

**Impact of Management Control Systems' Intensity of Use on Joint Venture's  
Performance: an Empirical Assessment**

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# **Impact of Management Control Systems' Intensity of Use on Joint Venture's Performance: an Empirical Assessment**

## **Abstract**

This paper contributes to the discussion of management control systems in international JVs (Groot and Merchant, 2000). To answer if intensity of use of management control systems play a role in perceived JV performance I used a contingent model to test data from 65 JVs in the motor and auto parts industry. The findings show that the impact on management control systems' intensity of use of some factors varies due to the role that each partner plays in the JV, which is shaped by the assets committed. High performers use management control systems more intensively to overcome the two main sources of uncertainty faced by the JV: local market conditions and product/process technology. Alternative explanations of JV performance are partners' trust and cultural fit (Das and Teng, 2001), however the results of partners strategic fit was not conclusive.

## **Keywords:**

management control systems, joint ventures, performance, market complexity, technological complexity, contingency theory, intensity of use.

## INTRODUCTION

The business press pays much attention to the phenomenon of strategic alliances because they have become an important issue in the internationalization strategy of many companies. But there are indicators that such operations are not so successful, being individual personalities and the lack of a common culture and open communications the main causes mentioned. Reports show that one-third of the 49 strategic alliances<sup>1</sup> tracked by McKinsey were flops (Sherman, 1992), that success rate improved only from 51% in 1991 to 53% in 2001 (Bamford et al., 2004), and that 55% of strategic alliances fall apart within three years while only 23% recovered the costs (Segil, 1999 and 2004). A study made by the consulting firm McKinsey found that management control systems are one factor commonly quoted as important (Sherman, 1992), and a survey made by Watson Wyatt International (2000) showed that the bottleneck is an incompatibility of cultures in 42% of the cases, followed by 22% of cases where the problem was rooted in the management accounting information systems.

The purpose of this paper is to contribute to the understanding of the intensity of use of management control systems as an uncertainty reduction mechanism that in turn impacts on joint venture (JV) perceived performance, being motivated by the varied results reported in the literature. Accounting and management studies have used performance as the dependent variable on which any other variable impacts. Although a large number of studies covered the impact of control on JV performance, the results are not convergent and some conclude that there exists a positive relationship (Killing, 1983; Lecraw, 1984; Pangakar and Klein, 2004), others show a negative relationship (Beamish, 1985; Blodget, 1991; Boateng and Glaister, 2002), while a third group offered mixed results (Beamish and Banks, 1987; Ramaswany et al., 1998).

Part of the problem is that there are many ways to define and measure JV performance and control. Performance measures include a variety of financial indicators typically employed in business research, such as profitability, growth and cost positions (Lecraw, 1983); objective measures such as survival (Killing, 1983; Geringer, 1990), duration (Kogut, 1988) and instability of ownership (Gomes-Caceres, 1987). This study considers the achievement of JV goals as the most comprehensive and complete measure of JV performance (Ariño, 2003; Child and Yan, 2003). Studies of JVs in management journals conceived control as parent control (Child and Yan, 2003; Chalos and O'Connor, 2004) or governance mechanisms (Bamford et al., 2004), however recent studies adopt a concept of control which through repeated interactions increases the commitment and trust between the JV participants (Madhok, 1995). In this study control is narrowed to the concept of intensity of use of five types of information and five control mechanisms which is more in line with the accounting literature tradition (Davila, 2000). The academic literature in accounting has only produced limited exploratory studies that do not look at intensity of use of controls as a way to reduce uncertainty and to improve perceived performance (Groot and Merchant, 2000; Van der Meer-Kooistra and Vosselman 2000), therefore this paper is aimed at partially filling that gap.

The rest of the paper is organized in five sections. After reviewing the theoretical foundations of the issue, the hypotheses to test will be developed. Then details of the research and survey design are provided as well as the results of the empirical study. The paper finishes with a discussion and a conclusion.

## RESEARCH LITERATURE

In broad terms, any management control system is designed and used with the purpose of determining, assessing and reducing the gap between what is desired, what is possible and what has actually been achieved. Management control systems are designed to create conditions that will increase the probability that desirable outcomes will be achieved by directing attention towards the goals to be achieved by the organization and toward the desired behavior of participants. Consequently in this paper management control systems are defined as the set of formal and informal mechanisms (structures and processes) that provides information that reduces uncertainty for decision making. In JVs, like in other organizational forms, there are two main types of controls: governance mechanisms and management accounting systems (Senaux, 2006).

The specific characteristics of strategic alliances, such as multiple decision-making centers, constant bargaining and clashes of interest, make them an unstable form of organization (Ariño and de la Torre, 1998). As management control systems in organizations in general, management control systems for equity JVs are designed, implemented and used to reduce, within the firm, the probability of occurrence of unforeseen events by influencing the JV managers behavior and JV output through the use of power, authority and a wide range of bureaucratic, cultural and informal mechanisms, in other words they are used to reduce uncertainty. In JVs the main sources of uncertainty are the partner's behavior and the particularities of the local environment and the industry. By studying JVs in the same industry this study is able to reduce the variability of the three sources of uncertainty that are believed to impact on JV performance. In the motor and auto parts industry has been observed in the last decade a globalization leaded by a small number of companies that are the main and direct suppliers (tier 1) of car makers. Previous studies argued that JVs are set

up as a way to reduce transaction costs (Kogut, 1988) where each partner contributes with particular tangible and intangible assets; particularly in this industry the pattern of JV formation observed is a big international firm (tier 1) with a local firm (tier 2 or 3), that although is familiar with local regulations and the socio, political and economic environment is not in the board of suppliers of major automotive firms. This matching of partners shows that the foreign partner contributes technological know how while the local partner contributes with local market knowledge (Meschi, 2004; Voicu, 2004).

Contingency theory is used to build the framework to study this emerging topic. This theory explains how an appropriate management control system can be designed to reduce uncertainty based on factors such as customer/industry (market) knowledge and product/process technology know-how. The contingent control literature is based on the premise that a correct match between contingent factors and a firm's control package will result in desired outcomes. The findings of contingency theory in the accounting literature can be summarized in the relationships between a group of factors and their impact on management control systems. The first relationship tested and accepted in the accounting literature is that environmental uncertainty has an effect on management control systems design. While Chenhall and Morris (1986) and Govindarajan (1988) assert that the impact of the environment on management control systems is direct, Gordon and Narayanan (1984) assert that impact is indirect, and is mediated by structure. Waterhouse and Tiessen (1978) were unable to separate the effects of environment and technology, while Chenhall and Morris (1986) assert that both environment and technology impact on management control systems design and are independent from each other. Management style (Govindarajan, 1988) and culture (Markus and Pfeffer, 1983) were used not as the main explanation for differences but were marginally mentioned as explanators. Although contingency theory reviews are largely negative indicating a lack of an overall framework for the analysis of the

relationship between contingent factors and accounting and control systems elements (Chapman, 1997, Chenhall, 2003), it is the best available theory to use as the framework of this study.

