# On Measuring Organizational Relationships: Threats to Validity in the Use of Key-Informants

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**Abstract:** The measurement of organizational characteristics in empirical studies that focus on inter-group, knowledge-based collaboration requires research methods different from those used for measuring the characteristics of individuals. As an answer to that, key-informant methodology is a frequently adopted approach that has been associated with qualitative methods. However, recently organizational researchers have used the technique to obtain quantifiable information on organizational structure, internal power distribution, within the group, and external relationships among groups that base their collaboration on the knowledge they share.

This paper focuses on the threats to validity, which are inherent in empirical studies that adopt the key-informant methodology as a social science tool. In particular, the paper thoroughly examines the effects that the Bagozzi and the Cook and Campbell construct validity criteria as well as the Huber and Power key-informant validity criteria have during the two important phases of a research, i.e. developing valid measures of the theoretical constructs, and testing the relationships between theoretical constructs. The empirical results used in this paper stem from an investigation that aimed to evaluate the contribution of Shared Knowledge and Information Technology to Manufacturing Performance. Mutual Trust and Mutual Influence, among the collaborating groups (in this case manufacturing, quality and R&D), which were used in our study, as the two antecedents of shared knowledge. For the purpose of this research, an evaluation model was developed and survey data was collected from 51 medium to large size industrial companies with a total of 112 manufacturing groups, representing five industrial sectors (alimentation, automotive, chemical and pharmaceutical, electro-mechanical, and textile), were analyzed to test the model.

The key-informant methodology that has been used for the selection of research responders was tested against threats to validity. As a conclusion, the paper exhibits the implications of the above widely accepted construct validity criteria and specific key-informant validity criteria, building upon the results of the above industrial empirical research. The lessons learned are presented in a way that may lead future organizational researchers to error preventive measures.

**Keywords**: inter-group collaboration, key-informant methodology, threats to validity, lessons learned

## 1. Introduction

It is typical for scientific investigations to begin with the formation of the concepts comprising the hypotheses and theory. At a later phase, upon testing the hypotheses, the concepts of 'validity' or 'invalidity' emerge, whenever researchers refer to the best available approximation of the 'truth' or 'falsity' of propositions, including propositions about cause and effect. As Cook and Campbell (1979, p. 37) suggest, the modifier 'approximately' should always be used when referring to validity, since we can never know what is true. This paper examines a set of formal criteria –usually termed construct validity- addressing two issues: the measurement scheme in use and its validity as well as threats to validity in key informant analysis.

Bagozzi (1980) states that "… the observational meaningfulness of concepts refers to the relationship between theoretical variables (which are unobservable) and their operationalizations (which, of course, are observable)" (p. 121). Operational indicators that are observable have been used in the empirical industrial research, upon which this paper is built, as long as we could demonstrate the link to theoretical constructs. In addition, the constructs used have either been validated in previous studies, or systematic pilot-testing was carried out for the constructs introduced for first time.

The methodology used in this paper addresses the most common construct validity issues and provides answers to the question of whether key-informant reports achieve construct validity, by estimating the reliability of each individual informant and modeling measurement error explicitly when testing inter-group relationships.

The rest of this paper is organized as following. In the following section the methodology that has been used for our empirical study is briefly presented. In section three we exhibit the opinion of pioneer researchers who have applied the key-informant methodology and we justify why we have chosen to use this method. In section four we report important findings on threats to validity, with an emphasis on the lessons learned. The last two sections encompass conclusions. We have chosen to briefly present them there as lessons learned


Reference this paper as:
Papoutsakis, H. "On Measuring Organizational Relationships: Threats to Validity in the Use of Key-Informants." *The Electronic Journal of Knowledge Management* Volume 6 Issue 2 2008, pp. 145 - 156, available online at www.ejkm.com

and, right after, in section five to tabulate them as error preventive measures based on the way the certain validity criteria were successfully addressed in our study.

