12-2009

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Alejandro Cataldo
Computer Science Department, Catholic University of Chile, ajcatald@uc.cl

Jens Hardings
Computer Science Department, Catholic University of Chile, jhp@ing.puc.cl

Robert J. McQueen
Department of Management Systems, University of Waikato, bmcqueen@waikato.ac.nz

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Alejandro Cataldo[1], Jens Hardings[2]
Computer Science Department
Catholic University of Chile
Santiago, Chile
[1]Email: ajcatald@uc.cl
[2]Email: jhp@ing.puc.cl

Robert J. McQueen
Department of Management Systems
University of Waikato
Hamilton, New Zealand
Email: bmcqueen@waikato.ac.nz

Abstract

This paper presents a test that helps practitioners and researchers to measure ICT alignment in SMEs. Practitioners and researchers have suggested SMEs use ICT in a way less than optimal, wasting important and limited resources. Although researchers have proposed several instruments to solve this problem, they show operative problems when applied to SMEs. We developed and applied a test that helps SME managers to diagnose and measure the misalignment of ICT in their firms. Additionally, we propose the usage of two indicators of misalignment of ICT in SMEs. We applied this test to 34 SMEs of different regions in Chile with positive feedback on behalf of the SME owners. SMEs are less misaligned at a strategic level than at the process level (23.9% and 42.6% respectively). Also, the findings showed statistically significant differences of alignment between firms of different regions. An open question: whether it is possible that in SMEs the process-level alignment delivers more information than strategic level alignment.

Keywords

SME, ICT Alignment, Information Technology, STROBE/STROIS, Strategy.

INTRODUCTION

The necessity for ICT alignment in businesses has aroused a special concern among researchers and practitioner. A problem that has received a lot of attention has been the technological alignment. In other words, the harmonic fit between the goals and activities of the organization and the information systems that support them (McKeen and Smith 2003). To help firms with the ICT alignment problem, researchers have proposed different solutions but there is little evidence showing that these techniques could be applied to real SMEs.

We developed an instrument that helps an SME discover technological misalignment in its processes and strategic orientation. We called it: *Technological diagnosis alignment Test* (TDAT). TDAT was built integrating several instruments proposed in the literature, such as: STROBE/STROIS by Venkatraman and Chan respectively (Chan et al. 1997a; Chan et al. 1997b; Venkatraman 1989b), Processes Analysis proposed by Cragg and Tagliavini (2007) and the Tagliavini et al. Check-Up method (Tagliavini et al. 2004). This document has the objective to present TDAT and show the preliminary results of its application to 34 SMEs of different Chilean regions. Mostly, TDAT was applied to the CEO/owner and the CIO of the firm.

The remainder of this paper is divided into four sections. Section two summarizes the literature which is the foundation for this work. Section three describes how TDAT was developed and details its most important components. Section four presents and discusses the main findings. The final section summarizes the conclusions and the potential for future work.

LITERATURE REVIEW

Technological alignment has been of significant interest among researchers of ICT and SMEs, and has very different and diverse approaches. One of these approaches has been about how to create instruments that help SMEs diagnose their misalignment. Some researchers have suggested that the same instruments used in larger firms could be utilized as diagnostic tools for SMEs (Gutierrez et al. 2009; Hale and Cragg 1996). Cragg and Hale (1996) adapted Venkatraman's STROBE and Chan's STROIS to SME's conditions. The STROBE

(*Strategic Orientation of Business Enterprise*) was developed by Venkatraman to assess the strategic orientation of any firm (Venkatraman 1989b). STROBE defines eight strategic dimensions, namely: Aggressiveness, Analysis, Internal Defensiveness, External Defensiveness, Futurity, Proactiveness, Risk Aversion and Innovativeness (Chan et al. 1997a). Later, Chan developed the STROIS (*Strategic Orientation of IS)* as a complement to the STROBE, and both are used to evaluate the ICT alignment in a firm (Chan and Reich 2007).

Cragg and Hale adapted the STROBE and STROIS to be used in SMEs applying it to eight New Zealand SMEs. They assessed the alignment of these eight dimensions using two techniques known as bivariates: matching and moderation. Matching consists in comparing a set of strategic variables, afterward matched variables are subtracted to get a value of alignment for each dimension. For example, respondents are asked to evaluate the STROBE and STROIS statements, from "strongly agree" to "strongly disagree", using a five point Likert scale. This results in a maximum (mis)match between any two items of $(5 - 1) = 4$, with a perfect match having a difference score of 0 (Hale and Cragg 1996). Moderation, on the other hand, is based on the idea that the relationship between business strategy and ICTs is synergic, so the score is defined by a multiplicative function. For example, under the moderation perspective, the STROBE and STROIS values for individual items are multiplied to produce a maximum of $(5 \times 5) = 25$, and a minimum of $(1 \times 1) = 1$ for each item.

