



**EUROPE :**

**CONDUITE DES PROJETS DE CONSTRUCTION**

***Fascicule 2***

***PROJECT MANAGEMENT IN CONSTRUCTION:  
TOWARDS A TRANSACTION COST APPROACH***

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## **Groupe Bagnolet**

Le groupe Bagnolet s'est créé, dans le cadre du programme Europroduction du PCA, à l'initiative de chercheurs issus de plusieurs pays européens. Les financements du PCA ont été complétés par des contributions du Leverhum Thrust, du Consiglio della Ricerca et de Byggeriets Udviklingsrade.

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**Chantier 2000**

# PROJECT MANAGEMENT IN CONSTRUCTION: TOWARDS A TRANSACTION COST APPROACH

RESUME .....	3
INTRODUCTION .....	4
WHY PROJECTS? .....	4
CONSIDERATIONS ON THE ORGANISATION OF PROJECTS.....	5
Transaction Costs.....	5
Production Costs .....	7
Forms of Collaborative Transaction Governance .....	8
Uncertainty, Variability and Risk .....	9
THE CHARACTERISTICS OF CONSTRUCTION PROJECTS .....	10
VARIABILITY IN CONSTRUCTION .....	12
CONCLUSIONS .....	14

# PROJECT MANAGEMENT IN CONSTRUCTION: TOWARDS A TRANSACTION COST APPROACH

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## RESUME

L'organisation des projets de construction est ici envisagée du point de vue de la théorie des coûts de transaction de "Williamson". Après une rapide présentation du cadre conceptuel développé par Stinchcombe et Williamson lui-même, sont analysés les traits spécifiques que recouvre de ce point de vue l'organisation des projets de construction.

Tout d'abord sont analysées les implications de la fréquence des transactions et de la spécificité des actifs. Puis est développé le concept de gouvernance comme mode de gestion distinctif des relations entre les firmes travaillant en réseau.

En introduisant le concept de pouvoir et les déterminants des relations entre les membres du réseau, une typologie des formes de gouvernance des relations coopératives est présentée. Les quatre types identifiés sont les *joint ventures*, les consortiums, les coalitions et les quasi-firmes.

La contribution se conclut sur une analyse critique des concepts d'incertitude, de risque et de variabilité appliquée à la gestion des projets de construction.

## INTRODUCTION

The aim of this paper is to explore some of the basic principles of project management from a transaction cost perspective in order to provide both a common frame of reference for the Groupe, and a basis for establishing what the research questions might be for the empirical phase of the research programme. It is one of five such theme papers which form the theoretical framework for the Groupe's empirical research. The first question to be addressed is why do project organisations exist, and the second is why they take the particular form that they do in construction? The paper will then go on to discuss some conceptual issues before making some concluding comments<sup>1</sup>.

## WHY PROJECTS?

The standard forms of organisation of any productive activity are the *functional form* and the *product form* (Mintzberg 1979). In the functional form, the resources required for production are organised into discipline-based departments, and the flow of information and materials in the production process passes sequentially from one to another as required. These functionally organised resources are normally shared between a number of production processes. In the product organisation, all the resources required for the production of a particular production process are organised into a single organisation, often called a product division. The advantage of functional organisation is that it facilitates the efficient use of resources, while the latter favours responsiveness to market needs. Inversely, product organisation can be inefficient, while functional organisation can be inflexible.

Where a combination of market responsiveness and efficient resource utilisation is required, the matrix form of organisation is sometimes chosen where both functional and product orientated managers collaborate. It may also be used where a product organisation requires a geographic dimension, such as in a marketing division. Such organisational forms tend to be unstable because of conflicts between the functional and product orientated managers, and are not widely used.

However, a version of the matrix form - project organisation - is well established in a number of industries, and the evidence is that its use is becoming more widespread. Its main distinction from matrix organisation is that it is temporary in character (Bryman et al 1987), and usually operates as an overlay on the functional form. While the life of a matrix organisation is normally indeterminate, the life of a project organisation is clearly determinate, with a delivery date identified as part of its declared objectives. The aim of a project organisation is to mobilise the required resources

from their functional bases towards the market demand; it can be considered to be a "création collective, organisée dans le temps et l'espace, en vue d'une demande" (Giard and Midler 1993 p 18). This temporary organisation consists of two types of firms which, building on the terminology of Kristensen (1995), may be called skill containers and project coordinators. The former provide the technical and human resources required to do the work of the project, while the latter ensure that those resources are effectively mobilised towards the client's objectives.

