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Competitive and Cooperative Strategies in Engineering Services

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This article explores the determinants of cooperative behaviour by comparing the attitude of a similar group of companies in two different segments in which they both operate. It then explains why companies seem to be more 'cooperative' in one segment and more 'competitive' in the other.

Over the last decade there has been a great deal of interest in cooperation among firms. Using Oliver Williamson's now famous framework, cooperation is frequently analysed as an intermediate form of relationship between 'markets' and 'hierarchies'.[1-3] Cooperating firms would interact neither through pure market forces, nor through internal administrative mechanisms.

Cooperative arrangements may be more or less formal. The most formal ones entail the explicit sharing of resources supported by a contract while others may be based on informal agreements to coordinate long term strategy among the partners.[4]

Informal arrangements among competitors, buyers and suppliers have not been studied very much. We intend to contribute at this level with our research into the relationships between Engineering Service companies and other organization in their immediate direct environment.

Cooperation and Networks

The set of cooperative arrangements that a company has formed is often referred to as its network. The concept of a network is not really new in management literature. It has been used for years by Organizational Theory specialists to describe the pattern or relationships between individuals within an organization. However, the term is now being used increasingly to refer to relationships between companies.

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In Organizational Theory, networks describe the structure of relationships among actors representing several organizations that participate in decision-making.[5]

In Industrial Marketing, 'networks' refer to the links between a firm and the suppliers and buyers with which it cooperates.[6]

In Strategic Management, networks are sets of long term cooperative relationships that firms, working in the same 'stream' of activities, develop in order to gain a better strategic position. 'Networks are [. . .] a mode of organization that can be used by managers or entrepreneurs to position their firms in a stronger competitive stance'.[7]

Networks may not be adopted by all the competitors in a given industry. Some firms may choose to build a competitive advantage by relying on a networks of allies while other firms may opt for a higher level of integration in the vertical stream of activities. (For a theoretical development of the concept of a 'stream of activities,' see Paul Laurent, 1986).[8]

This approach also emphasises that cooperative and competitive behaviour may be complementary. Cooperation is not just an alternative to competition, it is a way to increase competitiveness *vis-à-vis* competitors outside the network. A network of firms will thus compete ultimately both with other networks and with integrated organizations, in the 'vertical stream of industries' (see Figure 1).

This article is concerned with cooperative behaviour which is designed to help develop a strategic position.

The Factors Affecting Cooperative Behaviour

It is important to understand the reasons for cooperative behaviour.