## 2. The empirical study

The empirical results used in this paper stem from an investigation that aimed to evaluate the contribution of Shared Knowledge (SK) and Information Technology (IT) to Manufacturing Performance (MP). Mutual Trust (MT) and Mutual Influence (MI), among the collaborating groups, have been used in our initial study as the two antecedents of shared knowledge. For the purpose of this research, an evaluation model was developed and survey data collected from 51 medium to large size industrial companies with a total of 112 manufacturing groups, representing 5 industrial sectors (alimentation, automotive, chemical and pharmaceutical, electro-mechanical, and textile), were analyzed to test the model. The key elements of the methodology deployed for that investigation are summarized here below.

Two symmetrical relationship questionnaires, worded in a reverse form, were addressed to Production and Quality or R&D managers -and their assistants- and aimed at portraying the opinion and the attitude of the two collaborating groups towards each other, in reference to sharing knowledge. In addition, the role and level of contribution of Information Technology, both as a tool and/or enabler in supporting sharing knowledge among the collaborating groups, was investigated. A last, ad hoc question evaluated the use of commonly used IT infrastructure for inter-firm knowledge sharing.

A third, performance questionnaire, attempting to measure manufacturing group performance, was addressed to senior managers or their assistants. They were asked to compare the manufacturing group under question to other comparable manufacturing groups they had managed. In addition, the level of contribution of Information Technology to manufacturing group performance was investigated. Again, a last ad hoc question evaluated the use of specific IT functions on four knowledge sharing issues, closely related to the group performance.

Design of the indicators was carried out using two types of measures, for every variable: a general one, where each informant was asked to assess the overall level of interaction for a specific characteristic of a particular relationship; and a multiplicative or interaction measure, where each informant was asked, for example, to assess the role of manufacturing and either R&D or quality group for each characteristic separately. Using the conceptualization of fit as interaction, proposed by Venkatraman (1989), the measurements were operationalized as ‘manufacturing role X R&D or quality role’, by multiplying the two responses. There are a number of advantages to such a measurement scheme, as indicated by Churchill (1979) and Campbell and Fiske (1959). First, the two types of measures (general and multiplicative) can be thought of as different methods; second, it provides a stronger test for the validity of the measurement scheme, and third, it balances possible threats to validity inherent in either type alone.

Key-informant methodology was used for the selection of our research responders, and path analysis was applied for the testing of the investigation hypotheses that were found to be fully or partially supported, by the degree of significance of the relevant paths, as indicated in Figure 1. IT constructs that were measured with the relationship questionnaires, Type A and B are marked ITsk. Those measured by the performance questionnaire, Type C, are marked ITmp.

 

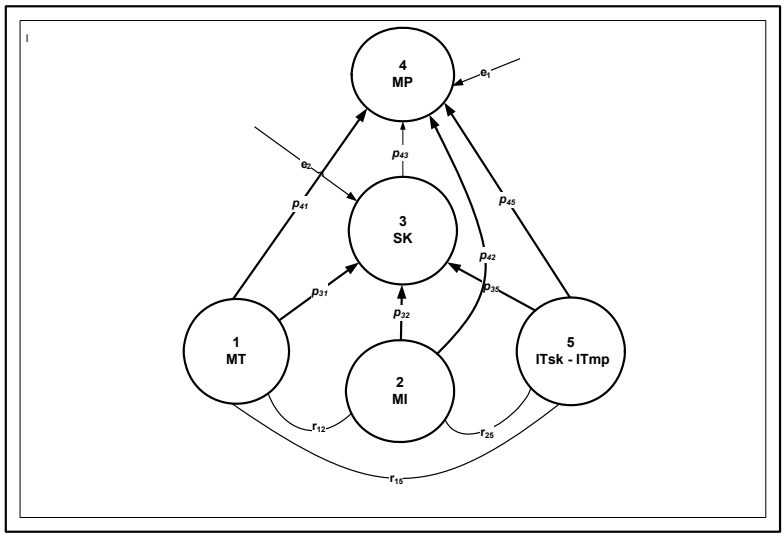


**Figure 1:** The proposed causal model

Finally, confirmatory tests were conducted in order to further secure the validity of the hypotheses. Three of them are mentioned here, as they are related to threats to validity. Cronbach's alphas were utilized to check the reliability of the instruments used for each of the constructs measured. The MTMM (Multi-Trait Multi-Method) correlation matrix for all construct indicators was used to check convergent and discriminant validity. Finally, analysis of variance was applied on each variable in order to test the homogeneity of variance among the key-informants.

