objective** is to develop a theoretically grounded evaluation framework for measuring the risk for opportunism in collective IT infrastructure investments. Figure 1.2/1 summarizes the problems of existing approaches and demonstrates their ties to the the novel approach follwed by the objective.

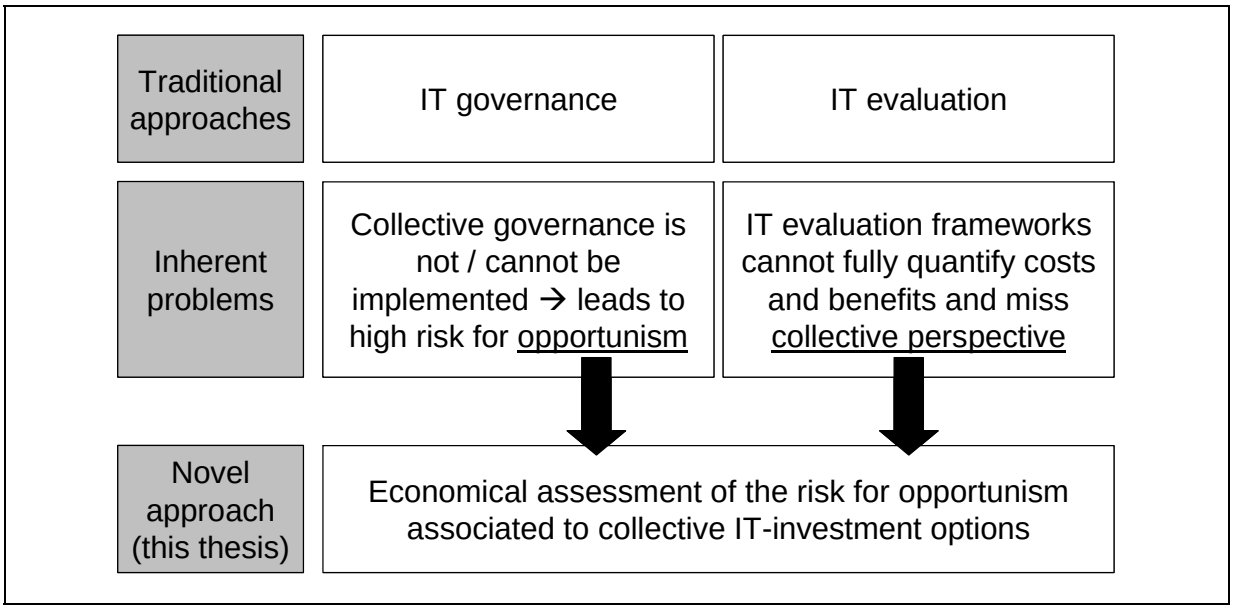


Figure 1.2/1: Traditional and novel approach

In essecence, the novel approach requires a full operationalization of an economic theory for use in management. As this approach has only found minimal attention in IS research so far, **methodological reflections** form an important part of advancing on the objective. While theoretic discourses such as this one are generally based on deductive logic, the process of operationalization itself is unclear and must be developed from drawing analogies to other operationalization attempts.

Evaluation frameworks for measuring the risk for opportunism associated to a specific investment have not yet been developed. In general, the aim of economic investigations is **relative**, not absolute **comparison** (Williamson 1991). But while economic comparisons are typically used with the purpose of (formally) explaining the dynamics of reality (in this case: governance of and investment behaviour in inter-firm networks / see Han/Kauffmann/Nault 2004, Beckman/Haunschild/Phillips 2004, Solf 2004, Casciaro 2003, Wohlgemuth/Hess 2003 for recent examples), this study sets out to develop a management framework for collective investments.

Numerous Principal-Agent analyses were conducted for real life cases (see Reid 1977, Rubin 1978, Block/MacMillan 1993, Bhattacharyya/Lafontaine 1995 or Casamatta 2003 on complex PA-analysis examples). Still, they have not been operationalized to a management framework. Generally, research has rather attended to **operationalizing transaction cost theory**. In this respect, attempts at transaction cost were scanned in order to obtain a general idea for approaching the operationalization of PA theory. For this case, works set in an atmosphere were focused where the object of analysis, the risk for opportunism, is considered as a major influence on decision making: IT sourcing. The analysis harvested three approaches: (1) quantifying transaction costs in order to use the figures in cost accounting (e.g. Albach 1988),

(2) quantifying the level of perceived transaction cost (e.g. Ang/Straub 1998) and (3) breaking down transaction cost into qualitatively assessable variables (e.g. Dibbern/Heinzl/Leibbrandt 2003).

Option (1) has been widely discussed, but contradicts the idea of relative economic comparison and has not yielded substantial results so far (Burr 2003). While the results of option (2) would foster the individual reflection of the personal decision making situation of a cooperation partner, option (3) additionally yields a basis for discussion and negotiation within the inter-firm network, as the composition of the risk levels is transparently developed in a structured manner. Therefore, breaking down the decision making situation at hand into **qualitatively assessable variables** (option 3) seems to be the most promising approach for a categorical operationalization in this setting.

The operationalization is carried out in three steps: model construction, qualitative analysis and result aggregation. In **step 1**, following vigorously structured scientific method, independent and dependent variables have to be developed. In this case, the dependent variables (the ones to be measured for different types of collective IT investment) are risk levels as induced by different risk sources identifies in Principal-Agent theory. The independent variables make up types of collective IT investments. While the dependent variables are clear, it is imperative to define adequate independent variables. Therefore the setting of investing collectively is translated into PA-theory: who can – abstracted away from a real case – take on the roles of Principal and Agent? Then, scenarios are built which are made up of all realistically possible combinations of PA-roles and participants in the real world. These scenarios constitute aggregations of independent variables. Having identified all relevant variables, all information asymmetries (→ qualitatively assessable dependent variables) in those scenarios are analysed and the results are recorded in a structured, comparable manner (**step 2**). Finally, these results are aggregated to arrive at a comprehensive risk assessment framework (**step 3**).

1.3 Structure of the paper

The paper's structure reflects the operationalization process and its embedding into existing efforts (see also figure 1.3/1). **Chapter 2** briefly provides background information on relevant concepts of this paper. First, inter-firm networks are introduced as one type of strategic inter-firm cooperation and examples of collective IT investments are presented. Second, the underlying concepts and relevant terms of the theory applied (Principal-Agent theory) are portrayed. In **chapter 3**, representing the first step of operationalization, scenarios for relative comparison are built by first identifying

relevant actors and phenomena and then deriving scenarios relevant to the Principal-Agent problems at hand. Following that, in step 2 of the operationalization process, opportunism risk levels within these scenarios are discussed and rated by deducting qualitatively using key arguments from Principal-Agent theory (**chapter 4**). To increase the transparency of any deductions made, a rigid structure is followed during these analyses. In **chapter 5** (step 3 of the operationalization process), the analyes' findings are aggregated to a framework and a dominant strategy is brought forward. Also, the framework's application is demonstrated in a reconstructed real life case. Apart from summing up, **chapter 6** portrays how this Master thesis fits into into the dissertation project "Evaluating collective IT-investments" and presents next research steps.