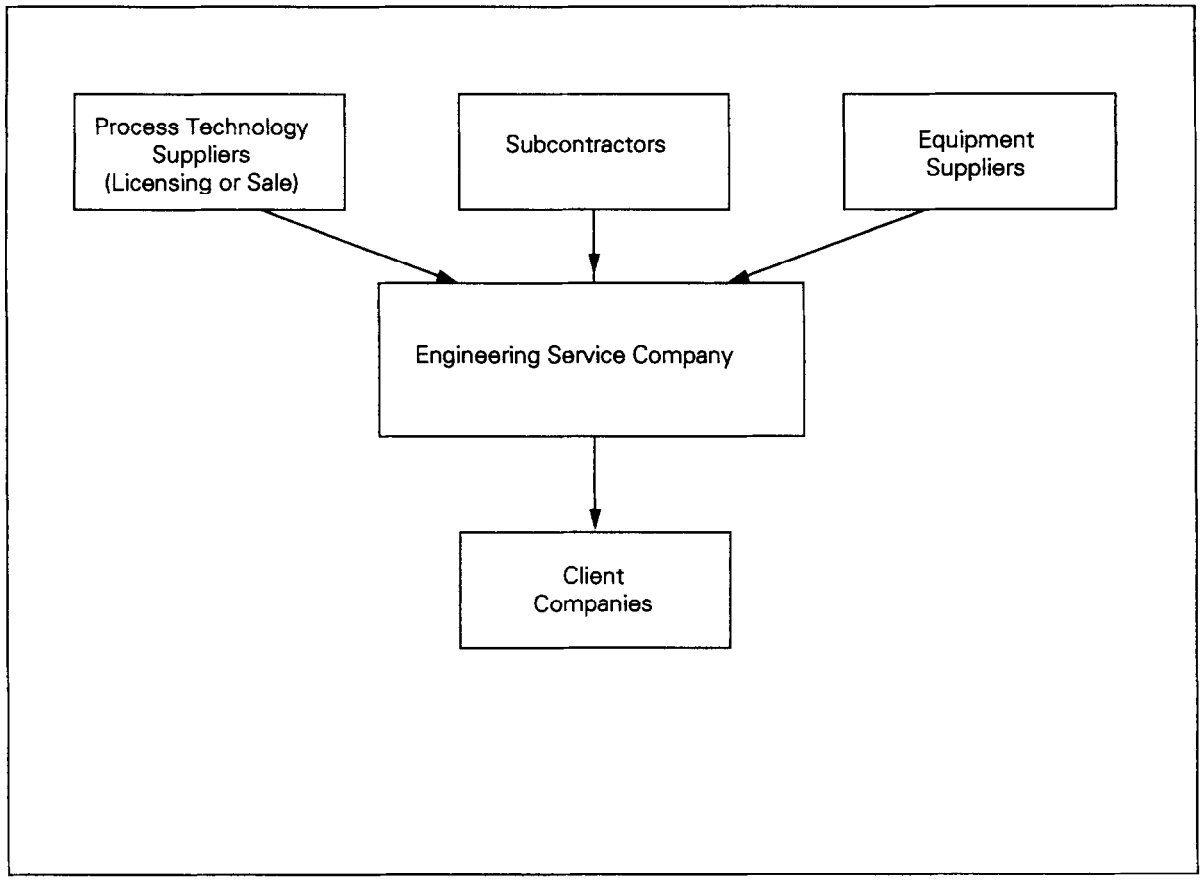

Figure 1. Networking and integration in a vertical stream of industries.

Cooperation is more frequent in some industries than in others. Specifically, as noted by Miles and Snow (1986),[9] the textile and clothing and the construction industries have a number of cooperative arrangements between buyers and sellers, subcontractors and among competitors.

Two factors help to explain why cooperation is so frequent in these industries:

1. they mobilize a large number of activities (trades) to deliver the end product.
2. they face a high level of uncertainty.

In the textile industry, changes in fashion make if difficult for the producer to know what and how much will be required by the market. In the construction industry, too, it is difficult for companies to predict what is going to be needed both in terms of type and in terms of quantity of each building trade. Therefore, companies in these industries generally prefer to limit their level of integration in order to avoid having to expand and shrink their organization continuously. However, this low level of integration might affect the quality of the end product if there were no coordination among the various parties. Therefore, cooperation mostly informal (i.e. not supported by explicit contracts) is essential.

Other research provides interesting insights into how the business environment in these two industries encourages cooperative behaviour.

After analysis the knitwear industry in Italy and the U.K. Baden Fuller, Lorenzoni and Utili (1990)[10] concluded that a *turbulent* environment tends to encourage cooperation between the producers while stability discourages it.

In the silk-twisting industry, which we studied a few years ago,[11] cooperation with the knit-wear and weaving industries was necessary because of continuous changes in fashion. These changes had a considerable impact on the selection of the raw material, the yarns, as well as on the specific twisting process used. It was important for both the client, (the knitter or weaver), and the supplier, that these changes should be anticipated.

Eccles (1981)[12] showed that contractors in the construction industry do not generally hire and fire their subcontractors as demand rises and falls. They tend to keep their subcontractors for long periods because of the cost associated with the search for and integration of new ones.

Hellgren and Stjernberg (1987),[5] looking at the development of a shopping centre also found that relationships among participants in the project could be explained by variations in demand. The network structure is a response to the complexity of

the task which requires a large number of different resources. *The network is a way to coordinate the use of resources.*

These research studies suggest that there are external reasons why firms build networks or alliances to gain a competitive advantage. In most cases, the field of analysis is the entire industry.