The time component of project organisation gives a particular characteristic. All projects consist of flows of information which define, initiate, and control flows of materials (Winch 1994). There

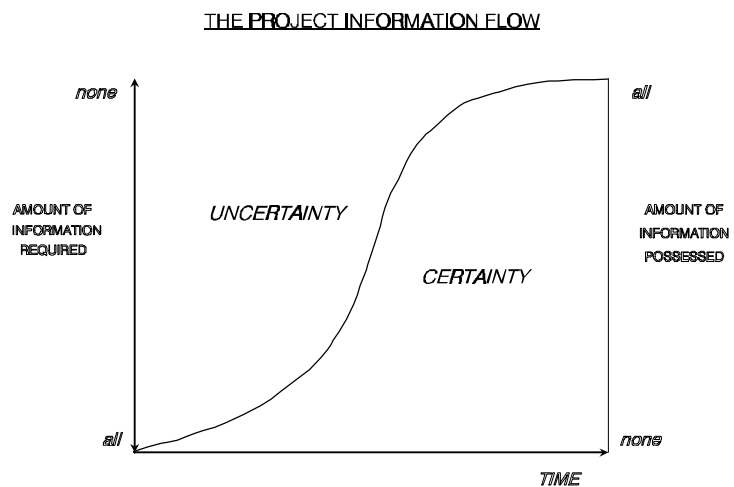


Figure 1

<sup>1</sup> I am very grateful to Graham Ive for his detailed comments upon the paper.

is, therefore, an inherent level of uncertainty at their inception. This level of uncertainty differs depending on whether the project represents an incremental or radical innovation, but is always present to some degree. Projects are only mounted when an innovation is required, otherwise the client would purchase the good or service "off the shelf". These flows of information and materials can, therefore, be seen as a process of reducing uncertainty through time in the manner illustrated in figure 1. This information flow is not, however, smoothly continuous. Within the flow are critical points where key decisions are taken that qualitatively narrow the breadth of the information flow. These may be considered as screens on the flow (Usmani and Winch 1993; Wheelwright and Clark 1992)

### CONSIDERATIONS ON THE ORGANISATION OF PROJECTS

The essential feature of project organisation is a temporary organisation which draws on the permanent resources provided by functionally organised skill containers. This general form of project organisation is illustrated in figure 2. The functional organisations are responsible for

#### THE MATRIX OF PROJECTS AND ORGANISATIONS

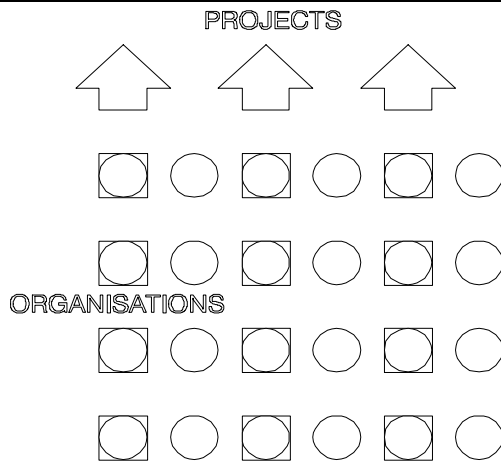


Figure 2

developing the productive resources required for the project. This activity may take the form of recruiting, developing, and retaining appropriate human resources, buying and maintaining production equipment, and the development of new product technologies and production techniques. The project organisation is responsible for ensuring that the appropriate mix of resources is mobilised to meet the clients needs. This client may either be a real entity, or a *virtual client* where the marketing department is responsible for interpreting the requirements of an as yet unknown group of customers. The skill containers providing the resources may either be internal

departments of a single organisation or independent organisations. Traditionally, project coordinating functions were integrated into the skill containing firms, but there has been a general trend in many industries to establish organisationally distinct project coordinating organisations.

#### Transaction Costs

It is this distinction between the internal and external provision of resources which is one of the main factors by which project organisations vary. Williamson (1975, 1985) has developed a comprehensive analysis of the factors which influence the choice of transactions. He defines a transaction as occurring when a good or service crosses a technologically separable interface (1980). In other words, if the efficient organisation of a production operation requires an integrated technology then transactions do not occur within it. For instance, if an assembly line is a technologically efficient choice of production technology, then transactions only occur at points where inputs of components arrive at that assembly line, and output of the product leaves that assembly line. Williamson argues that total costs of an economic activity are the sum of production costs and transaction costs, in distinction to the conventional approach which only focuses on production costs. While developed in order to understand the development of vertical integration, with particular reference to attempts to regulate the formation of monopolies, the framework has a more general relevance, and is particularly appropriate, I would contend, to the analysis of project organisation<sup>2</sup>.

The basic question posed is that, given that production is efficiently organised, how can transaction costs be kept to a minimum as well? Williamson argues that there are three main

<sup>2</sup> What follows is my own interpretation of Williamson, rather than an exposition of his ideas in their own terms.

environmental contingencies upon which the answer to this question rests. The first is *uncertainty*, which is a function of the difference between the amount of information required for a decision, and the amount of information available (Galbraith 1977). Uncertainty is generated for two reasons - through either *complexity* or *dynamism*. Complexity is the condition where the information is in principle available, but its collection or analysis is either technically impossible within the time available, or would cost more than the returns from complete information. Dynamism is the condition where the situation is changing so that present data are poor guides to future states. The future is inherently unknowable, but some futures are more unknowable than others due to differing levels of dynamism in the environment<sup>3</sup>. The second is *asset specificity* - the extent to which the resources required are available from a large number of sources and hence can be bought in a competitive market, or only a few sources and the market is oligopolistic or even monopolistic. The third is *transaction frequency* - whether the input is required on a regular or occasional basis.