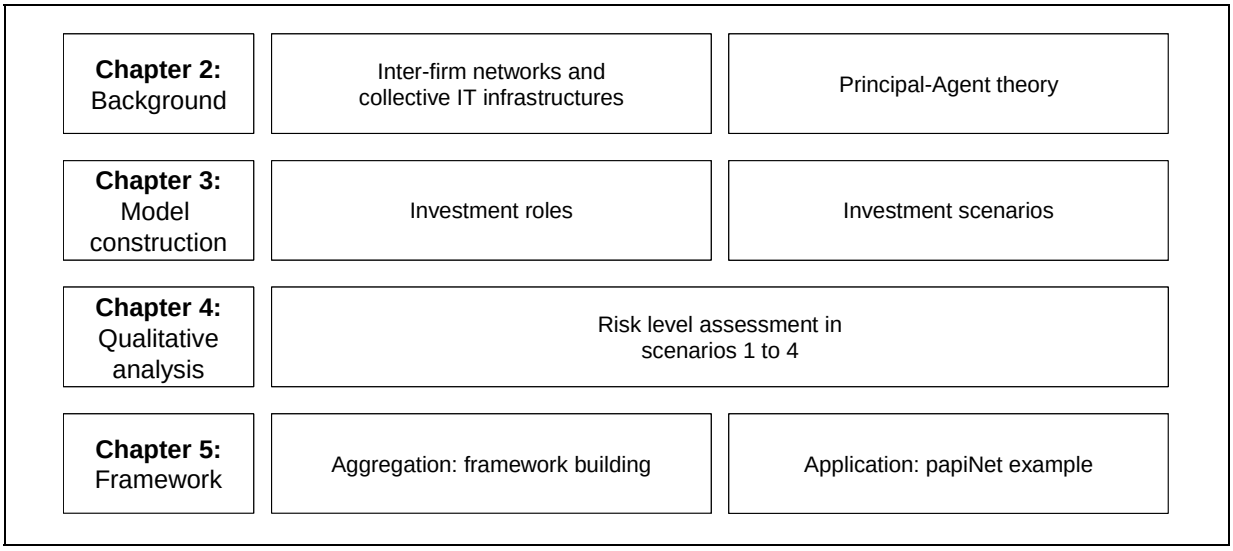


Figure 1.3/1: Main body of the thesis

2 Relevant background

2.1 Inter-firm networks and collective IT infrastructures

While cooperations between companies exist in manifold varieties (e.g. joint ventures, strategic alliances and inter-firm networks), definitions of and classification criteria for different types of cooperations are even more numerous. In general, however, most classifications include dimensions such as financial/legal independence of the participating partners, resource catenation, cooperation time/scope and size.

Inter-firm networks, which are also known as virtual organizations, value webs or modular production networks, possess several very particular characteristics in these regards (e.g. Miles/Snow 1986, Davidow/Malone 1992, Häcki/Lighton 2001, Hess 2002, Sturgeon 2002). First, the partners are financially and legally independent and

they do not primarily pool their resources (unlike setting up a joint venture where partners incorporate resources into a new firm). Second, unlike strategic alliances where cooperation is limited to a specific transactional aspect (e.g. 5 year preferred supplier relationships), inter-firm networks are not limited in time and cooperation scope. At the same time, every time an order arrives which is to be dealt with within the network, the configuration of the participating partners might change (see figure 2.1/1). Lastly, the number of participants in inter-firm networks can easily exceed 10 partners.

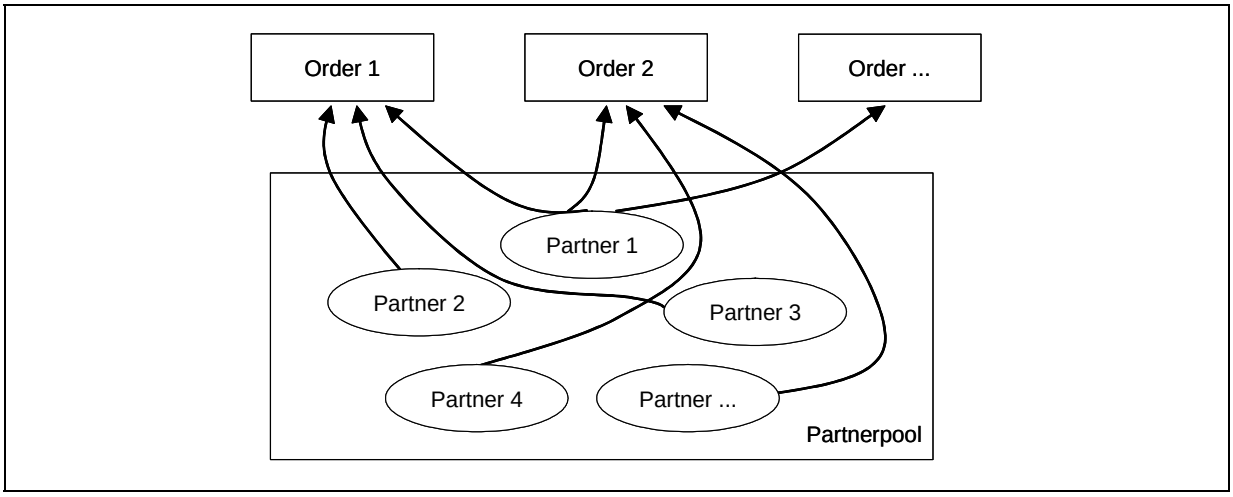


Figure 2.1/1: Order-based partner configuration (Veil/Hess 2002, p. 274)

An example of a global inter-firm network is the passenger airline association Star Alliance. Here, 16 financially and legally independent national carriers align their operations to jointly provide services to end customers. For example, passengers can travel across the entire Star Alliance Network using one single e-ticket. This was made possible by linking the individual carriers' IT systems via Star Alliance's collective IT infrastructure, StarNet. Benefits include reduced complexity, improved customer service and lower costs for member carriers.

As indicated in the Star Alliance example, collective IT infrastructures will typically not be set up in greenfield projects. Rather, the individual partners' systems will be integrated in one form or another. Methods and standards for integrating IT systems are hotly debated in practice and research and include EDI, XML, decentralized EAI, hub-and-spokes EAI, web services and central databases. Within these technologies and methods, two architectural approaches can be differentiated: centralization and decentralization. For instance, hub-and-spoke EAI (a middleware including adaptors, transformation services and process management tools) and collective databases represent centralized architectures while changing to a common standard counts to-

wards the other option. Still, they all constitute investments into relationship-specific IT. The IT options' common characteristic is that they all serve as a common infrastructure set between enterprise-wide and public infrastructures (for a categorization see Weill/Subramani/Broadbent 2002).

While all network partners face classical investment problems such as project uncertainty and the specificity of the investment object, special problems arise from the intentions and actions of the every single network partner. Wohlgemuth/Hess (2003) have identified partner uncertainties (about their actions and potentials) and opportunity costs as major influences on network-specific investment risk. These risks can be analysed with the help of Principal-Agent theory.

2.2 Principal-Agent theory

Principal-Agent (PA) theory is part of the new institutional economics and has several early contributors including Spence/Zeckhauser (1971), Ross (1973) and Jensen/Meckling (1976). A PA relationship is defined "as a contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf which involves delegating some decision making authority" (Jensen/Meckling 1976, p. 308). Today, in essence, PA theory deals with problems which arise whenever the principal cannot perfectly and costlessly assess the agent's action and information ("which is almost always the case", Pratt/Zeckhauser 1985, p. 2) and the agent derives **scope for opportunistic behavior** from this information asymmetry.

In the tradition of new institutional economics, PA theory assumes bounded rationality and individual utility maximization. The information asymmetry (→ bounded rationality) between principal and agent leads to a discretionary scope for autonomous and therefore opportunistic behavior on the agent's side (→ utility maximization). Such situations typically exist in buyer-supplier, owner-manager and venture capitalist-investee but also in landlord-tenant or doctor-patient relationships (Wigand/Picot/Reichwald 1997). As PA is a basic economic theory, it can explicitly be **applied to any social situation** (Ross 1973). Naturally, one person can find himself in numerous PA relationships, acting as principal in one, as agent in another context or even as principal *and* agent in reciprocal relationships (Pratt/Zeckhauser 1985).

When trying to reduce the uncertainties the information asymmetry poses, principals incur monitoring expenditures while agents have to commit resources to bonding. In addition, certain transactions do not take place which would have been beneficial to overall welfare (residual loss). These three items add up to Agency-costs which differ among organizational arrangements (Jensen/Meckling 1976).

In detail, three problems (which represent the dependent variables of this study) emerge from the underlying information asymmetry: (1) **hidden action** (2) **hidden intention** and (3) **hidden characteristics** (Wigand/Picot/Reichwald 1997).

(1) After the contract has been signed the principal cannot observe or judge the agent's efforts (hidden action) and the agent can maximize his utility at the expense of the principal. This phenomenon is known as "**moral hazard"**.

(2) In addition, the post-contractual intentions of the agent remain hidden. As the principal ex-ante advances resources (constituting sunk costs) to enter a *specific* relationship, he is then dependent upon the agent. Ex-post, he can observe the agent's actions but cannot change them. The resulting scope for opportunistically exploiting this dependency is categorized as "**hold up"**.

