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# An Empirical Investigation of the Relationship between Information Quality and Individual Impact in Organizations

Gilson Ditzel Santos
*Department of Business Administration*, ditzel@utfpr.edu.br

Hiroo Takaoka
*Business School University of São Paulo*, takaoka@usp.br

Cesar Alexandre de Souza
*Business School University of São Paulo*, calesou@usp.br

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**Gilson Ditzel Santos**
Department of Business Administration
UTFPR/Campus Pato Branco
ditzel@utfpr.edu.br

**Hiroo Takaoka**
Business School
University of São Paulo
takaoka@usp.br

**Cesar Alexandre de Souza**
Business School
University of São Paulo
calesou@usp.br

## ABSTRACT

The aim of this research is to confirm that information quality impacts individual work, considering external variables that may influence knowledge workers perception of information quality and individual impact. This research is descriptive and the constructs used are known and previously validated. However, the research model, that includes external variables that may influence the relationship between perceived information quality and individual impact, has never been proposed nor validated by other researchers. The research unit is the individual that work in organizations and use at least one information system to do his/her job. A survey using self employed electronic questionnaire was applied to one large organization that operates in Paraná State, Brazil. Structural Equation Modeling was used to analyze the data. The results confirmed the positive influence of information quality on individual impacts and pointed out external variables that influence these perceived variables.

### Keywords

Information Quality; Individual Impact; IS Success; Structural Equation Modeling.

## INTRODUCTION

Information Quality (IQ) is the characteristic of information of conformance to specifications and meeting/exceeding consumer expectations (Kahn and Strong, 1998). Organizational IQ started being intensively studied in the 1980´s, reaching its maturity in the 1990´s.

Eppler and Wittig (2000) did a literature review of relevant IQ research conducted from 1989 to 1999, choosing seven of them to be deeply studied. Among these, the work of Wang and Strong (1996) was considered the one that better met the evaluation criteria proposed by Eppler and Wittig (2000). Kahn, Strong, and Wang (2002) extended that model including the aspect of service, what resulted in the Product and Service Performance Model for Information Quality (PSP/IQ).

Besides the research about IQ assessment methodologies being quite mature, the research on the organizational impacts of IQ is still developing. Slone (2006) studied the organizational impacts of IQ, using the research instrument developed by Lee et al. (2002) to assess IQ, and the instrument proposed by Mirani and Lederer (1998) and Weill (1992) to measure organizational impacts. That research pointed out the need for deeper investigation on the organizational impacts of IQ, in order to clarify the cause-effect relationships. Considering the organization at the individual level, empirical researches confirmed that IQ perceived by Information Systems (IS) users positively influences individual performance (Belardo and Pazer, 1995; Fisher, Chengalur-Smith and Ballou, 2003; Jung, Olfman, Ryan and Park., 2005; Wu and Wang, 2006).

Ge and Helfert (2007) concluded that the main research questions on the organizational impacts of IQ were related to: establishing a relationship with application contexts; showing the relationship with IS research; and studying exogenous variables. This research therefore proposes a model of the impacts of IQ on individual work, using generic constructs, based on IQ and IS research, and classifying the IS users according to their individual characteristics and organizational role. The model was validated in an organization of the electric power sector.

## INFORMATION QUALITY

Eppler and Wittig (2000) did a literature review of relevant research on IQ assessment published from 1989 to 1999 and selected seven of them to a deeper study. Among those seven researches, the work of Wang and Strong (1996) was considered the one that better met the research criteria. That is to say, the IQ assessment methodology includes: IQ problems categories and specific indicators; implementation support tools; solid theoretical foundation; examples of practical applications; and possibility to be applied in different contexts.