## **HYPOTHESIS DEVELOPMENT**

The theoretical framework is constructed around one research question aimed at explaining if intensity of use of management control systems plays a significant role on JV performance due to its capacity to reduce uncertainty. To answer it, this study focuses on the impact of the intensity of use of management control systems as an intervening variable between external contingent factors such as JV partners market and technology experience and the dependent variable of JV performance. Previous studies have documented that management control systems contribute to reduce uncertainty, which in turn improves performance (Davila, 2000), because they reduce agency costs and facilitate decision making (Davila and Foster, 2005). In this study the focus is in JVs within the automotive industry where the main external sources of uncertainty, as understood by the JV managers based on the partners past experience, are local market and product/process technology issues. The view of resources committed to the JV is also in line with transaction costs literature (Kogut, 1988). JV partners enter into JVs to save some costs but have to commit certain assets, which by their nature are inseparable such as market and technology know how, therefore the use of controls as an effective manner of reducing uncertainty is critical for JV success. It is possible that JV partners' previous experience help to improve performance directly or indirectly through a more intense and knowledgeable used of management control systems. This paper

will explore the idea of intensity of use of management control systems as an intervening variable that affects JV performance given certain market and technology conditions.

### **JV Performance**

Adopting the JV manager perspective this paper asks if control mechanisms contribute to good JV performance. Alternatively, management papers argue that trust and strategic fit are critical for JV success (Das and Teng, 2001; Inkpen and Curral, 2004), consultants' surveys show that cultural fit is a key element, and this paper proposes that JV partners experience also improves JV performance. The first hypothesis to test considers all alternative mechanisms of reducing uncertainty in JV besides the intense use of management control systems, and stated in the null form is as follows:

**Hypothesis 1:** JV performance is not affected by any of the following uncertainty reductions mechanisms: JV partners past experience, trust, and JV partners cultural and strategic fit.

### **Management Control Systems**

Studies from the managerial literature seldom partition the concept of control into different components, the majority focuses on governance mechanisms such as ownership, key personnel appointments and board issues; however, few authors look at other mechanisms such as reporting and auditing (Wang et al., 1998). As mentioned, studies taken from the management literature only explore governance mechanisms while on the other hand the management accounting literature has studied a full array of management accounting systems such as budgeting and planning, performance evaluation, incentives and compensation, cost allocation mechanisms and transfer price rules.

This paper considers the existing literature on governance mechanisms, but will explicitly study also management accounting systems. JV managers need information to update the expectations of consequences of their decisions and actions, being management control systems, not only governance mechanisms, a relevant source of management information because JVs like entrepreneurial companies face dynamic settings that put a premium on timely information updating (Davila and Foster, 2005). Therefore it is expected a direct and positive relationship between JV performance and intensity of use of control mechanisms. Hence, the role of management control systems is reflected in hypothesis 2:

**Hypothesis 2:** JV performance is not affected by the intensity of use of management control systems.

### **Contingent Factors**

To provide some order and to guide this research, two hypotheses are developed that relate JV profile or characteristics (determined by contingent factors treated as sources of uncertainty) with the intensity of use of management control systems. First, it is expected that the larger the experience the lower the complexity and the more the uncertainty is reduced due to an efficient use of available information (Luo and Park, 2004; Meschi, 2004). If a firm serves an established group of customers, their needs and requirements are well understood and uncertainty is low; but when entering a new market or targeting a new group of customers, the uncertainty regarding customer requirements and information to evaluate it increases (Desai et al., 2004). More experience allows JV managers to know which type of information to use and how to use it in order to improve performance, therefore market and customer information are highly used in order to reduce uncertainty. This reasoning leads to hypothesis 3a stated in alternative one-sided form:

**Hypothesis 3a:** Management control systems are used less intensively as market and customer experience increases.

Second, in the particular setting of JVs, a certain product and production technology is familiar to at least one JV partner, implying low uncertainty; while it is probable that for the other partner the level of technology complexity is so high that in spite of having very detailed technology related information, it is not possible to use it (Desai et al., 2004; Nakamura and Nakamura, 2004; Voicu, 2004). In the first case, technology information will be intensively used to keep uncertainty low, while in the second case it is probable that the technology information is not used therefore it is expected that the intensity of use will not be high. In line with this reasoning, the paper will explore the intervening role of management control systems in the following hypothesis also stated in alternative one-sided form:

**Hypothesis 3b:** Management control systems are used less intensively as product and process technology experience increases.

## **EMPIRICAL METHOD**

To increase the power of the research design, this study made three choices. First, building on previous JV life-cycle models (Ariño and De la Torre, 1998) four stages in the evolution of an equity JV are identified for control purposes. The first stage involves agreeing on initial conditions (pre-forming discussion or negotiation); the second stage includes the signing of the shareholder agreement, licensing agreement and bylaws (initial agreement); the third stage is the lapse of time between the signing of the initial documents and the preparation for beginning operations (initial execution and learning); and the fourth stage

involves normal operations (execution, learning, re-evaluation, re-adjustment, and re-negotiation). This study focuses on the fourth phase because this phase shows clearly the information structure set in place in the JV. Only JVs that had been functioning for at least a couple of years can evaluate their performance. The focus on one stage of the JV's life permits to reduce the noise that would result when mixing responses from JVs in different phases.

The second design choice is the definition of the relevant unit of analysis. Anthony (1965) identified three levels of management control systems that are considered as relevant for this study, strategic, managerial and operational, therefore the unit of analysis selected is a position that works with the three of them to a certain extent (Davila, 2000). The JV manager (but not any manager from the JV partners), is the unit of analysis of this study and we focus on the management control systems that he/she uses on a regular basis. The relevant data of managers surveyed is in Table 1. The data on Table 2 show that JV managers receive information more frequently than any of the two JV partners, supporting the selection of this person as the unit of analysis of this study, because consistent with previous studies it is the manager of the unit, the JV in this study, the only one who intensively uses all management control systems.

Insert Tables 1 and 2 about here.

The third and last research design choice is the set of JVs analyzed. This study is based on one industry, motor and auto parts manufacturers (SIC 3174), to keep external variables both constant and small. This industry has been selected mainly due to the way it is configured, with international companies dominating the landscape which are engaged in multiple JVs between them but mostly with local companies across the world. Many studies on JVs have selected this industry to arrive at sound conclusions, providing a good

background on the topic (Burgers et al., 1993, Gulati, 1995; Dyer, 1996; Dyer and Nobeoka, 2000).