(3) Hidden characteristics are based on the assumption that the principal cannot accurately judge the quality of the agent's offer before the contract is signed. The key problem with hidden characteristics is not primarily opportunistic behavior itself but the information asymmetry's final consequence: it results in **adverse selection**, where unfavorable agents chosen which will, in extreme cases, lead to the closing of markets. By now, numerous tested strategies for reducing pre-contractual information asymmetries exist. But as the problem's focus is not on opportunism itself, hidden characteristics **will not be pursued further** in this thesis.

In general, Principal-Agent theory can be used to explain (positive analysis) or to design (normative analysis) such relationships. In **normative analyses**, recommendations are put forward as to which institutional arrangement is to be chosen (depending on agency-costs). In this paper, a **positive analysis** is conducted as institutional arrangements seem to be very hard to establish (see governance, section 1) and hence the degree of opportunistic scope of different options is to be measured. Also, escalated complexities in Principal-Agent relationships such as multiple principals, multiple concurrent tasks and reciprocal and recurrent relationships (as found inter-firm networks) can typically not be grasped in normative analyses (Göbel 2002).

3 Model construction

As indicated in chapter 2.2, Principal-Agent relations can be quite complex as they might encompass multiple agents and multiple principals and even be reciprocal (Grossmann/Hart 1983, Pratt/Zeckhauser 1985, Arrow 1985, Wigand/Picot/Reichwald 1997). Therefore, when analysing relationships in terms of Principal-Agent theory, it is imperative that all relevant roles of the participating players are clearly stated from the beginning. In order to supply a starting point for the following positive analysis, this chapter will first give an **overview of the relevant roles** and then detail how these roles are distributed amongst the participants in **four relevant scenarios** which represent the indepent variables of our analyis.

3.1 Investment roles

In the case of collective IT investment, **three roles** can be identified. One company might take on several roles; one role can be taken on by many companies.

- **Beneficiary:** Any network member who links up to the collective IS in order to benefit from using it. Beneficiaries do not necessarily have to invest into the collective IS.
- **Investor:** Any network member who actively designs and pays for setting up and running the system and benefits from using it himself and/or others using it. Investors hold most property rights to the system (system owners). If there are multiple investors, the total cost of the system is shared; if only one partner invests, he carries the total cost himself.
- **Supplier:** The institution which sets up and runs the system. Depending on the architecture/sourcing option chosen, suppliers can either be all investors, one/a small group of investors or an external supplier.

Relevant players can be clearly identified in all collective IT investments, an interesting example being the **papiNet** integration project. papiNet set out as a global transaction standard initiative and can now be regarded as an inter-firm network in our terminology (due to flexible production configuration, legal and financial independence of the partners, high number of partners and unlimited cooperation scope; see chapter 2.1). In June 2001, all major papiNet partners (a group of 80 print-media companies including publishers, printing shops, logistics companies and paper manufacturers) introduced ebXML-based communication software: Ponton X/P. This software (legacy system adaptors + messenger) is based on open-source products, but had to be customized to match industry processes. Development costs were

completely covered by the paper manufactures, whilst customization itself was outsourced to Ponton Consulting. Cleary, all network members who introduce this decentralized collective information system gain benefits from it in terms of process and resource economies (**beneficiaries**). At first, the paper manufacturers designed and paid the system (**investors**) but also benefit from the linking up to it (**beneficiaries**). Ponton Consulting, which developed the system, was the **supplier** of the collective IS at this stage of the project.

Figure 3.1/1 depicts an overview of the Principal-Agent relationships players can find themselves in. While the problems within these relations will be discussed in more detail later, this first classification is needed for describing important scenarios.

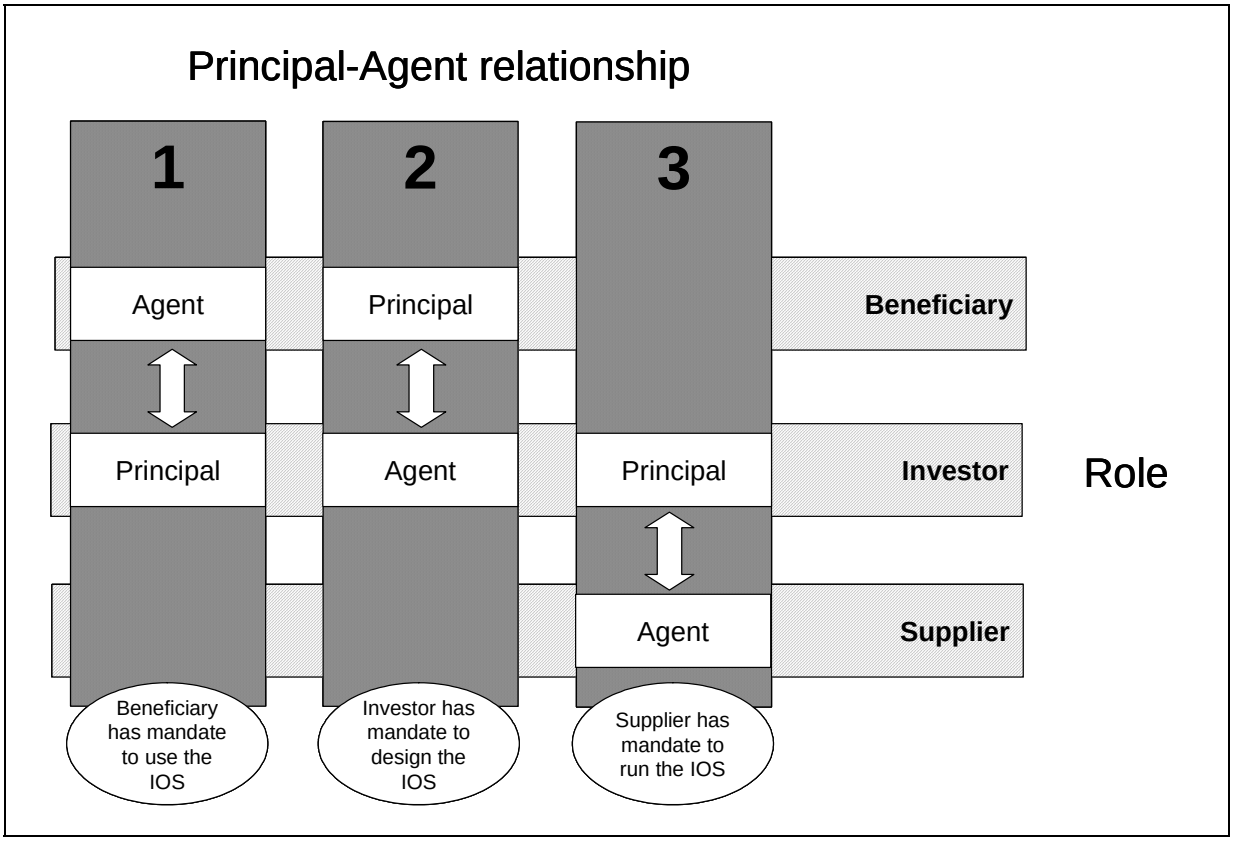


Figure 3.1/1: Generic Principal-Agent map for collective IT investment

- **PA-relationship 1:** A collective IS generates value only if enough network partners (beneficiaries) participate. So, once the investors have committed their resources to the investment (and have hence incurred *sunk costs*), they are dependent on the other network members to take part in the collective IS. If all investors are also beneficiaries, all network members are principals and agents to each other in this respect.

- **PA-relationship 2:** At the same time, in order to secure participation of enough beneficiaries, the investor must build an IS the partners agree with. In other words, the investor is commissioned to design and build an IOS on behalf of the participating partners. If all beneficiaries are also investors, all network members are principals and agents to each other in this respect.
- **PA-relationship 3:** The investor-supplier relationship is PA-classic. The investors select a supplier (network partner or external institution) to set up and run the collective IS. During the selection phase, investors incur transaction costs. Once the supplier (agent) is selected, the investors (principals) pay the supplier for setting up and running the IS.