These three environmental contingencies encourage particular behavioural characteristics. Uncertainty generates bounded rationality where intendedly rational managers take decisions based on incomplete information and tend towards satisficing rather than optimisation in decision-making (March and Simon 1993 chap 6). Asset specificity generates opportunism where holders of scarce assets take advantage of their situation by overcharging<sup>4</sup>, or by exerting their power to distort the behaviour of their customer. Transaction frequency influences the level of management attention given to the transaction - infrequent transactions are likely to be less closely managed than frequent ones. Williamson also emphasises the importance of *atmosphere* in transaction governance. This is the commitment of the parties to non-economic considerations, such as family commitments, preference for high trust relationships and long term relationships, cultural affinities and the like. Where *atmosphere* factors are strong, opportunism is likely to be suppressed and information to flow more freely between the parties, reducing bounded rationality and what Williamson calls "information impactedness".

Where uncertainty and asset specificity are low, transaction costs are likely to be minimised by the market governance of transactions. In other words, firms will obtain their supplies of inputs externally by competitive tender in the marketplace in what is known as *market* transaction governance. Low uncertainty means that buyers can clearly state their requirements in a specification, and low asset specificity means that prices will be competitive. At the other end of the spectrum, where uncertainty and asset specificity are high, firms will prefer to obtain their inputs internally because they are incapable of clearly specifying their requirements, or they face opportunistic behaviour by suppliers. This is known as *hierarchical* transaction governance. This is usually achieved by vertical integration, or by establishing internal production facilities.

Many have criticised Williamson's framework for its specification of mutually exclusive alternatives of market and hierarchy, when empirically, there are many different forms of relationship between firms. In particular, the concept of the *network* governance of transactions has been posed to describe the variety of collaborative relationships between firms. There is also some debate about whether the network is an intermediate form between market and hierarchy, or whether it can be considered to be an independent form of transaction governance (Powell 1990). Williamson addresses these issues by identifying the change that occurs after the "fundamental transformation" (1985 p 61) between pre-and post-contract relations. Where contracts are not discrete, and rely upon continuing relations between the parties during execution, then more elaborate forms of transaction governance tend to emerge. Which forms actually emerge is a function of transaction frequency and asset specificity. For a given level of uncertainty, if asset specificity is low, market governance suffices, but as it gets higher other forms merge. Where transactions are infrequent, it is not worth investing in transaction-specific governance structures, and trilateral governance emerges which relies upon third-party arbitration to resolve disputes. Where transaction frequency is high, bilateral governance structures emerge, and as it gets higher hierarchical governance tends to be more favoured.

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<sup>3</sup> This formulation of the problem highlights the importance of IT which both facilitates the collection and analysis of greater quantities of information, and allows real-time information collection and dissemination. The future remains inherently unknowable, but IT allows us to know more about the present and hence reduces uncertainty.

<sup>4</sup> In other words consistently obtaining more than the average rate of return on the resources deployed.

Williamson sees these relations very much as a continuum between the poles of market and hierarchy (1985 p 83). One problem with holding Powell's position of a non-polar account is the sheer vagueness in what network governance actually looks like. Market and hierarchy are clearly defined states; networks are not. One contribution of this paper will be an attempt to clarify what is meant by such network forms of transaction governance - which may be more generally defined as *collaborative* transaction governance types. It may be suggested that where asset specificity is low but uncertainty is high, then collaborative forms of governance may prevail. Similarly, where uncertainty is low but asset specificity high, collaborative forms may also prevail. Where atmosphere considerations are strong, this will reduce the tendency towards vertical integration in conditions of high uncertainty and asset specificity, and favour other forms of collaboration between firms. These relationships are illustrated in figure 3.