The research of Wang and Strong (1996) confirmed that high quality information should be intrinsically good, contextually appropriate, clearly represented and accessible to users. However, the authors considered only the product aspect of information. Kahn et al. (2002) extended Wang and Strong (1996) research, including service aspects to information, what resulted in the model called PSP/IQ, presented in Figure 1. Two concepts of quality are also represented in this model: conforming to specifications, and meeting or exceeding consumer expectations. The first concept refers to technical characteristics of information and is related to information collection and management. The second concept is more subjective, thus difficult to be measured, ant relates to users need of adding value to their job activities.

| | **CONFORMS TO SPECIFICATIONS** | **MEETS OR EXCEEDS CONSUMER EXPECTATIONS** |
|---|---|---|
| **PRODUCT QUALITY** | **Sound Information**<br>• Free-of-Error<br>• Concise representation<br>• Completeness<br>• Consistent representation | **Useful Information**<br>• Appropriate amount<br>• Relevancy<br>• Understandability<br>• Interpretability<br>• Objectivity |
| **SERVICE QUALITY** | **Dependable Information**<br>• Timeliness<br>• Security | **Usable Information**<br>• Belivability<br>• Accessibility<br>• Ease of manipulation<br>• Reputation<br>• Value-added |

**Figure 1 - PSP/IQ MODEL**

SOURCE: KAHN *et al.* (2002)

Ge and Helfert (2007) made an analysis of five methodologies considered to be representative of IQ assessment research from 1996 to 2006. The methodology proposed by Wang and Strong (1996) was used in four of the reviewed researches: Huang et al. (1999); Lee et al. (2002); Pipino, Lee and Wang (2002); and Stvilia et al. (2007). Furthermore, the PSP/IQ model was used by Lee et al. (2002) that proposed an extensive questionnaire to evaluate IQ.

It is necessary to emphasize that the terms data and information are treated as synonyms in this paper, as proposed by Levitin and Redman (1998), and Pipino et al. (2002).

## INDIVIDUAL IMPACTS

Considering that the impact of IQ on organizations is still an emergent area of research, it was necessary to consult the research on IS success. Which one of the most important models was developed by DeLone and McLean (1992). The model proposes that organizational IS success should be measured considering six dimensions: System Quality (SQ); IQ; IS Use; User Satisfaction (US); II; and Organizational Impact. Almost ten years after, DeLone and McLean (2003) proposed an extension of their model, based on all the published papers that cited it. The main changes were: inclusion of Service Quality as an additional dimension; substitution of II and Organizational Impacts for Net Benefits; consideration of the influence of Net Benefits on Use Intention/Use and on US. Wixom and Todd (2005) proposed a merger between the model of DeLone and McLean (2003) and TAM, which reinforces the need to examine the IS Users beliefs and their attitudes regarding the use of IS.

The study of the direct relationship between IQ and the impact on work, focusing on the success of IT, was analyzed by Wu and Wang (2006). The authors proposed the modification of the model of DeLone and McLean (2003) by exchanging positions between the constructs Use and Perceived Benefits. This decision followed the proposition of Seddon (1997) that the perceived benefits cause user satisfaction and the consequent use of the system.

Among the constructs of II used in Information Technology (IT) research, one that is broader and was validated by various researchers is the construct proposed by Torkzadeh and Doll (1999). Based on Attitude/Behavior theory, Torkzadeh and Doll (1999) describe a value chain of constructs employed to measure IT success that relates beliefs, attitudes, behaviors, economic, and social impacts of IT (Figure 2).

The impact on individual work is relatively important because it represents a direct consequence of Use and is the main cause of Organizational Impact.

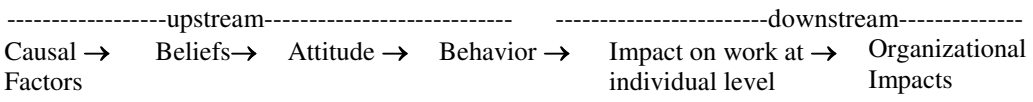


**Figure 2 – System to value chain**

SOURCE: TORKZADEH; DOLL, 1999

Through literature review, Torkzadeh and Doll (1999) proposed 4 dimensions of IT individual impacts (Task Productivity, Task Innovation, Customer Satisfaction, Management Control) and through a pilot study and a survey, the authors validated a research instrument with 12 items (three items per each dimension). The instrument is used in several studies (Stefanou, 2001; De Boer et al., 2002; Torkzadeh; Dhillon, 2002; Straub et al., 2004; Chang, King, 2005), and is suggested by DeLone and McLean (2003) for the measurement of individual impacts (II) of IT.