Scholars have diverse opinions about which approach is the best. Matching is simpler and more intuitive than Moderation but there is evidence about Moderation being mathematically more accurate (Chan and Reich 2007). Edwards has criticized approaches based on profile similarity indices (Cragg et al. 2002; Edwards 1993), demonstrating that techniques based on comparison of variables have limitations. He showed that more entities should be measured using normative (such as: Q-sorts and rankings) rather than ipsative measures, because former can provide large amounts of comparative information (Edwards 1993). For our objective of creating an instrument useful for Owner/CEOs of SMEs, another limitation of matching and moderation approaches can be argued: although these approaches could be used to diagnosis problems of alignment in SMEs, they do not provide information about how correct it or where to start resolving it.

Incidentally, other methods can be found in literature, most of them linked to strategic level. Venkatraman, for example, describe six perspectives of fit: moderation, mediation, matching, gestalts, profile deviation, and covariation (Venkatraman 1989a). However, researchers haven't achieved a consensus respect which one is the best. For instance, Bergeron et al. (2001) examining 110 SMEs concluded that system (deviation profile, covariation and gestalt) perspective will provide richer explanation of fit than bivariate approach (moderation, mediation, matching). They also suggested that deviation profile and covariation appear better to theory testing and gestalt appears better to building one.

Focuses in SMEs, those approaches based on strategy have failed because three reasons. First, its diversity and lack of agreement is one of the reasons why it has been difficult that a method become popular among practitioners. Second, mostly have been designed for large firms and do not consider the condition of smaller firms (Blili and Raymond 1993; Burgess 2002). Finally, for owners-managers those are neither practical, nor operative and don't delivery information about how to solve problems detected (Buonanno et al. 1997; Day 1996).

Trying to overcome the limitations of previous methods, other researchers have proposed alternative approaches to strategic orientation. Recently, Cragg et al. (2007) proposed to focus on processes to analyse the alignment in SMEs. The authors stated that for this kind of firm a process approach was more adequate than a strategic approach. They took the PCF Frame (*Process Classification Framework*) and built an evaluation instrument for SMEs. PCF is a detailed list of over seven hundred processes classified in twelve levels.

A special stream to help SMEs diagnose misalignment is based on *Check-Up* techniques. These methods do not only measure misalignment in SMEs, but also help to propose therapies. Ravarini et al. (2001) proposed a method that checked ICT alignment by matching and benchmarking. Likewise to Cragg et al., the Ravarini et al. method uses a process approach to analyse the ICT alignment. However, the authors utilized a different set of processes than Cragg et al. Another technique proposed by Tagliavini et al. looks for problems by dissension between CEO and CIO. Just like previous methods, this technique uses processes as SMEs model. To verify the alignment, the method ranks every process according to its strategic importance and technological covertures by interviewing the CEO and CIO. Comparing the positions of each process in the two rankings allows getting the ICT alignment (Tagliavini et al. 2004). One of the most complete check-up methods was designed by Buonanno et al. This technique is named ISCUM (Information System Check-Up Model) (Buonanno et al. 1997). Unlike other methods, ISCUM uses a model based on functions instead of processes. ISCUM was applied to 50 Italian SMEs.

Summarising both approaches research-based and check-up techniques that help SMEs align their ICT have limitations. On one hand, the techniques research-based have operative problems and do not deliver information

about how to solve the detected problems. On the other hand, there is not a lot of experience about Check-Up techniques and only limited reports about how to apply it.

DEVELOPING THE TDAT TEST

Next we describe the TDAT procedure, its components, how prioritizing was applied and how the misalignemt index was developed.

Introducing TDAT to participant firms

It is important to say that classification of SME was made according to Chilean Government's criteria. Chile's government uses two criteria to classify SME: employee number and turnover. Under the first one, small businesses have less than 10 employees (additionally they sub-classify micro businesses with less than 6 employees) and medium businesses that have up to 200 employees. Classification according to turnover is used particularly by the Chilean Tax Service (SII). In this study, we used number of employees as criteria of classification because is the most used by researchers and organizations (Burgess 2002; Levy and Powell 2005).
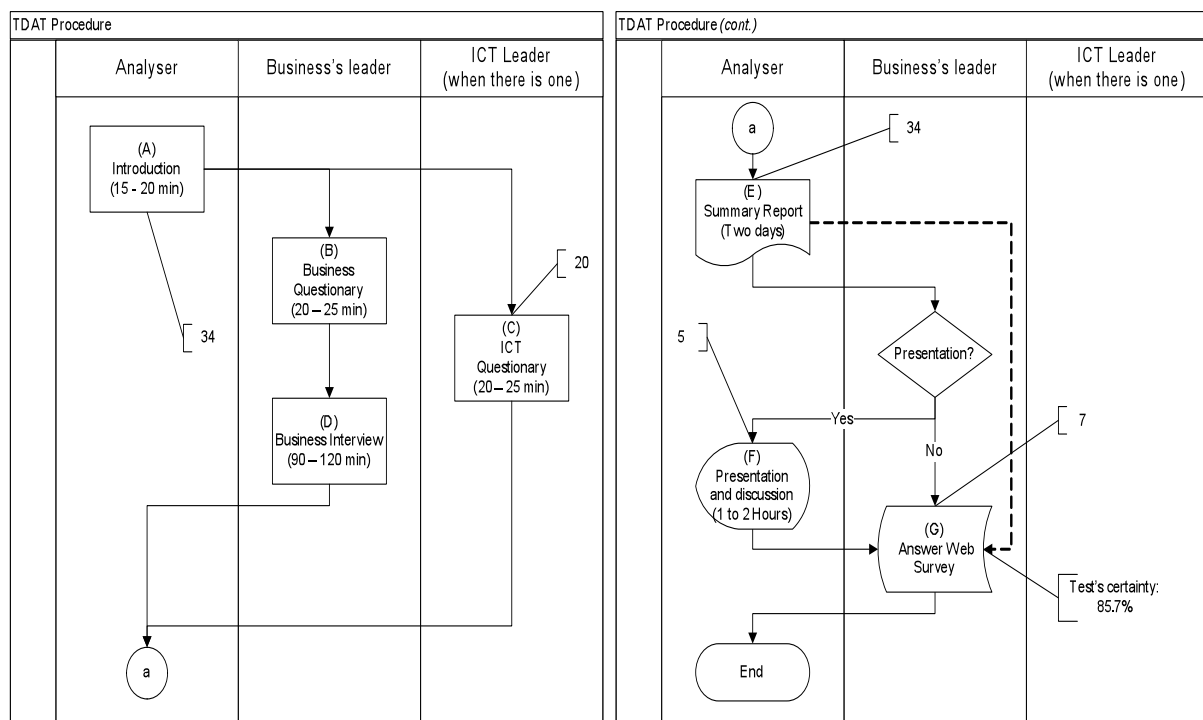

