

## 3.2 Governance in Chains and Networks

*George Hendrikse*

### 1 Introduction

Many stakeholders are involved in chains and networks, like suppliers, intermediaries, employers, employees, consumers, capital providers, insurance companies, governmental agencies, and so on. They have conflicting as well as joint interests. Governance is about the organization of their transactions, while a governance structure consists of a collection of rules, institutions and constraints structuring the transactions between the various stakeholders. Examples include the allocation of property rights (chain and network directorship), level of actual centralization or decentralization, the scope for discretionary behaviour, the allocation of responsibilities, the organizational structure, the accounting system, monitoring, the capital structure, the reward and incentive system, the board of directors, conflict resolution, public codes and regulations, the pressure of large investors, the competition in the product and labour market, and so on. These aspects of governance structure have a large impact on the flow of formal and informal information, the bringing to value of asymmetric information, and the structure and impact of formal (hard) and relational (soft) contracts.

A network consists of nodes and links. Standard market and enterprise structures can be formulated with this graphic, theoretic characterization of networks. Competitive exchange entails that each seller is directly connected to all buyers and each buyer is connected to all sellers, but there are no direct connections between the sellers or direct connections between the buyers. Bilateral exchange or monopoly consists of one tie between a buyer and a seller. A chain is, in its most simple version, a sequence of bilateral exchanges. It consists of at least three successive stages of production, with one party at each end of the chain and at least one party in the middle. An example at the enterprise level is the agricultural co-operative. A society of farmers (with many horizontal ties between them) owns a downstream stage of production, i.e. the tie between the sellers and the buyer has a certain distribution of power associated with it.

This characterization of networks raises questions (Zuckerman, 2003) like, what is meant by a node? How do we define the boundaries of the set? What is a tie? What constitutes pattern? The answer to the first question is easy, i.e. persons or organizations. However, there is hardly any agreement regarding

A party becomes a member of a certain chain or network when it is in its own interests, which is determined by the other participants, the possible choices, the available information, and the distribution of costs and revenues. This raises issues regarding optimal cost-sharing schemes, monitoring rules, self-selection devices, and enforcement considerations.

Incentives are structured in a way to reduce the various frictions in chains and networks. Two major causes are the conflict of interests between the parties and asymmetric information. The standard representation of a situation of conflicting interests and asymmetric information is the *principal-agent model* (Hendrikse, 2003a). One person (the principal) hires the other (the agent) to perform a certain task.<sup>2</sup> The relationship is governed by a contract, which is chosen and designed by the principal. Subsequently, the agent decides regarding acceptance of the contract. Finally, the agent chooses a level of effort.<sup>3</sup> The delegation of tasks and responsibilities from the principal to the agent is in general not without problems. The principal can observe the result of the effort of the agent, but the agent has usually superior information regarding the effort provided and the circumstances. Activities of the agents are therefore difficult to observe for the principal, which implies that the principal faces a *loss of control* over the agent. This may result in either 'moral hazard' or 'adverse selection', depending on the type of principal-agent problem. However, the principal will anticipate the behaviour of the agent in the design of the contract.

The principal will structure the payoffs of the contract offered to the agent in such a way that the *incentive compatibility constraint* is met, while taking the outside opportunities of the agent into account by meeting the *participation constraint*. Meeting the incentive compatibility constraint is crucial in order to have a well-performing chain or network. It ensures that the intentions of the principal match with the interests of the agent. These constraints can be met by choosing the payoffs<sup>4</sup> and the information structure right. For example, if the principal in a hidden action problem wants the agent to put forward a substantial effort, then the contract can motivate the agent to do so by paying a higher wage for a high level of output than for a low level of output. This seems obvious, but this condition is not always met in real life situations. For example, a fixed wage does not provide strong incentives to increase output above a certain, pre-specified threshold. Generating additional information is, next to structuring the payoffs, the most important managerial implication of the principal-agent model. This may take the form of signaling by the agent, e.g. maintaining a good reputation, or screening by the principal.

2 Dixit (1997) extends the most simple principal-agent relationship consisting of two persons to a situation with many stakeholders.

3 Effort applies to many different things, like the number of hours worked, the dedication of managers to take unpleasant decisions such as warning, punishing or firing employees, searching and developing new business opportunities, and so on.