### **Sample**

The industry estimates that are around 2,000 JVs with more than two years of operations (www.justauto.com by March 2003), being that number the population of reference. Due to the lack of an industry database, the researcher identified as many as possible, being able to confirm the existence of 201 JVs with somewhat balanced ownership between two partners and with a known mailing address (also e-mails and fax numbers were used when mailing address was not available). Table 3 has the details of the sample construction. This survey achieved an acceptable response rate of 32% (65 useful responses out of 201 questionnaires sent) which was achieved following several procedures (Dillman, 1978) such as: introductory letter, cover letter that accompanied the questionnaire, follow ups in one and three weeks, re-sending the questionnaire in 8 weeks, plus two follow ups in the week 9 and 11. Although many of the items used in the questionnaire were taken from Davila (2000) and Ariño (2003), to avoid perceptual biases the questionnaire was pre-tested with 21 subjects, being 7 of them JV managers, 7 managers of companies in the industry, and 7 academicians with experience in survey questionnaires.

Insert table 3 about here

### **Survey Questionnaire**

The measurement of items included in the survey and their transformation into variables has been subject to reliability and validity analysis. The measure of internal consistency considered for most of the constructs is Cronbach's alpha. To enhance construct validity the questionnaire included whenever possible item measures and scales already used in previous

studies. For internal validity purposes late response bias was tested by splitting the sample in halves and finding no significant difference in descriptive statistics or in regressions run with JV performance as the dependent variable; and non-response bias was tested by comparing participant and non-participant JVs in terms of size (employees and/or revenues), age, ownership structure and geographical localization; no significant differences were found in either case. Additionally the use of factor analysis to collapse several items into factors contributed to reliability and validity assessments (Carmines and Zeller, 1979).

The constructs that operationalize the research variables are based on the JV manager uses of information and are adapted from previous studies, Davila (2000) for management control systems and Ariño (2003) for JVs, with the purpose of increasing the construct validity. The following paragraphs details each variable used in this study.

### **Independent Variable: JV Performance**

Following the questionnaire design of Davila (2000) and adapting it to JVs based on Ariño (2003), JV performance can be rated as high or low based on the JV managers' opinion on 18 items; grouped in the JV manager perception of JV performance (13 items) and in the JV manager assessment of the importance of the criteria used to measure JV performance (5 items). The drawback of using self-reported measures is that they might be affected by perceptual biases, but it has the advantage of capturing most of the relevant dimensions and also takes into account the expectations. In 5 JVs, when public information was available, the perceived performance reported by the JV managers was contrasted with the financial performance reported by the JV to third parties. In all the cases it was found that there was a high concordance between both groups of indicators.

## Management Control Systems

In this paper the results reported are based on a questionnaire that was designed to capture all possible dimensions of information used for managing the JV, so it asked about control mechanisms and types of information frequently used in the automotive industry. A description of all of them follows:

### Control Mechanisms

- 1) Governance mechanisms: Ownership structure, objectives, obligations and purposes of the JV partners, decision making and conflict resolution processes, composition of the board of directors and top management team, and appointment of the external auditor.
- 2) Budgeting and Planning: Purpose, timeliness and appropriateness of budgets, unit of measure, periodicity of preparation and procedures, flexibility and employee participation, planning separated from budgeting, effort and stress to fulfill the budget, and budget slack.
- 3) Cost Allocation: Identification of direct and indirect costs, allocation of period and product costs, identification of service areas, joint costs, by-products and sub-products, assignment of costs and procedures for product cost construction.
- 4) Transfer Prices: Type of decentralization, responsibility centers, autonomy, mechanisms of transfer pricing systems, link with performance measures, object of the transfer price and decision making bias.
- 5) Performance Measurement: Segments and activities to be controlled, map of duties, responsibilities and powers, type and nature of the objectives set, patterns and rules of performance measurement, evaluation of results and analysis of variances, sanctions, rewards, compensation and incentives.

### Types of Information

- 1) Local Regulations: Issues that change from country to country such as labour safety and environmental regulation.
- 2) Time Related: Timing of each product or process, such as production line set up and logistic planning.
- 3) Financial: Measures of financial reporting system, such as budgets, cost, margin and profitability reports and analysis.
- 4) Customer and Market: Customer requirements and new products bids, such as periodic quantities based on the production plan.
- 5) Product and Process: Technological performance and efficiency measures, such as detailed specifications, quality conformance and blueprints.

The measures of intensity of use were obtained for both control mechanisms and information types. For control mechanisms the importance of the information provided to facilitate the JV manager's work and the time devoted to the information of each control mechanisms in the JV manager's meetings has been measured. These measures were collapsed into the variable of intensity of use of control mechanisms. Following the questionnaire design of Davila (2000) each type of information is evaluated in a 5 point

Likert scale along five characteristics: level of detail (high or low), frequency of updating (from never to weekly), degree of formality (high or low), importance for management (high or low), and time dedicated in meetings with the JV team and with the JV partners (indicated as percentage). It is expected that the five characteristics are *a priori* highly correlated because they all have the purpose of reducing uncertainty (Merchant, 1981), therefore they can be collapsed in one concept: intensity of use of information types.

### **Independent Variables: Contingent Factors**

Reviewing some of the differences in contingency studies done in management accounting (Chapman 1997; Harrison and McKinnon, 1999; Chenhall, 2003) it seems that most of them arise because researchers are not consistent with the meaning of each factor used, and with the variable constructs designed to measure them empirically. To provide for clarity and consistency, in this study, market complexity is measured as perceived JV partners past experience and is defined in terms of experience with customers, target and local market, industry, and competitors. All the measures of market experience can be collapsed into two variables, one related with the local partner experience (knowledge of the socio, political and economic environment) and the other with the foreign partner experience (industry trends and global supplier specifications).

Technological complexity is measured as perceived JV partners experience, and is measured in terms of process and product technology experience. In the questionnaire, process and product technology range from well-known to unknown, implying a low to high uncertainty for JV managers (Davila, 2000). In the particular setting of JVs in the auto and motor parts industry, a certain product and production technology is familiar to at least one JV partner which is committing it as an asset.

## **Control Variables**

In this study five variables are used as control factors with the aim to identify their impact on JV performance and on intensity of use of management control systems. This paper uses two measures of JV scope/complexity: JV duration and lines of products manufactured. Given the level of specialization in the industry, is normal to observe plants focused on only one product, for instance gas tanks, with 2 or 3 production lines that manufacture somewhat different gas tanks based either on the technology used (blowing or casting) or the level of completeness of the product (just the gas tank, or the final product ready to install in the car with the gas pump included among other parts). It is expected that older and more complex JVs will use control mechanisms more intensively to overcome the tendency towards poor performance due to the lack of direct communications between all parties involved, just as documented in early-stage/start up companies (Davila and Foster, 2005), therefore no relationship is expected to find between JV complexity and performance given the moderating effect of use of control mechanisms.

The second control variable used is the type of JV. In the industry three main types of partnerships are identified. The most common is type 1 where one international firm sets a JV in a country associated with a local firm; type 2 is when two international firms set up a JV in a third country; and type 3 is when two local firms set up a JV in their own country. However all JVs it is constantly observed a partner specialist in the technology and another partner that either knows the local market (other plants or investments in the JV host country) or knows the main customer (already a registered supplier).