Figure 14: The figure shows the TDAT procedure and how many firms applied every step (numbers in bracket)

Figure 14 shows the TDAT process, which begins with a presentation lasting between 15 to 20 minutes (A), which is followed by the application of two questionnaires, one to the business leader (CEO, Owner or some high-level supervisor) and a second to the ICT leader (CIO). Fourteen firms did not have an ICT leader, in which case both questionnaires were answered by the business leader. Each questionnaire took between 20 to 25 minutes to complete (B, C). Then the business leader was interviewed by the analyser/researcher (D). The interview consisted of semi-structured questions about topics such as: firm's vision and KPIs, ICT's role in the business, "major pain" of the firm, etc. This interview lasted between 90 to 120 minutes. Two days later, a summary report was sent to the business leader (E). This report had an extension of three pages containing the main results of TDAT such as: (1) ICT alignment according to strategic orientation, (2) ICT alignment according to processes and (3) CEO/CIO alignment based on the Tagliavini et al. method. The TDAT original version did not consider presenting and discussing results with respondents, but it was observed that it was a necessary and useful activity, so we included it (step F) as optional although we think it should be mandatory. Activity F lasted between one and two hours. Only five firms were provided this activity. Finally, all firms were asked to answer a Web survey to evaluate the utility and certainties of TDAT (G). While only a small number (seven firms) completed the Web survey, those evaluated the instrument very positively.

TDAT's Components

We built TDAT integrating three approaches suggested by the literature. The first approach was STROBE/STROIS which is one of the most cited in the literature. STROBE/STROIS helps to analyse the firm's

strategic orientation and how it confronts its competitive environment. To implement the STROBE/STOIS, we adapted the instrument developed by Byrd et al. (2006), who created a questionnaire to do operative instruments. The questionnaire consists of two sets of 28 questions. Each question is evaluated using a five point Likert scale. Finally, Moderation was used to measure the alignment.

The second part of the test measured the alignment of the processes. The advantage of evaluating alignment according to processes is that SMEs can analyse their intern situation. We used the approach of Cragg et al. (2007) to evaluate this kind of alignment, using the same set of twelve processes proposed by PCF shown in Table 2 and used by Cragg and Tagliavini. Interviewees were asked to evaluate each process in two ways: (1) using a five point Likert scale and (2) ranking it.

Table 2. APQC Process Classification Framework (Cragg et al. 2007).

Abbreviation	Process	Abbreviation	Process
P1	Develop Vision and Strategy	**P7**	Manage Information Technology
P2	Develop and Manage Products and Services	**P8**	Manage Financial Resources
P3	Market and Sell Products and Services	**P9**	Acquire, Construct, and Manage Property
P4	Deliver Products and Services	**P10**	Manage Environmental Health and Safety (EHS)
P5	Manage Customer Service	**P11**	Manage External Relationships
P6	Develop and Manage Human Capital	**P12**	Manage Knowledge, Improvement, and Change

In the last part of the test we applied the Tagliavini et al. check-up method. This method permits answer the question "*is the management of the information system coherent with the firm strategy*?" (Tagliavini et al. 2004). We adapt the method in two ways. First, we replaced the set proposed by Tagliavini et al. by the PCF set. In this way the test was updated with a newer set of processes and it was simplified. The second adaptation was establishing the ranges defined in the method. Tagliavini et al. evaluate alignment by classifying processes according to some criteria they did not specify clearly therefore we had to define criteria.