We felt, it would be interesting to go 'below' the industry level and examine the forces at work in a 'market segment' as part of an extensive study of the French Engineering Services industry. Engineering Services have a large number and a wide variety of cooperative arrangements, but, at the same time, competition remains intense.

Engineering Services

Engineering Services include a wide range of activities, essentially intellectual, which are combined to optimize investment decisions in terms of choice, design and project management and implementation.

The need for engineering studies is generally dealt with internally in most industries (integrated engineering). However, there are also some consulting engineers who help client organizations with their investment decisions. Their clients are usually either industrial firms or central and local government.

In France, there are three different 'markets' for Engineering Services: Construction (building), Infrastructure (roads, railways, underground systems . . .) and Manufacturing. Our study focused on this last market, which we call 'Industrial Engineering Services'. Most Engineering service companies specialize in only one of these three markets, although a few of them operate in more than one.

There are about 850 Industrial Engineering Service firms in France which have a work force of around 31,000 employees. The average size of each firm is rather small. There are hundreds of companies with less than 20 employees but the 20 largest firms have a work force of 200 persons or more with the two top firms employing nearly 1500 persons.[13]

Demand is directly related to the level of industrial investment, which fluctuates in accordance with the state of the national economy; interest rates, economic trends, forecasts . . . . A large part of the demand for engineering services comes from a few industries: Petroleum, Chemicals, Energy, Steel, Electronics and Mechanical Engineering whose investment levels can vary considerably over time. Uncertainty concerning future demand is thus a key feature of the Engineering Services industry.

The activities of engineering companies are intangible and 'intellectual' to the extent that they involve skilled labour in terms of design and evaluation. As shown in Figure 2, engineering services cover a wide variety of activities. A 'turn-key' contract, for example, includes all the stages mentioned in Figure 2. However, in most cases, the engineering service company's intervention is limited to stages 2 or 3 to 6 or 7.

Even with the narrower scope of activities, engineering services represent a wide variety of tasks: analyses, drawings, market studies, supervision of work in progress, purchasing . . . These activities do not require the same sets of skills. Technical drawing calls for one kind of work force, supervision of a major industrial yard requires another.

The diversity of skills and competences needed requires division of labour within the Engineering Services industry. Professionals tend to consider size as a key factor to determine a company's role in the industry. Small engineering companies are generally limited to stages which require fewer resources and skills and they act as subcontractors to large companies which are able to undertake turn-key projects.

In addition to clients and subcontractors, Engineering Service companies interact with two types of organizations: equipment suppliers and know-how suppliers. Equipment Suppliers provide machines or systems that will be installed in the client's plant. Know-how suppliers show the client how to use the equipment. These are generally firms which use this kind of equipment in their industrial activities. Engineering services are thus part of a 'vertical stream of industries' (see Figure 2).

The Research

We decided to select two market segments that are particularly important in the demand of engineering services: Refining and Petrochemicals and Fine Chemicals and Pharmaceuticals. According to professionals these two segments were homogeneous enough in terms of strategic considerations.

Interviews were conducted in seven companies in both segments. As expected, there is considerable overlap between the two segments with most companies operating simultaneously in each. Appendix 1 presents the companies represented in each sub-sample.

Six companies are represented in both sub-samples. So differences between the samples are likely to be due to differences between the market segments.

Research data was collected through personal interviews with the top managers of engineering services companies, either the General Manager or the Marketing Directors.

Table 1. Stages in engineering services

Stages	Actors	Comments
1. Decision to invest	Client	Often following studies by the planning department
2. Feasibility Study	Engineering Company	Often performed by a consulting company specialized in economic studies
3. Process engineering	Engineering Company	By the Engineering Company or another company in the same industry
4. General engineering	Engineering Company	Technical design of the production unit for the client
5. Detailed engineering	Engineering Company	Detailed technical design of a plant, equipment location, energy supply system. etc.
6. Procurement	Engineering Company	Selection of equipment suppliers
7. Construction	Construction Company	Based on the Engineering Company's design
8. Delivery and assembling of equipment on-site	Suppliers	According to Engineering Company specifications
9. Inspection and control	Specialized Control Organization	Control takes place each time a step has been carried out
10. Acceptance	Engineering Company	According to Control Organization's assessment
11. Staff training	Engineering Company	Possibly with the owner of the process
12. Start up	Engineering Company	In the case of a 'turn-key' contract

Adapted and translated from Alfred Hubert: *Le contrat d'ingénieur-conseil,* Paris: Masson, 1980, p. 127.