The third control variable is the culture. In the present study two elements of culture are considered, JV managers' experience with JV local culture and Hofstede's culture distance between the JV and each partner measured by localization of the JV and each partner country of origin. Information will be mainly used to reduce the uncertainty between the JV manager

and the partners in low culture distance situations. In the case of JVs it is expected that the culture of each partner is reflected in the reporting required to the JV. Cultural fit is view as a precondition to risk reduction as reported, among others, in surveys made by consulting firms (Sherman, 1992; Watson Wyatt, 2000), therefore it is expected to observe a positive relationship between culture fit, intensity of use of management control systems and JV performance.

The fourth control variable used is strategic fit between the JV partners. Strategic management theory draws attention to the need for prospective partners to achieve a fit between their respective strategies (Yan and Gray, 2001; Boateng and Glaister, 2002) and talks about the likelihood of establishing JVs and also about how the formation pattern of JVs should emerge from a competitive strategy perspective. Strategic fit is considered a precondition that reduces JV risks, therefore it is expected to observe a positive relationship between strategic fit, intensity of use of management control systems and JV performance.

The fifth control variable is trust, simply understood as having sufficient confidence in a partner to commit valuable know-how or other resources to transactions with that partner, despite the fact that there is a risk that the partner will take advantage of this commitment (this study considers partners' commitment as a proxy for trust). Traditionally, trust and control were viewed as opposite mechanisms, but Madhok's (1995) perspective complements ownership control structures with the trust control process. Therefore, trust is used to reduce the complexity of events, allowing a complementary relationship between trust and control (Das and Teng, 1998), because trust and control are viewed as two separate routes to risk reduction in alliances (Das and Teng, 2001). It is expected to observe a positive relationship between trust, intensity of use of management control systems and JV performance.

## EMPIRICAL RESULTS

Descriptive statistics for the three groups of variable considered in this study follows. Table 4 offers descriptive statistics of JV performance (JV\_Perf) and the results of the factor analysis done to reduce the variables used as dependent. Table 5 gives descriptive statistics of intensity of use of both information types (Int\_Inf) and control mechanisms (Int\_Mech) as well as the aggregate of both in the 'average' variable (Int\_Average). The five information types and the five control mechanisms are highly correlated because they all have the purpose of reducing uncertainty (Merchant, 1981), therefore they were collapsed into a concept such as intensity of use (Int\_Average). Table 6 gives descriptive statistics on significant items of the questionnaire related to contingent factors. Panel A shows that the JV local partner has more market experience (Mkt\_ExpL) than the JV foreign partner (Mkt\_ExpF), however it is not very significant; also factor analysis shows two factors, one related with experience in the industry which is positively associated with the foreign partner, and another related with experience with the market to be served by the JV which is positively associated with the local partner. Panel B shows that the technological experience of the JV foreign partner (Tech\_ExpF) is higher specially regarding products (it is also less dispersed because the local partner's standard deviation of 1.16 is higher than the foreign partner's standard deviation of 0.87); also factor analysis shows one major factor related with JV technology and a complementary factor related with industry technology. Table 7 has the descriptive statistics of the five control variables used. Panel A shows that the average JV has 4 different lines of products (Num-Prod), which are normally related and within one major group of homogeneous products such as transmission system, engine, fuel system, lights, navigation system, etc. Panel B shows that, as predicted by the literature, the culture is more similar between the local partner and the JV than between the foreign partner and the JV, it also

shows the level of culture fit between the partners (CultureFit). Panel C reports the calculation of strategic fit (StrategicFit) based on the fit of corporate values and partnering motives. Panel D describes how measures of commitment are collapsed into one factor that can be used as a proxy for trust. Finally panel E reports a contingency table where can be seen that those JVs made up by a foreign and a local partner outperform the other two types of JVs (JV-Type).

Insert Tables 4, 5, 6 and 7 about here

Table 8 presents the correlation matrix of the relevant independent variables using Spearman rank. It is interesting to see the relationship between foreign partner technology experience (Tech\_ExpF) and the market experience of the local partner (Mkt\_ExpL) reflects the nature of partners' contributions to the JVs in this industry, where usually the foreign partner contributes with technology and the local partner contributes with knowledge of the local market. The technology experience of the local partner (Tech\_ExpL) is positively related with the cultural fit (CultureFit), while the technology experience of the foreign partner (Tech\_ExpF) is positively correlated with trust (Trust) providing an interesting clue of why each partner is willing to commit its knowledge to the JV.

Insert Table 8 about here.

### **Impact of Management Control Systems' Intensity of Use on JV Performance**

For the research question – does intensity of use of management control systems positively impact on perceived JV performance? - regression models that estimate the explanatory power of different elements on the JV performance were used. The elements considered are intensity of use of information, contingent factors, and control variables.

Based on the results of Table 9 there are three ways of reducing uncertainty in JV which in turn impact on better performance. The first way to reduce uncertainty is the intensive use of management control systems. The other manners, which are consistent with exiting literature, are either an ex-ante condition defined by the cultural fit between the two partners, or an on-going condition that is trust between the JV partners and between them and the JV managers. Panel A of Table 9 shows in model 1 that none of the four contingent factors, defined as previous experience with the market or technology, has an impact on JV performance. Only the impact of two control variables (trust and culture fit) are significant implying that they play a critical role in JVs performance, which is consistent with previous studies, because they are considered by the management literature as other mechanisms to reduce uncertainty (Madhok, 1995, Das and Teng, 2001; Inkpen and Curral, 2004). Based on these results, the null form of hypothesis H1 can be rejected for trust and cultural fit between partners, implying that market and technology experience and partners strategic fit are not alternative explanations of uncertainty reduction mechanisms that can improve JV performance. Models 2 and 3 show the results of linear regressions with intensity of use as the sole predictor of JV performance, which is statistically significant. With this data, hypothesis H2 can be rejected implying that intensively used management control systems positively affect JV performance. Additionally model 4 reveals that the independent variables of market and technology experience do have an impact on management control systems intensity of use allowing also rejecting H3, but this topic will be explored in more detail in the next section. The same last model shows three statistically significant relationships that help to explain why management control systems are more intensively used in JVs. The number of lines of products manufactured, used as a proxy for complexity, is positively related with intensity of use demonstrating that those more complex JVs rely more intensively in formal information systems. Also cultural fit is important, giving some

evidence that management control systems are more intensively used when both partners have similar communication codes and values; this might be due to the way in which information is used, shared and discussed. Finally interesting to notice is that those JVs formed by a foreign partner and a local partner (JV\_Type = 1) make a more intense use of management control systems than other forms of JVs, this might reflect that each JV partner knows how to prepare and use the information needed to run the business and safeguard the assets committed to the JV.

Insert table 9 about here

### **Contingent Factors and Management Control System**

In all models analyses are performed with intensity of use of a particular type of information (customer requirements and product technology), intensity of use of information types (Int\_Inf) and control mechanisms (Int\_Mech), and then extended to management control systems which are an aggregate of both (Int\_Average). The testing of the null hypotheses is conducted against the one-sided alternatives stated in the hypotheses formulation section. These analyses were done independently for each contingent factor segregating the values for each partner.