Prioritizing the Alignment

A problem with the approaches described is that these methods do not deliver enough information to the owner. The delivered information should help the Owner/CEO detect where there are problems of alignment. We adopt a part of the ISCUM method to correct that problem. ISCUM orders and prioritizes each analysed firms' function according to its strategic importance, then present the information graphically (Buonanno et al. 1997) (see Figure 15a).
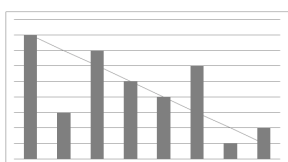

Figure 15a: ISCUM proposes decrement and prioritised graphical to present ICT alignment
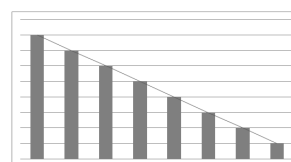
Figure 15b: Ideal pattern of alignment according to ISCUM

Thus TDAT delivers two kind of graphical information: the ICT alignment according to the firm's strategic orientation and the ICT alignment according to firm's processes. Graphics look similar to Figure 15a. The advantage of this delivery is to allow easy recognition of the most critical problems, helping to the owner to take corrective actions.

Using the (Mis)Alignment Index

Using the ISCUM approach it is possible to define an index to measure the alignment. Our proposal applies the suggestion of Tagliavini et al. that it is possible to develop an index to measure the alignment comparing the strategic and technological rankings (Tagliavini et al. 2004). Figure 15b shows an ideal alignment when the score of every variable measured follows a descendent straight line. Then it is possible to define an index based on the equation 1:

$$i_X = \sum_{k=1}^{N} |M(k) - (N + 1 - k)| \quad eq.\,1 \qquad\qquad MAX(i_X) = f(MOD(),N) \quad eq.\,2$$

In equation 1, N is the number of variables measured in the X ambit. The discrete function $M()$ represents the moderation score obtained for each variable. The value of $(N+1-k)$ is the ideal score for the discrete variable k (straight line). With equation 1 it is possible to determine the maximum and minimal value that i_X acquires. On one hand, i_X has a minimal value of cero. On the other hand, the maximum value will depend on N. To figure this value out, it is necessary find the function that maximizes $M()$ (equation 2). The solution for the equation 2 is not unique but it is convergent. We figured out $MAX(i_X)$ computationally, calculating it has two solutions depending on N being pair or odd. ICT alignment according to strategic orientation (N=8) will vary between 0 and 32 and according to processes (N=12) will vary between 0 and 72. To improve the interpretation of each index, we normalized it applying the formula $i_{Xnormal}=i_X/i_{X(MAX)}$ (Day 1996). Normalizing the indexes makes it possible to compare alignment between strategic orientation v/s processes and between firms. Given that the higher the index is, the worse the alignment, we called the index *Technological Misalignment Index* (TMI). We will use i_O for the STROBE/STROIS TMI and i_P for the Processes TMI.

Table 3. Classification of SMEs that was applied the TDAT

Activity	By location			Size by employees number			Total
	AFTA†	STGO††	Other	<6	6 – 9	10 – 200	
Computer (Hardware/Software)	0	4	0	0	1	3	**4**
Telecommunication	1	0	0	1	0	0	**1**
Construction/Home improving	1	1	0	0	2	0	**2**
Consulting	0	3	0	0	2	1	**3**
Retail	0	2	1	2	1	0	**3**
Education	0	0	1	0	0	1	**1**
Entertainment	0	2	0	1	1	0	**2**
Engineering/Architecture	4	0	1	0	2	3	**5**
Internet	1	0	0	0	0	1	**1**
Manufacturing	2	1	0	0	0	3	**3**
Mining	1	0	0	0	0	1	**1**
Publicity	1	1	0	0	2	0	**2**
Health/Medical Service	0	1	0	0	1	0	**1**
Printing/Editorial Service	1	0	0	0	1	0	**1**
Transport/Distribution	1	0	0	0	0	1	**1**
Other	1	2	0	0	1	2	**3**
Total	**14**	**17**	**3**	**4**	**14**	**16**	**34**

†   AFTA is abbreviation of Antofagasta that is one of the most important provincial cities with around 300,000 people. and whose economic activity is strongly concentrated in copper mining (65% of the local GDP). Antofagasta is located in the Atacama desert around 1,300 Km north of Santiago, the Chilean capital.

††   STGO is the abbreviation of Santiago, Chile's Capital. Santiago is the biggest city of Chile with a population of around 6,000,000, its economic activity is much diversified.

APPLYING TDAT

TDAT was applied to an original sample of 36 SMEs. Most respondents were either the SME's manager or owner, or the firm's CIO, where there was one. After TDAT was applied, every firm received a summary report with the main results. Some questions from the original instrument were adapted after applying TDAT to a preliminary group of SMEs. Table 3 summarizes the firms tested. The total number of firms interviewed is 36, but we eliminated two of them from the sample because they were not totally independent and had less than one year of existence (Levy and Powell 2005). The classification was based on activities, number or employees and location of the firms. The classification according to number of employees was made to facilitate the distinction between Micro, Small and Medium businesses. Classifying the firms according to physical location was attractive because the sample was composed by two zones mainly and we expected to compare both type of SMEs.

