

Headquarters' Control Capacity and the Choice of R&D Organizational Forms Abroad

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Abstract

The paper aims to explain the choice of organizational forms by multinational companies (MNCs) when decentralizing abroad their R&D activities. We identify five main organizational forms: wholly owned green-field subsidiary, wholly owned acquired subsidiary, joint venture, cross-licensing agreements and unilateral licensing agreements. On the basis of questionnaires addressed to the R&D managers of American and European MNCs, we highlight that the choice of an organizational form is related to the firm's capacity of control, performance measurement and incentive systems, to resolve the agency conflicts in each form. Our findings show that the internalization choice is underprivileged because of behavioral control difficulties. The possibility of ensuring a strategic performance evaluation of R&D activities favors the cross-licensing agreement over the joint venture choice. Finally, the choice of unilateral licensing agreements is not supported because of feasibility issues concerning the financial evaluation of the performance of R&D activities.

Keywords: R&D, Foreign Investments, Multinational Companies, Control Mechanisms, Organizational Forms.

1. Introduction

To engage in R&D activities abroad, multinational companies (MNCs) can use several types of organizational forms, which vary according to the expected degree of organizational interdependence (Narula and Hagedoorn, 1999). For instance, they can internalize intangible assets either by creating a wholly owned subsidiary, or by acquiring R&D intensive firms. They can also create alliances with partners by using two types of cooperative relations: equity or non-equity alliances. Finally, they may choose to externalize R&D activities entirely, by purchasing licenses. Although R&D has become an important option in market introduction (Lint and Pennings, 1998), only a few empirical studies incorporate all these organizational forms as alternative modes of governance, in terms of R&D investment. Given the complexity of the phenomenon, various theoretical approaches have been applied to explain the choice of organizational forms for conducting R&D. For example, we can list different combinations of transaction costs and social capital theories (Arranz *et al.*, 2007), core competence and cost advantage perspectives (Huang *et al.*, 2009) as well as transaction cost economics and real options reasoning (Van de Vrande *et al.*, 2006). Hence the scientific knowledge in this area is insufficiently structured. In addition, it needs a more comprehensive approach as previous researches generally study only one form, or compare some of the forms defined by Narula and Hagedoorn (1999). Sampson (2004) presents a study that examines the organizational choices in R&D alliances, but he studies only two alternative forms of R&D investment: the bilateral contract and the equity joint venture. Erramilli (1996) examines the subsidiary ownership preferences of American and European multinational firms. He distinguishes between two governance modes: majority ownership (more than 50% equity in the subsidiary, including full ownership) and minority ownership (50% or less equity). Odagiri (2003) analyses ten cases of R&D investment in Japan, in order to explain the R&D boundaries of firms. Nevertheless, all these cases relate only to research alliances with various partners, domestic

or foreign. In this context, our study has identified five organizational forms: wholly owned green-field subsidiary, wholly owned acquired subsidiary, joint venture as an equity alliance, cross-licensing agreement as a non-equity alliance, and, finally, unilateral licensing agreements.

The choice of type of R&D investment depends on the capacity of MNCs in terms of the allocation of decision-making rights and knowledge management. The delegation of certain decisions by leaders, to their subordinates or partners, may generate information asymmetry issues. Thus, incentive and control systems are required (Jensen and Meckling, 1992). However, the efficiency of incentive and control systems in resolving agency problems between partners depends on the degree of R&D decentralization, which differs from one organizational form to another. Hence, this paper examines the effect of control mechanisms, performance measurement and incentives systems on the choice of R&D governance mode. We address the following question: How do control mechanisms, performance measurement and incentive systems impact multinational firms' choice of the appropriate organizational form to invest in R&D abroad?

On the basis of 67 of 769 questionnaires addressed to the R&D managers of American and European multinational firms, our results show that the internalization choice is underprivileged because it involves behavioral control difficulties. The possibility of ensuring strategic performance evaluation of R&D activities favors cross-licensing agreements over a joint venture. Finally, we find that the choice of unilateral licensing agreements is not supported because of the difficulties related to the financial evaluation of the performance of R&D activities.

The rest of the paper is organized as follows. Section 2 introduces the theoretical background, and predicts how incentive and control mechanisms affect the choice of R&D governance modes by MNCs. In addition, we provide a more detailed description of the diverse governance modes, and of the capacity of MNCs to control R&D activities abroad. We will also develop propositions that indicate the effect of control capacity on the choice of governance mode. Section 3 presents the data gathered by a

questionnaire survey. Questionnaires were sent to R&D managers in the headquarters of MNCs based in Europe and North America. Section 4 highlights the research findings derived from our econometric models. The final section concludes with a discussion of our propositions, and some directions for future research. Hence, this paper intends to contribute to the literature by mobilizing organizational architecture theory to shed light on the choice by MNCs of different governance modes for developing R&D abroad. Considering these modes as complementary strategies allows MNCs to use more than one form to invest in R&D abroad.