4 The allocation of costs and the distribution of benefits are important examples of structuring the payoffs.

These insights from complete contracting will be illustrated and applied to two frequent issues in chain and network settings. First, team production with the free riding problem will be addressed by restructuring the payoffs. Second, an organizational solution regarding the asymmetry of information between the principal and the agent will be presented.

## 2.1 Team production and reward structure

*Team production* entails that the individual contributions of team members cannot be distinguished. There is joint production. An example is developing a new product. The total result is easy to determine, but the effort of the individual team members not. Payments to individual team members have therefore to be based on the joint result.

Team production is associated with incentive problems. An *independent entrepreneur*, i.e. a team consisting of one person, knows that he will receive all the benefits generated by his effort. This will not occur if the team consists of several individuals. Assume now that there is a team consisting of  $n$  members and the benefits are divided equally. Every team member knows that the benefit of an additional unit of effort has to be shared with all other team members, i.e. input of a team member generates a *positive externality* for all other team members. However, this positive externality is not taken into account when the level of effort is chosen, because the payoff of a team member is determined by the difference between the payment received and the costs of the provided effort. Benefits have to be shared, i.e. a share  $1/n$  is received by every team member, whereas the costs of providing effort are completely paid for by the provider of effort. The public character of team production results in every team member being a *free rider*, i.e. the incentive compatibility constraint is violated. Every team member will provide a lower level of effort than in the situation of independent entrepreneurship. However, the free rider problem can be solved by raising the share  $1/n$  in the additional result. The incentive compatibility constraint is solved when the principal chooses a salary structure that rewards every additional unit of output *n-fold* (McAfee and McMillan, 1989). For example, if an additional unit of effort by a team member results in an additional generation of value of 100, then this team member as well as all other team members will receive an additional benefit of 100. This restores incentive compatibility, because the optimal choice of effort of each team member now coincides with the optimal effort of the team as a whole. This reward structure eliminates the negative effect of the positive externality on the choice of the level of output. However, it is not feasible in terms balancing the budget because the variable part of the salaries paid by the principal is equal to  $n$  times the value of the output. The principal deals with this deficit by adjusting the fixed component of the salary structure, i.e. the participation constraint, in such a way that each agent earns his opportunity costs/reservation wage.

## 2.2 *Rural credit co-operatives*

Asymmetric information has also been a reason for farmers to set up rural credit co-operatives (Bonus, 1986). In the nineteenth century farmers could not obtain credit against reasonable interest rates. High interest rates were both a reflection of the monopoly power of the local moneylenders and the very high information costs they incurred. Because of the difficulty in collecting information needed to judge the small farmers' creditworthiness, commercial banks (often located in the cities) were not willing to provide credit to farmers. The rural credit associations solved the information cost problem by utilising the detailed information available to people who asked for credit – the members themselves. Given that the members were jointly responsible and indefinitely liable for each credit granted, they had a strong incentive to feed their personal knowledge into the decision process.

## 3 **Authority**

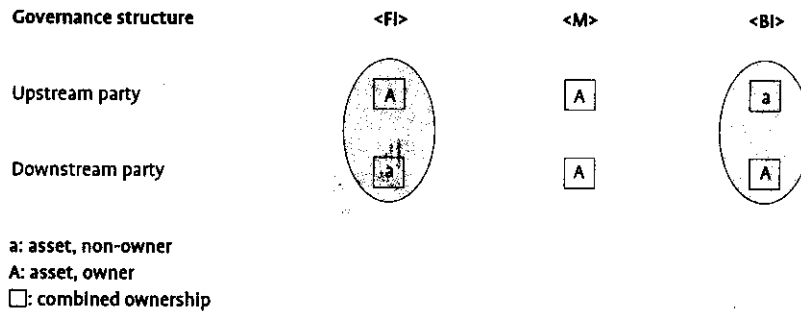
Exchange in chains and networks has formal as well informal aspects. The previous section has focussed on some results regarding the formal aspects by way of complete contracts (Hendrikse, 2003a), i.e. all observable information can and will be incorporated in (comprehensive) contracts. However, contracts are in general incomplete (3.1) or even relational (3.2). Contractual incompleteness is due to the impossibility to specify everything *ex ante*, either due to the vagueness of language or the bounded cognition of the parties involved. If certain aspects are therefore unspecified, then there will be *ex post* a quasi-surplus that has to be divided, and *ex ante* investment decisions will determine the size of the quasi-surplus. A governance structure affects the size of the surplus that will be generated by its effects on investments, the efficiency of bargaining, and risk-aversion (Zingales, 1998).