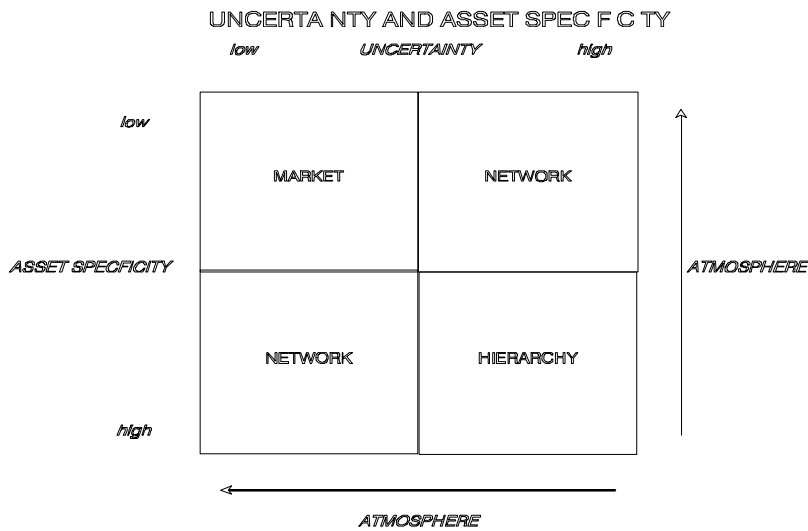


Figure 3

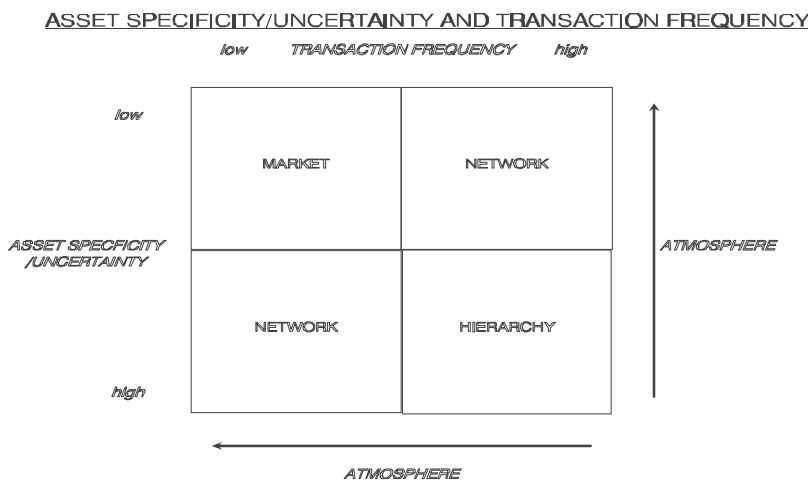


Figure 4

Transaction frequency also has a profound impact upon the choice of governance mode. In considering its effects, asset specificity and uncertainty can be held constant, as they both have similar implications for the choice of governance mode. Where uncertainty and/or asset specificity are high, and transaction frequency is high, then hierarchy is again likely to be appropriate, and the inverse also holds. Where transaction frequency is high, but asset specificity and uncertainty low, what Williamson calls bilateral governance, or what Eccles (1981) has called the quasi-firm, is likely to be appropriate. This is where the firm buys inputs from a stable network of suppliers. This reduces transaction costs associated with market governance by reducing search costs and the need for complete specification writing and by facilitating information flows between the parties - they know each other already. Where transaction frequency is low, but asset specificity and/or uncertainty are high, then what Williamson call trilateral

governance is likely to be selected. This is the situation where the contract between the parties provides for its continuing renegotiation in the light of circumstances, and provides for third party resolution of disputes which may arise during this renegotiation. Again, strong atmosphere considerations are likely to favour the more collaborative transaction modes. This analysis is summarised in figure 4.

**Production Costs**

The above analysis focuses upon transaction costs. In order to fully understand the nature of relations between firms, production costs need to be brought back into the equation. Williamson

tends to assume that production efficiency is attainable within the single organisation, and that only transaction costs are relevant in considering relationships between organisations. However, it is clear that there are many cases where individual organisations cannot achieve economies of scale internally, and are obliged to collaborate externally in order to produce efficiently. This is particularly true where different parts of the value chain have different economies of scale<sup>5</sup>. Under such conditions, firms also tend to form networks of relationships, in order to gain production economies for inputs that they do not wish to buy in the market place, but can only bring inside at the expense of production diseconomies.

A variant of this problem is the case where the firm can, in principle, achieve economies of scale but cannot raise enough capital to make the necessary investments. Such capital-sharing arrangements are common, for instance, in various areas of retailing where the parent company sells franchises which mean that the expansion of the branch network is largely financed by the purchasers

of the franchises. This facilitates rapid expansion and the early achievement of economies of scale in marketing. Similarly a firm may be reluctant to take the entire responsibility for a project. This could be either because the project is very large in relation to the size of the firm and its failure would bring down the whole firm, or because the activity, though attractive is peripheral to the firm's core business. In these cases, collaboration reduces risks, and allows the firm to be engaged in activities that its size would normally place beyond its reach.

**COLLABORATIVE TRANSACTION GOVERNANCE**

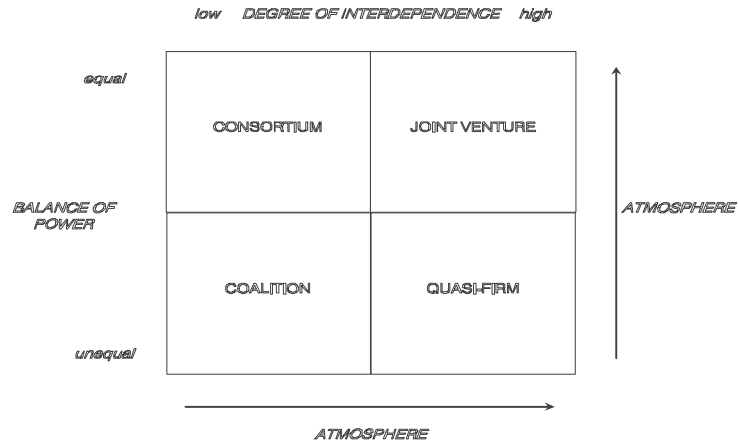


Figure 5

**Forms of Collaborative Transaction Governance**

The literature on network forms of transaction governance encompasses a diverse set of organisational forms, with little attempt to systematically differentiate types. In order to help in the identification of some different types, the literature on strategic alliances provides some useful frameworks.

A spectrum of collaborative forms can be identified. The first dimension by which such forms vary is *degree of interdependence*<sup>6</sup> - collaborative arrangements can be either project-based and therefore temporary, with a clean separation of resources allocated to the project and the returns generated from them at the termination of the project, or indeterminate in duration with much greater difficulty in separating returns and the development of relationship-specific investments.