Note: The scope of the engineering service, i.e. the number of stages provided, depends on the capabilities of the client company which may perform some of the stages themselves. The Engineering contractor may be responsible as a main contractor, for a stage which is subcontracted to another firm (a consultant, or another engineering company . . .)

The interview, included a series of questions about the relationships between the companies and the other organizations operating in the 'vertical stream of industries' (Figure 2). Our objective was to assess the relative importance of cooperative and competitive relationships. We tried to evaluate whether the relationships between the Engineering Services companies and other organizations in the vertical stream of activities were ruled by 'market forces' (through competitive bidding for example) or by collaborative arrangements, either implicit or explicit. We also introduced a number of questions which had been used in previous research studies (e.g. Eccles)[12] about the duration of commercial relationships and the method used to select suppliers, among others.

The research data clearly reflect, managers' perceptions rather than objective reality substantiated by facts. However cooperative behavior is itself the product of perceptions and we wanted to understand these perceptions.

The Results

We will first present the results of our survey and then provide some possible explanations.

Cooperative behaviour is substantially more developed in Refining and Petrochemicals than in Fine Chemicals and Pharmaceuticals (See Table 2).

Engineering Service companies, felt less competitive pressure on orders coming from their top client in the petrochemicals segment than in the fine chemicals segment. This was linked to the fact that this top client was more often a shareholder. They also had had a longer relationship with this top client.

Similarly, relationships with their competitors were more 'cooperative' in petrochemicals than in fine chemicals; four out of seven companies (57.1 per cent) perceived opportunities for cooperation in the petrochemicals segment, but only two out of seven (28.6 per cent) saw opportunities for cooperation in the fine chemicals segment.

The relationships with subcontractors were also more cooperative in petrochemicals than in fine chemicals; a larger proportion of companies mentioned longer relationships.

However, relationships with equipment and know-how suppliers were not so cooperative. The selection of equipment suppliers was clearly dictated by 'market forces' (competitive bidding). Few engineering service companies mentioned long-term relationships with their know-how suppliers,