### 3.1 *Incomplete contracts*

An incomplete contract is completed by allocating authority to somebody. This person decides, according to his own interest, what is most desirable in the prevailing circumstances. An important issue in organizing activities is therefore the allocation of control and authority, i.e. chain directorship. This allocation involves inevitable trade-offs in the choice of governance structure, because moving authority downward in a chain or network entails taking power away upstream (Grossman and Hart, 1986 and Hart and Moore, 1990). Figure 1 provides an illustration of an upstream and downstream party. Each party has to invest, but the level of investment is not independent of the choice of governance structure, i.e. the allocation of ownership. The governance structure 'Forward Integration' <FI> entails that the upstream party owns all the assets. Similarly, the governance structure 'Backward

Integration' <BI> assigns the ownership of all assets to the downstream party. Finally, the governance structure 'Market' <M> entails that each party owns the assets at his stage of production.

Figure 1 Three governance structures for when there are two parties



The ranking of these governance structures in terms of incentives to invest is straightforward. If a party has more control, then the incentive to invest is stronger. This boils down to the ranking if the intensity to invest for the:

Upstream party: BI < M < FI  
 Downstream party: FI < M < BI.

Notice that the choice of governance structure therefore inevitably entails a trade-off regarding the intensity of investment incentives for the various parties, i.e. strengthening the investment incentives for one party will deteriorate these incentives for other parties. The efficient choice of governance structure is determined by the importance of the various investments. Grossman and Hart (1986) conclude:

*'Integration is efficient when the investments of one party are relatively important compared to the other party, whereas abstaining from integration is desirable when the investments of both parties are more or less equally important.'*

Traditional analysis of vertical relationships usually only considers two parties. A chain consists of at least three parties; i.e. there is at least one party in the middle. This party is a buyer of the upstream product or service, while being a seller to the downstream party at the same time.<sup>5</sup> Hendrikse and Bijman (2002) extend the Grossman and Hart (1986) and Hart and Moore (1990) papers by considering a chain consisting of three parties. Figure 2 presents the ten possible governance structures in a three party chain.

5 A network is even more complicated because it consists of a chain together with the interdependent relationships surrounding it.

Figure 2 The ten possible ownership structures in a three party chain

	I	II	III	IV	V	VI	VII	VIII	IX	X
Agent 1	A									
Agent 2	A									
Agent 3	A									

The choice of governance structure entails a trade-off in terms of incentives to invest for the various chain participants. For example, it is obvious that agent 1 has the most intense incentives to invest in governance structure VIII, whereas this governance structure provides weak incentives to invest for the other two agents. The ranking of these ten governance structures in terms of intensity of incentives to invest is for

- Agent 1: VII < III < IX/X < I/IV/V < VI < II < VIII
- Agent 2: II/V < VIII/X < I/VI/VII < III/IV < IX
- Agent 3: VI < IV < VIII/IX < I/II/III < VII < V < X

There are a number of other insights in the incomplete contracting literature. Standard incomplete contracting theory indicates that the employee should be the owner of the assets when the relationship-specific investments of the employee are most important (Hart and Moore, 1990). For example, an employee involved in R&D knows the intricacies and specificities of the R&D process best, but this employee usually does not own the assets. However, this seems to be at odds with a basic feature of the firm. Crucial to the notion of the firm is the centralization of decision-making power; i.e. the employer, not the employee, is the owner of the firm. This seems problematic from an efficiency perspective when the relationship-specific investments of the employee are most important. Rajan and Zingales (1998) have formulated a solution by distinguishing ownership and access to assets, where ownership resides at the top and access to an agent is allowed or not. The efficient design of access to and ownership in chains and networks is a major challenge.