The main research instruments (questionnaires Type A, B and C) are presented in the Appendix together with an example of a construct measurement calculation. Details of the study (the regression equations, the construct measurements, the complete statistical analysis and the confirmatory tests) are presented in the relevant sections and Appendixes of a Doctoral Thesis available in the data base of the UPC (Universidad Politécnica de Catalunya, in Barcelona) at http://www.tdx.cesca.es/TDX-1019105-081507.

## 3. The key-informant methodology

As the measurement of organizational characteristics requires research methods different from those used for measuring the characteristics of individuals, key-informant methodology is a frequently adopted approach. Campbell (1955), by whom the use of the informant has been interpreted as a general social science tool, states that "… the technique of the informant means that the social scientist obtains information about the group under study through a member who occupies such a role as to be well informed but who at the same time speaks the social scientist's language." Campbell considers the use of informants as an alternative sampling technique "… epitomized by the use of one or a few *special* persons who are extensively interviewed and upon whose responses exceptional reliance is placed and, thus, is to be most clearly distinguished from randomly or representatively sampled interviews" (p. 339).

Phillips and Bagozzi (1986) describe the method as "…a technique of collecting information on a social setting by interviewing a selected number of participants. The informants are chosen not on a random basis but because they posses special qualifications such as particular status, specialized knowledge, or accessibility to the researcher" (p. 313). According to the authors, the measurement of group-level properties has often required the use of key-informant method, as a technique for collecting information from a selected number of participants.

Initially the use of key informants was associated with qualitative methodology. In these situations, the key-informant assumes the role of reporting on the behavioral patterns of a group (manufacturing, quality and/or R&D) after summarizing either observed or expected organizational relationships. At a later stage organizational researchers have used the technique to obtain quantifiable information on organizational structure, technology, environment, internal power distribution and external exchange relationships. Phillips (1981), Silk and Kalwani (1982), Phillips and Bagozzi (1986), among others, have often used key-informant methodology in conjunction with procedures for collecting survey data to obtain quantifiable measures on organizational characteristics. In these situations, survey responders assuming the role of key-informants provide information at the combined or collective unit of analysis (i.e. group or organizational properties) rather than reporting personal feelings, opinions, and behaviors.

At an early stage, due to the nature of the investigation, certain concerns aroused from the above literature review over the following potential sources of measurement error in key informant reports:

- Reliability of informant reports may be affected by factors such as the types of questions asked and the personal characteristics of informants.
- Informants may often be asked by the researcher to perform complex tasks of social judgment, instead of answering into simple questions.
- Questions which require an informant to aggregate over many events, persons, tasks, or organizational subunits may increase measurement error due to fatigue effects etc.
- Collection of data from only a single informant per unit of analysis may be regarded as insufficient data collection.

As the primary target was to investigate the relationship among manufacturing, R&D and quality groups, the relationship questionnaires were addressed to managers, and their assistants, of the three groups involved. Research responders were chosen based on the key-informant methodology and two relationship dyads for each one of the 112 manufacturing units, the unit of analysis of this study, were used. In relation to the second target (manufacturing group performance), data has been collected from 'stakeholders' in each company: senior managers or their assistants (general directors, plant managers, technical or quality directors, etc). These stakeholders, positioned at the upper levels of the company organization, were also chosen based on the key-informant methodology, as according to Huber and Power (1985) "… they have important information about organizational events. Their retrospective reports are accounts of facts, beliefs, activities and motives related to prior events." (p. 171).

As an answer to the previously expressed concerns, the following measures were taken in an effort to minimize all above sources of distortion in our investigation:

- Questionnaires were thoroughly checked prior to the investigation's final phase using a pilot questionnaire. This permitted clarification of all possible points of misunderstanding.
- Questionnaires were kept simple and in manageable size: Twelve questions for the inter-groups relationships and only nine for the stakeholders.
- Four informants for every unit of analysis were questioned.
- Questionnaires were customized. The actual department names of every unit and the related group were used, in order to avoid misunderstandings.
- Questionnaires were sent, completed and received in electronic form.

Although the precaution measures did not make participation in the investigation an easy task, they did minimize to a very large extent the number of cases where responders had to get back to the research team for clarifications.