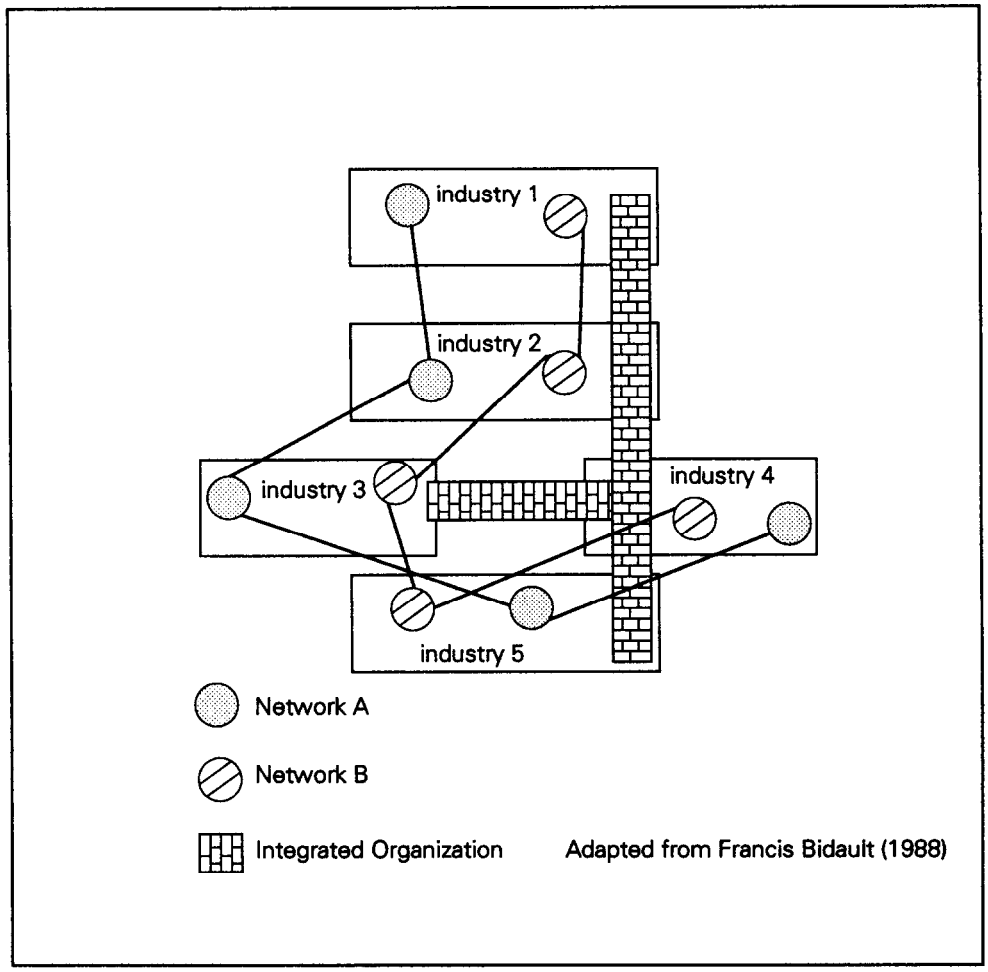

Figure 2. The vertical stream of industries in engineering services.

although there were more in fine chemicals than in the petrochemicals (two out of six vs one out of five).

Overall, the cooperative 'atmosphere' was more developed in petrochemicals. Cooperative behaviour is clearly influenced by external factors and in this case, these external factors reflect the market segment structure.

The two segments differ indeed along several dimensions.

1. Petrochemicals has been a traditional market for Engineering Services while Fine Chemical companies have become major clients only recently. This is consistent with the fact that clients are more often shareholders in Petrochemicals (Table 2). Similarly, top clients seem 'older' in the first segment i.e. top client placing orders for more than 5 years.

2. Refining and Petrochemicals companies for many years, have relied on Engineering Services to manage their investments and they buy their services regularly. Fine Chemicals and Pharmaceuticals firms are new clients and they do not use the Engineering Services as often. This is shown in Table 2: Top clients place more than five orders per year more often in Petrochemicals than in Fine Chemicals.

3. The technologies which are used in Refining and Petrochemicals are considerably more widely understood than the ones used in the Fine Chemicals–Pharmaceuticals segment. Petrochemical firms use similar technologies. Furthermore, Engineering Service companies continue to diffuse these technologies: they acquire them from existing users and transfer them to new firms. Since users are equally competent in the technologies, Engineering Service companies need not establish long term relationships with them as know-how suppliers. Instead, they prefer to 'pick up' new technological improvements wherever they appear (see Table 2). On the other hand in the Fine Chemicals and Pharmaceuticals industries, there is a wider variety of technologies for a given application. Some of these technologies are obviously better and provide their users with a stronger competitive position. In this context, product and process technologies have to be kept secret. The role of Engineering Service companies, as 'transferers' of technology, is thus reduced. However, professionals consider that Fine Chemical and Pharmaceuticals is progressively becoming more open to Engineering Services because there is a need to rationalize past investments.

4. Refining and Petrochemicals firms tend to buy Engineering services that are broad in scope (encompassing more stages of activities, see Table 1)