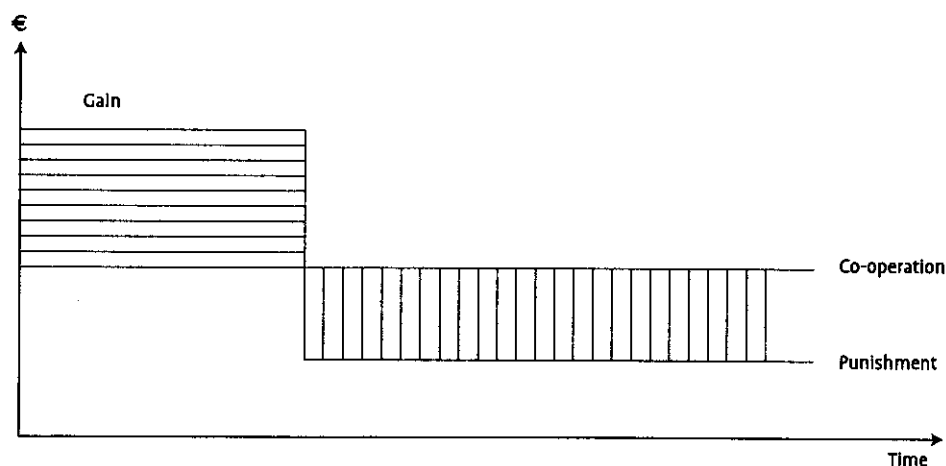
Another way out of this problem (of the centralization of formal authority) is to view ownership as more than a simple (non-contingent) long-term contract allocating authority. Formal authority does not preclude that control is delegated to another party, e.g. the employee or a professional management. Formal authority resides at the top, whereas informal authority can be either centralized or decentralized. So, the efficiency of a relationship may be enhanced by giving up some control, i.e. giving real authority away, even though the formal control stays at the top (Aghion and Tirole, 1997; Baker et al., 1999, 2002). These ideas regarding contingent authority are not only implemented in function and task design, but also in the allocation of authority in the design of financial instruments, e.g. debt (Aghion and Bolton, 1992).

### 3.2 *Relational contracts*

Sections 2 and 3.1 have two features in common. First, they focus on the formal aspects of relationships. Section 2 focuses on formal, complete contracts, whereas the incomplete contracts in section 3.1 emphasize the formal allocation of authority in unforeseen circumstances. However, there are also many silent agreements, informal understandings, and historically determined customs inside and between organizations. Implicit and/or informal contracts may overcome some of the difficulties with formal contracts, i.e. the role of informal contracts is to utilize the parties' detailed knowledge of their situation to adapt to new contingencies as they arise. Second, the models formulated within the property rights approach are usually limited to one period of interaction. A general feature of short-run interaction problems is the unattractive prisoners dilemma outcome. Under-investment, due to hold-up, is a prominent example. However, relationships in the real world usually last more than one period. This holds of course not only within enterprises, but also between parties in a market setting. Multi period interactions between the same parties opens the possibility to build a reputation, which might overcome the unattractive prisoners dilemma outcome when there is only one period of interaction.

Informal agreements that last for a long period of time are called *relational contracts*. One tool for addressing the stability of these agreements is the theory of repeated games. Repetition is crucial because it provides the stick, i.e. *reciprocity*, behind the door when bad behaviour emerges. It provides possibilities for establishing an attractive equilibrium outcome in the *repeated prisoners dilemma*. If the other player exhibits unattractive behaviour towards me, then my future choices will be harmful for the other player. The perspective of low payoffs in the future when co-operation is withheld will prevent each player from exhibiting unattractive behaviour. It is therefore possible, despite the divergence in interests, to establish an attractive outcome for both players in the repeated prisoners dilemma. Fudenberg and Maskin (1986) have shown this formally and have labelled this result the *Folk theorem*.

Figure 3 shows the costs and benefits of bad behaviour in a repeated relationship. The advantage of bad behaviour is that in the current period an additional payoff is earned, but the drawback is that a loss will be suffered in all subsequent periods. The prospect of low payoffs in the future, i.e. the other player *retaliates*, establishes that each player will not behave badly. Another way of formulating this result is that a *reputation* of good behaviour is maintained as long as it pays to do so.

**Figure 3** Costs and benefits of bad behaviour in a repeated relationship

The Folk-theorem is important because it specifies three aspects determining the stability of attractive, informal, long-term relationships:

- the costs and benefits of finishing a relationship;
- the history of the relationship;
- the observability of decisions.

The first aspect is illustrated in figure 3. If the benefit of defection is larger than the costs, then it is predicted that the relational contract will fall apart. Second, the history of the relationship is important. A relationship is hard to restore once it is damaged, i.e. recurring relationships are path dependent. The emergence of relational forms of organization and which ones flourish depend on the history of prior relationships. Finally, the importance of the observability of decisions for the stability of long-term relationships can also be illustrated with figure 3. If it is hard to detect that an implicit agreement is violated, then the gains of bad behaviour will extend over a longer period of time. Cheating on implicit agreements becomes more attractive when the observability of decisions decreases (Johnson et al., 2002).