Next we summarize our findings. First we present illustrative results of alignment, then we summarize the findings according to MTI and finally we present findings based on results of the satisfaction survey.

Alignment According to Strategic Orientation and Processes

For illustrative purposes, Table 4 shows average orientation strategic for all firms. The table has been ordered in descending way according to the STROBE score. Interpreting the information directly from the table, we can say that for SMEs tested, *Innovativeness* was rated the most important dimension of strategy but its STROIS score of 3.69 did not gain an extremely high score (Hale and Cragg 1996). Regretfully, that way to read the information from Table 4 is not intuitive.

Table 4. The most important STROBE/STROIS dimensions

Abbreviation	STROBE	STROIS	Matching	Moderation
Innovativeness	4,29	3,69	0,61	15,83
Proactiveness	4,18	3,49	0,68	14,64
External Defensiveness	4,13	3,75	0,38	15,56
Internal Defensiveness	4,02	3,89	0,13	15,66
Aggressiveness	3,87	3,73	0,15	14,44
Analysis	3,75	3,86	0,39	14,48
Futurity	3,42	3,42	0,49	11,62
Risk Aversion	3,29	3,64	0,35	11,95

A simpler way to present information is achieved using the ISCUM techniques (see Figure 16a). Applying these techniques shows that *Innovativeness* is well aligned. It occurs because given that innovativeness is the most important dimension to the firms, it also is the dimension most supported by technology. Thus ISCUM helps to evaluate the coherence between the strategic profile of the firms and the distribution of technological resources inside of them. Scores under the reference line (straight line) would indicate fewer resources than intended and vice versa. Similar analyses could be done for processes alignment (Figure 16b). On average, the most important process is *Market and Sell Products and Services* (P3) which presents a good alignment with ICT. However, for business leaders the second most important processes is *Develop vision and strategy* (P1) and it is one of the worst aligned processes. It could mean a need for systems to manage firms.
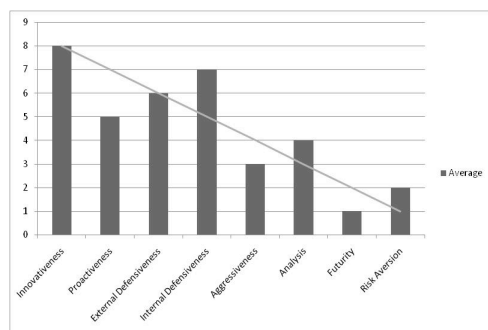

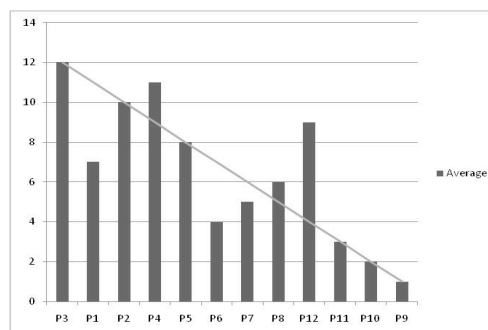Figure 16a: Average ICT alignment according to orientation strategic

Figure 16b:Average ICT alignment according to importance strategic of processes

Technological Alignment Index

Table 5 summarizes the statistic of both indexes. On average the firms are more aligned to strategic orientation level (0.239) than processes (0.426). Clearly SMEs are more aligned to strategic orientation than to processes level. A deeper discussion respect to this finding is made in the last section of this article.

Figure 17a shows the distribution of indexes i_o and i_p by firms. Figure 17b shows a scattergraph for i_o v/s i_p by firms. Variables present an inverse relation with an r^2 de 0.0374. We analysed the relation between i_o and i_p and demonstrated that are independent (*H0: $\rho=0$; p=0.273*).

We analysed whether the indexes showed significative difference of alignment between firms from Santiago and other regions. Given that there are two big groups of data, Antofagasta and Santiago, we compared alignment between them. Then, we explored the hypothesis that means between Santiago's firms were equal to those in Antofagasta. Using Two-Sample t-tests was demonstrated that to strategic orientation level the firms have a similar grade of alignment. However, Santiago's firms are better aligned than Antofagasta's SMEs to processes level (see Table 6).

Table 5. Singles statistic for i_o and i_p

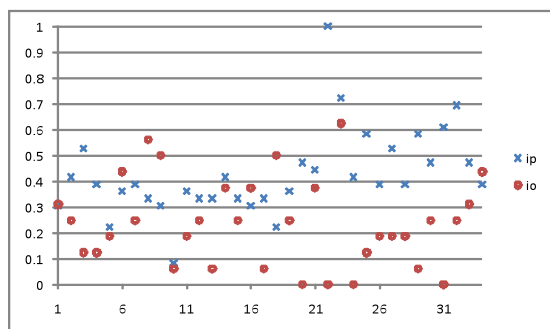| Statistic	i_o	i_p
Number	34	34
Mean	0.239	0.426
St Dev	0.169	0.166
Min	0.000	0.083
Max	0.625	1.000
Median	0.250	0.389