While relationship 3 is quite intuitive, the Principal-Agent reciprocity modelled in relationships 1 and 2 might need a more detailed derivation. As stated at the beginning of this section, economists have long claimed that Principal-Agent relationships can be reciprocal and that it is hence both possible and reasonable to model these relationships in both directions. Several authors have operationalized the concept of PA double-sidedness. For example, Reid (1977), Rubin (1978) and Bhattacharyya/Lafontaine (1995) have expanded on double sided moral hazard in situations such as sharecropping and franchising. They conclude that when moral hazard is analyzed in both directions, relevant economic optima change. Casamatta (2003) formally analysed double moral hazard between venture capitals and investees and derived optimal contracts between the parties while Fink (2002) examined double hold-up and double moral hazard in corporate venture cooperations. Before that, Block/MacMillan (1993) came across the phenomenon in extensive empirical studies on all internal corporate venturing. In respect to information systems development, Wall (2003) analyzed Principal-Agent roles in a three player environment and found that the IS itself changes information asymmetries amongst the relevant actors.

3.2 Investment scenarios

One can easily spot that analogously the PA-relationships modelled here bear great potential for opportunistic behaviour. However, the degree of discretionary scope for opportunistic action varies depending on how the investment atmosphere is shaped. The optimal shape of that atmosphere for a company depends on its individual position within the network, or, in other words, the role it takes on (Baker/Gibbons/Murphy 2002). When considering information asymmetries between the parties, the question is to what extent the participants take on all roles or to what extent the roles are divided amongst individual parties. The differentiating criterion between beneficiary and

investor is optional investing (beneficiaries can, but do not necessarily have to invest). If suppliers are external to the network, they are separate entities with own information levels. If suppliers are internal, roles are combined. Hence, four possible scenarios can be identified (graphically depicted in Figure 3.2/1) which differ by the amount of partners who incur expenditures for designing, setting up and running the IOS (all partners or only a fraction of the partners) and how the IOS is sourced. In the following chapter, the two potential information asymmetries (hidden action, hidden intention) will be discussed in regard to the three Principal-Agent relationships in all four scenarios, the central measure being the risk for opportunism. Every scenario ends with a short conclusion and a summary of the risk levels identified.

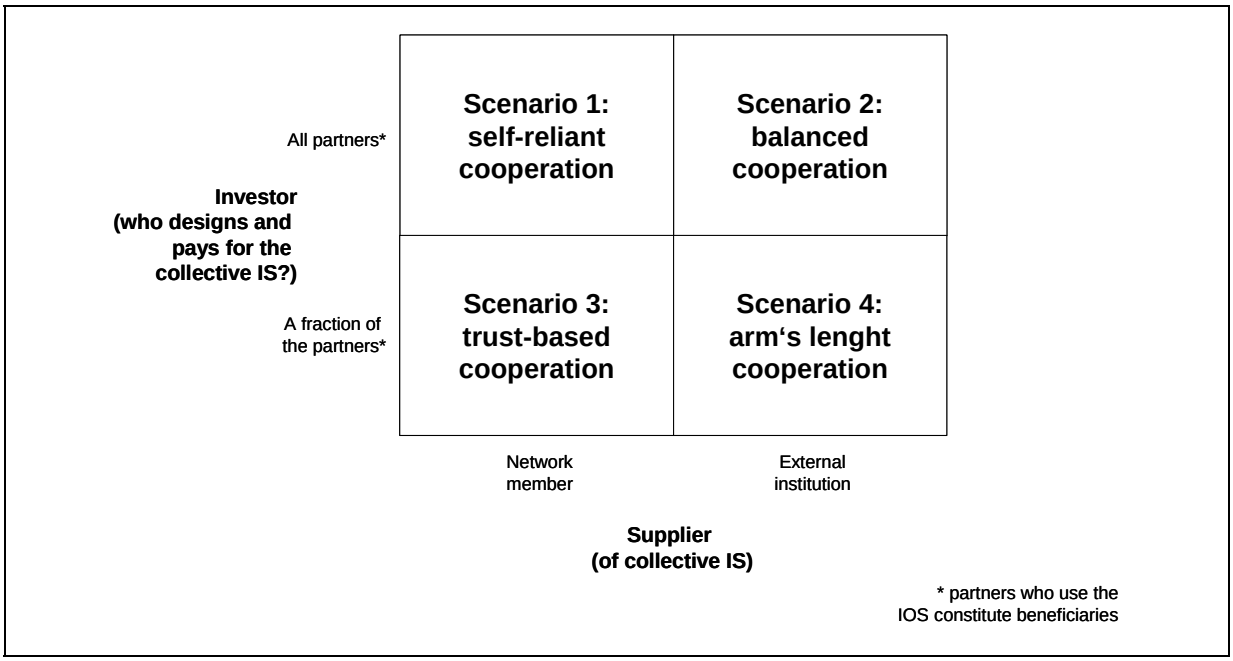


Figure 3.2/1: Principal-Agent scenarios in collective IT investment

Certainly, a PA-relationship also exists between beneficiaries and suppliers. However, as the relationship between investing beneficiaries and suppliers is already modelled in PA-relationship 3 and as a central difference between scenarios 2 and 4 lies in cutting off non-investing beneficiaries from suppliers this scenario is not analysed in detail.

4 Qualitative analysis of collective IT investment scenarios

As a third step of operationalization, the structured qualitative analysis is now turned to. In detail, the analysis shows how the “values” of the independent variables (i.e. the opportunism risk levels due to the two relevant information asymmetries hidden action and hidden intention) differ by different instances of the dependent variables (all three Principal-Agent relationships in all four scenarios).

The risk for opportunism constitutes the central efficency measure and is recorded on a **three point scale**: low, medium and high. Initially, every risk is considered to be low. If a relevant **information asymmetry** exists, the risk level rises to medium. If the agent also has a realistic **incentive to behave opportunistically**, the risk level is considered to be high. On some cases, agents might have a strong incentive but only little scope (derived from an information asymmetry) to behave opportunsitcally. In these cases, a medium risk level is recorded. Every scenario ends with a short conclusion and a summary of the risk levels identified.

4.1 Scenario 1: self-reliant cooperation

In the first scenario, all network members ex-ante agree to invest into the collective IS – they are all beneficiaries and investors at the same time and hence everybody has to rely on everybody else. The interorganizational system (IOS) is run by one (centralized architecture) or all (decentralized architecture) network partners.

Risk 1: Hidden action/moral hazard

Relationship 1: Grave hidden action information asymmetries exist in this investor (principal) - beneficiary (agent) relationship. The central moral hazard feature here is known as **free riding**, was first focused by Holmstrom (1982) and has been attributed to inter-firm networks by Rokkan/Buvik (2003). In our context, free riding denotes a situation where network members enjoy access to the common good (IOS) without having to bear the full costs: either an investor understates his benefit derived from the IOS and pays less or the ex-ante investor changes his mind and refuses to pay at all. The free riding partner can do so as a) partners cannot adequately judge the utility to the free rider and hence cannot know that he is free riding and b) the utility of the IOS depends on all partners participating, and hence the network members will not always exclude the free rider from using it. However, investors will only invest if they expect an individual positive return and that return is in a fair relation to the returns the other investors receive (Wohlgemuth/Hess 2003). Fundamentally, investors find themselves in catch 22: while they are basically willing to pay for a collective service, they have an incentive to engage in free riding as they could potentially yield

higher returns. In consequence, reserved participation in the investment can lead to an inadequate IOS or even inhibit its installation. In summary, as an information assysemtry exists along with a suitable incentive for the agent, **investors** are confronted with a **high risk due to potential free riding**.

Relationship 2: When all beneficiaries invest, they are all actively involved in designing the collective IS. Therefore, **no relevant information asymmetries** exist in this respect. If an ex-ante investor chooses to free ride and hence decides to not take part in the design process, neither his nor the network's utility is notably reduced as the typically large number of partners in a network is still likely to agree on a suitable IOS. The **risk for opportunistic behavior is low**.