## 4. Threats to validity and lessons learned

In order to test the proposed model, we had to measure each theoretical construct and analyze the relationships between the measured constructs. This task was completed in two phases: while developing valid measures of the theoretical constructs, and through testing the relationships between theoretical constructs.

In the literature on industrial group relationships, in particular, and in organizational research, in general, a considerable amount of attention is paid to the statistical analysis of the relationships between measured variables, but the objective of measuring validity is only partially carried out (Bagozzi 1980, Cook and Campbell 1979, Churchill 1979, Huber and Power 1985). This practice assumes that the measures are valid and adequately reflect the theoretical constructs under consideration. But, as Phillips and Bagozzi (1986) note, a possible lack of correspondence between the operational measures and the theoretical concepts they are intended to measure may result in the rejection of a hypothesis as either weak or totally absent.

### 4.1 Bagozzi construct validity criteria

Bagozzi (1980) who defines construct validity "… as the degree to which a concept (term, variable, construct) achieves theoretical and empirical meaning within the overall structure of one's theory" (p. 114), is proposing six criteria or 'components of construct validity':

- Theoretical Meaningfulness of Concepts

 

- Observational Meaningfulness of Concepts
- Internal Consistency of Operationalizations
- Convergent Validity
- Discriminant Validity
- Nomological Validity

We shall briefly introduce Bagozzi's six criteria while, at the same time, we shall demonstrate the facts or parameters upon which the validity of the constructs used in this study is proved.

The first two criteria of validity involve semantic issues, not statistical tests, and refer to the internal consistency of the language used to represent a construct and the conceptual relationship between a theoretical construct and its operationalization. The theory, upon which this research is based, has derived from previous research on organizational theory (from the resource-based to the knowledge-based theory), so the constructs used are consistent with prior theories.

The third criterion is a strictly empirical one designed to determine the degree of internal consistency which requires more than one observational indicators or variables for each theoretical construct. The most commonly used summary statistic of internal consistency is the Cronbach's *alpha* coefficient. For attitudinal measurements, Cronbach's *alphas* above 0,6 are generally considered acceptable, whereas Nunnally (1978) suggests the adoption of a higher cutoff value of 0,7 in cases where these instruments have been adopted previously, as in our case. When this minimal level of internal consistency is not achieved, the implication is that these variables could be measuring more than one construct, a threat we did not face in this study as all *alphas* were found above 0,78.

Criteria number four and five, are traditional objects of the Multi-Trait Multi-Method Matrix (MTMM) approach. Convergent validity refers to the degree to which two or more measures of the same theoretical construct are in agreement. Discriminant validity refers to the degree to which one theoretical construct differs from another. Campbell and Fiske (1959) proposed a Multi-Trait Multi-Method matrix to assess convergent and discriminant validity of data gathered on multiple traits (theoretical constructs), using maximally dissimilar methods such as self report and unobtrusive observation. To assure that convergent validity and discriminant validity have been achieved in an empirical study, researchers should use more than one theoretical constructs and more than one method. Unfortunately, in many areas of organizational relationships research, multiple methods of measuring a theoretical construct are not applied, although most studies do include more than one theoretical construct.

As already mentioned, in our study we used two different methods and at least two constructs for each variable. The criterion for convergent validity is that the correlation between measures of the theoretical construct should be different from zero and significantly large to encourage further investigation. The criterion for discriminant validity is that a measure should correlate with all measures of the same theoretical construct higher than it does with any measure of another theoretical construct. Both criteria are successfully met in this study.

Bagozzi's final component of construct validity is nomological validity which refers to the degree to which predictions from a formal theoretical network containing the concept under scrutiny are confirmed. Nomological validity can be interpreted as whether one's own theory, once it has been found semantically and empirically valid, is consistent with a wider body of theory and whether it contributes to that theory. Assessment to nomological validity takes place with reference to related research. The theoretical background of our research is founded upon the resource- and knowledge-based theory of the firm (Wernerfelt 1984, 1995; Prahaland and Hamel 1990; Grant 1997).