The second dimension is *power balance* - the relationship may be one between equals, or power within the network may clearly favour one member<sup>7</sup>. From these two dimensions, four

<sup>5</sup> Where economies of scale through the value chain are roughly in balance, firms unable to achieve them would simply die or be obliged to merge. If they can compete on at least one major value chain element, then they can collaborate to achieve economies of scale on other elements, and indeed, may have a competitive advantage over firms large enough to gain all economies of scale which may hit diseconomies of scale in those parts of the value chain with lower economies of scale.

<sup>6</sup> This dimension is taken from the work of Lorange and Roos (1992). Their work is very much focused on questions associated with corporate strategy, while the focus here is on the organisation of production by business units. However, any arrangement made on behalf of a business which involves equity would need the authorisation of the corporate centre, and so corporate and business strategy are not clearly distinguishable here. The issue is more one of perspective - whether the collaborative arrangement is made to improve the competitiveness of a particular business activity, or to develop an aspect of corporate strategy such as the portfolio.

<sup>7</sup> Lorange and Roos (1992) discuss "dominant" and "shared" strategic alliances, but restrict their analysis to the global companies. Even here, the fundamental issue would appear to be that of the balance of power between the strategic alliance members.



basic types emerge as illustrated in figure 5. The *consortium*<sup>8</sup> is formed when firms collaborate on an equal basis to achieve a particular end, and then separate once it has been achieved. Such consortia may be *integrated* in that the parties are jointly and severally liable for contract execution, operate with a common budget, and divide profits and losses at contract completion according to their original investment, or *limited* where one or more of these conditions are not met. The *joint venture* is formed between parties who intend a continuing relationship, which is usually symbolised by the investment of equity in the joint venture and the right of the joint venture itself to keep at least some of the returns from that investment.

The *coalition* is formed when firms come together on a project basis, but in a clear principal contractor and junior contractor relationship between the parties. *Quasi-firms* are formed where a powerful lead firm with a nodal position in the value chain - often a final assembler - mobilises a network of suppliers and distributors. There is again a clear hierarchical relationship between principal and junior contractor but the relationship is continuous. This may be because the relationship continues from project to project, or because production is on a continuous basis. Apart from the human capital resources which are built up in such continuing relationships, both buyers and suppliers may make capital investments which are dedicated to the transaction series, and so the cessation of the relationship may be very traumatic, particularly for the junior member of the quasi-firm. Quasi-firms reach their strongest form in franchise networks. Atmosphere considerations are likely to favour equality of power and longer term relationships.

**THE DYNAMICS OF COLLABORATIVE TRANSACTION GOVERNANCE**

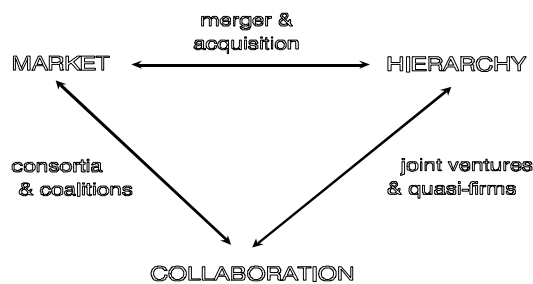


Figure 6

The relationships between firms also change through time, moving between the three basic types of hierarchy, market and collaboration in response to the changing market and institutional environment. This is illustrated in figure 6. The shift from market to hierarchy through merger and acquisition

is well known, while the reverse process of demerger is increasingly common. It might also be suggested that consortia and coalitions are more market-like forms of collaborative governance tending to reinforce market transaction governance, while joint ventures and quasi-firms are closer to hierarchical governance, and may lead to the formation of fully hierarchical forms.

**Uncertainty, Variability and Risk**

Within the concept of uncertainty is the condition that, although the precise outcome may be unknown, the range of outcomes can be fully predicted in advance. This condition may be called *variability* where, in the analogy of the restaurateur trying to predict diners' orders, a menu of options is offered. The precise option required at any point in time may not be known, but the range of options is. Applying this principle to the notion of the project as a flow of information, it can be argued that uncertainties become variabilities at the screens. The objective of decision-making at the screen points is to reduce uncertainties to a clear set of variables, and then to choose between them. Some choices may remain open for later decision, but they are then made within a predetermined set of options. It follows from this position that high variability is only possible in conditions of relatively high certainty - it must be possible to pre-specify the set of options. Of course, such transformation of uncertainty into variability can only take place with respect to internal aspects of the project, for it still remains vulnerable to uncertainties derived from external dynamism.

<sup>8</sup> This distinction between consortium and joint venture is in accord with the standard definitions in the economic literature (Clark and Ball 1991).

The distinction between variability and uncertainty is an important one. If the production process is merely variable, then rationality is not bounded, and comprehensive contracts can be written in advance of the contingent claims type (if X; then Y). Flexibility in response to customer demands can, in Volberda's terminology (1992) be operational rather than strategic. If the process is uncertain, rationality is bounded and forms of contracting are therefore required which contain means of mutual adaptation between the parties in the face of the revealed conditions. For instance, one way of handling variability is through contracts which provide for after-measurement of work completed against a schedule of rates. It is not possible to deal with uncertainty in this manner due to the impossibility of drawing up a comprehensive schedule of rates. Under uncertainty, the contract has to contain mechanisms for changing the agreement between the parties in an efficient and mutually agreeable way. Variability, then generates few contractual problems; uncertainty remains central to the contracting problem and hence to the organisation of projects.