### 3.3 Merchant guilds

In the late Middle Ages, trade between different geographical areas took place in centrally located cities, like Bruges in Belgium, Constantinople in Turkey and Genoa in Italy. The possibilities for beneficial long-distance trade (law of comparative advantages) and the presence of an attractive location did however not guarantee that trade did actually occur. Information costs were lowered by the '... development of standardized weights and measures, units of account, a medium of exchange, notaries, consuls ...' (North, 1991,



p. 100). In the Middle Ages, a problem for a potential trade centre was creating credible facilities for foreign traders, to prevent theft, confiscation, or tax increases. Merchant law courts were developed to provide incentives for contract fulfilment and trade centres had to offer protection. An institutional environment – for example one with guilds – was desired to ensure the safety of the merchants. Guilds also played a role in reducing the costs of negotiation, registering trade flows and taxes, and creating a strong, common negotiation position.

Greif, Milgrom and Weingast (1994) formulate a contractual explanation for institutions like guilds. The focus is on the role of guilds in providing a contractual solution for ensuring the safety of individual merchants who trade over long distances. A *bilateral reputation mechanism* can prevent that both parties behave badly in order to not endanger future profitable transactions. The idea is that individual merchants who are treated badly by a local ruler refuse to return in the future. However, this is only effective as long as the trader is important enough to the other party. If the trade flows in the economy develop and the transactions of an individual merchant decrease, his position changes from an important business partner to a marginal merchant. Bad behaviour of the local ruler towards a trader is more likely, because there is less at stake for him. The bilateral reputation mechanism is therefore not sufficient to establish the credibility of the governor as a trustworthy business partner. The punishment for bad behaviour is small and does not have a deterring effect.

A possibility to enlarge the punishment is to formulate an answer of all merchants together when one of them is being treated badly. This restores the balance of power. However, a collective response causes new problems, like examining the causes of a conflict, executing the boycott by everyone, and restoring trust. Therefore, an organization is needed that is able to co-ordinate the activities of the individual traders and to issue effective sanctions to both members as well as others. In the Middle Ages, the merchant guild served this purpose. The guild provided a centralized mechanism that controlled transactions, evaluated the behavior of city councils, gave the signal to a boycott, and policed that members did not evade the boycott.

The core of a merchant guild was formed by an administrative unit that co-ordinated the activities of traders from a specific geographical area and enforced this to some extent. It provided the traders with leadership and a mechanism to issue information about collective action. This ensured coordination as well as internal participation. Only with an organization like this, the *multilateral reputation mechanism* can solve the problem of commitment. The effectiveness of a guild was based on a system of explicit and implicit contracts between the guild and the city, the guild and the individual traders, and between guilds. The guild was a nexus of contracts, which means a legal entity that concluded agreements with individual traders and with trade cities.

In the late Middle Ages, the political power of the local rulers was considerable. Trade flows developed due to the rise of merchant guilds. Traders came on a more equal footing with local rulers. This more equal balance of power made it easier to establish a more credible commitment regarding the safety of foreign traders. However, the success of the merchant guild has led to its demise. The increasing trade flows resulted in an increase in the political integration of the various city states and the rise of larger political entities (for example countries) that slowly took over the functions of the merchant guilds.

#### 4 Complementarity

The transformation of chains and networks has implications for work practices, strategy, products and services, supplier and customer relationships. The fit between organizational, accounting, communication, financial, production, logistics and marketing attributes of chains and networks becomes important. Increasing synergies between production, distribution and marketing among firms will have an impact on the investment decisions of each party. Investments in one tier of the chain or network must be co-ordinated with investments in other tiers to obtain optimal performance. As there are complementarities and/or synergies among the activities of different chain participants, the governance of these relationships matters.

The crucial concept regarding the relationship between the various instruments is complementarity (Milgrom and Roberts, 1990). Complementarity entails that doing more of one activity increases the return to doing more of the other activity. It gears the attention towards the interdependencies between these various attributes of chains and networks, and results in the identification of viable combinations of these attributes. Complementarity is usually represented with a co-ordination game (Hendrikse, 2003a), i.e. a situation with two or more equilibria.

##### 4.1 *The costs of network size expansion*

We like exchange to be efficient. An important requirement is that contractual agreements are credible, i.e. the involved parties have to commit themselves ex ante to contractual agreements that will be honoured ex post. Formal institutions, like the judicial system and private institutions that have emerged within the judicial system, are often helpful. However, incomplete contracting theory shows that there are also various limitations associated with formal institutions, which brings the value of informal institutions to the attention. This example focuses on two different ways of choosing the monitoring and enforcement technologies in a society.

