

Regular Paper

Potential Problems in People Management concerning Information Security in Cross-cultural Environment—The Case of Brazil

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This paper discusses the potential problems due to cultural differences, which foreign companies may face in Brazil concerning information security. Top 3 investing countries in Brazil, namely US, Netherlands, and Japan are examined. Potential problems concerning the management of people in information security are developed by using Geert Hofstede's framework and based upon the authors' experience in global business activities. To evaluate the magnitude of potential of problems, a recently proposed measure called Level of Potential (LoP) is adopted. A survey was conducted in Brazil to evaluate the severity of potential problems and the practicability of LoP. To examine the practicability of LoPs, the logical LoPs are compared with their surveyed severities. Our results show that LoP can predict problems to a certain extent in the Brazilian business environment. The results reveal that Japanese companies may face problems least, while the Dutch ones face the difficulties most. The problem of "Using previous company's confidential information" is a problem with the highest severity among the potential problems since "teaching others" is encouraged by employees' belief.

1. Introduction

There are still many people who believe that information security management (ISM) is a matter of technology because the discussion about information security started with securing computer-based information systems against computer viruses and/or crackers. Asai¹⁾ has pointed out that it is important to take

people management into account as well. Solms²⁾ states that ISM should cover both technical and non-technical activities. Moreover, Bean³⁾ states that eighty percent of information security breaches are caused by human error.

In the context of ISM, it is natural to think that culture may have some relationship with human errors, especially in cross-cultural environments. This is because people act on their perceptions, which may be influenced by their culture. According to Hofstede⁴⁾, culture gives influences to people's beliefs and expectations. Pronin⁵⁾ states that people's beliefs and expectations may lead them to make mistakes. Schneier⁶⁾ and Komatsu⁷⁾ also state that people's expectations may be one of the causes of misjudgment when reacting to risks. This paper analyzes the relationship between culture and human errors.

There are extensive studies concerning the cultural impact on how business is conducted^{8)–11)} in fields like organizational behavior (OB) and human resources management (HRM). One of the objectives of these fields is to better understand the reasons behind employees' reactions. Thus the unfavorable reactions can be predicted^{9),12)}. However, these studies have not focused on ISM yet. No one had carried out a quantitative study on this relationship between culture and human errors with respect to ISM until Asai and Waluyan¹³⁾, who studied the cultural impact on ISM and measured its magnitude by applying a newly developed measure called Level of Potential (LoP).

The purpose of this paper is to explore potential problems faced by foreign companies in Brazil because of cultural differences when dealing with information security practices. It also tries to adopt LoP. We conducted a survey in order to evaluate the severity of potential problems and to confirm the practicability of LoP. This research may help foreign investors to recognize potential problems due to cultural differences.

Brazil is chosen here because of its attractiveness for foreign direct investment¹⁴⁾. According to the Foreign Direct Investment (FDI) confidence index 2007, Brazil was the country that was ranked as the 6th most favored FDI destination in the world¹⁵⁾. JETRO¹⁶⁾ reported that Japan's investment in Brazil has increased since 2005. Potential problems that may be faced by foreign companies in this country are examined by our work. Major investing countries (including Japan) are selected based on the accumulated direct investment in Brazil. They

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are the United States of America (US), the Netherlands (NE) and Japan (JP).

Section 2 outlines the framework of cultural dimensions by Hofstede. Section 3 summarizes the magnitude of cultural dimensions of the studied countries and introduces a new measure named Level of Potential (LoP) measure. Section 4 evaluates the problems due to cultural differences and examines the severity of potential problems. This section also analyzes the practicability of LoP. Moreover, the three severest problems encountered by each investing country in this study, are also studied in detail in this section. Recommendations to ISMS and foreign companies are presented in Section 5. Section 6 concludes this research.

2. Cultural Dimensions

There are extensive theories concerning cultural differences, such as the ones studied by Hofstede⁴⁾, Hall¹⁷⁾, Trompenaars¹¹⁾ and House¹⁸⁾. We adopt Hofstede's framework of cultural dimensions because his study on how the sense of values in workplaces is influenced by culture is the most comprehensive. Also, he analyzed a large database which covered almost all of the major countries⁴⁾.

Hofstede's cultural dimensions are explained in **Table 1**. Hall¹⁷⁾ has added the note that ways of communications are different depending on cultures. There is no statistical data available about countries' score, though. Trompenaars's framework is not adopted because his framework treats two aspects, culture and personality, as the same, while they should be treated differently. Finally, the specification of House's framework¹⁸⁾, which mostly concerns on leadership, has made his framework less applicable to this research.