The conventional distinction between uncertainty and risk is that the latter is quantifiable on the basis of data derived from previous experience and hence insurable, while the former remains inherently unmeasurable. Thus probabilities can be assigned to the risk of a future event occurring. Much of the work in an area such as risk management is aimed at turning uncertainty into risk on the basis of the intensive analysis of previous performance. This may be termed *actuarial risk*. There is, however, another use of the term risk which is the acceptance of the rewards or liabilities from uncertain outcomes. This is the classical entrepreneurial risk, but also risk in the legal sense of liability for negative outcomes. Actuarial risk is not conceptually different from uncertainty as defined above; it is a state of relatively low uncertainty, where, due to low dynamism, previous experience is a good predictor of future outcomes. It is the second definition of risk which is the more interesting, and within the framework developed above, may be defined as the acceptance of the consequences of uncertainty by an actor. Thus an actor takes a *risk* when uncertain outcome X produces a reward, while uncertain outcome Y produces a liability, where X and Y are part of a single distribution of indeterminate (i.e. uncertain) shape. Where the shape of the distribution is determinate, then dynamism has been reduced to actuarial risk. There remain, outside any distribution, an additional set of uncertainties which, by definition, remain unknown and unknowable.

## THE CHARACTERISTICS OF CONSTRUCTION PROJECTS

How then do construction projects fit into the overall picture of project organisation? There has been some debate amongst specialists on construction as to whether it is the firm or the project which should be considered as the unit of analysis. However, it is clear from reading Williamson that the most helpful perspective is to take that of the firm (Winch 1989); in particular, analysis should start with the client, and then move backwards down the value chain. In terms of the transaction cost analysis reviewed above, considered from the point of view of the client, construction can be considered to be characterised by low asset specificity<sup>9</sup>, low transaction frequency, and high uncertainty. The market for the vast majority of construction services is highly competitive; indeed, it is considered by some to be too competitive, and clients may deliberately limit tender lists to ensure that poor competitors do not drive out good ones. Clients, even "experienced" ones, procure relatively few buildings each year, and even when they do procure more, this is likely to be a burst of activity which is not sustained year on year<sup>10</sup>.

However, construction projects can be considered to suffer from high levels of uncertainty (Winch 1989). In terms of dynamism, they usually suffer from a lack of task information. The site specific nature of construction means that each project has a high number of unique features which need to be resolved through the project life cycle. At the early stages, factors such as the interaction of the project with existing facilities, regulated through urban planning procedures, and the dynamic nature of the client's requirements, can lead to considerable amounts of uncertainty which can only be reduced by negotiation, reworking and abortive work. For larger infrastructure projects, political considerations, particularly budgetary ones, can generate considerable dynamism. This high level of dynamism at the early stages means that it is difficult to smooth programmes of projects so that productive resources can be easily

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<sup>9</sup> At least in advanced industrialised countries.

<sup>10</sup> The main exception to this is maintenance work, which is beyond the scope of this paper.

transferred from one to another. Once on site, dynamism generated by the unknowabilities of natural conditions - both geological and climatological - generate further uncertainties. These are reinforced by the temporary nature of the project organisation - many of the actors will not have worked together before, and this creates an organisational dynamism which can easily generate conflict rather than cooperation within the project coalition. As the organisation is temporary, the returns to building long term relationships are inherently limited, and so atmosphere considerations are muted in their effects.

This dynamism is compounded by complexity. At the upper end, construction projects are amongst the most complex of production undertakings. While it remains true that construction is largely an assembly industry, that assembly work has to be undertaken on sites which, for the reasons described above, are inherently dynamic. The components to be assembled vary considerably in character and the skills that they require for their assembly. These components range from low tolerance simple components such as bricks, to high tolerance complex components such as advanced engineering services installations. Particular problems derive from the interactions between such components, or more correctly, component systems. There is also a trend through time for this complexity to increase due to technological change and more demanding client requirements. The combination of high dynamism with medium to high complexity on most construction projects generates high levels of uncertainty.

These high levels of uncertainty would be enough to drive construction procurement towards hierarchy if it were not for the low asset specificity and, especially, very low transaction frequency. The overwhelming preference by clients is for market governance of construction procurement. This preference is shared by the principal actors within the project organisation. The coalition form, as defined above, tends to be favoured. There is, however, another peculiarity of construction which derives from the time dimension of projects. The market transaction is *relational* rather than *junctural*, and it is a capacity to produce rather than a product that is purchased. This relational character of transactions pervades the entire value chain. Its most important result for our purposes here is that *once contracts have been exchanged*, considerable asset specificities are generated - the transformation is truly fundamental. The costs of replacing a project actor part-way through their service delivery are normally punitive. It is for this reason that trilateral governance of transactions both between project coalition members themselves, and between the client and the project coalition are favoured. This point is illustrated by the prevalence of complex contract forms such as the Joint Contracts Tribunal and Institution of Civil Engineers series in the UK, Code des Marchés Publics in France, the Verdingungsordnung für Bauleistungen in Germany, and FIDEC internationally.