The relationship between wholesalers and their representatives abroad was endangered in various ways before the ascent of modern judicial systems

and institutions. The wholesaler supplied the merchandise for the exchange abroad. He could travel abroad himself or hire a local representative. Appointing the local representative was efficient because it prevented the loss of time and dangers associated with travel, diversification across different trade centres became possible, and so on.

The relationship between a wholesaler and a local representative usually does not blossom without supporting institutions, because the representatives may behave opportunistically by embezzling the merchandise of the wholesaler. The wholesaler anticipates this behaviour and will therefore not hire the local representative, which results in the loss of valuable exchange. There was a demand for an institution that enabled the local representative to commit himself to honour contractual agreements *ex post*.

Greif (1993, 1994) compares a relation-based trading system with a rule-based trading system in the twelfth century around the Mediterranean. There were two trading areas: Northern Africa and an area with Genoa as its centre. The Maghribi traders were descendants of Jewish traders who left the politically unstable Baghdad of the tenth century for Northern Africa, where the Maghrib indicates the west of the Muslim world. They used relation-based governance. It is based on the multilateral reputation mechanism, i.e. all traders collectively punish someone who doesn't abide by the rules. For example, in the world of the Maghribi a cheater would not be hired as a representative by somebody else. The prospect of losing all future exchange activities induced the local representatives to honour agreements. The social and commercial network took care of generating the required information to detect fraud and to spread the news. This choice of the enforcement and communication technology entailed that new local representatives were only recruited from the local community. It was a closed community with a horizontal social structure. Every Maghribi trader was wholesaler as well as representative. Trade could therefore be very informal, which expressed itself in a handshake to seal an exchange.

The relation-based trading system is based on unco-ordinated decisions of traders in various locations. In order to build countervailing power against swindlers, consensus was needed regarding cheating. This could in principle also be established with a complete (contingent) contract, but this was impossible given the slow communication and the complexity of trade. There are two substitutes for a complete (contingent) contract. Hierarchy, i.e. an authority relationship, is a substitute for an *ex ante* complete (contingent) contract by allocating the *ex post* authority to the wholesaler. Culture is a substitute for complete (contingent) contracts by specifying *ex ante* codes of behaviour. These two substitutes differ substantially. The commercial codes of a culture have to be mastered *ex ante*, while there is *ex post* no communication necessary between the parties. The opposite holds for a hierarchy. Nothing has to be learned *ex ante*, while communication between the parties is necessary *ex post*.

It is not surprising that the Maghribi traders used culture as a substitute for complete (contingent) contracts, given the slow communication and transport technologies. This culture expressed itself in a system of trade rules, which was treated as a commercial standard or code of conduct. The conviction of joint punishments serves as a focal point in the trade system of the Maghribi and is in line with their collectivistic Islamic culture. It is a specific institution which efficiently handles problems with honouring contracts and establishes co-ordination in situations characterized by asymmetric information, slow communication technology, incompleteness of contracts, and limited enforceability of judicial agreements.

#### *Rule-based governance*

Traders from Genoa were also active in the Mediterranean. They used rule-based governance, which was based on the bilateral reputation mechanism and was formally supported by the government. The traders from Genoa had a culture with an individualistic orientation. They were part of the feudal world where bilateral patronage relationships were common. The focus on the individual was in line with Christianity, which placed the individual instead of the group at the centre of the theology. This created a society with the individual as starting point. Individual punishments are the focal point in the cultural world of Genoa.