To clarify magnitudes of cultural dimensions, each one is divided into 5 degrees, which are very low, low, moderate, high and very high¹³⁾. **Table 2** shows the classified magnitudes of the cultural dimensions concerned. It is found, as shown by the dotted boxes, that the degrees of US and NL are almost the same. JP and BR have almost the same degrees except for MAS. This implies that as far as cultural difference is concerned, geographical distance is less important.

Table 1 Hofstede's cultural dimensions.

	Level	
	High	Low
PDI	The members expect that some individuals wield larger amounts of power than others.	Reflects the view that all people should have equal rights.
IDV	Ties between individuals are loose.	Ties between individuals are tight.
MAS	Stress on equity, competition and performance. Managers are expected to be decisive and assertive.	Stress on equality, solidarity and quality of work life. Managers use intuition and strive for consensus.
UAI	Many rules and low tolerance of deviant ideas, resistance to change.	Few rules and high tolerance of deviant ideas.
LTO	Persistence, ordering relationships by status, thrift and having a sense of shame.	Personal steadiness and stability, protecting your face, respect for tradition and reciprocation of greeting.

Source: Hofstede, G. and Hofstede, G. J. (2004)

Table 2 Hofstede's cultural dimensions scores.

Culture	Degree	BR	US	NL	JP
PDI	Very low				
	Low		35	38	
	Moderate				54
	High	69			
	Very high				
IDV	Very low				
	Low	38			
	Moderate				46
	High				
	Very high		89	80	
MAS	Very low			14	
	Low				
	Moderate	49			
	High		66		
	Very high				95
UAI	Very low				
	Low		35		
	Moderate			53	
	High	76			
	Very high				92
LTO	Very low				
	Low		29	44	
	Moderate	65			
	High				80
	Very high				

Source of scores: Hofstede, G. and Hofstede, G. J. (2004)

3. Research Method

3.1 Level of Potential

Generally speaking, risk is evaluated based on the combination of probability of occurrence and its severity. The word "potential" in this paper means proba-

Table 3 Characteristics of respondents (%) (March, 2009, n = 61).

Ages	Sex	Business Type	Work for Company of	Experience Abroad (study / training / work)
20-29 54.1	Male 75.4	Manufac. 19.7	US 32.8	Yes 61.0
30-39 26.2	Female 24.6	Services 67.2	NL 34.4	No 39.0
40-49 14.8		Education 4.9	JP 32.8	
50-59 4.9		Other 8.2		

bility. In order to evaluate the magnitude of potential of problems when a foreign investor applies its own way of business to another country without recognizing the cultural differences or without filling the cultural gaps, this research adopts a measure, named level of potential (LoP)¹³. In this paper, the word “potential” means how soon a problem may become real, or for our purposes, the probability. The word “severity” means how big an influence a problem may cause. The LoP is the extent to which problems may arise because of cultural differences. In other words, LoP is the absolute value of the difference between the scores of a cultural dimension (hereafter, CD) of an investor country and the score of an investee country, see formula (1). To have a detailed categorization, LoP is equally divided into five levels that are very low potential (▲), low potential (△), potential (○), high potential (◎) and very high potential (●).

$$LoP = |CD \text{ of an investor country} - CD \text{ of an investee country}|, \quad (1)$$

where LoP = Level of Potential, CD = Score of Cultural Dimension.

3.2 Profile of Survey

We conducted a survey in order to evaluate the severity of potential problems and to verify the practicability of LoP. The survey was conducted in March, 2009. Sixty one answers were collected from Brazilian employees who worked for American, Dutch and Japanese companies. The sample sizes were 20, 21 and 20, respectively. The respondents' characteristics are summarized in **Table 3** (percentages). This table shows that people in their twenties and thirties are the largest proportion (80.3%). The majority of respondents work in the service sector (67.2%).

3.3 Hypotheses

One of the authors, who is Brazilian, used to work for foreign companies in Brazil for several years. Taking his experiences and the analysis of Section 2 into

Table 4 Brazilian cultural dimensions and potential problems in Brazil.