2. Theoretical framework

To contribute to the analysis of the choice of R&D governance modes, we focus on the control mechanisms and incentive systems that are needed in each form, to limit conflicts and inconsistencies between the players involved. Ouchi (1979, 1980) formulated one of the most recognized typologies of these mechanisms, by distinguishing three modes of control: behavior control, control by results (outcomes) and clan control. Ouchi's framework (1979, 1980) has been used by different academics, particularly to explain organizational efficiency in multinational firms (Eisenhardt, 1989, Chang and Taylor, 1999). In our study, Ouchi's mechanisms are used to explain multinational firms' choice of the above R&D organizational forms.

2.1. Behavioral control

Behavioral control involves, on one hand, the direct supervision of subsidiaries' operations by the parent company, and, on the other hand, the formalization of various rules and the standardization of various procedures, and the specification and the meticulous planning of the contents of work (Martinez and Jarillo, 1989). Such control depends on the headquarters having a deep understanding of subsidiaries' operations (whether wholly owned or joint venture). However, for MNCs, geographic distance prevents headquarters from directly overseeing the behavior of the foreign subsidiaries'

executives (O'Donnell, 2000). Mascarenhas (1984) notes that, although these mechanisms may, in a stable environment, facilitate interdependence between firms, this will not be the case in an uncertain and complex international environment. Furthermore, given the uncertainty tied to R&D activities and the ambiguity of their results, the use of such bureaucratic mechanisms may undermine the effectiveness of the control of agency issues between parent company and subsidiaries (wholly owned or joint venture). Indeed, the presence of partners (at least two) may also affect the effectiveness of behavior control. Indeed, any possible disagreement between parent firms on the rules and procedures to be standardized, and any inappropriate coordination, may disturb the management of the joint venture. Thus, this control mechanism may be insufficient, or even ineffective, in controlling R&D activities in a subsidiary located abroad. The existence of an information asymmetry between headquarters and subsidiaries may limit the use of this type of control.

Under licensing agreements, the licensee and the licensor firms can agree on working rules and contractual clauses that refer, for instance, to royalties, contract duration, intellectual property rights issues and the conditions of contract termination. Some of these rules, which Oxley (1997) and Lui and Ngo (2004) call contractual safeguards may help to reduce opportunistic behavior by each contracting party, as well as informational asymmetries. Strengthening these clauses may compensate for the lack of control resulting from the low degree of interdependence between the partners.

Hypothesis 1: All things being equal, regarding R&D investment abroad, the difficulties of exercising behavioral control by the headquarters do not support the choice of wholly-owned subsidiary and joint venture, as compared to unilateral and cross-licensing agreements.

2.2. Outcome control

MNCs may opt for outcome control when performance information is available (Eisenhardt, 1989). This control consists of evaluating performance and attributing rewards or penalties. The parent company can control its subsidiaries' executives and assess their performance by financial control tools

(Budgets, IRR, NPV, etc.). Nevertheless, this control mechanism is “short-term,” and is based on a large number of financial criteria. This may be misleading because the financial evaluation of R&D is not easy to achieve, due, among other things, to (i) the time horizon for such investment being particularly long, (ii) the uncertainty tied to such activities, and the ambiguity of their results, and (iii) the complexity of the international environment. Indeed, such financial evaluation of the performance of R&D activities is more problematic to implement for a joint venture than for a wholly-owned subsidiary (Geringer and Hebert, 1991), because the partners do not necessarily have the same perception of the results, or use the same financial evaluation criteria. Ojanen and Vuola (2006) consider R&D performance measurement a multi-dimensional, multi-criteria and multi-person task.

In the case of licensing agreements (unilateral or cross contracts), the progress of the R&D project performed within an independent laboratory prevents the partners from evaluating not only each other, but also the ex ante performance of R&D activities. Generally, R&D performance is difficult to assess accurately due to its inherent uncertainty. However, ex-post performance can be estimated by the royalties paid. Indeed, low fees paid to an innovation owner may indicate the market’s poor acceptance of the output, and thus reveal the poor performance of the research activities. It is worth mentioning that the success or failure of a product may not be directly associated with the performance of the licensor’s R&D activities, but is sometimes related to poor efforts by the licensee, in terms of marketing and advertising.

Hypothesis 2: All things being equal, regarding R&D investment abroad, the difficulties in assessing financial performance do not support the choice of joint venture, unilateral and cross-licensing agreements, as compared to wholly-owned subsidiary.

There is an obvious need for a strategic control that may be more long-term oriented and more based on qualitative criteria, such as strategic scorecard, innovation, product quality and the competitive position of the subsidiary (Kim and Oh, 2002). The assessment of performance based on strategic

control may be considered subjective, as it involves the judgment of the parent company according to its understanding of the subsidiary's activities. However, this control is easier to use in the case of a wholly-owned subsidiary than for any other organizational form (joint venture, unilateral or cross-licensing agreement), insofar as potential cultural and managerial differences may induce divergent interpretations of these criteria. As a result, joint or licensed R&D activities may be considered strategically successful by one partner, but far from it by another. In this respect, Buchel and Thuy (2001) note that the evaluation of a joint venture may be influenced by (1) the appreciation of the interests of each parent company, (2) changes in relationships and behaviors among the partners, and (3) an individual assessment by each partner of the learning process success. This subjectivity and divergence in interpretations decreases the probability of selecting joint venture, unilateral or cross-licensing agreements, rather than wholly-owned subsidiary, as an organizational way to invest in R&D abroad.