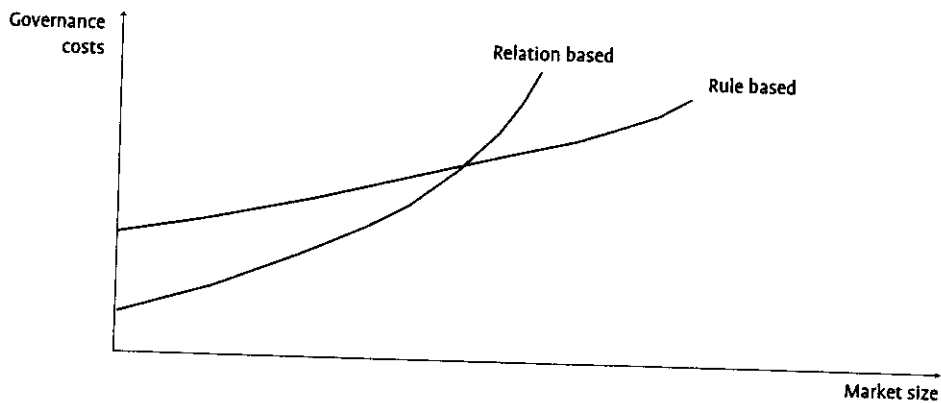
A representative honoured agreements with the wholesaler in this system because the relationship would otherwise not be continued. The judicial system ensured also that agreements were written down, that badly treated parties were refunded, and cheaters were punished. This individualistic orientation generated a vertical social structure with two groups: wholesalers and representatives. There was an open community in the sense that people from outside the Genoese system were easily absorbed in this trading system. The requirement for success of outsiders was only that one had to function well in the bilateral relation within the formal judicial framework. Figure 4 summarizes the composition of the attributes of these two trading systems.

**Figure 4** Two aligned trading systems in the twelfth century

Attribute	Trade system Maghribi	Trade system Genoa
Orientation	Collectivistic	Individualistic
Reputation mechanism	Multilateral	Bilateral
Agreements	Informal	Formal
Society	Closed	Open
Social structure	Horizontal	Vertical
Functions	Homogeneous	Differentiated

Li (1999) addresses the costs of running these two governance systems. The costs of a governance system consist of the costs of the observation technology, i.e. the costs of the detection of cheating and communication of this information to others, and the costs of the enforcement technology, i.e. the costs of imposing sanctions on cheaters. Relation-based governance like the Maghribi trading system has low fixed costs because the relationship exists already by being raised in the community and no system-wide investment is necessary to sustain it. However, the marginal costs of relation-based governance are high and rising. Marginal costs are high because each additional relationship requires a reputational investment. Marginal costs are rising because new trading partners are less and less known, i.e. larger initial investments in building and enforcing the relationship are needed and there is a greater risk of collapse. Rule-based governance like the Genoese trading system has high fixed costs, e.g. costs of setting up legislative and judicial institutions, and costs of establishing credibility. However, the marginal costs of trade expansion are low and almost constant, i.e. additional parties can be dealt with easily once the system is established. The prediction is therefore that small communities will have self-governance, whereas large communities will have official governance. Figure 5 illustrates this result.

Figure 5 The costs of trade expansion



Concluding, a chain and/or network is a web of complementary economic, judicial, political, social, and moral attributes, which blossom in either an individualistic or collectivistic setting. The efficiency of a specific orientation depends on the circumstances. For example, a collectivistic system is relatively good at supporting agency relations in the system and requires less expensive formal organizations, like courts, but it limits the agency relationships with other entities. The opposite holds for an individualistic setting. It has more specialization, where economic growth is enhanced by formal institutions supporting anonymous exchange. Entrepreneurial activities and innovation seem to blossom in this system because the social pressure is less to abide to certain behavioural rules.

This extensive illustration has highlighted a number of implications of the complementarity perspective. First, the multiplicity of equilibria entails that there are various ways in which a coherent chain or network can be organized, i.e. there is no 'one best way of organizing' a chain or network. Second, the many attributes of a chain or network has implications for system innovation, i.e. the switch from one equilibrium to another. Brynjolfsson and Hitt (2000) show that substantial productivity increases emerge once the adoption of new information technologies is accompanied by coherent changes in all the other attributes, like supplier relationships, customer relationships, work practices, strategy, and products and services. It entails that 'best practice' innovation may be adopted for one attribute, but not for all attributes separately because it undermines the coherence of the system. Third, a complementarity perspective has implications for the pace of change. It advocates 'all-or-nothing' (Big Bang) change, because changing only one attribute destroys all the synergies. Fourth, it stresses the contingent nature of the superiority of one network over the other.

## 5 Conclusions

This chapter has presented an established body of knowledge regarding the governance of chains and networks. Insights regarding incentives, authority and complementarity are highlighted. The other chapters stress other aspects of chains and networks, which may enrich the framework presented here. However, chain and network science is far from being complete, whatever this might mean. There are questions regarding the boundaries of the network, the ties in the network (Sobel, 2002) and the structure and functions of patterns (Zuckerman, 2003). Some directions for future research are formulated in Hendrikse (2003b).