Brazilian CD*	Links between cultural dimensions and potential problems **	Potential ISM-related problems in Brazil	
		Descriptions	Remarks
High PDI	Less powerful members tend to accept or expect that information (or power) is distributed unequally.	P1: Unequal distribution of knowledge about information security policy among departments.	Information security policy may not prevail in a company.
Low IDV	People like to chat with friends while working.	P2: Unintentional sharing of confidential information.	Information may leak unintentionally.
	People from birth onwards are integrated into groups, which continue to protect their members in exchange for unquestioning loyalty.	P3: Concealing faults made by friends.	We can not learn anything from security incidents.
	People are relationships-centered.	P4: Less task-centered and more oriented to a chat with coworkers or friends.	Brazilians may make mistakes due to lack of concentration.
Moderate MAS	People tend to get involved with activities that are considered to be less masculine activities. (Some people still consider that information security is a matter of technology).	P5: Lower priority to information security management.	Brazilians may not be interested in ISM.
	People tend to value good working relationship with their managers. They are afraid of problems with their managers.	P6: Less reporting or consulting on information security incidents.	We can not learn anything from security incidents.
	High MAS society is characterized to be assertive and competitive.	P7: Using any means to reach goals owing to high competitiveness.	Brazilians may commit information security breaches to reach goals.
High UAI	People are less tolerant of deviant ideas and resistant to changes.	P8: Unwilling to follow information security policy without a complete understanding.	Brazilians may follow information security policy only if they understand it completely.
Moderate LTO	People in low LTO society like favors or gifts. They may use previous company's information as a gift.	P9: Using previous company's confidential information.	Thus trade secrets may leak.

* CD = Cultural Dimension, ** Adapted from Hofstede, G. and Hofstede, G.J.

consideration, we developed the nine ISM-related problems, as shown in **Table 4**. These problems constitute hypotheses (hereafter, potential problems). Table 4 also shows the relationships between Brazilian cultural dimensions and related potential problems in Brazil. By using formula (1), the LoPs of the three main investing countries are calculated, as presented in **Table 5**. LoP is calculated from Hofstede's cultural dimension and the two countries being compared, the home country (investor country) of a foreign company and the other country where it has established offices (investee country). LoP is similar for the potential problems which correspond to the same Hofstede's cultural dimension. In this table, it can be seen that the potential problems are mostly caused by IDV and MAS. The score of overall potential is calculated by summing the levels. Numbers 1 through 5 are assigned from the lowest level (▲) to the highest (●), respectively.

Table 5 Possible potential problems and their LoP.

	Potential Problems	Level of Potential (LoP)*		
		US	NL	JP
PDI	P1	△	△	▲
	LoP	34	31	15
IDV	P2	○	○	▲
	P3	○	○	▲
	P4	○	○	▲
	LoP	51	42	8
MAS	P5	▲	△	○
	P6	▲	△	○
	P7	▲	△	○
	LoP	17	35	46
UAI	P8	△	△	▲
	LoP	41	23	16
LTO	P9	△	▲	▲
	LoP	36	21	15
Overall Potential		18	20	15

*) Symbols of LoP (number of level)= state of level
 ▲ (1)= very low potential, △ (2)= low potential, ○ (3)= potential,
 ◎ (4)= high potential and ● (5)= very high potential.

Based on the LoP shown in Table 5, Table 6 shows our predictions. Predictions in Table 6 concerning PDI, IDV, MAS, UAI, LTO and overall potential, are named **Prediction 1** through **Prediction 6**, respectively. Each prediction also refers to a ranking of the countries ordered by decreasing potential. It is predicted that an American company faces the problems due to PDI, IDV, UAI and LTO most, while Japanese companies least. It is also predicted that a Japanese company faces MAS-originated problems most, while American companies least. However, as a whole, Dutch companies face difficulties most.

4. Analysis of Potential Problems

In order to help foreign companies know what problem is serious, the severity of each potential problem is calculated in this section. Moreover, the practicability of LoP is evaluated. Furthermore, the serious problems and their conditions in American, Dutch and Japanese companies are analyzed in depth. In this section, the word “severity” means how big an influence a problem may cause.

4.1 Potential Problems and Their Conditions of Occurrence

Questions were created to find the magnitudes of the severity of the potential problems and to find when they would take place based on the presence of pre-

Table 6 Predictions of Level of Potential (LoP).

	Related Problem	Prediction	(ordered from the highest potential to the lowest)
PDI	P1	Prediction 1	US → NL → JP
IDV	P2	Prediction 2	
	P3		
	P4		
UAI	P8	Prediction 4	JP → NL → US
LTO	P9	Prediction 5	
MAS	P5	Prediction 3	
	P6		
	P7		
Overall potential		Prediction 6	NL → US → JP

Table 7 Severities of problems.