## INDIVIDUAL CHARACTERISTICS THAT INFLUENCE IQ AND II PERCEPTIONS

According to Seddon (1997), each group of stakeholders has its own interests and needs, expects different results from IS, ignore information that are not considered relevant, and use specific criteria to evaluate data.

Studies that analyze the IT value focusing the business processes (Mooney, Gurbaxani and Kraemer, 1996; Tallon, Kraemer and Gurbaxani, 2000; Kohli, 2003; Melville, Kraemer and Gurbaxani, 2004) show that the generation of value occurs in the processes. Therefore, in different processes, the generation of value also occurs in a unique way. Basically, processes are classified as management processes; and operational processes (Mooney et al, 1996). In addition, it is discussed the difference in perspectives and information needs according to the employee hierarchical level (Gorry and Scott Morton, 1971; Shang and Seddon, 2002). The three main hierarchical levels in an organization, according to Anthony (1965), are: strategic, middle level and operational.

Venkatesh and Morris (2000) did research on the differences of IT individual adoption and use behavior related to gender. Data was collected from five organizations, during five months resulting in 445 valid questionnaires. The authors could also evaluate the influence of respondents´ experience on the specific IS being implemented. The results indicate the influence of gender and experience on IT adoption and use.

Venkatesh et al. (2003) proposed and validated an IT adoption model called Unified Theory of Acceptance and Use of Technology (UTAUT). The model considers four control variables that had already been tested in other models: experience, freedom of use, gender and age. The four variables were confirmed as control variables.

The work of Fisher et al. (2003) verifies the influence of experience and time to make a decision on the use of meta Data Quality (DQ). Experience was operationalized as working time. Fisher et al. (2003) also included age, gender and education as demographic variables. The results showed that the experienced respondents used meta QD more than the inexperienced ones. It was also observed that age and education influenced meta QD use: aged respondents tended to pay more attention to meta QD, as well as respondents with lower educational level. The results did not show the influence of gender on the use of meta QD.

Saeed and Abdinnour-helm(2008) tested the effects of IS characteristics and perceived usefulness on future IS adoption. The results of that research pointed out that gender and experience influenced IS future adoption: women considered websites IQ more important than men while evaluating IS value; more experienced respondents considered IQ as more relevant than less experienced ones.

## RESEARCH MODEL

The relationship between IQ and the impact on work has extensively been the subject of research focusing on IS Success, specifically considering IQ research, studies on the individual impacts of IQ have been performed recently and focused on specific contexts (Fisher et al., 2003; Jung et al., 2005).

The model proposed in this research is presented in Figure 3. The construct of IQ is the PSP/IQ model (Kahn et al., 2002). As it is a model that considers both product and service aspects of information, it was decided not to include the constructs System and Service Quality proposed by Delone and McLean (2003). The construct of II was operationalized using the instrument developed by Torkzadeh and Doll (1999). However, it was added to the construct the latent variable Decision Making, given its importance in IT management, as stated by DeLone and McLean (1992, 2003), Redman (1998), Shang and Seddon (2002); Wixom and Todd (2005); Lucht et al. (2007). The three observed variables that represent the Decision Making factor are the following:

a) Measure of effectiveness - the use of information made possible an improvement in the quality of decisions, adapted from Wixom and Todd (2005) and Sanders and Courtney (1985).
b) Measure of efficiency - the use of information reduced the average time for decision-making, adapted from Benbasat and Schroeder (1977).

c) Measure of efficiency - the use of information reduced the effort for decision-making, adapted from Wixom and Watson (2001).