Relationship 3: Depending on the architecture of the IOS, different PA-problems arise. In **decentralized settings** (e.g. adaptation of a standard or decentralized EAI (see papiNet example)), there is **no scope for hidden action** as diverging from the agreed standard or IT component will heavily diminish the utility to the deflecting supplier/investor, but not to the entire network (→ **low risk**). If too many suppliers/investors deflect, the standard is de facto not introduced; the problem here, however, is rather not a typical investor-supplier but a beneficiary-investor problem. The picture is different in **centralized architectures** (e.g. hub-and-spokes EAI, collective physical databases). Here, the investors pay lump sums for IOS access. The supplier/investor himself will not agree to purely transaction-based access-fees, as he would incur sunk costs and he is uncertain whether the beneficiaries will really invest into the system (a hidden intention problem, see relationship 1 below). Anyway, the actions of the network-internal supplier remain hidden. He can reduce his efforts on the IOS (and hence his costs and the quality of the IOS) without the other partners being able to directly attribute their reduced utility from the lower-quality IOS to the internal supplier. The **internal supplier** hence has an incentive to behave opportunistically which results in a **high risk** for opportunistic behavior due to hidden action information asymmetries.

Risk 2: Hidden intention/hold up

Relationship 1: If all beneficiaries invest, no hold up problems occur. If, however, moral hazard (in the shape of free riding) sets in, investors will have high **sunk costs** and will then be dependent on the participants. To minimize the information assymetry, risk, investors will ex-ante pool their payments for setting up the system and not agree to ex-post usage-based fees only. While the information asymmetry can be notably reduced this way, agents have a strong incentive for behaving opportunistically. Therefore, this relationship is rated with a **medium risk** level. Originally, however, this is a scenario 3 hold up problem, and will hence be detailed in chapter 4.3.

Relationship 2: When all beneficiaries invest, no hold up problem occurs as the dependency on setting up a suitable IOS is mutual. In free riding situations, the problem again lies in the reduced financial and factual participation in the IOS and therefore the reduced ex-post utility of the system. Again, a **medium risk** due to sunk costs exists; as this is also a typical scenario 3 hold up problem, please also refer to that chapter.

Relationship 3: The key factor determining hold up problems in investor-supplier relationships is **transaction specificity**. Typically, inter-firm network IT is considered to by highly specific (e.g. common standards, common databases, etc.). From an ex-ante hidden intention perspective, however, this is not necessarily the case: as there can be an intense market-based competition for the contract, the economic specificity of the transaction is relatively low. Once the supplier is chosen, however, a **fundamental transformation** occurs (Williamson 1985): with the supplier building up idiosyncratic knowledge about the network he gains advantages over competitors which they cannot catch up. This way, an ex-ante starting position with low specificity can, over time, lead to a monopoly-like exchange situation.

Again, we have to distinguish between architectural variations. In **decentralized solutions**, the investors set up and run their IT themselves. A constellation where investor and supplier are one and the same institution does not represent a Principal-Agent relationship. Still, investors are dependent on other network partners to introduce the relevant components in their companies. **Hold up exists and can be classified as a medium risk** as, on the one hand, the asymmetry exists but on the other hand investors have no real incentive to change their mind and simply not introduce the decentralized IOS at all. However, **hold up is much stronger in centralized architectures**. In these cases, investors have incurred sunk costs (lump sum payments; see relationship 3 above). The intentions of the one supplying investor remain hidden. If the supplier/investor now exploits his opportunistic scope for action, the other investors can only do little about it. As discussed earlier, they cannot always clearly observe the opportunistic behavior. If they can observe it, the deflecting investor/supplier will probably be punished by a lower reputation within the network (Wittenberg/Hess 2002). The deflecting investor might therefore a) not be chosen as an IT supplier in the future and b) not obtain as many orders within the network. The investor/supplier will not mind consequence a) too much as IT provision is not his business. Consequence b) might be more of a deterrent; depending on the degree of observable opportunistic behavior, the investor/supplier might not even get a single order from within the network. Still, there is great potential for opportunistic behavior as the IOS was planned with him definitely taking part. If his skills and special resources are lost, the investments into the network (IOS and other) might have been in vain. For example, if a supply chain champion behaved opportunistically in this respect,

the network partners would still cooperate with him because they are strategically dependent on him (e.g. he holds central “property rights” to the Information System; see Alchian/Demsetz 1972 or Furubotn/Pejovich 1974 on property rights). Therefore, in this constellation, hidden intentions lead to a very **high risk** for opportunistic behavior in this constellation.

Summary of scenario 1

If a centralized architecture is to be introduced, scenario 1 is very risky for investors who do not act as suppliers at the same time. By definition, this scenario does not have beneficiaries who are not investing at the same time. If, however, investors choose to free ride and de facto become beneficiaries only, they can do so quite easily. Table 1 summarizes these findings.

Relationship	Risk for opportunistic behavior due to		Risk summary
	Hidden action	Hidden intention	
1 Principal: **Investor** Agent: Beneficiary	High	Medium	↗
2 Principal: **Beneficiary** Agent: Investor	Low	Medium	↘
3 (decentralized arch.) Principal: **Investor** Agent: Supplier	Low	Medium	↘
3 (centralized arch.) Principal: **Investor** Agent: Supplier	High	High	↑

Table 4.1/1: Summary of analysis for scenario 1

4.2 Scenario 2: balanced cooperation

Like in the scenario just described, all network members ex-ante agree to bear their share of the costs of the collective IS. Again, all beneficiaries are also investors. Unlike scenario 1, however, the supplier is a company *external* to the network. In other words, the collective IS was sourced "in-network" in scenario 1 and is now being "**outsourced**" in scenario 2. The three roles identified earlier are distributed to a balance which reduces infighting. One central difference for our analysis is that external providers allow usage-based fees (such as application service providers / ASPs).

Risk 1: Hidden action/moral hazard

Relationship 1: As in scenario 1, **free riding** is a major topic in this setting and can, in extreme cases, lead to an inadequate IOS or even inhibit its installation. When entering an outsourcing relationship, both the provider and the investor incur information and communication costs during the initiation, negotiation, settlement, adaptation and control of the exchange (commonly known as transaction costs, Williamson 1975). The provider will add his transaction costs to the price he charges. The investors have to add their transaction costs to their net expenditure for the IOS. When an ex-ante investor deflects and chooses to free ride, he can examine the negotiated contracts after the process has ended. If he favors the contract, he can realise it without incurring as high transaction costs. If he considers the conditions to be inappropriate, he can either not introduce the IOS at all or negotiate his own contract. He defers his decision to participate into the future without taking extra risks. The **reduced transaction costs** and his **real option to defer the investment** both constitute potential extra utility and hence an incentive to the agent. In addition, typical outsourced IT is highly standardised. As the outsourcing contracts themselves reflect this feature, network partners can more easily deflect from the group of original investors. Hence, sourcing an IOS externally when all beneficiaries ex-ante agree to be investors even **increases the danger of free riding** due to standardised contracts. Therefore, the **risk** for opportunistic behaviour due to moral hazard is considered to be very **high**.

Relationship 2: As all beneficiaries invest and hence take part in system/outsourcing contract design, information asymmetries can be ruled out. When an ex-ante investor chooses to **free ride** and become a beneficiary only, he could still be quite sure to obtain access to an appropriate IOS due to the high degree of standardization. But at the same time, this goes for the remaining investors. Hence, the information asymetry has no real effect and the agents have no strong incentive. Therefore, the **risk** level can be regarded as **low**.

Relationship 3: If an external entity sets up and runs the IOS, a hidden action information asymmetry initially arises between the investors and the supplier. While the supplier's performance can be measured and management through Service-Level-Agreements, the inter-firm network looses control over *how* the IOS is run (e.g. what happens to externally saved data). Still, as external suppliers typically handle several clients, the information asymmetry is notably reduced (all clients undertake *monitoring* to some extent) and the supplier's incentive to behave opportunisticall is diminished as follow-up contracts are dependent on this reputation. In addition, the more standardized and the more centralized an outsourced IOS is, the lower monitoring costs to the individual partners are. Therefore, moral hazard is unlikely which leads to a **low risk** for opportunistic behavior.