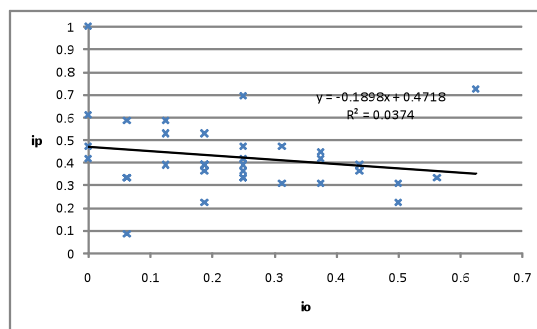Figure 17a: Scatterplot for i_o and i_p by individual firm   Figure 17b: Scatterplot for i_o v/s i_p by individual firm

Table 6. There are differences in the alignment between Antofagasta and Santiago firms

Index	Means$_{AFTA}$	Means$_{STGO}$	H$_O$	H$_1$	p	Result
i_o	0.202	0.271	$\mu_{AFTA}=\mu_{STGO}$	$\mu_{AFTA} \neq \mu_{STGO}$	0,291	Accept H$_O$
i_p	0.532	0.349	$\mu_{AFTA} = \mu_{STGO}$	$\mu_{AFTA} > \mu_{STGO}$	0,002	Refuse H$_O$

TDAT evaluation

As part of this research, we wanted measured how TDAT helps SMEs and what elements were better evaluated by owner/CEOs. Feedback by a web survey was added as an additional step. The survey was directed to business leaders who participated in TDAT sessions. The most important problem of this research was that only seven of 36 SMEs answered the survey representing a 19% of the sample. Although this is an expected rate for web survey, we considered its results limitedly (Cragg et al. 2002; Chan et al. 1997a; Hussin et al. 2002). Despite of this, it is interesting to present some results. For example, 100% of the respondents considered the information delivered by TDAT as slightly positive to very positive. Most SMEs considered TDAT very positive. However, the global test was evaluated more useful than its components (see Table 7). We asked about the degree of certainly on TDAT and its components. We used a scale of 1 to 7 to measure the degree of certainty. In this scale a score of four is considered minimal to approve the object evaluated.

Table 7. Global and partial evaluation of TDAT by business leaders

Instrument	Very positive	Slightly positive	Useless	Slightly negative	Very negative
Global Test	5	2	0	0	0
Alignment according to strategic orientation	5	1	1	0	0
Alignment according to standard processes	5	1	1	0	0
Mean	5,00	1,33	0,67	0,00	0,00

Figure 18 shows minimal, maximum and average score for total and partial TDAT. Again global TDAT is considered slightly better than its components. Alignment according to strategic orientation was considered more accurate than the other instrument's TDAT. The least accurate was Tagliavini's method. The global degree of certainty was 6.14 (equivalent to 85.7%) that are considered a very good qualification.

The low response rate of participating firms to the feedback questionnaire could raise concern respect to its validity. It may well be that the non-respondents' attitude was "I lose time caring for you" which would not be a good testament to the usability of the methodology[3]. Although this is possible, we would not conclude that business leaders who did not respond the web survey think that they lose their time. To illustrate this point, we can mention two successful cases: An owner who asked us comes back in other occasion to re-evaluate his company and other who evaluated very well the TDAT and considered it very accurate. Both of them did not respond the feedback survey. However, when we designed TDAT, we expected it might have problems to get an

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[3]   We appreciate the suggestion of one of reviewers who recommended this point would be boarded.

important level of answers of satisfaction survey. So we decided triangle information as method to reduce the uncertain. This is an accepted method in literature to eliminate the non-response bias (Collis and Hussey 2003).
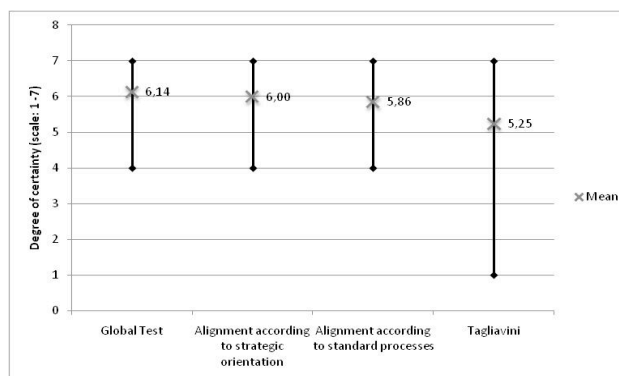

Figure 18. Global and partial degree of certainty of TDAT by business leaders (scale 1 – 7, minimal positive: 4)

To triangle the information, we observed the changes in the attitude of owner/CEOs when TDAT was applied and then classified the firms based on attitude before and after TDAT. The attitudes were classified from hostile to excited, according to comments and common corporal signals seen in business leaders during testing. Table 8 shows results from this exercise and examples of commentaries typically seen in interviewees. Initially we had defined a scale from hostile to excited for both initial and final attitude, but we did not observe hostile or negative behaviour in the final attitude in respondents, so we decided delete these categories.