## 4.2 Cook and Campbell construct validity criteria

Cook and Campbell (1979, pp. 37-39) focus on four types of validity threats for, what they call 'quasi-experiments' and is more universally understood as empirical methods:

- Statistical Conclusion Validity
- Internal Validity
- Construct Validity
- External Validity

Although they consider all four criteria of equal importance, they recognize a "… special stress on internal validity" (p. ix). We shall briefly introduce Cook and Campbell's four criteria, and at the same time we shall compare them with the ones of Bagozzi. We shall also indicate the facts or parameters which reveal the validity of the constructs used in this study.

Statistical conclusion validity refers to conclusions about whether it is reasonable to presume covariation between two variables, given a specific probability level (i.e. 0,05, or 5 per cent) and the obtained variances. Threats to statistical conclusion validity are threats to drawing valid conclusions about whether two variables covary. These threats closely correspond to Bagozzi's criterion of internal consistency and add an explicit focus on the assumptions underlying the statistical techniques used. In our study, statistical conclusion validity is addressed by employing multi-item scales tested with Cronbach's *alphas*.

Internal validity is a criterion that does not appear in Bagozzi's framework. Internal validity includes the consideration of alternative explanations –other than the theory being tested– which might account for study consequences such as selection bias, historical reasons, etc. Cook and Campbell (1979, pp. 51-55) list a vast number of threats to internal validity that apply both to randomized and quassi experiments. The ones most suitable to empirical studies, like this, are: history; instrumentation (i.e. changes in the measuring instrument: the questionnaire, in our case) and selection (i.e. differences between the people in one group as opposed to another). In this study, it is addressed by the variety of industry sectors, companies and units of analysis as well as the range of management levels that key- informers derive from.

Construct validity, for Cook and Campbell (1979), refers to the possibility that the operations which are meant to represent a particular cause or effect construct can be constructed in terms of more than one construct. It plays an especially crucial role in empirical experiments which only aim to test causal propositions. The criterion of construct validity is well covered by Bagozzi's six criteria and it has already been addressed as such, in this study.

External validity refers to the approximate validity with which we can conclude that the presumed causal relationship can be generalized to and across different types of organizational settings, persons, and times. As the issue of external validity is not addressed by Bagozzi we have relied upon Cook and Campbell (1979, pp. 73-74) who are listing three threats to external validity in terms of statistical interaction effects. Interaction of selection and treatment –or method, in our terminology- relates to the categories of persons (i.e. social, geographical, or personality groups) on which a cause-effect relationship can be generalized. Interaction of setting and treatment (method) is of particular relevance to our study, as its settings are on such different levels as the organization, the group, and the individual. Finally, interaction of history and treatment (method) relates to the periods in the past and future that a particular causal relationship can be extrapolated. As this study focuses on industrial organizations, the above threats have been addressed by selecting a variety of sectors and implementing easy-to-understand questionnaires in relevantly 'similar' groups. As our sample could not be a random one, the self-selection bias can not be totally dismissed.

As our investigation is heavily built upon the key-informant methodology, we consider it appropriate to discuss one more set of validity criteria that focus on this specific method.

### 4.3 Huber and power key-informant validity criteria

A number of threats to validity simply exist due to the very use of key-informants. Unlike the respondent method which requires the respondent to report about himself or herself, the collection of data on group properties or relationships from individual key-informants may introduce considerable measurement errors. This occurs because questions which require a person to combine data on many events, persons or tasks may place unrealistic demands on survey responders (Silk and Kalwani, 1982; Philips and Bagozzi, 1986). Huber and Power (1985, pp. 172-174) have identified the following three criteria, each one corresponding to a threat to validity.

- Motivator Barrier
- Perceptual and Cognitive Limitations
- Lack of Information

We shall briefly introduce Huber and Power's three criteria and we shall indicate the facts or parameters which reveal the validity of the constructs measured in this study.

 

Motivator Barrier: Huber and Power claim that key-informants may believe that providing certain information could have an undesirable impact on their careers. To a certain extent, this constitutes a bias in the form of a motivation barrier to their participation and they suggest that investigators should remove as many motivational 'disincentives' to participation as possible. These suggestions have been considered very seriously, no self-report was included and strict confidentiality was guaranteed to every key-informant, who e-mailed his/her responses directly to the research team.