Panel A of Table 10 shows that the larger both partners market experience (Mkt\_Exp), the more intensively customer and market information is used (Int\_InfCR), but the more the market experience of the JV local partner (Mkt\_ExpL), the more intensively all information types (Int\_Inf) and mechanisms (Int\_Mech) are used as well as management control systems (Int\_Average). Therefore, and based on the results of all the models, the null form of hypothesis H3a, can be rejected, implying that customer and market measures are more intensively used as market experience increases, particularly for the case of the JV local partner. Panel B of Table 10 shows that the larger the technology experience of the JV

foreign partner (Tech\_ExpF), the more intensely product technology (Int\_InfPT) and control mechanisms (Int\_Mech) are used as well as management control systems (Int\_Average). None of the equations show a significant relationship for the JV local partner. Therefore, the null form of hypothesis H3b can be rejected because management control systems information is more intensively used as technology experience increases for the case of the JV foreign partner.

Insert Table 10 about here.

Building on all the significant relationships, Table 11 organizes the findings into a model of contingent relations. The model shows all significant relationships between JV partners' experience, contingent factors and intensity of use of management control systems and their impact on JV performance. It is interesting to notice that there are three independent variables that improve JV performance: intensity of use of management control systems, trust and cultural fit between the partners, therefore they can be conceived as three alternative mechanisms to reduce uncertainty. Even more interesting is to see that trust has no impact on intensity of use of management control systems, while culture fit do increase their intensity of use and the performance of the JV, opening the door to consider this ex-ante condition to JV formation a critical pre-requisite that can be overcome by the building of trust and by a proper use of management control systems.

Intensity of use of management control systems is affected by the JV partners' previous experience, complexity of the JV and the type of JV. In the automotive industry it is observed that the intensity of use of management control systems depends on the previous experience and assets committed by each partner to the JV (technology know how by the foreign partner and local market and environment knowledge by the local partner), the increase in JV complexity (measured as number of different lines of products manufactured) and by the type

of JV formed, being the association of a foreign company with a local firm the combination that most intensively uses management control systems, but this type *per se* does not affect JV performance.

Insert Table 11 about here.

## **DISCUSSION**

The purpose of this paper and the corresponding survey was to contribute to the understanding of the impact of intensity of use of management control systems on the perceived performance of JVs in one particular industry regardless of geographical limitations. Diverse conclusions are reported about the impact of contingent factors on the intensity of use of management control systems in JVs. The findings are partial because a contingent model is used to test the relationships between factors and management control systems intensity of use. However, the main relationship established is that the larger the JV partners' experience, the more the uncertainty is reduced by a more intense use of information that in turn positively impacts on JV performance.

The impact on the intensity of use of management control systems of some factors varies due to the role that each partner plays in the JV which is defined by the assets committed. First, information is more intensively used by the JV managers when the JV local partner has larger market experience. Considering that most of the JVs in this industry are formed by a foreign company coupled with a local firm, it is reasonable to observe that the larger the technological or local market experience of the JV foreign and local partner respectively, the more intensively the information is used by JV managers to reduce uncertainty and as a way to protect the assets committed by the JV partners. Also JV managers use

management control systems more intensively as JV complexity increases as a way to reduce agency costs and to facilitate decision making (Davila and Foster, 2005).

Regarding the contribution of well designed management control systems to JV success, it is found that the more intensively management control systems are used, the better the JV performance. Searching for alternative explanations of JV performance it was found that the better the performance the more the partners' commitment (a proxy for trust) and cultural fit, however the results of partners strategic fit was not conclusive. These findings justify the assertion that management control systems are used to give transparency to JV operations and JV management team decisions, reinforcing the initial trust between the partners, and between them and the JV management team (Choi and Beamish, 2004; Inkpen and Curren, 2004).

## **CONCLUSION**

The results support the theoretical predictions that management control systems are mainly used to reduce uncertainty in highly uncertain environments such as JVs. Uncertainty is reduced by an intensive use of management control systems. Considering the sample size (65) and its representativeness (3.25% of the population), the results provide evidence of how management control systems contribute to improve the JV performance.

This study provides a model for understanding the role of control mechanisms in JVs by unraveling the elements of control according to the JV partners' roles and contributions to the JV. Previous studies on controls in JVs, unaware of the difference in JV partners experience and special assets contributed to the JV, lead to varied results. A novel contribution of this paper is to segregate the impact on intensity of use of management control systems by the

experience or contingent factors mastered by each partner which are defined by the assets, mostly know how, committed in the JV.

The findings of this study are aligned with the research question and with a portion of the existing literature. The larger the market experience of the JV local partner and the technology experience of the JV foreign partner, the more intensively management control systems are used; and the more intensively management control systems are used the better the JV performance. Besides considering other factors that helps to reduce uncertainty in JVs, such as partners' commitment (trust) and cultural fit between the JV partners, it is clearly demonstrated that the impact of experience whether with the market or with the technology only impacts on JV performance through the use of management control systems.

There are still some issues that remain unresolved because the sample size affects the robustness of results and prevents to run more complex statistical models. The proxies used for some variables might be improved and this is an opportunity for future studies. The questionnaire developed and adapted to capture the information content and intensity of use of management control systems proved to be robust and could be used in future research. The purpose of this study was to partially explain the role of management control systems in JV performance, through a clear understanding of the relationship between intensity of use and assets committed that shape the expertise of each JV partner. Future studies need to clearly define theoretical concepts, develop models and test them empirically to be able to reject or not the belief that management control systems contribute to JVs failure as reported in the business press.

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Footnote:

<sup>1</sup> Strategic alliances are any kind of cooperation between two separate firms, but in equity joint ventures two or more companies decide to collaborate sharing a portion of their resources and creating a new entity legally independent from the parent companies. Cross shareholdings are a particular form of equity joint ventures, but they are not included in this study because no new entity is created.