Stinchcombe in his analysis of the North Sea oil industry has argued that under such conditions market transaction governance takes on hierarchical forms. He argues (1985 chap 2) that the reasons mainly arise from:

- difficulties in the prediction of the client's desire for contractor performance;
- uncertainty about the costs of performance, resulting in the client retaining the right to alter performances through the project life cycle;
- inability of the client to clearly measure the relative performance of the separate parties.

Due to these problems, market contracts are written in such a way that they achieve hierarchical effects by:

- specifying authority systems to facilitate change
- providing incentive systems to motivate the project actors
- using administered pricing systems to handle uncertainties such as bills of quantities
- providing conflict resolution procedures
- providing standardised operating procedures

It is these features that characterise what has been defined above as *trilateral* transaction governance.

Lorange and Roos assert that no firm will enter a strategic alliance when it can operate alone, due to the greater costs associated with working collaboratively with independent organisations. These are a combination of loss of autonomy, and hence power, and the increased transactions costs inherent in inter-organisational relations. Only where the gains outweigh the costs will collaborative forms be preferred. By extension it may be argued that unbalanced power

relations will be preferred by powerful project actors in such collaborations. In other words, coalitions and quasi-firms will be favoured over consortia and joint ventures by those actors who are nodal in the value chain. These nodal actors in construction are the principal designer (architect or civil engineer) and the principal contractor (general contractor or construction manager). Empirically, these power imbalanced forms are generally favoured, particularly by principal contractors, and may range from a strong form such as domestic subcontract in the British system to a weak form such as *groupement conjoint* in the French system. Atmosphere considerations mean that principal designers tend more towards consortia. In systems such as the UK, such consortia members are often in separate contract with the client, although this is less common in France.

However, there is an important set of reasons why at least some of the actors move more firmly towards consortia, or even joint ventures. One reason is that discussed above - the size of project relative to the size of firm. A second is to do with atmosphere considerations - the site-specific nature of production means that the idea of a local firm has a particular resonance. In some systems, such considerations are embodied in local labour requirements by public clients, or technology transfer agreements in international contracting. Such local firms may not have the necessary technology for undertaking the project, while firms that have the technology may not meet the local labour and other requirements. This is resolved by local and non-local firms entering into formal consortia such as *groupement mandataire* in the French system, and the *Arbeitsgemeinschaft* in the German.

A third reason is the problem of asset specificity. As Clark and Ball (1991) argue, where particular assets are critical to the project principal contractors prefer to enter into a formal consortium with the holders of those assets. This binds that asset holder more tightly to the principal contractor thereby reducing the latter's risk. In other words the consortium is a deliberate means of avoiding opportunistic behaviour that might be generated in the more power imbalanced collaborative forms. Such consortia are sometimes also encouraged by clients with the objective of obtaining smoother running projects. For instance British health authorities tend to favour consortia between general and services contractors because engineering services form such a high proportion of total project cost. A peculiar variety of this is the British nominated subcontract where actors with real equity of power are put into formal imbalance. As might be predicted, this causes considerable frictions.

## VARIABILITY IN CONSTRUCTION

A number of commentators have argued that variability is the main explanatory variable in the organisation of the construction industry. In a comparative study of the construction and mass production sectors, Stinchcombe (1959) argued that the distinctive "craft organisation" of production in construction was different from the "bureaucratic" organisation of production in mass production because of the greater "variability" of production process in the former. This variability, he argued was due to the seasonality of construction work, fluctuations in the volume of work, and variety in the product mix. He then deployed data to show that the more seasonal the work, the less bureaucratic was the organisation.

Building on her earlier work (1984), Campinos-Dubernet (1988) also deployed "variabilité" as an explanatory variable in her cross national analysis of the organisation of the structural trades in the construction industries of France, (west) Germany, Italy, and the UK. Variability in production processes was here defined as a result of "l'instabilité de leur lieu de production", which would appear to be a similar usage to that of Stinchcombe<sup>11</sup>. She reported that general contractors in France and Germany deployed a strategy of the "acceptation de la variabilité des processus" (internalisation of variability) by directly employing the labour and plant required for structural works, while their counterparts in Italy and the UK deployed a strategy of the "extériorisation de la variabilité des processus" (externalisation of variability) by sub-contracting for such inputs.

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<sup>11</sup> It is clear from both the context of the two arguments, and a reference to *Le Petit Robert*, that "variabilité" can be translated as "variability". However, Campinos-Dubernet appears at times to slip from a definition based on "changements prévisibles" to an inclusion of "détails totalement imprévisible" (1984 p 213).