Hypothesis 3: All things being equal, regarding R&D investment abroad, difficulties related to the assessment of the strategic performance do not promote the choice of joint venture, unilateral and cross-licensing agreements, as compared to wholly-owned subsidiary.

To motivate its subsidiaries' executives, the parent company generally uses two basic pillars of the incentive system: compensation policy and career policy (O'Donnell, 2000; Galbraith and Merrill, 1991). The remuneration of the subsidiary's executives or directors may be either fixed (monthly salary) or variable (bonus plans, profit sharing, stock option plans, etc.). As a dynamic for achieving good performance, variable pay may be much more motivating than fixed fees, because it depends on the fulfillment of predetermined goals. Career policy aims in particular to assign the appropriate people to the most suitable position (the right person in the right place). This kind of policy is also intended to encourage ambitious persons - those who look for higher remuneration and prestige in relation to high-

ranking positions - to act accordingly. Hence, depending on the outcomes of the evaluation of the wholly-owned subsidiaries' executives, the parent company may maintain them in their position, promote them within the subsidiaries or headquarters, or sanction them. These incentive systems are more difficult to establish in the framework of a joint venture than in a wholly-owned subsidiary due, amongst other reasons, to the potential divergence in the pay systems of the parent firms. Such a problem is quite absent in the case of a wholly-owned subsidiary, which is characterized by the existence of a single parent firm. As a result of differences in pay systems between countries, generally the foreign partner (the joint venture) prefers to reward expatriate executives via the pay system of the country of origin. However, local leaders in the same position may then be paid much less than their colleagues. These differences relate primarily to bonuses based on performance, family allowances, benefits and repatriation premiums (Leung and Kwong, 2003). Career policy may also be affected by discrepancies between managers and executives. In the case of the top management of the joint venture, each parent company seeks in particular to put its former employees in key positions, at the expense of the other partner. As a consequence, this may raise problems between parent firms and between executives of the joint venture who come from different companies.

For unilateral or cross-licensing agreements, the compensation clause may motivate more partners to behave in an appropriate way, and to provide the information needed for the proper conduct of R&D activities. The pay system comprises a fixed lump sum and variable royalties. The lump sums paid at the signature of the agreement are intended to protect the licensors against the unpredictable failure of their technologies on the market. They correspond to the minimum operating costs of the innovations associated with unilateral or cross-licensing agreements. If it subsequently appears that the royalties paid are lower than the required minimum amounts, the termination of the contract may become possible. According to this logic, the lump sums paid may have an incentive effect, in the sense that

each of the two co-contracting firms becomes more motivated to develop its marketing and industrialization policy to ensure that it is not paid royalties below these required amounts.

Hypothesis 4: All things being equal, regarding R&D investment, difficulties in the implementation of incentive systems by headquarters do not promote the choice of joint venture, as compared to other organizational forms of R&D investment.

2.3. Clan control

Clan control, the so-called socialization practices, includes expatriation, staff training, visits, and operational meetings between representatives of headquarters and subsidiaries (Chalos and O'Conner, 2004). These allow the subsidiary to share the same values, the same culture and the same behavioral standards, in order to facilitate the transfer of know-how and expertise. Asakawa (2001) states that MNCs operating in the R&D area generally prefer the use of short-term social control (i.e. training, visits and meetings) rather than a long-term one (i.e. expatriation). The author justifies this choice by noting that the excessive use of political expatriation may threaten the independence of subsidiaries located abroad. Also, this may depreciate subsidiaries' specific assets, as a result of excessive interaction between expatriate managers and local staff. Several firms, such as Canon and Sharpe, adopt visits or training seminars as socialization practices, rather than expatriation. In so doing, these companies aim to reduce headquarters' influence on laboratories located abroad, specifically because R&D activities are very sensitive to their local environment (Asakawa, 2001).

However, it is less complicated to use clan control, and so to harmonize cultural aspects in a green-field wholly-owned subsidiary, than in a joint-venture, unilateral or cross-licensing agreement, due to headquarters' cultural differences. Indeed, partners or contracting firms are generally from different countries, and therefore belong to different cultures and use different managerial practices. Once the contract of cooperation is signed, the partners provide mutual technical assistance, by means of meetings and training seminars, to ensure the proper exploitation of R&D. This mutual training has

more chance of success in the presence of a climate of trust and transparency. Nevertheless, the opportunism of some partners may help to protect their own basic knowledge, and to avoid any transfer of it to other parties.

Hypothesis 5: All things being equal, the use of short-term socialization practices as control mechanism supports the choice of the green-field wholly-owned subsidiary, as compared to other organizational forms of R&D investment.