**Table 1: Descriptive Statistics of JV Managers Surveyed**

|                            |                                  |     |
|----------------------------|----------------------------------|-----|
| Age:                       | less than 30 years               | 3%  |
|                            | 31-40 years                      | 20% |
|                            | 41-50 years                      | 43% |
|                            | 51-60 years                      | 34% |
| Sex:                       | Male                             | 86% |
|                            | Female                           | 14% |
| Education (completed):     | High School                      | 3%  |
|                            | University (undergraduate)       | 35% |
|                            | Graduate Studies                 | 62% |
| Average:                   |                                  |     |
| Time in present position:  | 3.27 years                       |     |
| Time in similar positions: | 4.80 years                       |     |
| Time with the current JV:  | 3.79 years                       |     |
| Time with one JV partner:  | 7.62 years                       |     |
|                            | Working for the local partner:   | 51% |
|                            | Working for the foreign partner: | 26% |
| Main experience:           | Manufacturing                    | 31% |
|                            | Marketing                        | 25% |
|                            | Financial                        | 22% |
|                            | Human Resources                  | 19% |
|                            | Other                            | 3%  |

**Table 2: Descriptive Statistics of Frequency of Update of Types of Information**

|                           | Frequency of update per type of information (1 low – 5 high) |                |               |                        |                    |
|---------------------------|--|----------------|---------------|------------------------|--------------------|
|                           | Local Regulations  | Time to market | Profitability | Customers requirements | Product Technology |
| Update JV Manager         |  |                |               |                        |                    |
| Mean                      | 1.77   | 3.52           | 3.43          | 3.51                   | 2.89               |
| 95% Confidence interval   | 1.51-2.03  | 3.22-3.83      | 3.17-3.69     | 3.18-3.83              | 2.54-3.25          |
| Update Local JV Partner   |  |                |               |                        |                    |
| Mean                      | 1.43   | 2.26           | 2.86          | 2.15                   | 1.95               |
| 95% Confidence interval   | 1.11-1.75  | 1.94-2.58      | 2.60-3.12     | 1.85-2.46              | 1.65-2.26          |
| Update Foreign JV Partner |  |                |               |                        |                    |
| Mean                      | 1.46   | 2.45           | 2.82          | 2.34                   | 2.08               |
| 95% Confidence interval   | 1.18-1.74  | 2.12-2.97      | 2.57-3.06     | 1.99-2.69              | 1.76-2.39          |

**Table 3: Sample Construction**

|                                 |              |
|---------------------------------|--------------|
| Estimated population            | 2,000        |
| JVs that cannot be identified   | <u>1,779</u> |
| JVs in the initial database     | 201          |
| JVs that did not respond        | 121          |
| JVs that declined participation | 7            |
| Incomplete answers              | <u>8</u>     |
| Final sample of JVs             | 65           |

**Table 4: Descriptive Statistics of JV performance (JV-Perf)**

| <b>JV Performance</b>  |   |
|--|---|
| Eighteen measures of performance (range: 1 low – 5 high):  |   |
| Subjective rate of JV performance:   | Importance of criteria to assess JV performance |
| Actual compared with initial projections   | Operate according local regulations             |
| Operating according local regulations  | Meet timing goals                               |
| Meeting timing goals   | Be profitable (meet costs and budgets)          |
| Being profitable (meet costs and budgets)  | Fulfill customer’s requirements                 |
| Fulfilling customer’s requirements   | Meet product specifications                     |
| Meeting product specifications   |   |
| Evolution of the JV targeted market share  |   |
| Financial indicators (ROE, ROI, ROA)   |   |
| Operating indicators (defects per million)   |   |
| Subjective indicators (employee evaluation)  |   |
| Your overall evaluation of the JV performance  |   |
| Estimated level of satisfaction of Local Partner   |   |
| Estimated level of satisfaction of Foreign Partner   |   |
| <p>Since the correlations of the eighteen measures of performance are high, significant and positive, they were collapsed into one calculated as the average of the eighteen measurement points:<br/>           JV_Perf mean = 3.76 95% confidence interval = 3.61-3.90<br/>           Cronbach <math>\alpha</math> (0.9216) calculated with the original measures of the questionnaire.</p> <p>Additionally these measures are reduced to only one by means of factor analysis to corroborate the previous calculation (variance explained 44.56%). The factor loadings were done with Principal Components, while the model fit was calculated using Maximum Likelihood (<math>X^2= 206, p=0,000</math>), but both factor loadings were similar.</p> |   |

**Table 5: Descriptive Statistics of Intensity of Use of Types of Information and Control Mechanisms (Int\_Info, Int\_Mech, Int\_Average)**

| <b>Intensity of use of Management Control Systems</b>                    |      |                            |                   |
|--|------|----------------------------|-------------------|
| <b>Int_Inf</b> - Intensity of Use of Type of Information: 1 Low – 5 High |      |                            |                   |
|  | Mean | Confidence Interval 95%    | Cronbach $\alpha$ |
| Int_InfLR Local Regulations  | 1.12 | 0.90 – 1.35                | 0.8756            |
| Int_InfSI Time (scheduling)  | 2.72 | 2.46 – 2.97                | 0.7411            |
| Int_InfFM Financial  | 4.59 | 4.18 – 4.99                | 0.6511            |
| Int_InfCR Customer and market  | 3.26 | 2.91 – 3.61                | 0.6701            |
| Int_InfPT Product technology   | 2.71 | 2.36 – 3.06                | 0.7634            |
| Int_Info Average intensity of use of info types                          | 2.36 | 2.30 - 2.42                | 0.5529            |
| <b>Int_Mech</b> - Intensity of Use of Control Mechanism: 1 Low – 5 High  |      |                            |                   |
|  | Mean | 95% Confidence Interval    |                   |
| Int_MechPM Performance measurement                                       | 2.80 | 2.52 – 3.08                |                   |
| Int_MechGM Governance mechanisms   | 1.76 | 1.62 – 1.88                |                   |
| Int_MechCA Cost systems and allocations                                  | 2.50 | 2.28 – 2.74                |                   |
| Int_MechTP Transfer prices   | 1.82 | 1.66 – 1.96                |                   |
| Int_MechBP Budgeting and planning  | 4.06 | 3.76 – 4.34                |                   |
| Int_Mech Average Intensity of use of control mechanisms                  | 2.58 | 2.54 – 2.64                |                   |
|  |      | Cronbach $\alpha = 0.5830$ |                   |
| <b>Int_Average</b>   |      |                            |                   |
|  | Mean | 95% Confidence Interval    | Range             |
| Int_Average Average intensity of use of inf.types and mech.              | 2.46 | 2.40 - 2.52                | 1 - 5             |