		Questions (Conditions)	Favorable answers (%)		
			US n=20	NL n=21	JP n=20
PDI	P1	1) Workers should not be burdened with information security-related activities, there should be a specific department to deal with them.	45.0	71.4	55.0
IDV	P2	2) I don't mind sharing any skill or knowledge.	80.0	81.0	50.0
		3) Sometimes, I like sharing anything concerning my job with others.	85.0	76.2	60.0
		4) Information spreads easily.	95.0	85.7	65.0
		5) It is better to share any piece of information than keep it to yourself.	60.0	71.4	60.0
		Average	86.7	78.6	58.8
	P3	6) I hardly decline to help others.	25.0	23.8	25.0
		(*) 7) I place high priority to company's rules above friendship.	25.0	28.6	35.0
		Average	25.0	26.2	30.0
	P4	(*) 8) I am focused on what I am working on even while talking with others at work.	10.0	14.3	15.0
	MAS	P5	9) Information security is a matter of technology.	65.0	61.9
10) Rules should be flexible.			60.0	52.4	45.0
Average			62.5	57.2	50.0
P6		(*)11) I don't hesitate to consult my boss about my business activities anytime.	65.0	90.5	65.0
		12) I'm not reluctant to share information even if I'm not asked.	50.0	57.1	40.0
		Average	57.5	90.5	52.5
P7		13) I want to continue my work even if the working hours have ended.	75.0	71.4	70.0
		14) If I want to reach a goal, I do whatever it may require me to do it.	80.0	90.5	90.0
		15) I often take my work home to please my boss by finishing everything in time.	55.0	66.7	25.0
		16) I can bring any document to my home, I am responsible for my actions.	75.0	76.2	50.0
	Average	76.7	79.4	80.0	
UAI	P8	(*)17) I can adjust myself easily to any new policy with no doubt.	25.0	19.0	20.0
		18) If a new policy is against my way, I will not follow it.	35.0	47.6	35.0
		Average	30.0	33.3	27.5
LTO	P9	19) The know-how that I have acquired at work is my valuable assets. Therefore I'm free to use them even after moving to another company.	80.0	95.2	75.0
		20) According to my morals and values, teaching others with any of my personal experience and knowledge is a good thing to do.	95.0	95.2	95.0
		Average	87.5	95.2	85.0

* Answers of “strongly disagree” or “disagree” are favorable answers.

existing (or igniting) conditions. Each question consists of 4 levels of answers. They are “strongly agree”, “agree”, “disagree” and “strongly disagree”. A favorable answer is a trigger for the associated problem to take place. The higher the percentage of favorable answers is, the higher the severity is. All the questions are listed in Table 7. The questions (hereafter, called conditions) are marked with an asterisk (*) if their favorable answers are “strongly disagree” and “disagree”. The results of the survey are also summarized in this table.

A condition is considered as serious if more than 50% of the workers of foreign companies from each country give favorable answers. Thus the statistical test on a single proportion with a 95% level of confidence is adopted. Table 7 shows

Table 8 Agreements between the logical LoPs and surveyed severities.

	Potential Problems	The averaged surveyed severities (%)			Prediction	Agreements between surveyed severities and the predictions
		US n=20	NL n=21	JP n=20		
PDI	P1	45.0	71.4	55.0	1	X
IDV	P2	86.7	78.6	58.8	2	O
MAS	P6	57.5	90.5	52.5	3	X
	P7	76.7	79.4	80.0	3	O
UAI	P8	30.0	33.3	27.5	4	△
LTO	P9	95.0	95.2	95.0	5	△
<i>Total serious problems</i>		3	5	2	6	O

X = inconsistent, O = perfectly consistent, △ = partly consistent

that 5 problems (marked gray) have serious severity. This fact implies that more than a half of the predicted problems are serious.

Table 8 summarizes the agreements found between logical LoPs and surveyed severities. In this table, severities of each problem are calculated by averaging the percentages of serious conditions. In other words, the severities of problems are averages of the numbers in gray areas shown in Table 7. Although Problem 8 is not serious, we selected it in order to determine how well Prediction 4 matches with the severities of Problem 8. If a problem does not have a serious condition, the severity of the problem would be the average of all possible conditions. Table 8 indicates that:

- 1) most of the predictions matched with surveyed severities to a certain extent,
- 2) the prediction of overall potential matches with the total number of serious problems. The Dutch, the American and the Japanese companies have serious problems with 5, 3 and 2, respectively.

The use of averaged severities here may result in unfair treatment of initial conditions. Moreover, we have ignored some non-serious conditions. Thus in the next section we will examine the practicability of LoP by treating each condition fairly.

4.2 Practicability of LoP

LoP is a logically deduced potential based on Hofstede's scores as shown in Section 3.1. On the other hand, the word "severity" in this paper refers to an empirically surveyed potential dependent on the number of people who give favorable answers to the questions which may trigger related problems. The more

employees with favorable answers are there, the higher the potential is as far as human-related problems are concerned. At the same time, the more employees with favorable answers are there, the more severe the concerned problem is if it takes place. Thus it is natural to understand that both LoP and severity are dependent on the number of favorable answers. Therefore, if we find positive correlation between LoPs and surveyed severities, we can conclude that LoP is practical to foresee potential problems.