Risk 2: Hidden intention/hold up

Relationship 1: Similar to scenario 1, there is no hold up if all beneficiaries invest. In the case of free riding, sunk costs are the key issue again. In this scenario, however, it is the external supplier who carries the biggest part of the original investment. The **sunk costs** network investors incur are transaction costs which are far lower than the costs of the original investment. While the information asymmetry exists in an alleviated form due to the supplier's reputation effects, the relatively low sunk costs the investors incur lead to low incentive and therefore to a **low level of risk** in this relationship.

Relationship 2: No risk can be identified when all beneficiaries invest. In **free riding** situations, the reduced functionality due to free riders not taking part in the design process of the IOS can be considered minimal (see relationship2 above). Analogously, the **risk** is **low**.

Relationship 3: As described earlier, **transaction specificity** is the key variable in this relationship. When sourcing externally, **specificity is likely to be reduced** for two reasons: Investors have an interest in standardized systems as they want to be able to source the IOS from another supplier and hence **reduce the risk for fundamental transformation**. Suppliers have an interest in standardized systems as they want to be able to sell the same resource to other customers. Even if suppliers do not agree to/cannot offer a standardized system, the hold up is low due to reputation effects. As a supplier's key business is IT provision, reputation loss would directly affect his business. In other words, the supplier incurs signaling costs by not behaving opportunistically and, this way, builds up his reputation.

Even when taking into consideration that the externally sourced system can have different levels of specificity, the **risk** for hold up is regarded to be rather **low**.

Summary of scenario 2

In comparison to scenario 1, the risk for opportunistic behavior is notably reduced. This is particularly true for a reduced risk for sunk costs and a lower probability of opportunistic behavior on the supplier's side. However, the potential free riding of ex-ante investors is facilitated. Table 2 summarizes the evaluation carried out in this chapter.

Relationship	Risk for opportunistic behavior due to		Risk summary
	Hidden action	Hidden intention	
1 Principal: **Investor** Agent: Beneficiary	High	Low	→
2 Principal: **Beneficiary** Agent: Investor	Low	Low	↓
3 Principal: **Investor** Agent: Supplier	Low	Low	↓

Table 4.2/1: Summary of analysis for scenario 2

4.3 Scenario 3: trust-based cooperation

In scenario 3, only a fraction of the network partners invest into the IOS. In contrast to scenarios 1 and 2, the fact that several beneficiaries do not invest is planned from the outset and is therefore not considered to be free riding. Still, both the investors and the beneficiaries have to rely on the each other to a) install an appropriate IOS and b) use it once it is operational.

Risk 1: Hidden action/moral hazard

Relationship 1: When network partners invest into an IOS, they rely on their non-investing partners to participate in the system as only then their **individual utility** and in turn network welfare can be increased. Whether or not beneficiaries use the system can be easily observed. What cannot be observed is whether the investors-beneficiaries commit enough resources in relation to their benefits (see chapter 4.1). The **free riding** problem, as discussed earlier, exists in an alleviated form. However,

when taking into account the very high level of risk identified in scenario 1, the **risk** for hidden action in this relationship can be classified as **relatively low**.

Relationship 2: Moral hazard can occur when the beneficiaries cannot observe how the system is designed by the investors. As the investors have supervised the implementation of the relevant software, they also hold the rights to change order allocation algorithms and the like. This also holds true for decentralised systems: remote updates introduce these changes into the decentralized systems. In general, investors can easily generate extra utility by designing a system specifically for their goals rather than those of the entire network. The lack of controllability of the investors hence poses a **high risk** to the non-investing beneficiaries.

Relationship 3: In a decentralized IOS, both investors and non-investing beneficiaries run the relevant components themselves. The investors cannot know whether the partners run and use the system the way it was planned (depending on the system rights). Still, investors can observe whether the system is being used at all. And as a **decentralized** system is relationship-specific to a great extent due to specific adaptors and workflows, the scope for other beneficiaries/supplies using it differently is smaller and hence the **risk** for opportunistic behaviour is relatively **low**. In **centralized** architectures, the problem takes a different shape. Again, the actions of the network-internal supplier remain hidden. The effect this phenomenon has was discussed in chapter 4.2/risk 1 and was determined to constitute a **high risk**.

Risk 2: Hidden intention/hold up

Relationship 1: As IOS are often useless for tasks other than enabling the cooperation, the profitability of an IOS depends on the participation of enough partners. After designing and paying for the system, investors become dependent on the beneficiaries as they have incurred **sunk costs**. The beneficiaries are not constrained to using the system and in fact might threaten to join a different inter-firm network and in turn start demand even better conditions or. In turn, the specificity of the IOS leads to a **high risk** for the investors due to the beneficiaries' hidden intentions.

Relationship 2: Non-investing beneficiaries hold only little property rights to the IOS. As indicated before, their rights are mostly limited to using the system. Besides the hidden action problem discussed earlier, the hidden intentions of the investors are also a relevant factor. So if the beneficiaries can observe opportunistic behaviour (such as the investors changing specifications and workflows), they might still have to stick to the modified IOS as they a) have incurred sunk costs in the form of opportunity cost (such as not taking part in other ventures) and b) are in a strategic dependency as their right to access the IOS can easily be withdrawn by the investors. In summary, the **risk** for beneficiaries is very **high**.

Relationship 3: The risk profile in this scenario/relationship is very similar to that of chapter 4.1. In **decentralized solutions**, the investors have to rely on the non-investing beneficiaries to run their part of the IOS themselves. Hold up exists and was classified as a **medium risk**. In **centralized layouts**, again, reputation effects set in as a moderating variable. However, due to strategic dependencies, an internal supplier can more easily behave opportunistically. For example, once the system is in use, the supplier can increase his prices due to lock-in effects. In summary, hidden intentions lead to a **high risk** for opportunistic behavior in this constellation.

Summary of scenario 3

In scenario 3, non-investing beneficiaries are exposed to a high risk of opportunistic behavior. This results from their limited property rights to the system. While they do have expenditures for the IOS as such, they incur opportunity costs and potentially enter a strategic dependency. Investors themselves are dependent on the non-investing beneficiaries to use the IOS as they have also incurred sunk costs. The risk for being exploited as an investor is high if one of the investors runs the centralized IS by himself. Decentralized IS pose a relatively low threat to investors.

Relationship	Risk for opportunistic behavior due to		Risk summary
	Hidden action	Hidden intention	
1 Principal: **Investor** Agent: Beneficiary	Low	High	→
2 Principal: **non-investing Beneficiary** Agent: Investor	High	High	↑
3 (decentralized arch.) Principal: **Investor** Agent: Supplier	Low	Medium	↘
3 (centralized arch.) Principal: **Investor** Agent: Supplier	High	High	↑

Table 4.3/1: Summary of analysis for scenario 3

4.4 Scenario 4: arm's length cooperation

As in scenario 3, deliberately only a fraction of the network partners invest into the IOS. The supplier is external to the network. Hence, the distance between non-investing beneficiary and supplier is increased.

Risk 1: Hidden action/moral hazard

Relationship 1: The risk for moral hazard (originating both from investing and non-investing beneficiaries) can turn out to be slightly higher than in scenario 3 as the utilization statistics lie with the external provider. The investor is still dependent on the other partners' participation. However, outsourcing agreements typically include precisely defined service level agreements which are constantly monitored. In less professionalized sourcing options (such as souring the IOS in-network) contract control and hence service levels reviews might not be performed as precisely. In summary, the **risk** for hidden action in this relationship can still be classified as relatively **low**.

Relationship 2: As in scenario 3, the non-investing beneficiary cannot observe how the investors design and manage the IOS. They only have little influence on supplier selection. In addition, non-investing beneficiaries have no means for controlling the agreements between investors and suppliers which will almost certainly increase the investors' utility. Hence, the **risk** for non-investing beneficiaries must hence be classified as **high**.

Relationship 3: Again, standardization leads to reduced scope for hidden action on the suppliers' side (see chapter 4.2). Costs for monitoring, however, are now shared amongst fewer partners. As a result, the total monitoring efforts might be reduced which in turn leads to additional scope for opportunistic behavior which leads to a **medium risk** categorization only, as reputation effects on the supplier's side work against his incentive to exploit his opportunistic scope of action.