3. Data and descriptive statistics

To test the aforementioned hypotheses, we conducted a survey from November 2005 to January 2006, by means of a questionnaire sent to R&D managers of 769 MNC headquarters located in Europe (499) and North America (270). All companies operate in the industrial sector regardless of their activities (biology, pharmaceutical, electronics, computers, telecommunications etc.). We used WorldScope database and companies' websites in order to select firms. We relied on two main criteria: (1) foreign assets ratio (foreign assets to total assets), and (2) foreign sales ratio (foreign sales to total sales). To identify R&D managers, we referred to companies' websites and annual reports, French "Guide of headquarters executives" as well as *Osiris* database. After following up by phone, fax and e-mail, we received 67 valid responses, a response rate of 8.71%. The 67 MNCs totalize 206 R&D organizational forms. Table 1 presents the distribution of companies by countries of origin.

Table 1. Sample distribution by countries of origin

Countries	Number of questionnaires	Number of responses	Response rate
Germany	92	12	13,04%
Belgium	12	4	33,33%
France	100	13	13%
Italy	15	4	26,67%
Netherlands	14	3	21,43%
Sweden	45	6	13,33%
Suizerland	53	4	7,55%
UK	168	9	5,35%
Canada	90	1	1,11%
USA	180	11	6,11%
Total	769	67	8,71%

3.1. Dependent variables

The dependent variables represent the five organizational patterns in R&D investment: (i) internalization by acquiring R&D intensive companies (ACQ), (ii) internalization by establishing wholly-owned subsidiaries (WOS), (iii) joint ventures with foreign R&D intensive companies, as an equity alliance (JVE), (iv) cross-licensing agreements, as a non-equity alliance (CLA), and (v) unilateral licensing agreements, as a mode of externalizing R&D (ULA).

Table 2 shows the descriptive statistics of the five organizational patterns in R&D investment. Our results indicate the preference of MNCs for the internalization of their R&D, rather than other organizational forms (equity or non-equity alliances, or unilateral licensing agreements). Forty-seven percent (25% + 22%) of these firms internalize their R&D through the acquisition or creation of subsidiaries, against 37% (16% + 21%) who prefer equity or non-equity alliances; and, finally, only 16% opt for outsourcing through the purchase of unilateral licensing agreements. We also note that internalization through the acquisition of R&D intensive firms (53.1% = 51/96) is more practiced than internalization through the creation of a wholly-owned subsidiary abroad (46.9% = 45/96). Non-equity alliances represent 56.6% (43/76) of total R&D alliances, against 43.4% (33/76) for equity alliances.

Table 2. Foreign R&D investment forms by Multinational Firms

Acquisition of R&D intensive firm (ACQ)		Greenfield wholly-owned subsidiary (WOS)		Joint venture with foreign partners (JVE)		Cross-licensing agreement (CLA)		Unilateral licensing agreement (ULA)	
Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
51	25%	45	22%	33	16%	43	21%	34	16%

3.2. Independent variables

To measure the independent variables, we deploy a principal component analysis (PCA). The explanatory variables are related mainly to control, performance measurement and the incentive mechanisms used by headquarters to control R&D activities abroad. Thus, we asked respondents to indicate the relative importance of each item on a Likert scale from 1 = very weakly to 5 = very strongly. The principal component analysis leads to representing the different variables investigated by the factors described, in Table 3. Before beginning factors analysis, we verified that the data are suitable for factor analysis, by calculating KMO index and Bartlett's test of sphericity. To determine the number of the extracted factors, we retained those with eigenvalue > 1. Note that these factors were extracted using a Varimax rotation. In addition, Cronbach's alpha was calculated for each factor. The accepted level of alpha is 0.6. The extracted factors provide the value of the total variance explained.

Table 3. PCA regarding the explanatory variables

Variable	Factor	Variance (%)	Initial eigenvalue	Cronbach's alpha
Difficulties related to the exercise of behavioral control on R&D managers	Factor 1-1 (fact11): The uncertainty of the international environment and R&D activities	27.671	1.660	0.759
	Factor 2-1 (fact21): Geographical distance, informational asymmetries and difficulty of coordination	27.532	1.652	0.607
	Factor 3-1 (fact31): The divergence of rules, laws and procedures between partners	19.709	1.183	0.621
	Total	74.912		
Difficulties related to the financial evaluation of the performance of R&D activities	Factor 1-2 (fact12): High number of criteria and differing interpretations	34.574	2.074	0.758
	Factor 2-2 (fact22): the mismatch between the characteristics of R&D and financial control	32.454	1.947	0.699
	Total	67.028		
Difficulties related to the strategic evaluation of the performance of R&D activities	Factor 1-3 (fact13): The subjective character of the strategic evaluation and divergences in criteria interpretation and in national cultures	32.259	2.258	0.704
	Factor 2-3 (fact23): Uncertainty and difficulty of coordination	28.049	1.963	0.756
	Total	60.308		
Difficulties related to the implementation of incentive systems to motivate the R&D managers	Factor 1-4 (fact14): Restrictions and ambiguity in laws and divergence between incentive systems of parent companies	39.342	2.361	0.7673
	Factor 2-4 (fact24): The difficulty of performance measurement and of coordination of R&D activities	26.214	1.573	0.647
	Total	65.556		
Recourse of the parent firm to clan control	Factor 1-5 (fact15): The recourse of the parent firm to clan control	58.717	1.762	0.641
	Total	58.717		

3.3. Descriptive statistics

Through Table 4 to Table 8, we show some descriptive statistics of behavioral and clan control, the performance assessment and incentive mechanisms used within MNCs.