To evaluate the practicability of LoP, a correlation level between logical LoPs and surveyed severities is calculated. To calculate surveyed severities, a set of the answers is evaluated as the average of weighted answers. The 4 levels of answers, which are "strongly agree", "agree", "disagree" and "strongly disagree" are weighted with 2, 1, -1 and -2, respectively. The levels of severity can be seen in **Fig. 1**. The coefficients of Pearson's correlation between logical LoPs and surveyed severities are shown in **Table 9**. Although none of the LoPs is found to be significantly related to surveyed severity, four problems out of nine, have positive medium correlations (marked gray). We can conclude that LoP is practical to a certain extent as far as Brazilian business environment is concerned.

Table 9 also reveals that Problem 9 "Using previous company's confidential information" has the highest severity among the questions (Q20, shaded). Hereafter, the 3 problems which were the severest among the developed problems of each investing country are analyzed in depth. These problems are outlined in **Table 10**. To study the relationships between questions and the characteristics of respondents, the test of statistical independence with a confidence level of 95% is applied (hereafter, simply called the statistical test).

4.3 Analysis Based on Investor-country

4.3.1 American Companies

Hereafter, we elaborate on each serious problem in numerical order.

Problem 2 Unintentional sharing of confidential information

Problem 2 is IDV-originated. The statistical test has proved that there are 3 igniting conditions (questions) for Problem 2 (Table 7, Q2–Q4). These 3 conditions show tendencies toward information sharing as employees regard it as natural in a workplace. American companies are found to have the highest number of favorable answers to Q3 and Q4 among the companies from the 3 countries.

Table 9 Pearson's correlation coefficient between logical LoPs and surveyed results.

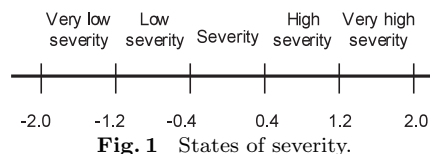
Cultural dimension	Problem	Question	% of Favorable Answer			p-value	Pearson's coef.
			US n=20	NL n=21	JP n=21		
PDI	P1	1	Sev. -0.1 LoP 34	0.8 31	0.0 15	0.825	0.319
		2	Sev. 0.8 LoP 51	0.9 42	0.0 8	0.192	0.954
IDV	P2	3	Sev. 0.8 LoP 51	0.8 42	0.4 8	0.127	0.976
		4	Sev. 1.4 LoP 51	1.0 42	0.3 8	0.107	0.998
		5	Sev. 0.4 LoP 51	0.7 42	0.4 8	0.794	0.318
		6	Sev. -1.0 LoP 51	-0.9 42	-0.9 8	0.540	-0.242
	P3	7	Sev. -0.7 LoP 51	-0.5 42	-0.6 8	0.873	-0.283
		8	Sev. -1.1 LoP 51	-1.0 42	-0.8 8	0.085	-1.000
MAS	P4	9	Sev. 0.4 LoP 17	0.2 35	0.1 46	0.033	-0.996
		10	Sev. 0.2 LoP 17	0.1 35	-0.1 46	0.209	-0.952
	P6	11	Sev. -0.4 LoP 17	-1.1 35	-0.5 46	0.828	-0.197
		12	Sev. 0.0 LoP 17	0.3 35	-0.2 46	0.828	-0.239
	P7	13	Sev. 0.7 LoP 17	0.6 35	0.4 46	0.209	-0.843
		14	Sev. 0.9 LoP 17	1.3 35	1.1 46	0.579	0.509
		15	Sev. 0.3 LoP 17	0.4 35	-0.7 46	0.474	-0.716
		16	Sev. 0.7 LoP 17	0.8 35	0.0 46	0.495	-0.742
UAI	P8	17	Sev. -0.8 LoP 41	-1.0 23	-0.7 16	0.946	-0.155
		18	Sev. -0.3 LoP 41	-0.1 23	-0.2 16	0.508	-0.540
LTO	P9	19	Sev. 0.9 LoP 36	1.3 21	0.7 15	0.091	0.070
		20	Sev. 1.5 LoP 36	1.5 21	1.4 15	0.488	0.570

results

* Note: As to absolute value of coefficient
 Weak correlation = 0.1~0.3
 Medium correlation = 0.3~0.5
 Strong correlation = 0.5~1.0

On average, this fact is consistent with our logical analysis (Table 6, **Prediction 2**), which mentions that American companies may face more IDV-originated problems than Dutch and Japanese companies. The results of the statistical test suggest that employees' behavior concerning Q3 "like sharing anything" is associated with Q4 "information spreads easily", as shown in **Table 11**.