Risk 2: Hidden intention/hold up

Relationship 1: Parallel to relationship 3, investors have to rely on beneficiaries to use the system once it is online. Sunk costs can lead to hold up; however, now the external supplier carries the biggest part of the initial costs. The **sunk costs** network investors incur are transaction costs which are far lower than the costs of the original investment. Still, the IOS which is being designed by the investor has a higher chance of not meeting the standards of a large number of planned users as they are not involved in the design. The risk for sunk costs itself is elevated; in the context of

the relatively low sunk costs the investors incur, a **medium level of risk** in this relationship is identified.

Relationship 2: The risk level here differs only slightly from the preceding scenario. The beneficiaries still incur opportunity cost and are in danger of entering a dependency relationship. Unlike in the previous scenario, they now do not even have a direct contact to the supplier; intentional changes in workflows, service levels, etc. can now not directly be attributed to either the implementing supplier or the designing investor. The **risk** must therefore be classified as **high**.

Relationship 3: Hold up in external sourcing options was already discussed in scenario 2 (see chapter 4.2). The risk levels here are perfectly the same, as the supplier's scope for opportunistic behavior is again reduced by standardization and reputation effects. Hence, the **risk for hold up** is regarded to be rather **low**.

Summary of scenario 4

Non-investing beneficiaries are again exposed to a high risk of opportunistic behavior because of their limited property rights to the IOS. They incur opportunity costs and potentially enter a strategic dependency. Investors themselves are dependent on the non-investing beneficiaries to use the IOS as they have also incurred sunk costs. In comparison to scenario 3, outsourcing the IOS is particularly useful when centralized architectures are planned.

Relationship	Risk for opportunistic behavior due to		Risk summary
	Hidden action	Hidden intention	
1 Principal: **Investor** Agent: Beneficiary	Low	Medium	↘
2 Principal: **non-investing Beneficiary** Agent: Investor	High	High	↑
3 Principal: **Investor** Agent: Supplier	Medium	Low	↘

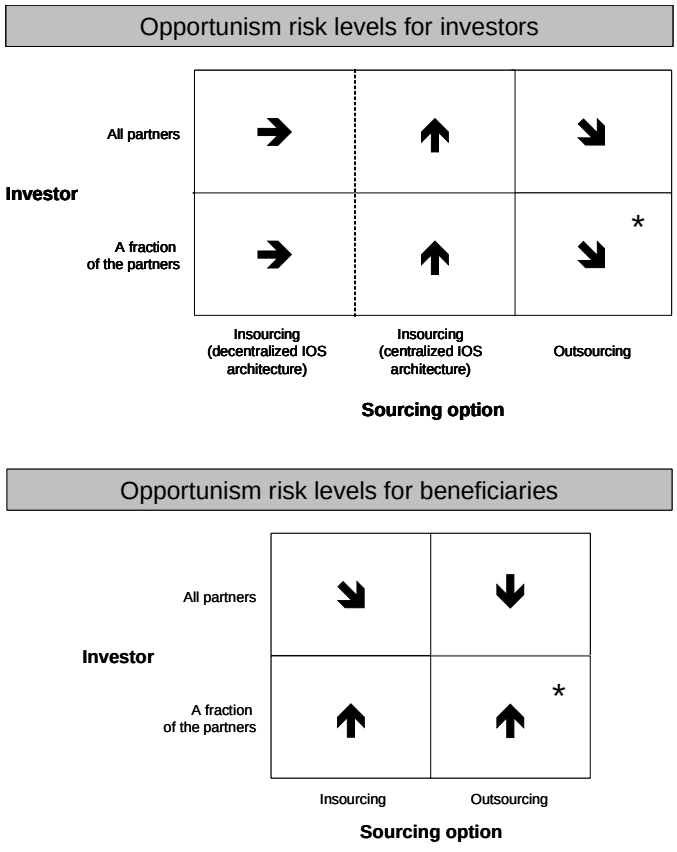
Table 4.4/1: Summary of analysis for scenario 4

5 Risk assessment framework

5.1 Aggregation: framework building

In summing up the detailed analyses found in the preceding chapter, a comprehensive framework for assessing opportunism levels of specific IOS investments was developed. The framework allows any network member to quickly read off the risk for opportunism he faces with different IOS alternatives. In this respect, we have to distinguish between the risks investors and the risks beneficiaries face. As discussed earlier, beneficiaries might not have direct expenditures for the IOS but they do incur opportunity costs and are endangered of entering strategic dependencies.

The final risk assessment framework is depicted in Figure 5.1/1.



* Reading example: when only **a fraction of the partners** can be counted towards the **investors** and **outsourcing** is chosen as the IOS **sourcing option**, investors face a relatively low risk for opportunism whereas beneficiaries are confronted with a high risk level.

Figure 5.1/1: Risk assessment framework

The framework was derived by aggregating the discussion's results in two stages. First, the summarizing tables of chapter 4 were restructured to reflect a management setting. While the discussion leads to scenario summaries, a management framework must take on a stakeholder-based view. Hence, the risk levels assessments have to be carried over into risk assessment frameworks for investors and beneficiaries respectively. Once this restructuring had finished, the risk levels were aggregated and averaged in order to reduce complexity. The risk levels shown can easily be reconstructed from the summary of analysis for the individual scenarios. For example, when all partners invest and the IOS is outsourced (scenario / chapter 4.2 / table 4.2/1), the investors' risk is aggregated to ↘. This rating is averaged from to the investors' opportunism risks for relationship 1 (➔) and relationship 3 (🡻).

Also, a guide to the framework's application had to be developped. In essence, the application of the framework reflects the full operationalization process. But as the discussion has notably reduced the theory's complexity, its application is now considerably less time-consuming and less complex. The transformation led to 4 simple steps which must be followed when putting the framework to use.

Step 1 - Investigate the dimensions: First, a few basic facts must first be gathered on what the investment setting is like: all network members/a fraction of the network members invests, the IOS is sourced externally/internally and, if sourced internally, the proposed architecture is centralized or decentralized.

Step 2 - Choose your perspective: Then, participants must become clear about the roles they personally take on in the investment at hand which is not as easy as it seems. For example, whilst paying for the collective IS (making the company an investor), a company might want to retreat from designing the IOS. Their mindset is that of a pure beneficiary.

Step 3 - Map dimension values onto framework: With those easily observable facts, any IOS investment can be positioned within the risk assessment framework and the risk level can be read off.

Step 4 - Take corrective action if necessary: Once the risk levels for the individual participants are identified, they can be discussed within the network and, if risk is unequally distributed, a different IOS option could be chosen. Of course, the outcome of such discussions depends on factors such as strategies, negotiating power and risk aversions of the participants involved. Nevertheless, the framework can be useful for creating transparency in collective investments. So even if one partner insisted on keeping his opportunistic scope for action, his intentions would become clearer *before* the IOS was introduced which also constitutes a reduction of information asymmetries.

Overall, it seems that **outsourcing when all participants invest** is the **dominant risk management strategy**. Investors reduce their risk levels by outsourcing set up and running of the IOS. (This result does not contradict Currie/Willcocks (1998) claims on client/supplier interdependencies in outsourcing contracts as insourcing in this context describes in-network, not in-house sourcing.) In terms of risk, they are indifferent whether all or only a fraction of the partners invest. To beneficiaries, on the other side, it is highly advisable to participate in the investment from the outset. When beneficiaries invest, their risk levels are reduced by outsourcing (see investors). Only if beneficiaries do not invest, the risk level does not change with outsourcing.

5.2 Applying the framework: papiNet revisited

In the beginning of chapter 3.1 the IOS introduction within papiNet was briefly introduced. This section will now shortly expand on this example and then demonstrate the application of the framework just developed.

The aim of the integration project was to allow electronic execution of typical industry processes within this international 80 company inter-firm network (comprising publishers, printing shops, logistics companies and paper manufacturers). The paper manufacturing industry was the driving force of the project. After collectively defining industry-wide business processes, ebXML-based document descriptions were agreed on. Subsequently, a communication software (including workflow descriptions) was developed by Ponton Consulting on behalf of the paper manufacturing industry (which also carried the development costs). The implementation and running efforts (and costs) were then individually shouldered by all partners. Whenever changes are made to the communications standard (forwarded by the paper manufacturing industry), they are subject to a public review and comment period. Only after that period (and revisions to the changes if needed) the changes take effect.