To determine the nature of the behavioral control that the parent firm may have on the directors in charge of R&D based abroad, we relied mainly on the work of Martinez and Jarillo (1989) and O'Donnell (2000). The behavioral control mechanisms and their related statistics are presented in

Table 4. It appears that difficulties related to the exercise of behavioral control of R&D activities emanate from issues related to direct supervision, and to the specification and planning of tasks. In fact, Table 4 shows that 71% of the MNCs surveyed use slightly (very weakly, weakly and somewhat) ‘direct supervision and the close personnel surveillance of R&D managers.’ Direct supervision seems difficult to achieve, given the geographical distance between headquarters and their subsidiaries. Over 50% of MNCs state that they use slightly (very weakly to somewhat) ‘job specification and the planning of different tasks.’ Indeed, the definition, the description and the scheduling of various duties and functions within a MNC are considered a very complex issue, due to the geographical dispersion.

Table 4. The use of behavioral control mechanisms (in %)

	The standardization of procedures and the formalization of clauses and rules (%)	Direct supervision and close surveillance of R&D managers (%)	Job specification and the programming of the different tasks (%)
Very weakly	3	6	5
Weakly	11	28	20
Somewhat	20	37	26
Strongly	40	18	35
Very strongly	26	11	14
Total	100	100	100

For the financial criteria performance assessment of R&D activities, we referred mainly to Ojanen and Vuola (2006). The criteria used are (1) the budget, (2) productivity, (3) the NPV/IRR, (4) the payback period and (5) the ROE/ROA. The results of the survey show that budget and productivity are the two financial criteria most used to evaluate the performance of R&D activities abroad. Table 5 indicates that 70% and 61% of respondents used budget and productivity, respectively, at least strongly. Regarding more defined financial metrics, 61% and 50% of firms surveyed stated that they used the criteria ROE/ROA and NPV/IRR, respectively, at very low to medium level.

Table 5. The use of financial criteria to evaluate the performance of R&D activities

	Budget (%)	Productivity (%)	NPV/IRR (%)	Payback period (%)	ROE/ROA (%)
Very weakly	4	5	5	7	3
Weakly	8	12	18	13	21
Somewhat	18	22	27	25	37
Strongly	44	46	39	43	25
Very strongly	26	15	11	12	14
Total	100	100	100	100	100

Following Kim and Oh (2002) and Ojanen and Vuola (2006), we distinguish the following strategic criteria to evaluate R&D performance (Table 6). The strategic assessment of the performance of R&D activities located abroad seems to be based mainly on the criterion ‘degree of acceptance of innovative products by the market,’ which is strongly used by 88% of the sample. In second position are ranked equally ‘the competitive position of the firm’ and ‘innovation capacity.’ They are used at least strongly by 76% of firms surveyed. The ‘strategic scorecard’ is therefore used at least strongly by 56% of firms. The ‘number of patents obtained,’ ‘reputation’ and ‘absorptive capacity’ are used very weakly, weakly and moderately by 67%, 69% and 85%, respectively, of the sample.

Table 6. The use of strategic criteria to evaluate the performance of R&D activities

	Strategic scorecard (%)	Extent of the absorptive capacity of the firm (%)	Number of patents obtained (%)	Degree of acceptance of products by the market (%)	Competitive position of the firm (%)	Degree of technological and scientific development (%)	Innovative strength (%)	Reputation (%)
Very weakly	8	7	7	1	0	3	2	7
Weakly	14	30	30	5	2	5	2	17
Somewhat	22	48	30	6	22	32	20	45
Strongly	42	15	30	58	52	43	59	25
Very strongly	14	0	3	30	24	17	17	6
Total	100	100	100	100	100	100	100	100

To measure the incentive systems that the multinational firm can use to motivate R&D managers, we refer to O’Donnell (2000) and Galbraith and Merrill (1991). We highlight monetary incentive systems and non-monetary incentive systems. Table 7 indicates that bonuses are the most used monetary incentives to encourage R&D managers, insofar as 77% of respondents declared using them at least strongly. Unlike bonuses, monthly wages seem to be much less considered. In fact, less than a third of the sample (29%) used them at least strongly. Profit-sharing plans and stock option plans are used at an intermediate level. These results suggest that, to motivate R&D executives, variable monetary incentives are used much more than fixed monetary incentives. Regarding non-monetary incentives, our results suggest that career policy creates more incentives than benefits in kind (housing assistance, travel, etc.). Indeed, for almost half the sample (53%), the parent companies used career policy as an incentive criterion at least strongly, while only 20% of firms attribute the same importance to benefits in kind.