Problem 7 Using any means to reach goals owing to the high competitiveness
 Problem 7 is an MAS-originated problem. The statistical test has proved that

**Table 10** Three severest problems.

Problem*	P9	P2	P7
Condition (Question)	Q20	Q4	Q14
From	LTO	IDV	MAS
US	Severity 1.5	1.4	0.9
	LoP 36	51	17
NL	Severity 1.5	1.0	1.3
	LoP 21	42	35
JP	Severity 1.4		1.1
	LoP 15		46

* In order of severity (severest conditions are shown here)

Table 11 Proportion of answers to Q3 by Q4 (n = 20).

%	Information spreads easily (Q4)	
	Yes	No
I like sharing any information (Q3)	Yes 89.5	10.5
	No 0.0	100.0

Table 12 Proportion of answers to Q14 by Q13 (n = 20).

%		Persist in working late (Q13)	
		Yes	No
Do whatever it may be to reach a goal (Q14)	Yes	73.3	26.7
	No	20.0	80.0

Table 14 Proportion of answers to Q13 by Q10 (n = 20).

%		Rule is flexible (Q10)	
		Yes	No
Persist in working late (Q13)	Yes	73.3	26.7
	No	20.0	80.0

Table 13 Proportion of answers to Q16 by Q13 (n = 20).

%		Persist in working late (Q13)	
		Yes	No
Bring documents home (Q16)	Yes	86.7	13.3
	No	40.0	60.0

Table 15 Proportion of answers to Q13 by "Have experience abroad (study/training/work)" (n = 20).

%		Have experience abroad (study/training/work)	
		Yes	No
Persist in working late (Q13)	Yes	20.0	80.0
	No	73.3	26.7

there are 3 igniting conditions, (Table 7, Q13, Q14 and Q16) for Problem 7. They are outlined in order of severity as follows:

Q14 "do whatever it may be to reach a goal" (associated with Q13 (**Table 12**)), Q16 "bring documents home" (associated with Q13 (**Table 13**)), Q13 "persist in working late" (associated with Q10 and experience abroad (**Table 14** and **Table 15**) in addition to Q14 and Q16).

Problem 9 Using previous company's confidential information

Problem 9 is LTO-originated. The statistical test has proved that there are 2 igniting conditions, (Table 7, Q19 and Q20) for Problem 9. These facts reveal that employees have a belief that confidential information can be used carelessly. They are outlined in order of severity as follows:
 Q20 "information sharing is morally encouraged",
 Q19 "the know-how acquired by their own effort is considered as theirs".

The results of the statistical test indicate that Q19 "the know-how acquired by their own effort is considered as theirs" is associated with the following 2 conditions which are,
 Q12 "I'm not reluctant to share information even if I'm not asked" (**Table 16**),
 Q4 "Information spreads easily" (**Table 17**).

Table 16 Proportion of answers to Q19 by Q12 (n = 20).

%		I'm not reluctant to share information even if I'm not asked (Q12)	
		Yes	No
The know-how that I have acquired at work is my valuable assets (Q19)	Yes	100.0	0.0
	No	60.0	40.0

Table 17 Proportion of answers to Q19 by Q4 (n = 20).

%		Information spreads easily (Q4)	
		Yes	No
The know-how that I have acquired at work is my valuable assets (Q19)	Yes	84.2	15.8
	No	0.0	100.0

Table 19 Proportion of answers to Q14 by Q13 (n = 21).

%		Persist in working late (Q13)	
		Yes	No
Do whatever it may be to reach a goal (Q14)	Yes	78.9	21.1
	No	0.0	100.0

Table 20 Proportion of answers to Q14 by employees' gender (n = 21).

%		Gender	
		Men	Female
Do whatever it may be to reach a goal (Q14)	Yes	94.7	0.0
	No	5.3	100.0

Table 18 Proportion of answers to Q5 by Q2 (n = 21).

%		I don't mind sharing any information (Q2)	
		Yes	No
It's better to share any information (Q5)	Yes	87.5	12.5
	No	25.0	75.0

Table 21 Proportion of answers to Q20 by employees' gender (n = 21).

%		Gender	
		Men	Women
Teaching others is a good thing (Q20)	Yes	0.0	100.0
	No	100.0	0.0

4.3.2 Dutch Companies

Problem 2 Unintentional sharing of confidential information

The statistical test has proved that there are 4 igniting conditions for Problem 2 (Table 7, Q2–Q5). These 4 conditions reveal that Brazilian employees have a background in information sharing since they regard this behavior as natural in a workplace. Q5 “it's better to share any information” is found to be associated with Q2 “don't mind sharing any information” (**Table 18**). This fact suggests that careless sharing of information is associated with employees' belief that encourages them to teach others.