The use of variability by Stinchcombe and Campinos-Dubernet appears to fit within the definition of variability made earlier. Both develop their analysis in contrast to the organisation of the mass production sector - Stinchcombe's focus is a critique of bureaucracy, while Campinos-Dubernet's is on Taylorism. Stinchcombe puts the emphasis upon seasonality in the construction industry, and Campinos-Dubernet prefers to emphasise the site-specific nature of the production process, but both can be seen as applications of the idea of variations within a predictable range of possibilities. However, Eccles (1981b) has criticised Stinchcombe's work, and argued that "subcontracting in the construction industry is a response to uncertainty arising from complexity" - it is complexity rather than variability which explains the development of subcontracting in the construction industry, where complexity is defined in terms of the number of functions performed by the structure. In a study drawing on US Census data, he shows that firms which subcontract (i.e. externalise the production process) more tend to specialise in technologically more complex projects, in larger projects, and to operate in more extensive markets. Variability, defined as seasonality, was found not to correlate with the extent of subcontracting. Eccles' work has been supported by Üsdiken and his colleagues' (1988) findings that extent of subcontracting was correlated with project technology.

This debate raises a number of complex conceptual and empirical issues which cannot be addressed here. In particular, there is a lack of clarity in the definition of terms such as variability and complexity in the work of these three researchers, and the empirical testing of the relationships is dubious. Eccles' ranking of the complexity of building types is open to contention; Stinchcombe only attempts to measure one component of his own definition of variability, while Campinos-Dubernet offers no empirical measure of variability. The position maintained here is that Galbraith's contention about the nature of uncertainty remains central. Uncertainty can be defined as consisting of two distinct components, complexity and dynamism as defined above, where it is not possible to define the full range of options in advance. Rationality is inevitably bounded, and decisions tend to be made on a sequential adaptive basis. Actors which contract to take the consequences of uncertainty and the pattern of rewards and liabilities flowing therefrom can be considered to be taking a risk. Under certain conditions uncertainty can be commuted into a weaker condition defined as variability where the full range of options can be specified in advance, while the final choice remains contingent. Under certain other conditions, actors can insure their actuarial risk, thereby hedging their liabilities. In both cases, the level of risk taken by actors is reduced.

In the cross-national comparison of phenomena linked to uncertainty/variability, a number of points can be made. Firstly, there is evidence that behind the apparent similarity in the definition of the terms lie profound cultural differences. Hofstede (1984) notes that on a measure of "uncertainty avoidance", French managers score much more highly than the Americans and British<sup>12</sup>. In other words, French managers might be expected to try much harder to avoid conditions where they face uncertainty than the British. This may be summarised in the aphorism that, for British managers, coping with uncertainty is the central management task, while, for the French, uncertainty is what you cannot manage.

Secondly, there is the possibility that firms in different countries face differing levels of system-derived uncertainty. From a comparative study of Britain and France (Winch and Campagnac 1995), it would appear that the differences identified by Campinos-Dubernet are strongly linked to the ability of French contractors to choose the structural technology themselves, while such choices are the responsibility of the principal designer in Britain. In other words, French principal contractors may face less uncertainty simply because they have the power to choose the structural technology. By opting overwhelmingly for *in situ* concrete French contractors can raise transaction frequencies and move down the experience curve more rapidly than their British counterparts. They can, therefore, transact hierarchically for the construction of structural elements, while the British favour collaborative trilateral governance due to lower transaction frequencies.

Thirdly, the strategic orientation of contractors is also correlated with extent of subcontracting. Campinos-Dubernet concludes that her findings show how contractor's strategies in the

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<sup>12</sup> This high uncertainty avoidance would appear to be a French peculiarity. Amongst the Groupe Bagnole countries, all display less than average uncertainty avoidance except France, with the Danes the lowest. Amongst the G7 countries, only the Japanese also display high uncertainty avoidance.

construction sector reflect the more general differences between the industrial strategies favoured by firms within the French and German economies, and financial strategies favoured by firms within the British and Italian economies - that there is a national effect in the strategic orientation of principal contractors. She does not elaborate the linkages between national system and principal contractor strategic orientation, and there can be considerable variation in the strategic orientation of principal contractors within a particular economy, as Üsdiken and his colleagues (1988) show for Turkey. However, the link between the national financial system and firm behaviour is now well established (Whitely 1992) and warrants further exploration in the context of construction.

## **CONCLUSIONS**

The study of the construction industry offers a considerable opportunity for the exploration of collaborative transaction governance. Much of Williamson's own attention has recently been directed to bilateral forms such as franchises, and franchise bidding problems. Other work on collaborative transaction governance forms has tended to be vague in terms of its specification of how transactions are being governed. The wide variety of third party actors, and the complexity of standard contract types suggests a considerable sophistication in trilateral transaction governance. In addition, the development of concession contracting for public infrastructure, and partnering for experienced clients suggests that new challenges of bilateral transaction governance may be emerging.

The study of international consortia in European construction provides a particularly fertile ground for exploring these issues. The actors in the consortia bring different skills and different cultures to the project organisation, and the dynamics of these pose considerable management problems. Additionally the consortia as principal contractors form coalitions with designers on the one hand, and subcontractors on the other. In pursuit of these enquiries, the key research questions would appear to turn around relations with the client; the internal dynamics of the principal contractor consortium in the context of the project coalition; conflict resolution procedures and the role of third party actors; and the dynamics of the project delivery process. It is these issues that the Groupe Bagnolet are presently exploring in their five case studies.