Table 7. Incentive systems of R&D managers (in %)

	Monetary incentive systems				Non-monetary incentive systems	
	Monthly wages	Profit-sharing plans	Bonus plans	Stock options plans	Benefits in kind	career-based rewards
Very weakly	11	6	3	11	7	5
Weakly	16	13	2	5	30	8
Somewhat	44	29	18	27	43	34
Strongly	21	34	43	37	15	40
Very strongly	8	18	34	20	5	13
Total	100	100	100	100	100	100

Following Chalos and O’Conner (2004), we emphasize that clan control can be summarized in (1) frequent visits, (2) operational meetings and (3) vocational training. The expatriation is excluded from our study because this mode of clan control is not practicable in all organizational forms (i.e. unilateral and cross-licensing agreements). Table 8 shows that vocational training is used by parent companies much less than frequent visits or operational meetings. Only just over one-fourth of respondents (27%)

consider that parent firms used vocational training at least strongly to disseminate the values, the organizational culture and the norms of the MNC. However, about two-thirds of the sample, and almost eight respondents out of ten, declared that the parent firms rely at least strongly on frequent visits (67%) or operational meetings (83%).

Table 8. Clan control practices (in %)

	Frequent visits	Operational meetings	Vocational training
Very weakly	0	0	10
Weakly	10	0	34
Somewhat	23	17	29
Strongly	47	67	24
Very strongly	20	16	3
Total	100	100	100

4. Econometric models

We built a Zellner SUR (Seemingly Unrelated Regressions) model. It consists of five equations. The model assumes that the dependent variables, although apparently unrelated, are in fact related through the structure of error terms. It supposes that there are common factors that are not observable but can simultaneously influence the dependent variables (namely, different choices regarding R&D investment abroad). The adoption of a SUR model is explained by the fact that MNCs may use more than one form of investing in R&D abroad. Thus, the use of this model is justified by the complementarity between the organizational forms, which cannot be treated by the multinomial logit model.

4.1. Testing hypotheses

4.1.1. SUR model

The study of multicollinearity among the factors relative to the five independent variables above mentioned led us to eliminate the factor fact 11 ‘uncertainty of the international environment and R&D

activities.’ We noticed that some VIF were quite high and that the correlation matrix of factors shows only one correlation coefficient > 0.5. The latter was related to factors: fact11 ‘uncertainty in the international environment and R&D activities’, and fact23 ‘uncertainty and difficulties of coordination’. To overcome multicollinearity, we decided to retain only the factor fact23 insofar as the factor fact11 did not provide better results and that removing it shows more significant coefficients than those obtained after removing the fact23. As a result, the new correlation matrix of the 9 remaining factors shows no correlation coefficient > 0.5. In addition, all VIF are below 10, the tolerances are greater than 0.1 and the condition index values under 20. As a result, the Zellner model is as follows:

$$ACQ_i = \alpha_0 + \alpha_1 \times fact21_i + \alpha_2 \times fact31_i + \alpha_3 \times fact12_i + \alpha_4 \times fact22_i + \alpha_5 \times fact13_i + \alpha_6 \times fact23_i + \alpha_7 \times fact14_i + \alpha_8 \times fact24_i + \alpha_9 \times fact15_i + \varepsilon_{1i}$$

$$OWS_i = \beta_0 + \beta_1 \times fact21_i + \beta_2 \times fact31_i + \beta_3 \times fact12_i + \beta_4 \times fact22_i + \beta_5 \times fact13_i + \beta_6 \times fact23_i + \beta_7 \times fact14_i + \beta_8 \times fact24_i + \beta_9 \times fact15_i + \varepsilon_{2i}$$

$$JVE_i = \gamma_0 + \gamma_1 \times fact21_i + \gamma_2 \times fact31_i + \gamma_3 \times fact12_i + \gamma_4 \times fact22_i + \gamma_5 \times fact13_i + \gamma_6 \times fact23_i + \gamma_7 \times fact14_i + \gamma_8 \times fact24_i + \gamma_9 \times fact15_i + \varepsilon_{3i}$$

$$CLA_i = \theta_0 + \theta_1 \times fact21_i + \theta_2 \times fact31_i + \theta_3 \times fact12_i + \theta_4 \times fact22_i + \theta_5 \times fact13_i + \theta_6 \times fact23_i + \theta_7 \times fact14_i + \theta_8 \times fact24_i + \theta_9 \times fact15_i + \varepsilon_{4i}$$

$$ULA_i = \lambda_0 + \lambda_1 \times fact21_i + \lambda_2 \times fact31_i + \lambda_3 \times fact12_i + \lambda_4 \times fact22_i + \lambda_5 \times fact13_i + \lambda_6 \times fact23_i + \lambda_7 \times fact14_i + \lambda_8 \times fact24_i + \lambda_9 \times fact15_i + \varepsilon_{5i}$$

With

ACQ: Acquisition of foreign R&D intensive companies/

WOS: Greenfield wholly-owned subsidiary.