Problem 7 Using any means to reach goals owing to the high competitiveness

Problem 7 is an MAS originated problem. The statistical test has proved that there are 3 igniting conditions (Table 7, Q13, Q14 and Q16) for Problem 7. The order of severity for conditions is the same as that of American companies.

Q14 “do whatever it may be to reach a goal” has “very high severity”. Moreover, Q14 is found to be associated with Q13 “persist in working late”. **Table 19** shows that 78.9% of those who agreed to Q14 also indicated that they persist in working late. Therefore, a relationship may exist between employees' determination (Q14) and persisting to work late (Q13). Furthermore, being goal-oriented is found to be associated with the respondents' gender. **Table 20** shows that women are less goal-oriented than men since women are less competitive.

Problem 9 Using previous company's confidential information

Problem 9 is LTO-originated. The statistical test has proved that there are 2 igniting conditions (Table 7, Q19 and Q20) for Problem 9. These facts reveal the cause of using confidential information carelessly. They are outlined in order of severity as follows:

Q20 “information sharing is morally encouraged”,

Q19 “the know-how acquired by their own effort is considered as theirs”.

These 2 igniting conditions have comparably high percentages of favorable answers, 1.5 and 1.3, respectively (Table 10). The results of the statistical test suggest that Q20 is dependent on the employees' gender. **Table 21** shows that the number of women who agree that information sharing is morally encouraged is higher than that of men. This indicates that women are more generous in sharing information than men.

4.3.3 Japanese Companies

The survey has shown that Japanese companies have the least problems (Table 7). This fact is consistent with the logical analysis of LoP (Table 6, **Prediction 6**), by showing that Japanese companies have the lowest overall potential. The 2 problems that Japanese companies face are as follows:

Problem 7 Using any means to reach goals owing to the high competitiveness

Problem 7 is an MAS-originated problem. The statistical test has indicated

Table 22 Proportion of answers to Q19 by “Has suffered information security incidents” (n = 20).

%		Their company has suffered information security incidents	
		Yes	No
The know-how that I have acquired at work is my valuable assets (Q19)	Yes	89.5	10.5
	No	0.0	100.0

that there are 2 igniting conditions (Table 7, Q13 and Q14 only) for this problem. Q14 “do whatever it may be to reach a goal” is found to trigger Problem 7 with higher severity than Q13 “persist in working late” by 0.7 (Table 9, Q14). Q14 may have a direct impact on a company’s information leakages.

Problem 9 Using previous company’s confidential information

Problem 9 is LTO-originated. The statistical test has proved that there are 2 igniting conditions (Table 7, Q19 and Q20). These facts reveal that employees have a belief that confidential information can be used carelessly. They are listed in order of severity as follows:

Q20 “information sharing is morally encouraged”,

Q19 “the know-how acquired by their own effort is considered as theirs”.

It is found that the severity of Q20 “information sharing is morally encouraged” is higher than Q19 by 0.7 (Table 9, Q19 and Q20). By referring to the states of severity shown in Fig. 1, Q20 has a “very high severity”, implying that Brazilian employees of Japanese companies are less conscience-stricken at sharing information as they believe that sharing information is encouraged.

Q19 “the know-how acquired by their own effort is considered as theirs” is found to be associated with whether respondents’ company had an experience of suffering information leakages or not. **Table 22** shows that 89.5% of those who agreed to Q19 answered that their company had experienced information security incidents. This fact suggests that a tendency to mistreat information may be associated with information security leakages.

Japan is found to face LTO-originated problems least (Table 7 and Table 9, Q19 and Q20). This is consistent with our logical analysis (Table 6, **Prediction 5**).

4.4 Influence Given by Experience Abroad

To know the influence of workers’ experience on information security-related behaviors, the relationships between igniting conditions (Q1 through Q20) and

Table 23 Proportion of answers to “Have experience abroad (study/training/work)” by Q5 (n = 61).

%		It’s better to share any information (Q5)	
		Yes	No
Have experience abroad (study/training/work)	Yes	38.5	61.5
	No	82.9	17.1

Table 24 Proportion of answers to “Have experience abroad (study/training/work)” by Q9 (n = 61).

%		Information security is a matter of technology (Q9)	
		Yes	No
Have experience abroad (study/training/work)	Yes	29.7	62.5
	No	70.3	37.5

Table 25 Proportion of answers to “Have experience abroad (study/training/work)” by Q16 (n = 61).