### References

- Aghion, P. and Bolton, P., An Incomplete Contracts Approach to Financial Contracting, *Review of Economic Studies* 59 (1992), pp. 473-494.
- Aghion, P. and Tirole, J., Formal versus Real Authority, *Journal of Political Economy* 105-1 (1997), pp. 1-29.
- Baker, G., Gibbons, R. and Murphy, K.J., Informal Authority in Organizations, *The Journal of Law, Economics, & Organization* 15-1 (1999), pp. 56-73.
- Baker, G., Gibbons, R. and Murphy, K.J., Relational Contracts and the Theory of the Firm, *Quarterly Journal of Economics* 117-1 (2002), pp. 39-84.
- Bonus, H., The Cooperative Association as a Business Enterprise: A Study in the Economics of Transactions, *Journal of Institutional and Theoretical Economics/Zeitschrift für die gesamte Staatswissenschaft* 142-2 (1986), pp. 310-339.
- Brynjolfsson, E. and Hitt, L.M., Beyond Computation: Information Technology, Organizational Transformation and Business Performance, *Journal of Economic Perspectives* 14-4 (2000), pp. 23-48.

- Chiesi, A.M., Network Analysis, in *International Encyclopedia of the Social and Behavioral Sciences*, 2001, pp. 10499-10502.
- Dixit, A.K., Power of Incentives in Private versus Public Organizations, *American Economic Review* 87-2 (1997), pp. 378-382.
- Fudenberg, D. and Maskin, E., The Folk Theorem in Repeated Games with Discounting or with Incomplete Information, *Econometrica* 54-3 (1986), pp. 533-554.
- Greif, A., Contract Enforceability and Economic Institutions in Early Trade: The Maghribi Traders' Coalition, *American Economic Review* 83-3 (1993), pp. 525-548.
- Greif, A., Cultural Beliefs and the Organization of Society: a Historical and Theoretical Reflection on Collectivist and Individualist Societies, *Journal of Political Economy* 102-5, (1994), pp. 912-950.
- Greif, A., Milgrom, P. and Weingast, B.R., Coordination, Commitment, and Enforcement: The Case of the Merchant Guild, *Journal of Political Economy* 102-4 (1994), pp. 745-776.
- Grossman, S.J. and Hart, O.D., The Cost and Benefits of Ownership: a Theory of Vertical and Lateral Integration, *Journal of Political Economy* 94-4 (1986), pp. 691-719.
- Hart, O. and Moore, J., Property Rights and the Nature of the Firm, *Journal of Political Economy* 98-6 (1990), pp. 1119-1158.
- Hendrikse, G.W.J., *Economics and Management of Organizations*, McGraw-Hill, 2003a.
- Hendrikse, G.W.J., Governance of Chains and Networks: A Research Agenda, *Journal on Chains and Networks Science* 3-1 (2003b), pp. 1-6.
- Hendrikse G.W.J. and Bijman, W.J.J., Ownership Structure in Agrifood Chains: The Marketing Cooperative, *American Journal of Agricultural Economics* 84-1 (2002), pp. 104-119.
- Johnson, S., McMillan, J. and Woodruff, C., Property Rights and Finance, *American Economic Review* 92-5 (2002), pp. 1335-1356.
- Li, S., *The Benefits and Costs of Relation-based Governance: An Explanation of the East Asian Miracle and Crisis*, City University of Hong Kong, Hong Kong, 1999.
- McAfee, P. and McMillan, J., Optimal Contracts for Teams, *International Economic Review* 32 (1991), pp. 561-577.
- Milgrom, P. and Roberts, J., The Economics of Modern Manufacturing: Technology, Strategy, and Organization, *American Economic Review* 80-3 (1990), pp. 511-528.
- North, D.C., Institutions, *Journal of Economic Perspectives* 5-1 (1991), pp. 97-112.
- Rajan, R. and Zingales, L., Power in a Theory of the Firm, *Quarterly Journal of Economics* 113 (1998), pp. 387-432.
- Sobel, J., Can we trust Social Capital?, *Journal of Economic Literature* 40-10 (2002), pp. 139-154.
- Zingales, L., Corporate Governance, in J. Eatwell (ed.), *The New Palgrave*, MacMillan, London, 1998.
- Zuckerman, E.W., On Networks and Markets by Rauch and Casella, eds., *Journal of Economic Literature* 41-2 (2003), pp. 545-565.