JVE: Joint venture as an equity alliance/

CLA: Cross-licensing agreement as a non-equity alliance.

ULA: Unilateral licensing agreements as an externalization mode of R&D.

4.1.2. Results

The findings of our model are shown in Table 9.

Table 9. SUR Model results

Hypothesis	Factors	ACQ	OVS	JVE	CLA	ULA
1	fact21	0.3898 (1.27)	0.3916 (1.31)	-0.1076 (-0.71)	-0.5010 (-2.80) ***	-0.1031 (-0.70)
	fact31	-0.7193 (-2.49) **	-0.1113 (-0.39)	-0.0829 (-0.59)	0.4906 (2.91) ***	0.5537 (4.02) ***
2	fact12	-0.2012 (-0.58)	0.2164 (0.64)	0.3867 (2.27) **	-0.0299 (-0.15)	-0.1677 (-1.01)
	fact22	0.2439 (0.72)	0.2250 (0.68)	0.4429 (2.67) ***	-0.2794 (-1.42)	-0.3741 (-2.31) **
3	fact13	-0.3778 (-1.20)	0.1258 (0.41)	-0.0386 (-0.25)	0.3492 (1.91) **	0.0271 (0.18)
	fact23	-0.2191 (-0.71)	0.3035 (1.00)	-0.3867 (-2.55) **	0.1429 (0.79)	0.0542 (0.37)
4	fact14	0.4218 (1.33)	-0.4236 (-1.37)	-0.2325 (-1.50)	0.0238 (0.13)	0.0346 (0.23)
	fact24	0.1084 (0.41)	-0.2555 (-0.98)	-0.1484 (-1.13)	0.0000 (0.00)	0.2448 (1.92) *
5	fact15	-0.1942 (-0.68)	-0.0734 (-0.27)	-0.0579 (-0.42)	0.1347 (0.82)	0.0274 (0.20)
	constant	1.9532 (8.02)	1.8533 (7.80)	0.6747 (5.66)	1.2002 (8.47)	0.7814 (6.73)
	R ²	19.57%	9.15%	27.43%	31.53%	34.14%

***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Our results show that the coefficient α_2 is negative and significant at the 5% level, and that the coefficients θ_2 , λ_2 are both positive and significant at 1% level. Under hypothesis 1, the variable ‘The difficulties related to the exercise of behavioral control on R&D managers,’ via its third factor ‘divergence of rules, laws and procedures between partners,’ does not favor the choice of acquisition of an R&D intensive firm (ACQ), and promotes the choice of unilateral and cross-licensing agreements (ULA and JVE). Indeed, in the case of unilateral or cross-licensing agreements, a difference in laws and bureaucratic procedures between firms may strengthen the development of ‘contractual safeguards.’ These contracts, which are particularly useful in the case of a low degree of interdependence, compensate for the lack of control by a better description of the duties and obligations of each firm, and by guaranteeing transparent relationships.

Table 9 shows that γ_3 and γ_4 are significantly positive, at 5% and 1%, respectively, and that λ_4 is significantly negative at 5% level. The positive sign of the first two factors (fact12 and fact22) means that the factors extracted a ‘high number of criteria and differing interpretations,’ and that ‘the mismatch between the R&D characteristics and financial control’ supports the choice of JVE. This finding partially contrasts with hypothesis 2. The effectiveness of joint ventures in the exchange of resources and technological know-how held by the partners may be a plausible explanation for the positive effects of both factors. Indeed, despite the difficulty of the financial evaluation of R&D activities, the partners agree to collaborate through the constitution of a JVE, in order to benefit from the transfer of skills. The impact of the two factors on the choice of wholly-owned subsidiaries (acquired or created) is not significant. Nevertheless, in accordance with our hypothesis, fact22, ‘the mismatch between the characteristics of R&D and financial control,’ has a negative effect on the choice of unilateral licensing agreement (ULA). We notice that the licensee is often characterized by its lack of experience in the R&D area, and its shortage of the technological resources required for a successful R&D project. Hence, the licensee may be unable to properly assess the performance of the R&D of its partner. This is due mainly to the uncertainty of R&D activities, the ambiguity of their results and their long-term horizon, on the one hand; and to the short-run focus of financial control, on the other hand.