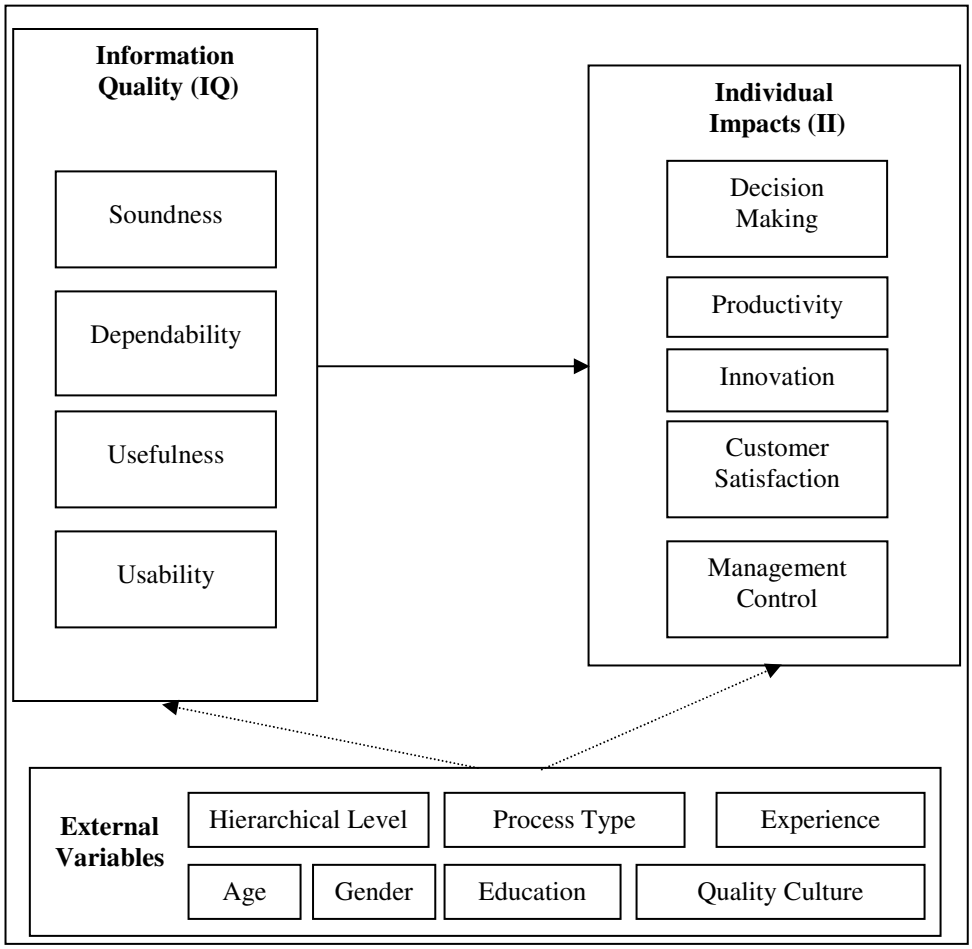


**Figure 3 – Research model**

Relying on the studies presented in the previous section, it was included in the model the following external variables: Hierarchical Level; Process Type; Experience, operationalized as working time; Age; Gender; and Education. It was also included a variable to assess the respondent's experience with quality management. This allows the assessment of whether previous experience with quality management of products and processes can positively influence the perceptions of IQ and II.

Summarizing, this model evaluates the individual impacts of IQ from the perspective of IS users, taking account of their status within the organization. The focus of the model is the information provided to the user and not the systems that manage it. The evaluation of II is based on respondent past behavior and organizational objectives. The aim is also, to show that external variables related to individual influence the perceptions of IQ and II. Thus, the hypotheses are:

H1. Considering IS users, perceived IQ is positively associated with perceived II.

H2. The latent variables Soundness, Dependability, Usefulness and Usability are coaligned first-order constructs that reflect IQ, a second order factor.

H3. The latent variables Decision Making, Productivity, Innovation, Customer Satisfaction and Management Control are coaligned first-order constructs that reflect II, a second order factor.