Several comments could be made seeing Table 8. People with a hostile and negative attitude were kept indifferent towards TDAT. Although people with an indifferent attitude mostly maintained their attitude, there was a group that changed their attitude positively and showed a positive or excited response to TDAT. However, the best response came from people who had an exciting initial attitude, who showed positive and exciting final attitude. This is coherent with works that concluded that interest and enthusiasm of owners drive ICT adoption (Levy and Powell 2005).

Table 8. Attitude initial and final toward TDAT

		Symptoms – Commentaries	Final aptitude			Total
			Without reactions	*TDAT made me think!*	*Could repeat the test again soon?*	
			Indifferent	Positive	Exited	
Initial aptitude	Hostile	*I lose time caring for you!*	5.882%	0.000%	0.000%	5.882%
	Negative	*It won't serve much to me*	2.941%	0.000%	0.000%	2.941%
	Indifferent	*Tell me what this is*	47.059%	2.941%	5.882%	55.882%
	Positive	*Tell me more because I am interested*	17.647%	8.824%	2.941%	29.412%
	Exited	*I heard about TDAT and I want apply to my business!*	0.000%	2.941%	2.941%	5.882%
	Total		73.529%	14.706%	11.765%	100.000%

CONCLUSION

Findings showed TDAT could be a contribution for Owners/CEOs of SMEs and investigators. The former could use TDAT as a tool that might help them improve ICT benefits in their firms. Preliminary results presented above showed that SMEs value this kind of instruments positively. Enthusiast Owners/CEOs are a key factor to apply TDAT successfully. The more negative the initial attitude, the more probable is that TDAT fails and vice versa. Also, although indexes proposed here (i_o and i_p) were important for this research, these still are not completely useful for Owner/CEOs, further researching is needed. For example, the use of clustering tools could allow discovery of types of SMEs according to their indexes; it could be utilized to create patterns or maturity models of SMEs, likewise to CMMI used in software engineering.

Using STROBE/STROIS it is possible to analyse the coherence between the intended and realized strategy. Chan et al. (1997a; 1997b) proposed that using STROBE and STROIS it is possible to discover the realized strategy

and compare it with the intended strategy by. If we apply this assessment, we can understand the misalignment shown in Figure 16a. For example, the two most important STROBE dimensions for SMEs are *Innovativeness* and *Proactiveness* but according to STROIS the two most important are *Innovativeness* and *Internal Defensiveness*; in other words: despite of Owners/CEOs of SMEs wanting to have innovative and proactive firms, the reality shows that SMEs are more defensive than desired, i.e., they push strongly to control costs and being more efficient.

The findings showed surprising results. For example, it was shown that differences in alignment are statistically significant. On the one hand, Provincial SMEs are better aligned with their strategic orientation than those in the capital. On average, firms of Antofagasta present a high level of alignment (see Table 6). On the other hand, this behaviour is reversed at the processes level, actually, Santiago's SMEs are statistically better aligned with their processes than Antofagasta's firms. These differences of alignment between Antofagasta and Santiago firms raises the question about how the strategic and process alignment are affected by local conditions.

We think structural differences between Antofagasta and Santiago could explain the similarities and differences of alignments of SMEs (see Table 3). Antofagasta is smaller than Santiago. The former is a mono-economic city that is located in the centre of Atacama Desert, one of the driest deserts of the World. All of Antofagasta's firms tested were related directly or indirectly to mining, so its relationship with big businesses was mostly with Mining Companies. On the other hand, Santiago is the biggest city of Chile with a much diversified economic activity. Santiago has lots of services, commercial and industrial companies. Santiago's SMEs are more related with different kinds of big companies, more modern and sophisticated than their peers in Antofagasta. Despite of researchers such as Powell and Levy relating structural characteristics such as location and industrial sector with ICT in SMEs (Levy and Powell 2005), the findings show that further research is needed to understand how the local conditions affect the ICT alignment in SME.

Results that SMEs are more aligned to strategic orientation level than processes could seem contrary to other researching. For example, Levy and Powell (2005) concluded in SMEs "*the limited planning that is undertaken tends to focus on operational systems to improve efficiency and effectiveness, and there is little concern with competitiveness*" (Page 109). We think this unexpected finding is due to two reasons. Firstly, there are methodologic differences between both studies, Levy and Powell's researching is based on longitudinal multiple cases and mostly qualitative methods, on the other hand, our research is mainly quantitative.

Secondly, our results would suggest that alignment based on process could suit better in SMEs than strategic-approach. Actually, despite models such as SAM describe different types of alignment, researching has been focused mostly on strategic alignment, though, there are a lot of evidences (including to Levy and Powell) that SMEs mostly don't implement sophisticated strategic planning process (Blili and Raymond 1993; Chan and Reich 2007; Hussin et al. 2002). Recently, Cragg et al. (2007) asserted "*operational alignment in SMEs could be at least as important as strategic alignment, and possibly of greater importance*". Initially, our findings would confirm this statement. Thus, we think our results are not contrary to other research like Levy and Powell (2005) but extend it deeper. In fact, it is possible that in SME alignment to process-level delivers more information than strategic level. That could be the reason why we find lower alignment to process-level than strategic-level and, simultaneously, significant difference in the alignment of processes between SMEs in Antofagasta and Santiago while not at the strategic level (Table 6). This is a question that has left open and future works could respond it.