The classifications in this case are interesting as they are different for two phases: A) the first development of the system and B) the actual implementation of the system. In phase A), merely the paper manufacturers can be counted towards the original investors, while in phase B) all participants invested. Still, in phase B, design initiatives lie with the paper manufacturers while all others merely pay for IOS participation. While all invest, only the paper manufacturers have an investor mindset. Table 5.2/1 provides a summary of the relevant classifications for steps 1 and 2.

	Phase A	Phase B
	Step 1 - Investigate the dimensions	
Investors	Fraction (Paper manufacturers)	All
Supplier	Outsourcing partner	Network partners
System architecture	Decentralized	Decentralized
	Step 2 - Choose your perspective	
Investor mindset	Paper manufacturers	Paper manufacturers
Beneficiary mindset	All others	All others

Table 5.2/1: papiNet investment classifications

These classifications can easily be mapped onto the framework (see figure 5.2/1, **step 3**). In Phase A, investors were confronted with a relatively low level of risk for opportunism while the risk level for beneficiaries was very high. In phase B of the papiNet project, two relevant classifying factors (investor dimension and supplier dimension) have changed. As mapping the values for phase B onto the framework shows, the risk for opportunism was considerably reduced for all network partners who are not paper manufacturers (→ **step 4**, take corrective action if necessary). The paper manufacturers' risk levels slightly increased. However, a better risk balance was achieved which increases overall network welfare and hence works positively towards a longer lasting success of the entire inter-firm network.

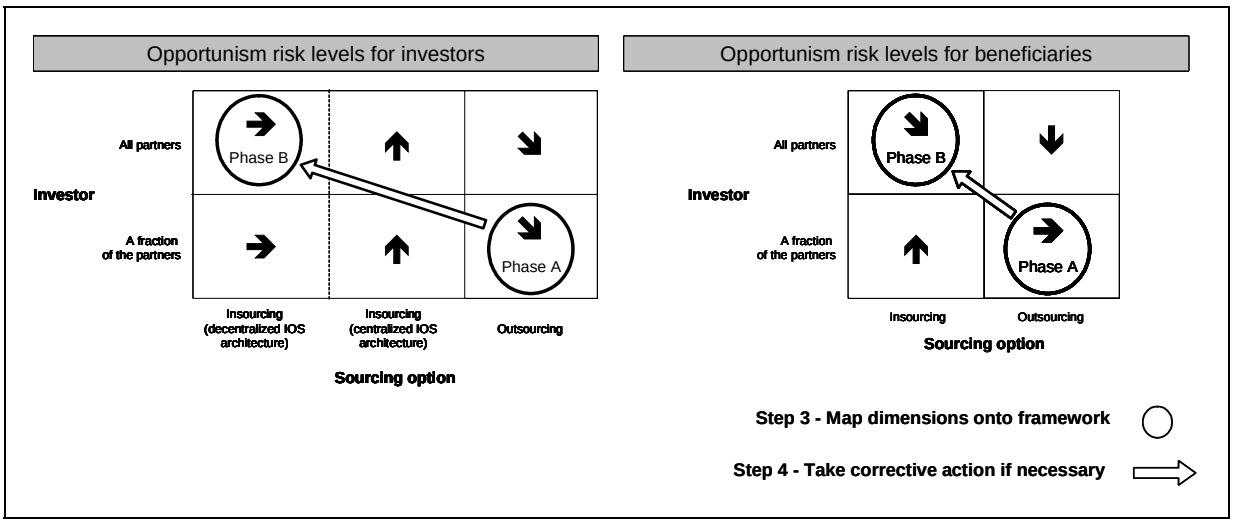


Figure 5.2/1: Risk level assessment for papiNet

6 Summary and outlook

In this master thesis, a framework for assessing the level of risk for opportunism associated to IOS investments was developed by qualitatively analyzing different investment scenarios with the help of Principal-Agent theory. The analysis showed that that the risk differs considerably depending on a) what role the individual partners take on, b) what IOS architecture is chosen and c) who provides the IOS. In chapter 5 a completely novel framework was presented. Its application showed the balancing of risk levels amongst cooperating partners.

Several points of critique must find a mention. First and foremost, a qualitative analysis lacks the apparent rigor of a formal economic model. Second, by aggregating risk levels, complexity might be reduced too strongly. Third, the framework is rather a basis for negotiation that a strict evaluation instrument in the sense of a net present value calculation. The instrument can only act as a guideliune to boundedly rational mangers whose decisions, moreover, are set in complex decision-making atmospheres of power, consensus and contextual insight (Kirsch 1998). For example, in supply chain networks, an industry champion might have the power to push trough specific standards; other cooperations were built on mutual trust and can probably handle centralized in-network sourced IOS-solutions.The management framework presented here only addresses the last facor: insight.

In next steps, collective IT investments must be examined with the help of other economic organization theories. While this study showed that risk levels differ with IT-investment options, no clear statement could be made as to where the optimal level of risk would lie in terms of overall network welfare. One part of the new institutional economics which was hinted at during the discussion seems to be a highly promising in this regard: Property-Rights (PR) theory. PR theory consequently deals with the efficient distribution of 5 classes of property rights to goods and fundamentally discusses the problems of joint ownership (Richter/Furubotn 1997). When analyzing organization structures (in this case: how is the IOS organized), PR theory allows a relative comparison of the options given (Ibid.) which is in line with the operationalization efforts carried out in this paper.

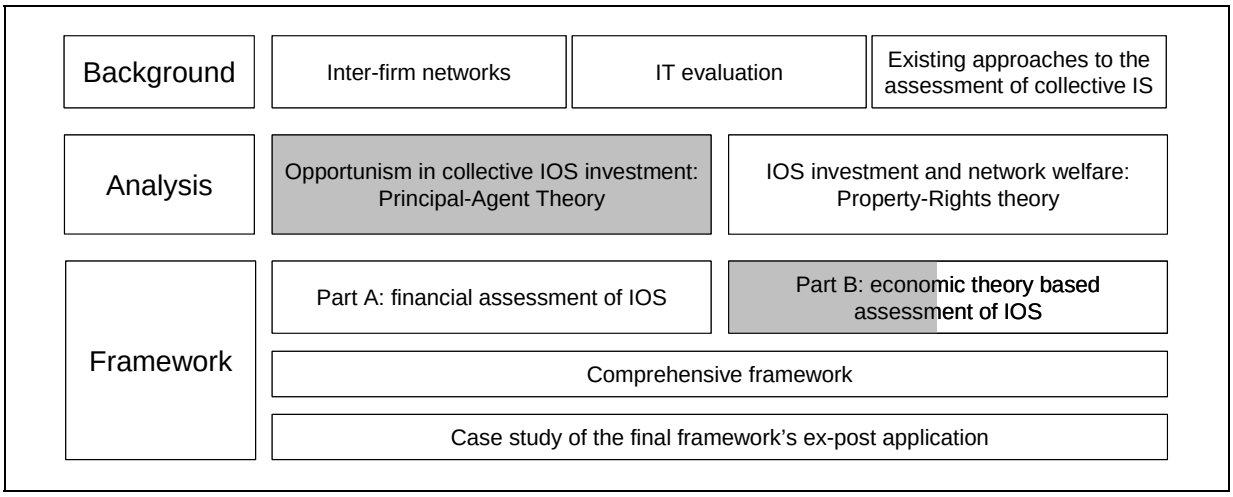


Figure 6/1: Role of this Master's thesis in the doctoral dissertation

In the end, the doctoral dissertation "Evaluating collective IT investment" shall present a comprehensive framework for assessing IOS investments. The final framework will then include both traditional financial measures and operationalized economic factors and will give recommendations to individual companies based on the positive interaction between network welfare and individual utility. This paper forms an integral part of the doctoral dissertation (see figure 6/1).

However, this thesis can also stand alone. To get back to Williamson (1985): when relation-specific investments are needed, companies are more likely to invest if the risk for opportunism is low. The framework presented allows all stakeholders to easily, quickly and transparently assess the individual risks they face.

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