Table 2. Stages in engineering services

Data: numbers and percentages of responses in agreement with assertion below	Oil Refining and Petrochemicals (7 companies) Number	%	Fine Chemicals and Pharmaceuticals (7 companies) Number	%
Relationships with top client				
— Top client is the shareholder or the parent co.	2/7	28.6	0/7	0
— Top client places more than 5 orders per year	4/7	57.1	2/6	33.3
— Top client has been top for more than 5 years	5/7	71.4	4/7	57.1
— Engineering company always perceives competition *vis-à-vis* this client	3/7	42.8	5/7	71.4
Relationships with equipment suppliers				
— Contracted through competitive bidding	7/7	100	7/7	100
Relationships with know-how suppliers				
— Existence of long term relationship with some suppliers	1/5	20	2/6	33
Relationships with subcontractors				
— Subcontracting represents more than 30% of activities in segment	4/7	57.1	2/7	28.6
— Duration of relationships is, on average, more than 5 years	4/6	66.6	2/4	50
Relationships with competitors				
— Perception of an intense competitive pressure	3/7	42.8	5/7	71.4
— Existence of cooperation opportunities	4/7	57.1	2/7	28.6

while Fine Chemicals and Pharmaceutical firms 'subcontract' engineering studies that are more limited. This is consistent with the fact that these firms are worried about the possible loss of their technology secrets. Also there is a difference in the relationship with subcontractors which suggests a difference in the nature of the services provided to clients. Subcontractors are generally specialized in certain activities and their intervention seems to be more limited in the Fine Chemicals segment than in Petrochemicals (see Table 2).

We believe that the differences between the two segments can be interpreted in terms of the market life cycle.

The Refining and Petrochemicals segment looks more mature: the market is 'older', technologies are no longer able to provide differentiation, relationships are well established. With time, repeated interaction has progressively led to partnership.

The Fine Chemicals and Petrochemicals segment is 'younger', and is growing faster, with technologies that are less diffused, and less 'mature'. Consequently, the interaction beween Engineering Services and their clients in these industries has a shorter history. Clients have not interacted enough with their service suppliers to eliminate bidding. Mutual knowledge and trust have not been built sufficiently to allow cooperation to rule the selection of commercial counterparts.

Our analysis suggests that the degree of cooperative behaviour in a market segment depends on its maturity: the more mature the market, the more cooperation there is among firms. However, we must stress that the relationship between 'maturity' and 'propensity to cooperate' should not be generalized to all kinds of industry setting. *Engineering Services have certain characteristics that are 'conducive' to cooperate behaviour: multiplicity of trade and uncertainty.* Therefore, maturity should only be considered as an additional factor influencing 'propensity to cooperate'. In another industrial context, maturity might well have an opposite effect, e.g. in commodity markets.

Conclusion

This article explores the origins of cooperative behaviour. We looked at the relationships between Engineering Service, companies with their buyers and suppliers in two market segments, Refining–Petrochemicals and Fine Chemicals–Pharmaceuticals.

1. Cooperative behaviour was more developed in the Petrochemicals segment than in the Fine Chemicals.

2. Petrochemicals is more 'mature' than Fine Chemicals in various dimensions. For an industry like Engineering Services which requires the intervention of a large number of specialists, from different businesses, and in which there is great uncertainty about future demands, we believe that 'maturity' tends to encourage 'cooperative behaviour'.

The limited size of our sample does not allow us to go beyond the formulations of hypotheses. A larger, more international, sample would be needed to check our assumptions.

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Appendix 1: Data on the two sub-samples

The Sample of Engineering Services Companies in the Oil Refining–Petrochemicals Segment

	A	B	C	D	E	F	G
Size (employees)	<250	>350	250–350	250–350	250–350	<250	>350
Corporate status (Parent co. or affiliate)	P	A	A	A	A	A	A
Main business of parent co.	Engineer	Manufa.	Constru.	Manufa.	Engineer.	Constru.	Manufa.
Share of segment of the engineering co.'s activities	20–50%	>50%	<20%	>50%	<20%	<20%	<20%

The Sample of Engineering Service Companies in the Fine Chemicals–Pharmaceuticals Segment

	A	B	C	E	F	G	H
Size (employees)	<250	>350	250–350	250–350	<250	>350	>350
Corporate status (Parent co. or affiliate)	P	A	A	A	A	A	P
Main business of parent co.	Engineer	Manufa.	Constru.	Engineer.	Constru.	Manufa.	Engineer.
Share of segment in the engineering co.'s activities	20–50%	<20%	<20%	<20%	>50%	>50%	>50%