**Table 6: Descriptive Statistics of Contingent Variables** (Mkt\_ExpL, Mkt\_ExpF, Tech\_ExpL and Tech\_ExpF)

| <b>Panel A – Mkt_Exp</b>  |      |                         |                          |                     |
|---|------|-------------------------|--------------------------|---------------------|
| Market Experience   | Mean | 95% Confidence Interval | Local market (Factor 1)  | Industry (Factor 2) |
| Local Partner: Target Market  | 3.92 | 3.73 – 4.12             | 0.341                    | 0.836               |
| Competitors   | 3.83 | 3.63 – 4.03             | 0.537                    | 0.548               |
| Industry  | 4.46 | 4.30 – 4.63             | 0.166                    | 0.367               |
| Average Local Partner (Mkt_ExpL)  | 4.07 | 3.94 – 4.20             |                          |                     |
| Cronbach $\alpha$ = 0.6012  |      |                         |                          |                     |
| Foreign Partner: Target Market  | 3.75 | 3.51 – 4.00             | 0.689                    | -0.480              |
| Competitors   | 3.54 | 3.28 – 3.80             | 0.878                    | -0.170              |
| Industry  | 4.02 | 3.77 – 4.26             | 0.808                    | -0.199              |
| Average Foreign Partner (Mkt_ExpF)  | 3.77 | 3.56 – 3.98             |                          |                     |
| Cronbach $\alpha$ = 0.6672  |      |                         |                          |                     |
| <p>Additionally these measures are reduced to two measures by means of factor analysis to corroborate the previous calculation (variance explained 62.74%). The factor loadings were done with Principal Components, while the model fit was calculated using Maximum Likelihood (<math>X^2= 12.28</math>, <math>p=0,015</math>), but both factor loadings were similar.</p>  |      |                         |                          |                     |
| <b>Panel B – Tech_Exp</b>   |      |                         |                          |                     |
| Technology Experience   | Mean | 95% Confidence Interval | JV Technology (Factor 1) | Industry (Factor 2) |
| Local Partner: Process  | 3.91 | 3.61 – 4.21             | 0.840                    | 0.490               |
| Product   | 3.95 | 3.67 – 4.24             | 0.849                    | 0.478               |
| Average Local (Tech_ExpL)   | 3.93 | 3.65 – 4.22             |                          |                     |
| Cronbach $\alpha$ = 0.6715  |      |                         |                          |                     |
| Foreign Partner: Process  | 3.91 | 3.67 – 4.14             | -0.770                   | 0.505               |
| Product   | 4.09 | 3.86 – 4.33             | -0.702                   | 0.611               |
| Average Foreign (Tech_ExpF)   | 4.00 | 3.78 – 4.22             |                          |                     |
| Cronbach $\alpha$ = 0.6110  |      |                         |                          |                     |
| <p>Additionally these measures are reduced to two measures by means of factor analysis to corroborate the previous calculation (variance explained 90.23%). The factor loadings were done with Principal Components, while the model fit was calculated using Maximum Likelihood (<math>X^2= 37.522</math>, <math>p=0,000</math>), but both factor loadings were similar.</p> |      |                         |                          |                     |

**Table 7: Descriptive Statistics of Control Variables** (Num-Products, CultureFit, StrategicFit, Trust and JV\_type)

|   |                            |                           |                           |                         |
|---|----------------------------|---------------------------|---------------------------|-------------------------|
| <b>Panel A: Number of manufacturing product lines</b>   |                            |                           |                           |                         |
|   | Mean                       | 95% Confidence Interval   |                           |                         |
| Num_Prod  | 3.78                       | 3.39 – 4.18               |                           |                         |
|   | Range: min 1 max 7         |                           | Median: 4                 |                         |
| <br>  |                            |                           |                           |                         |
| <b>Panel B: Culture</b>   |                            |                           |                           |                         |
|   | Mean                       | 95% Confidence Interval   |                           |                         |
| Local Partner: Average Culture Experience   | 3.57                       | 3.38 - 3.75               |                           |                         |
| Average Culture Distance (1 Low – 5 High)   | 1.96                       | 0.39 - 3.52               |                           |                         |
| Foreign Partner: Average Culture Experience   | 2.93                       | 2.74 - 3.12               |                           |                         |
| Average Culture Distance (1 Low – 5 High)   | 3.48                       | 1.79 - 5.17               |                           |                         |
| CultureFit: Culture fit between the partners  | 3.77                       | 3.63 - 3.92               |                           |                         |
| <br>  |                            |                           |                           |                         |
| <b>Panel C: Strategic Fit between partners</b>  |                            |                           |                           |                         |
|   | Mean                       | 95% Confidence Interval   |                           |                         |
| Fit of core corporate values  | 3.75                       | 3.59 - 3.92               |                           |                         |
| Fit of partnering motives   | 3.80                       | 3.61 – 3.99               |                           |                         |
| StrategicFit: Average Fit   | 3.78                       | 3.63 – 3.92               |                           |                         |
|   | Cronbach $\alpha$ = 0.4555 |                           |                           |                         |
| <br>  |                            |                           |                           |                         |
| <b>Panel D: Trust</b>   |                            |                           |                           |                         |
|   | Local Partner              |                           | Foreign Partner           |                         |
| Investment in:  | Mean                       | 95% Confidence Interval   | Mean                      | 95% Confidence Interval |
| Personnel   | 3.49                       | 3.34-3.75                 | 3.29                      | 3.07-3.51               |
| Facilities  | 3.20                       | 2.91-3.49                 | 2.91                      | 2.61-3.20               |
| Management Time   | 3.35                       | 3.14-3.57                 | 3.45                      | 3.22-3.67               |
| Money   | 3.31                       | 3.02-3.60                 | 3.49                      | 3.23-3.75               |
| Commitment  | 3.88                       | 3.62-4.14                 | 3.91                      | 3.66-4.16               |
| Importance  | 3.85                       | 3.64-4.06                 | 4.11                      | 3.90-4.32               |
| <br>  |                            |                           |                           |                         |
| Total Commitment Average (trust proxy): Mean = 3.52    95% Confidence Interval = 3.36-3.68  |                            |                           |                           |                         |
| <br>  |                            |                           |                           |                         |
| Factor analysis (variance explained 43.51%). The factor loadings were done with Principal Components, while the model fit was calculated using Maximum Likelihood ( $X^2= 337$ , $p=0.000$ ). The Cronbach $\alpha$ (0.8740) was calculated with the twelve original measures of the questionnaire. |                            |                           |                           |                         |
| <br>  |                            |                           |                           |                         |
| <b>Panel E: Type of JV</b>  |                            |                           |                           |                         |
| JV types  | Total cases                | Above average performance | Below average performance |                         |
| 1: JV formed by a foreign firm and a local firm   | 33                         | 17                        | 16                        |                         |
| 2: JV formed by two foreign firms   | 19                         | 7                         | 12                        |                         |
| 3: JV formed by two local firms   | 13                         | 5                         | 8                         |                         |

**Table 8: Correlation Matrix of all Independent Variables**

|              | Mkt_ExpF         | Tech_ExpL         | Tech_ExpF          | CultureFit         | Strategic Fit     | Trust             |
|--------------|------------------|-------------------|--------------------|--------------------|-------------------|-------------------|
| Mkt_ExpL     | 0,044<br>(0,730) | 0,079<br>(0,531)  | 0,530**<br>(0,000) | -0.155<br>(0.222)  | 0.071<br>(0.576)  | 0.219<br>(0.082)  |
| Mkt_ExpF     |                  | -0,014<br>(0,912) | 0,147<br>(0,243)   | -0.034<br>(0.789)  | -0.040<br>(0.755) | -0.054<br>(0.672) |
| Tech_ExpL    |                  |                   | -0,099<br>(0,434)  | 0.346**<br>(0.005) | -0.217<br>(0.085) | 0.144<br>(0.254)  |
| Tech_ExpF    |                  |                   |                    | -0.054<br>(0.674)  | -0.213<br>(0.091) | 0.255*<br>(0.042) |
| CultureFit   |                  |                   |                    |                    | 0.124<br>(0.330)  | -0.021<br>(0.866) |
| StrategicFit |                  |                   |                    |                    |                   | 0.194<br>(0.124)  |