Table 9 also shows that γ_6 and θ_5 are both significant at 5% level, with negative and positive signs, respectively. In other words, the second factor, ‘uncertainty and difficulty of coordination,’ of the variable ‘difficulties related to the strategic evaluation of the performance of R&D activities’, negatively influences R&D investment through joint ventures (JVE). This confirms partially hypothesis 3. Here we recognize that the uncertainty related to R&D activity and the ambiguity of its results, as well as that of the international environment, and the difficulty of coordinating R&D activities scattered over the world, reduce the parent firms’ capacity to assess the strategic performance of R&D activities in a joint-venture. However, the first factor, ‘the subjective character of the strategic

evaluation and divergences in criteria interpretation and in national cultures,' which influences positively the choice of cross-licensing agreements (CLA), contradicts partially the third hypothesis. We notice from these results that, despite the difficulty of the strategic assessment of R&D performance, MNCs prefer to cooperate through cross-licensing agreements (CLA) rather than by establishing a joint venture (JVE). This can be explained by the flexibility of the cross-licensing mode compared to joint ventures. A cross-licensing agreement (CLA) is often characterized by lower exit costs than a joint venture (JVE). When the cooperation ends, firms do not have to support the additional costs inherent in equity alliances.

Through its second factor, 'the difficulty of performance measurement and coordination of R&D activities,' the variable 'difficulties related to the implementation of incentive systems' favors the choice of unilateral licenses (ULA). This result confirms partly assumption 4, and the coefficient λ_8 is significantly positive at 10% level. Firms investing in R&D through a unilateral licensing agreement can overcome the problems related to incentive systems by establishing a remuneration scheme based on variable royalties and a fixed lump sum payment. This will signal the quality of the knowledge transferred. High royalties paid to the licensor motivate the latter to provide more information and transfer more valuable know-how to the licensee. However, if the remuneration is based only on fixed lump sums or lower royalties, the licensor is not encouraged to transfer its expertise to the licensee. The transfer may then be restricted to general information that the licensee can also find in textbooks, or in the brochures accompanying the license agreement.

Regarding the effect of clan control on the organizational form choice, Table 9 shows that none of the five coefficients is significant. Hence, there is no relationship between the use of socialization practices and the choice of the organizational form of foreign R&D investment. Thus assumption 5 is not validated.

5. Conclusions

The aim of this paper is to explain the choice of organizational forms of R&D investment abroad regarding MNCs' control capacity and incentive systems. Using Ouchi's classification, we distinguished three mechanisms of control: behavioral control, outcome control and clan control. Given the characteristics of R&D and the specificities of each organizational form, some difficulties may arise in the exercise of these different types of control. The degree of success or failure of each mechanism of control leads to the choice of one among many organizational forms. For instance, behavioral control appears to be easier to employ under unilateral or cross-licensing agreements than in wholly owned subsidiaries or joint ventures. In the case of unilateral or cross-licensing agreements, the low degree of interdependence between partners tends to reinforce certain contractual terms necessary to replace the lack of control resulting from a majority stake in the capital. The financial evaluation of performance is complicated to perform, regardless of the organizational form chosen, as a result of (i) the uncertainty associated with R&D and the usually long time horizon, and (ii) the multitude of financial criteria and the short-term orientation of such control mechanisms. Despite its subjective nature, the strategic evaluation of performance seems to be less difficult to perform in the context of wholly-owned subsidiaries than in other organizational forms. However, incentive systems are more difficult to establish in the framework of joint ventures than in other organizational forms, due to the differences in incentive systems between the home countries of the parent companies.

Regarding the aforementioned propositions, our statistical tests produce evidence that the choice of internalization within a wholly-owned subsidiary is not preferred, given the difficulties in performing behavioral control in such an organizational form. Consistent with our prediction, the results also confirm that the choice of a joint venture is disadvantaged by the difficulties related to the strategic assessment of the R&D performance. Moreover, this choice is made despite the weak feasibility of assessing the financial performance of R&D activities. A plausible explanation for this finding may lie

in the ability of the joint venture to exchange and transfer resources held by the partners. Also, the choice of cross-licensing agreements is made despite the difficulties related to the strategic assessment of R&D activities. This in turn is related to the flexible nature of this kind of cooperation. In the case of contract termination, companies bear lower exit costs than those involved in exiting from other organizational forms with a high degree of interdependence. Consistent with our hypotheses, the choice of unilateral licenses is disadvantaged by the difficulties in assessing the financial performance of R&D activities. Firms are more likely to opt for this choice when the hurdles related to the exercise of control behavior and the introduction of incentive systems can be overcome through an appropriate specification of contractual terms that clarifies the duties and obligations of each partner, and its remuneration system.

Finally, we emphasize that Ouchi's clan control is not validated within our study. We found no relationship between the socialization practices and the choice of organizational forms of R&D investment abroad.

Despite its contributions, our study has a few limitations that offer interesting opportunities for further research. First, it is based on a limited number of firms, and thus does not allow us to compare the control practices of European and American multinationals' firms regarding their R&D investments abroad. Second, this study investigated R&D control systems as viewed by headquarters' R&D managers. This influences the independence embedded into the study. Hence we suggest that future researches could consider a larger number of firms across several countries, and perhaps also address a questionnaire to both headquarters and their partners. Case studies conducted within MNCs may also provide additional insights into the dynamic of the choice of R&D investments abroad. This would be particularly helpful in explaining why a large firm may switch from one organizational form to another.

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