Perceptual and cognitive limitations are, according to Huber and Power the second reason for biased or inaccurate reports. Since key-informants are asked to provide the researcher with group-level properties, this can increase the burdens of their information processing activity. They suggest that investigators should use pre-tested questions that should, at the same time, be as specific and simple as possible. In this study the validity of a number of the questions used have been previously tested and the ones specifically invented for this research have been pilot tested.

Lack of information is the third source of data inaccuracy, as in many studies researchers do not select those key-informants whose positions give them access to the required information. Often key-informants are chosen because of their proximity to the researcher. In this study, all key-informants were senior members of the groups of which the relationships were to be measured and, thus, they were very well informed about the constructs under investigation.

## 5. Conclusions

The research experiences presented in this paper aim to provide a basis for assessing the construct validity of empirical research using key-informant methodology for the measurement of organizational properties among collaborating groups. It is true that previous research has significantly improved methodology in situations where individuals constitute the unit of analysis. Little work, though, has been done to apply the same standards for valid inference to situations where more complex units of analysis are involved, as it is the case with the manufacturing unit, in this research. This paper contributes to the resolution of this problem by providing guidelines for assessing the validity of measures of organizational properties of industrial groups obtained through key-informant methodology.

As already explained in the introductory section, we have chosen to briefly present the lessons learned through this research in sections three and four. In this section we are tabulating our conclusions either as error preventive measures or as ways by which the three, above examined, validity criteria have been successfully addressed in this study. Recommendations and lessons learned are tailored to each one of the three validity criteria.

### 5.1 Bagozzi construct validity criteria

As Bagozzi (1980) clearly states, referring to his criteria: "The achievement of construct validity (…) requires satisfaction of all six of the above criteria." (p. 114). That means that after empirical research is undertaken, the internal consistency of operationalizations, convergent validity, discriminant validity, and nomological validity criteria should be ascertained before the relationships among theoretical construct are analyzed on the basis of the empirically measured constructs. Table 1 summarizes Bagozzi's criteria and briefly indicates how these have been applied in this research.

**Table 1:** Bagozzi's Criteria and how addressed in our study

| **Bagozzi's Six Criteria** | **How Addressed in our Study** |
|---|---|
| Theoretical Meaningfulness of Concepts | Built upon the emerging discipline of the firm's resource- and knowledge-based theory. |
| Observational Meaningfulness of Concepts | Used previously validated measures, together with new measures that had been pilot tested. |
| International Consistency of Operationalizations | Employed multi-item scales and tested with Cronbach's alphas |
| Convergent Validity | Employed multi-methods and tested with MTMM (Campbell and Fiske, 1959) |
| Discriminant Validity | Employed multi-methods and tested with MTMM (Campbell and Fiske, 1959) |
| Nomological Validity | The results of the study are consistent with a large body of theory and contribute to the reference field |

### 5.2 Cook and Campbell construct validity criteria

Table 2 summarizes Cook and Campbell's criteria and briefly indicates how these have been addressed in this research.

**Table 2:** Cook and Campbell's criteria and how addressed in our study

| Cook and Campbell's Criteria | How Addressed in our Study |
|---|---|
| Statistical Conclusion Validity | Employed multi-item scales and tested with Cronbach's alphas |
| Internal Validity | Cross-sectional study, variety of industry types (5 sectors, 51 companies, 112 manufacturing units) |
| Construct Validity | Tested by the six Bagozzi's criteria |
| External validity | Variety of organizations and industries, still degree of generalization is low due to self-selection bias. (Use of random sample was impossible.) |

The analysis and comparison of the above two sets of criteria indicates that there is a significant overlap between them, although they both make unique contributions. Specifically, there are several areas where Cook and Campbell add to Bagozzi's criteria and for this reason it is important to consider both the Bagozzi and the Cook and Campbell sets of validity criteria upon designing research to test theories.

### 5.3 Huber and Power key-informant validity criteria

Table 3 summarizes Huber and Power's criteria and briefly indicates how these have been addressed in this research.

**Table 3:** Huber and Power's criteria and how addressed in our study

| Huber and Power's Criteria | How Addressed in our Study |
|---|---|
| Motivator Barrier | No self-report included and guaranteed strict confidentiality |
| Perceptual and Cognitive Limitiations | All questions anchored to group relationships and pilot-tested |
| Lack of Information | All key-informants were members of the group under investigation<br>All stakeholders (for the performance questionnaire) have had relevant experience. |

We believe that the above tabulation format facilitates future researchers to benefit from the lessons we have learned on threats to validity issues related to the use of key-informant methodology in empirical studies that focus on the organizational characteristics of collaborating groups.