Finally, as future work it is necessary to apply TDAT to bigger samples and other conditions. A bigger number of SMEs could improve interpretation and validation of TDAT. Also, it might help to give more value to the indexes for practitioners. Some problems detected in TDAT might be corrected, too. For example, it was detected that when respondents assigned the same scores to a group of questions, prioritization was made more difficult. Additionally, applying TDAT in other conditions would help understand behaviour patterns that subsequently would help to refine the existing models.

REFERENCES

Bergeron, F., Raymond, L. and Rivard, S. 2001. "Fit in strategic information technology management research: an empirical comparison of perspectives," *Omega* (29:2), pp 125-142.

Blili, S. and Raymond, L. 1993. "Information technology: Threats and opportunities for small and medium-sized enterprises," *International Journal of Information Management* (13:6), pp 439-448.

Buonanno, G., Ravarini, A., Sciuto, D. and Tagliavini, M. 1997. "An information system check-up model for small and medium enterprises," Sixth international conference on Systems development methods for the next century, Plenum Press New York, NY, USA, Boise, Idaho, United States, pp. 421-440.

Burgess, S. 2002. "Managing information technology in small business: challenges and solutions. Introduction," in: *Managing information technology in small business: challenges and solutions,* Burgess, S. (ed.), IGI Global, Hershey, PA.

Byrd, A., Lewis, B.R. and Bryan, R.W. 2006. "The Leveraging Influence of Strategic Alignment on IT Investment: An empirical examination," *Information \& Management* (43:3), pp 308-321.

Collis, J. and Hussey, R. 2003. *Business Research: A practical guide for undergraduate and postgraduate students* Palgrave Macmillan, Hampshire, New York.

Cragg, P., King, M. and Hussin, H. 2002. "IT alignment and firm performance in small manufacturing firms," *The Journal of Strategic Information Systems* (11:2), pp 109-132.

Cragg, P., Tagliavini, M. and Mills, A. 2007. "Evaluating the Alignment of IT with Business Processes in SMEs," 18th Australasian Conference on Information Systems (ACIS 2007), University of Southern Queensland, Toowoomba, pp. 38-48.

Chan, Y.E., Huff, S.L., Barclay, D.W. and Copeland, D.G. 1997a. "Business Strategic Orientation, Information Systems Strategic Orientation, and Strategic Alignment," *Information System Research* (8:2), pp 125-150.

Chan, Y.E., Huff, S.L. and Copeland, D.G. 1997b. "Assessing realized information systems strategy," *Journal of strategic information systems* (6:4), pp 273-298.

Chan, Y.E. and Reich, B.H. 2007. "IT alignment: what have we learned?," *Journal of Information Technology* (22:4), pp 297-315.

Day, J.G. 1996. "An executive's guide to measuring I/S," *Strategy & Leadership* (24:5), pp 39-41.

Edwards, J.R. 1993. "Problems with the use of profile similarity indices in the study of congruence in organizational research," *Personnel Pyschology* (46:3), pp 641-665.

Gutierrez, A., Orozco, J. and Serrano, A. 2009. "Factors affecting IT and business alignment: a comparative study in SMEs and large organisations," *Journal of Enterprise Information Management* (22:1/2), pp 197-211.

Hale, A.J. and Cragg, P.B. 1996. "Measuring strategic alignment in small firms," Information Systems Conference of New Zealand (ISCNZ'96), IEEE Computer Society Washington, DC, USA, Palmerston North, New Zealand.

Hussin, H., King, M. and Cragg, P. 2002. "IT alignment in small firms," *European Journal of Information Systems* (11:2), pp 108-127.

Levy, M. and Powell, P. 2005. *Strategies for growth in SMEs: The role of information and information systems* Butterworth-Heinemann.

McKeen, J.D. and Smith, H. 2003. *Making IT Happen: Critical Issues in IT Management* Wiley, UK.

Ravarini, A., Tagliavini, M. and Faverio, P. 2001. "Supporting IS Management within SMEs: a Process Based Approach," Eighth European Conference on Information Technology Evaluation, Academic Conferences Limited, riel College, Oxford, UK, pp. 239-251.

Tagliavini, M., Faverio, P., Ravarini, A. and Sciuto, D. 2004. "Monitoring the strategic effectiveness of SME information system," 49th ICSB World Conference, University of Pretoria, South Africa, Johannesburg.

Venkatraman, N. 1989a. "The concept of fit in strategy research: Toward verbal and statistical correspondence," *Academy of Management Review* (14:3), pp 423-444.

Venkatraman, N. 1989b. "Strategic Orientation of Business Enterprises: The Construct, Dimensionality, and Measurement," *Management Science* (35:8), pp 942-962.

ACKNOWLEDGEMENTS

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