%		I can bring any document to my home (Q16)	
		Yes	No
Have experience abroad (study/training/work)	Yes	50.0	50.0
	No	80.0	20.0

workers’ experience (study/training/work) are studied. As a result, it is revealed that the responses to 5 questions (Q5, 6, 9, 15 and 16) are related to experience abroad. It is found that the employees with experience abroad agreed less to the following igniting conditions in comparison with those without experience abroad.

1. “It’s better to share any information” (see **Table 23**)
2. “Information security is a matter of technology” (see **Table 24**)
3. “I can bring any document to my home” (see **Table 25**)

5. Recommendations

5.1 To Information Security Management System (ISMS)

We recommend that ISO/IEC 27001 should state the necessity of managing change in foreign operations more clearly. At present, it refers to the security concerning human resources mainly in regards to employment, but does not mention anything about the influence of cultural differences. On the other hand, the COSO framework¹⁹⁾ refers to it in a more concrete manner. The COSO framework says in Chapter 3 of the Foreign Operations in Circumstances Demanding Special Attention in Managing Change, “The expansion or acquisition of foreign operations carries new and often unique risks that management should

Table 26 Recommendations.

Problems	Brazilian CDs	Links between problems and CDs	Recommendations	US	NL	JP
“Using previous company’s confidential information”	Moderate LTO	People in low LTO society like favors or gifts. They may use previous company’s information as a gift.	1) Convince employees that “teaching others” is not always good in practice of ISM. 2) Have employees understand that any know-how acquired in their companies is not their assets but company’s.	-	Women are more generous than men.	-
“Unintentional sharing of confidential information”	Low IDV	People like to chat with friends while working.	3) Educate employees that sharing information must follow the right procedure of “Need to Know Principle”.			
“Using any means to reach goals”	Moderate MAS	High MAS society is characterized to be assertive and competitive.	4) Explain employees that they need to obey rules even if they think the purpose of their actions are right			

* CD = Cultural Dimension

address. For instance, the control environment is likely to be driven by the culture and customs of local management.”

Our research results do not show any necessity to change the framework of ISO/IEC 27001 nor COSO framework. We merely recommend that ISO/IEC 27001 should give special attention to the influence of cultural differences on foreign operations.

5.2 To Foreign Companies

Based on the results mentioned previously, this research recommends practical actions to the countries considered in this study. They are summarized in **Table 26**.

6. Conclusions and Future Work

We conclude that,

- 1) The new measure named LoP (Level of Potential) has been proved to be practical to a certain extent as far as Brazilian business environment is concerned.
- 2) As for the severity of problems, it is concluded based on a real empirical survey that
 - 2-1) Overall, Japanese companies are found to have problems least, followed by American, and then Dutch companies.

- 2-2) The kinds of problems that may arise in American and Dutch companies are quite similar, but with different levels of severity. On average, American companies have severer individualism-originated problems than Dutch ones. Dutch companies have severer masculinity-originated problems than American ones. In order of severity, the serious problems at American and Dutch companies are as follows:

- “Using previous company’s confidential information”

This occurs because they believe that teaching others is a good thing. In Dutch companies, women are found to be more generous than men. Another igniting condition is the notion that the know-how acquired by staff belongs to them.

- “Unintentional sharing of confidential information”

This problem may take place since employees believe that sharing information is quite normal at workplaces.

- “Using any means to reach goals”

This occurs since they believe that they may use any means to reach their goals. In Dutch companies, Brazilian men are found to have a smaller conscience than women in the workplace. Other conditions include tendencies to bring documents home and persistence in working late.

- 2-3) Japanese companies face individualism-originated problems least among the three types of companies. In order of severity, the serious problems in Japanese companies are as follows:

- “Using previous company’s confidential information”

The conditions for occurrence are similar to those of companies from the other two countries. In Japanese companies, a tendency to treat information improperly is found to be associated with information security incidents.

- “Using any means to reach goals”

This occurs because employees believe that they can attain their goals through any means as long as they think their actions are right. Another condition for this problem is employees’ tendency to persist in working late.

- 3) It is recommended that
 - ISO/IEC 27001 should give particular attention to the influence of cultural differences on foreign operations,
 - American, Dutch and Japanese companies need to convince their employees that “teaching others” is not always good in practice of ISM. This is because Brazilians have the tendency to believe that “teaching others” is encouraged in their society.

Hofstede’s cultural framework is old and some cultural dimensions change easily as time passes. It is necessary to consider developing a cultural framework which is more dynamic than Hofstede’s. His framework is based on the concept that one country has one score for each cultural dimension. This is unrealistic for a multiracial country like Brazil. Thus, it is necessary to verify how far Hofstede’s framework is applicable. To explore threats, vulnerabilities and attacks caused by the explained problems, we need to explain how the potential problems interrelate with components of IT systems.

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