H4 - H10. Gender, Age, Experience, Hierarchical Level, Education, Process Type and Quality Culture influence perceptions of IQ and II.

## RESEARCH METHOD

The construct of IQ, a second order Latent Variable (LV), is divided into four primary factors, and 16 observed variables according to the model PSP/IQ (Kahn et al., 2002). The variables were measured using Likert scale ranging from (1) strongly disagree to (5) strongly agree.

The construct of II, also a second order LV, was implemented through the instrument for measuring the impact of IT on work developed by Torkzadeh and Doll (1999), adapted for this research, through a pre test, and the inclusion of the first-order factor Decision-Making. The original instrument of Torkzadeh and Doll (1999) assesses the impacts of the use of IS. However, in this work, the impacts of the use of available information in one or more applications are evaluated. Since the phenomenon under evaluation is still a behavior, it was considered that this adaptation of the II construct is feasible. Slone (2006) also adapted the constructs of organizational impacts, originally designed to assess the impacts of the use of IS, to measure impacts of the use of information.

### Data Collection

The model validation was performed in two steps. Initially it was pre-tested, in order to adjust the survey instrument, and then the validated survey instrument was applied to the target population.

The pretest was conducted with 12 IS users from a mid-size furniture company and five professionals which were either experts in IT, or IT users (a doctor in IS, a doctoral student in Administration, two managers of a large company, a manager of a mid-size company). The pre-test provided the amendment and the exclusion of questions in order to improve understanding and give parsimony to the research instrument.

The survey was implemented through self-administered questionnaire, with closed ended questions, made available on the Internet.

The sample used to choose the surveyed organization was accessibility or convenience. The organization that agreed to participate in the research belongs to the electric power sector. However, the sample of individuals in the organization followed the model of stratified sampling, where the sample is a selection of population subgroups (GIL, 2007, p. 102). The potential respondents received an e-mail showing the website where the questionnaire was located and information about the research. As a result of the 3000 emails sent to the organization, 494 valid questionnaires were received back. Each respondent used more than one IS, but all of them used Transaction Processing Systems and Collaboration Systems, and most of them also used Management Information Systems and one Expert System directed to electric power companies.

The non-response analysis was made by comparing external variables values of valid and incomplete questionnaires, resulting that the respondents represent well the non-respondents (Table 1).

| **External Variables** | | **Total (%)** | **Valid Responses (%)** | **Incomplete Responses (%)** | **P-value** |
|---|---|---|---|---|---|
| **GENDER** | M | 72,3 | 73,1 | 69,5 | 0,42 |
| | F | 27,7 | 26,9 | 30,5 | |
| **AGE** | <=20 | 0,3 | 0,4 | 0,0 | 0,51 |
| | 21-30 | 19,1 | 18,2 | 22,7 | |
| | 31-40 | 19,1 | 19,2 | 18,8 | |
| | 41- 50 | 49,0 | 50,6 | 43,0 | |
| | 51-60 | 11,9 | 11,1 | 14,8 | |
| | >60 | 0,5 | 0,4 | 0,8 | |
| **TIMEORG (years)** | <1 | 2,4 | 2,4 | 2,3 | 0,77 |
| | 1<t<5 | 25,7 | 24,7 | 29,7 | |
| | 5<t<10 | 4,2 | 4,5 | 3,1 | |
| | 10<t<20 | 23,5 | 24,1 | 21,1 | |
| | >20 | 44,2 | 44,3 | 43,8 | |
| **TIMEIND (years)** | <1 | 8,7 | 8,7 | 8,6 | 0,77 |
| | 1<t<5 | 23,0 | 22,5 | 25,0 | |
| | 5<t<10 | 6,9 | 6,5 | 8,6 | |
| | 10<t<20 | 24,0 | 24,9 | 20,3 | |
| | >20 | 37,5 | 37,4 | 37,5 | |
| **LEVEL** | Strategic | 4,7 | 4,9 | 3,9 | 0,02 |
| | Middle level | 34,9 | 37,4 | 25,0 | |
| | Operational | 60,5 | 57,7 | 71,1 | |