\*\* significant at the 1% level

\* significant at the 5% level

**Table 9: Factors that affect JV Performance and Intensity of Use of Management Control Systems**

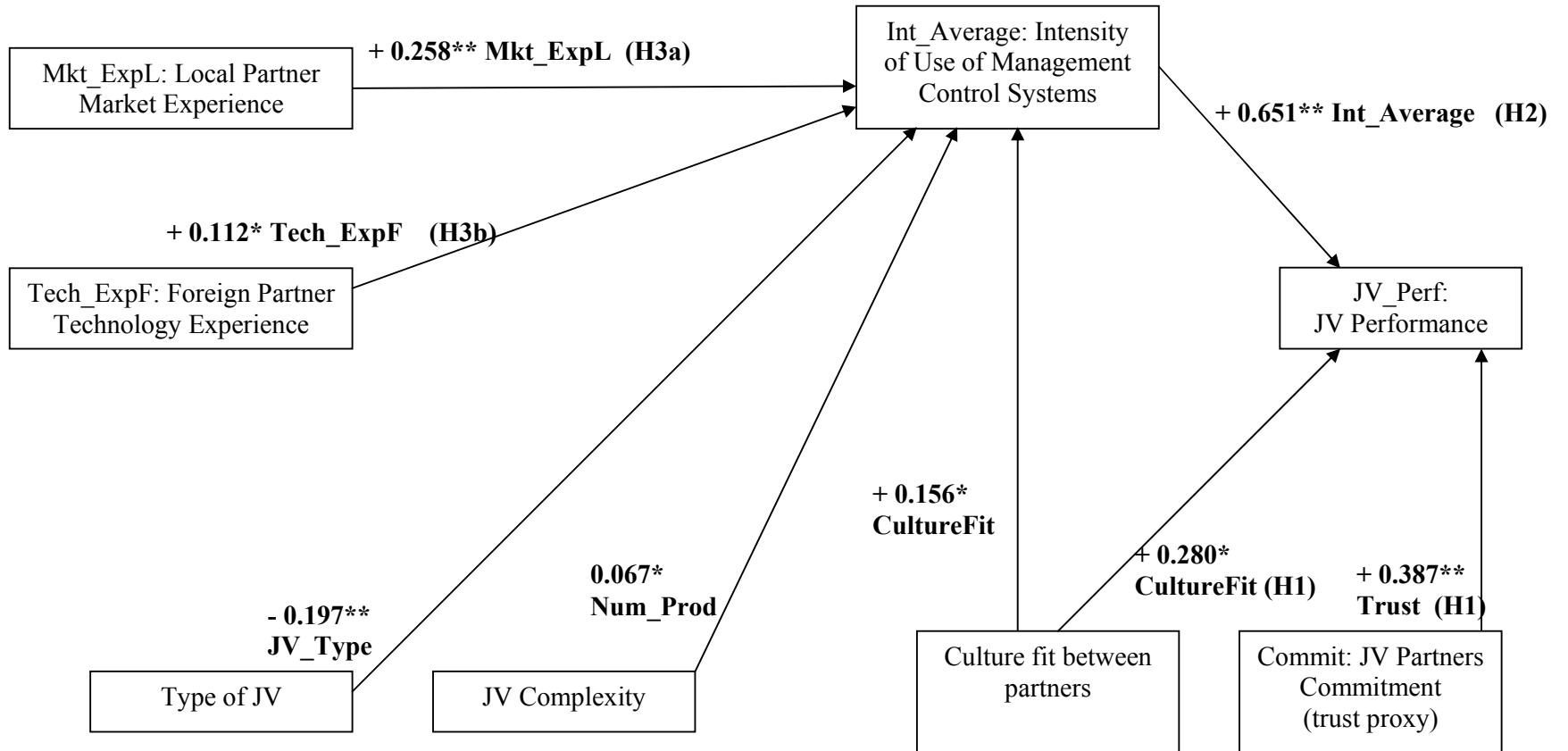
|                    | Model 1<br>H1 | Model 2<br>H2 | Model 3<br>H2 | Model 4<br>H3 |
|--------------------|---------------|---------------|---------------|---------------|
| Dependent variable | JV-Perf       | JV_Perf       | JV_Perf       | Int_Average   |
| Constant           | 1.033         | 2.927         | 3.498         | -1.751        |
| Mkt_ExpL           | 0.195         |               |               | 0.258**       |
| Mkt_ExpF           | 0.008         |               |               | -0.034        |
| Tech_ExpL          | -0.098        |               |               | -0.033        |
| Tech_ExpF          | -0.006        |               |               | 0.112*        |
| Trust              | 0.387**       |               |               | 0.094         |
| CultureFit         | 0.280*        |               |               | 0.156*        |
| StrategicFit       | -0.132        |               |               | 0.016         |
| Num_Prod           | 0.050         |               |               | 0.067*        |
| JV_Code            | 0.109         |               |               | -0.197**      |
| Int_Info           |               | 0.309**       |               |               |
| Int_Mech           |               | 1.046         |               |               |
| Int_Average        |               |               | 0.651**       |               |
| R <sup>2</sup>     | 0.272         | 0.156         | 0.138         | 0.451         |

\*\* significant at the 1% level                      \* significant at the 5% level

**Table 10: Intensity of Use of Management Control Systems**

| <b>Panel A – Hypothesis H3a: Intensity of Use = <math>f</math> (Market Experience)</b>     |           |                               |          |             |
|--|-----------|-------------------------------|----------|-------------|
|  | Model 1   | Model 2                       | Model 3  | Model 4     |
| Dependent Variable   | Int_InfCR | Int_Inf                       | Int_Mech | Int_Average |
| Constant   | -0.058    | -0.075                        | 0.792    | 0.396       |
| Mkt_ExpL   | 0.233*    | 0.260**                       | 0.025*   | 0.142**     |
| Mkt_ExpF   | 0.312**   | 0.129                         | -0.019   | 0.055       |
| R <sup>2</sup>   | 0.152     | 0.182                         | 0.087    | 0.199       |
| ** significant at the 1% level   |           | * significant at the 5% level |          |             |
| <b>Panel B – Hypothesis H3b: Intensity of Use = <math>f</math> (Technology Experience)</b> |           |                               |          |             |
|  | Model 1   | Model 2                       | Model 3  | Model 4     |
| Dependent Variable   | Int_InfPT | Int_Inf                       | Int_Mech | Int_Average |
| Constant   | 0.046     | -0.015                        | 0.792    | 0.396       |
| Tech_ExpL  | -0.061    | -0.070                        | 0.011    | -0.030      |
| Tech_ExpF  | 0.248*    | 0.132                         | 0.041**  | 0.087*      |
| R <sup>2</sup>   | 0.065     | 0.048                         | 0.160    | 0.071       |
| ** significant at the 1% level   |           | * significant at the 5% level |          |             |

**Table 11: Summary of Significant and Relevant Relationships Found**



\*\* significant at the 1% level  
 \* significant at the 5% level