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## Appendix: Research Instruments

1. **Relationship questionnaires** (Type A and B) included twelve questions aiming to measure:

- dependent or mediating variable Sharing Knowledge (3 questions)
- independent variable Mutual Trust (2 questions)
- independent variable Mutual Influence (4 questions)
- the role and level of contribution of Information Technology (ITsk),
- both as a tool and/or enabler in supporting sharing knowledge
- among Manufacturing, Quality and/or R&D groups (2 questions)
- the use of IT infrastructure –under the above described concept
- (1 question with multiple sub questions)

2. **Performance questionnaire** (Type C) included nine questions aiming to measure:

- operational manufacturing performance (3 questions)
- service manufacturing performance (3 questions)
- the level of contribution of Information Technology (ITmp)
- to Manufacturing group performance (2 questions)
- the use of IT functions –under the above described concept
- (1 question with multiple sub questions)

3. An example

The Mutual Trust Construct measurement, using two indicators, is presented as an example here below. The two indicators of predisposition measure the extent to which the two partner groups trust each other. The first indicator directly assesses the level of trust between the groups, through a general assessment. The second indicator is a multiplicative assessment that evaluates the reputation of each group for meeting its commitments.

### *Mutual Trust Indicator 1:*

(General Assessment, Mean 5,4509; SD 0,8620; Range 4)
A4/B4. The level of trust that exists between the [Manufacturing] group and the [Quality or R&D] group is:

- A4: Mean 5,54464; SD 1,10599; Range 5
- B4: Mean 5,35714; SD 0,92860; Range 4

### *Mutual Trust Indicator 2:*

(Multiplicative Assessment, Mean 28,304; SD 8,374; Range 43)
The product of the responses to the following:

- A5. The reputation of the [Quality or R&D] group for meeting its commitments to the [Manufacturing] group is: Mean 5,44643; SD 0,96646; Range 4
- B5. The reputation of the [Manufacturing] group for meeting its commitments to the [Quality or R&D] group is: Mean 5,13393; SD 0,97256; Range 6

### *Mutual Trust Construct:*

The mean of the above indicators, Mean 16,877; SD 4,452; Range 21,5

Note: Questionnaire items for shared knowledge, mutual trust and mutual influence used in our study had been validated and used by Nelson and Cooprider (1996) upon exploring the concept of shared knowledge between Information Systems (IS) groups and their line customers as a contributor to IS performance.

## Relationship Questionnaire (Type A)

(Manufacturing)
Please characterize the general working relationship that currently exists between the [Manufacturing] group and the [Quality or R&D] group.

Use the following scale to measure constructs:

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Extremely Weak | Weak | Moderately Weak | About Average | Moderately Strong | Strong | Extremely Strong |

1. The level of appreciation that the [Manufacturing] group and the [Quality or R&D] group have for each other's accomplishments is: ☐
2. The level of understanding of the [Quality or R&D] group for the work environment (problems, tasks, roles, etc) of the [Manufacturing] group is: ☐
3. The level of appreciation that the [Quality or R&D] group has for the accomplishments of the [Manufacturing] group is: ☐
4. The level of trust that exists between the [Manufacturing] group and the [Quality or R&D] group is: ☐
5. The reputation of the [Quality or R&D] group for meeting its commitments to the [Manufacturing] group is: ☐
6. In general, the level of influence that members of the [Manufacturing] group and the [Quality or R&D] have on each other's key decisions and policies is: ☐
7. In general the ability of members of the [Manufacturing] group and the [Quality or R&D] group to affect each other's key decisions and policies is: ☐
8. In general, the level of influence that members of the [Quality or R&D] group have on key decisions and policies of the [Manufacturing] group is: ☐
9. In general, the ability of members of the [Quality or R&D] group to affect key policies and decisions of the [Manufacturing] group is: ☐
10. In general, the role and the level of contribution of Information Technology (IT) as a tool and/or enabler, to support shared knowledge between [Manufacturing] group and [Quality or R&D] group is: ☐
11. In general, the use of the Information Technology (IT) infrastructure in the [Manufacturing] group is: ☐
12. Specifically, the use of the following IT infrastructure is:

Intranet ☐ Extranet ☐ Groupware ☐ , Workflow ☐
Internet ☐ , e-mail ☐ , …… ☐ , ……. ☐
Data warehouse ☐ ,
Other …… ☐ , ……..…. ☐ …. ……. ☐

 

## Relationship Questionnaire (Type B)

(Quality or R&D)

Please characterize the general working relationship that currently exists between the [Quality or R&D] group and the [Manufacturing] group.
Use the following scale to measure constructs:

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Extremely Weak | Weak | Moderately Weak | About Average | Moderately Strong | Strong | Extremely Strong |

1. The level of appreciation that the [Quality or R&D] group and the [Manufacturing] group have for each other's accomplishments is: ☐
2. The level of understanding of the [Manufacturing] group for the work environment (problems, tasks, roles, etc) of the [Quality or R&D] group is: ☐
3. The level of appreciation that the [Manufacturing] group has for the accomplishments of the [Quality or R&D] group is: ☐
4. The level of trust that exists between the [Quality or R&D] group and the [Manufacturing] group is: ☐
5. The reputation of the [Manufacturing] group for meeting its commitments to the [Quality or R&D] group is: ☐
6. In general, the level of influence that members of the [Quality or R&D] group and the [Manufacturing] have on each other's key decisions and policies is: ☐
7. In general the ability of members of the [Quality or R&D] group and the [Manufacturing] group to affect each other's key decisions and policies is: ☐
8. In general, the level of influence that members of the [Manufacturing] group have on key decisions and policies of the [Quality or R&D] group is: ☐
9. In general, the ability of members of the [Manufacturing] group to affect key policies and decisions of the [Quality or R&D] group is: ☐
10. In general, the role and the level of contribution of Information Technology (IT) as a tool and/or enabler, to support shared knowledge between [Quality or R&D] group and [Manufacturing] group is: ☐
11. In general, the use of the Information Technology (IT) infrastructure in the [Quality or R&D] group is: ☐
12. Specifically, the use of the following IT infrastructure is:

Intranet ☐ Extranet ☐ Groupware ☐, Workflow ☐
Internet ☐, e-mail ☐, …… ☐, ……. ☐
Data warehouse ☐,
Other …… ☐, …….. ☐ …. ……. ☐

## Performance Questionnaire (Type C)

(Organizational Stakeholders)

The following questions ask you to compare the [Manufacturing] group to other such Manufacturing groups. In relation to other comparable groups you have observed, how the [Manufacturing] group rates on the following.
Use the following scale to measure constructs:

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Non – Existant | Very Weak | Weak | About Average | Strong | Very Strong | Extremely Strong |

1. In general, the quality of the work produced for the [Quality or R&D] group by the [Manufacturing] group is: ☐
2. In general, the ability of the [Manufacturing] group to meet its organizational commitments (such as project schedules and budget) is: ☐
3. In general, the ability of the [Manufacturing] group to meet its goals is: ☐
4. In general, the ability of the [Manufacturing] group to react quickly to the [Quality or R&D] group's changing business needs is: ☐
5. In general, the responsiveness of the [Manufacturing] group to the [Quality or R&D] group is: ☐
6. In general, the contribution that the [Manufacturing] group has made to the accomplishment of the [Quality or R&D] group's strategic goals is: ☐
7. In general, the level of the Information Technology (IT) contribution to the [Manufacturing] group performance is: ☐
8. In general, the use of the Information Technology (IT) infrastructure, between the three groups is: ☐
9. Specifically, the use of the following IT function is:

- Coordinating business tasks: ☐ (collecting, facilitating, sharing, etc. information)
- Supporting decision making: ☐ (reaching the right information at the right time)
- Facilitating member' team to work together: ☐ (no matter where they are)
- - Facilitating access of information in Data Bases: ☐ (no mater where they are)
- - Other ……: ☐
- - Other ……: ☐

Note for all three questionnaires: In every question, titles in brackets were customized to reflect the exact names of the participating organizations and functional groups, as they are used in every firm.

 