**Table 1 – Respondents profile and nonresponse bias analysis**

| External Variables | | Total (%) | Valid Responses (%) | Incomplete Responses (%) | P-value |
|---|---|---|---|---|---|
| **EDUCATION** | Elementary | 0,3 | 0,4 | 0,0 | 0,07 |
| | High school | 5,9 | 4,9 | 10,2 | |
| | Technical | 17,5 | 16,0 | 23,4 | |
| | Bachelor | 48,2 | 49,2 | 44,5 | |
| | Specialist | 23,3 | 24,9 | 17,2 | |
| | Master | 4,5 | 4,5 | 4,7 | |
| | Doctor | 0,2 | 0,2 | 0,0 | |
| **PROCESS** | Management | 49,2 | 49,8 | 46,9 | 0,56 |
| | Value chain | 50,8 | 50,2 | 53,1 | |
| **QUALI** | Yes | 94,5 | 95,1 | 92,2 | 0,19 |
| | No | 5,5 | 4,9 | 7,8 | |

**Table 2 – Respondents profile and nonresponse bias analysis**

## DATA ANALYSIS AND RESULTS

It was used SEM for data analysis, with the support of AMOS. The initial model was respecified in order to obtain a better overall and measurement model adjustment. The goodness of fit indices presented in Table 3 show that all values were improved in the adjusted model, and almost all of them are within the ranges of recommended values. The only exception is NFI, which value is equal to 0,9.

| Fit Indices | Criteria | Initial | Adjusted |
|---|---|---|---|
| $\chi 2$/df | 3-5 | 3,053 | 3,184 |
| NFI | >0,9 | 0,861 | 0,890 |
| TLI | >0,9 | 0,893 | 0,913 |
| CFI | >0,9 | 0,902 | 0,922 |
| RMSEA | 0,05-0,08 | 0,066 | 0,068 |

**Table 3 – Adjusted model characteristics**

Considering the respecified model, Table 4 shows that only Usability has reliability below 0,7 and that all constructs have explained variance equal or over 0,5.

| | Reliability | Explained Variance |
|---|---|---|
| QI | 0,95 | 0,85 |
| II | 0,94 | 0,75 |
| Soundness | 0,77 | 0,47 |
| Usefulness | 0,80 | 0,45 |
| Usability | 0,63 | 0,46 |
| Decision Making | 0,83 | 0,61 |
| Productivity | 0,84 | 0,64 |
| Innovation | 0,91 | 0,78 |
| Customer Satisfaction | 0,90 | 0,74 |
| Management Control | 0,92 | 0,80 |

**Table 4 – Reliability and Explained variance**

Figure 4 shows the respecified model with standardized path coefficients ($p<0,01$), and coefficient of determinant ($R^2$) for II.

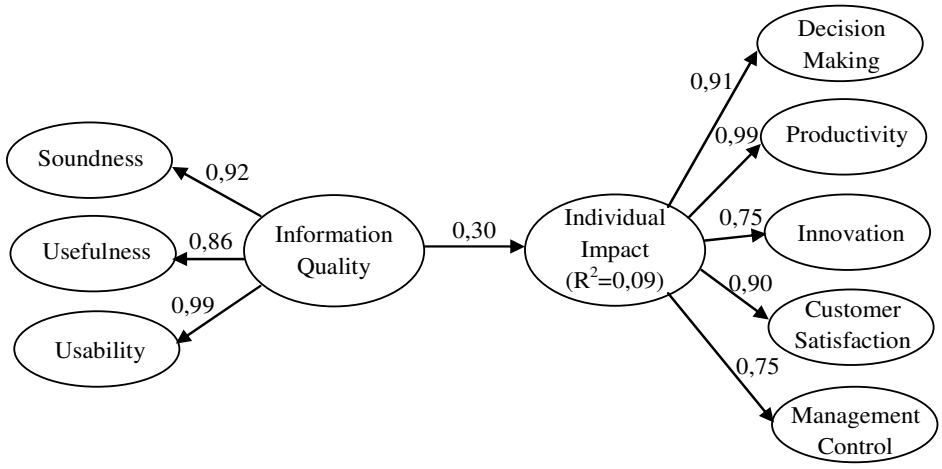


**Figure 4 – Respecified Model**

The positive influence of IQ on II was confirmed (H1), as the structural coefficient between IQ and II is significant and its standard value is 0,3 and $R^2$ is 0,09. This result shows that II is a construct that measures the impact of IQ on work. Almutairi and Subramanian (2005) failed to find significant relationship between IQ and II, using constructs similar to those used in this work, but showed that Use explains 10% of II. Wu and Wang (2006) found $R^2$ = 0.54 for the relationship IQ → Perceived Benefits. However, the constructs are distinct from those used in this work.

The first order factors Soundness, Usefulness and Usability are co-aligned and represent the second order factor IQ (H2). Similarly, the first order factors Decision Making, Productivity, Innovation, Customer Satisfaction and Management Control, are co-aligned and represent the second order factor II (H3). Therefore, it was proven that the use of second order factors to represent IQ and II is an appropriate treatment for the interdependence between the categories of IQ and II.

The influence of gender on IQ and II (H4) was not confirmed. This result contradicts the results of researches on IT Value (Venkatesh and Morris, 2000; Venkatesh et al., 2003; Saeed and Abdinnour-Helm, 2008). However, the result confirms what was obtained by Fisher et al (2003), which failed to confirm the influence of gender on the use of meta DQ.

Age influences IQ positively, what means that H5 was partially confirmed. Fisher et al (2003) found similar results, they observed that older experts paid more attention to meta DQ.

It was confirmed the positive influence of Experience on the perception of IQ, but not on II (H6). This could be possibly explained by the fact that the employee learns to accomplish his/her tasks using available information. Then, the employee new to the organization that does not know neither the work processes nor the information available will face greater difficulties while using information. Other works have confirmed the positive influence of experience on the adoption of IT (Venkatesh et al, 2003; Saeed and Abdinnour-Helm, 2008) and on the use of meta DQ (Fisher et al., 2003).

The hierarchical level influences the perception of II, partially confirming H7. The higher the hierarchical level, the more positive is respondents´ assessment of individual impact.

H8 was also partially confirmed, as it was observed that respondents with specialist´s degree, or lower, tend to evaluate IQ better than masters and doctors. Fisher et al. (2003) found out that respondents with lower educational level tended to use more meta DQ.

There was no indication that the Process Type or Quality Culture influences perceptions of IQ or II, what means that H9 and H10 were not confirmed.

## CONCLUSIONS

It was possible to confirm that IQ, as defined by Kahn et al (2002), is a second order construct. Likewise, II, as defined by Torkzadeh and Doll (1999) plus the Decision Making first order factor, is also a second-order construct. Therefore, it is not possible to correlate the categories of IQ and II directly. However, Dependability seems to have not been correctly specified, because its reliability and explained variance were not suitable. Therefore, considering the respecified second-order constructs, the positive influence of IQ over II was confirmed.

The validation of the model confirms the hypothesis that the construct of II, originally developed by Torkzadeh and Doll (1999) to assess the impacts of IT in the workplace, is adequate to measure the impact of IQ on work. Similarly, the

validation of IQ as a second order construct shows that it is necessary that empirical evaluation of IQ consider the interdependence among its dimensions.

The fact that some of the external variables did not influence perceptions on IQ or II, and some of them did, leads to the necessity of deeper studies on the influence of external variables.

The validation of the model showing the influence of IQ on individual work may justify that Brazilian organizations take actions towards the management of IQ.

To support the development of more specific strategies that may guide the management of IQ, organizations can use the model to determine which IQ dimensions influence more the II dimensions they consider as priorities.

The definition of which individual characteristics change significantly the perception of individuals regarding IQ and II helps the organization to develop strategies for continuous improvement of IQ, that are focused on people.

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