Psychometric Properties of the Icelandic Version of the Denison Organizational Culture Survey

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Abstract

The aim of the study was to evaluate psychometric properties of the Icelandic version of the Denison Organizational Culture Survey. It consists of four factors; involvement, consistency, adaptability and mission. Each factor is further divided into three sub-factors derived from five items each. The sample included 1,132 managers and employees in 13 Icelandic firms. The majority of the participants were males or 59.3% (n=658), and 40.7% (n=452) were females. The factors and sub-factors showed good internal consistency and item-total correlation was within an acceptable range for all but two items. Factor structure was evaluated by conducting confirmatory factor analysis. Results showed acceptable goodness of fit of the original structure within involvement and consistency but not adaptability and mission. Factor analysis of the 12 sub-factors showed acceptable goodness of fit for the original four factor model, which were in line with previous studies. The psychometric properties of the survey are satisfactory.

Keywords: Organizational culture, Psychometric properties, Factor analysis.

1. Introduction

Research on organizational culture has been ongoing since the early 80s with the advent of Japanese competitiveness in sectors such as car manufacturing and electronics (Morgan, 2006; Ouchi, 1981; Peters & Waterman, 1982). As a consequence, the main objective of research has been to identify factors of organizational culture that are associated with competitiveness and performance (Ashkanasy, Wilderom, & Peterson, 2010; Denison, 1984, 1990; Fey & Denison, 2003). Qualitative assessment of organizational culture has been the dominant trend within the field (Davey & Symon, 2001; Schein, 2004; Yauch & Steudel, 2003). However several quantitative measures have been designed such as Organizational Culture Survey (Cooke & Lafferty, 1989; Cooke & Rousseau, 1988) and the FOCUS questionnaire (van Muijen et al., 1999). Ashkanasy, Broadfoot & Falkus (2000) and Jung, Scott, Davies, Bower, Whalley, McNally & Mannion (2007, 2009) have provided an extensive review of quantitative measures.

Denison Organizational Culture Survey (DOCS) was designed to evaluate the relationship between organizational culture and effectiveness (Denison, 1984, 1990). The measure is based on two premises. First cultural traits that are associated with organizational performance are identifiable (Denison, 1990; Denison, Janovics, Young, & Cho, 2006). Second the common pattern of beliefs and assumptions are fundamental to organizational culture, and they are not easily accessible. However they create other components such as rules, rituals, values and behavior that are more easily accessible (Schein, 2004) and possible to measure (Denison, 1990; Denison, Haaland, & Goelzer, 2004; Denison & Mishra, 1995). The survey consists of four factors, involvement, consistency, adaptability and mission.

All factors are associated with organizational performance (Denison, et al., 2004; Denison & Mishra, 1995; Denison & Neale, 2002; Kotter & Heskett, 1992; Mobley, Wang, & Fang, 2005). Each factor consists of three sub-factors that are derived from five items (See measures in methods).

Psychometric properties of the original and translated versions of the survey have been deemed acceptable (Bonavia, Prado Gasco, & Barberá Tomás, 2009; Carter, Diab, Lin, Pui, & Zickar, 2007; Denison, et al., 2006). The largest evaluation of psychometric properties of the survey was conducted in a sample of 35,474 employees from 300 firms and institutions in various sectors. The vast majority of the firms were from USA or Canada, (74%) but other firms were from Europe, Asia and the Middle East. Internal consistency was deemed acceptable, and both factors and sub-factors correlated highly which indicates a strong relationship between different aspects of organizational culture. Item-total correlation was satisfactory except for low correlation (r=.23) on the item no. 15 which is one of the eight negatively worded items. The investigators used this low correlated item in further analysis, but they remarked that the item will perhaps be excluded in the future. Confirmatory factor analysis was conducted on the first-order factor structure where 15 items of each factor loaded on the relevant sub-factor and the second-order factor structure. Both resulting in acceptable goodness-of-fit (Denison, et al., 2006). Similar results have been shown on the Spanish version (Bonavia, et al., 2009).

The Institute of Business Research within University of Iceland Business School started in 2006 to study organizational culture within Icelandic firms that operate on international markets by finding traits that could be associated with their performance (Aðalsteinsson & Guðlaugsson, 2007). A part of the project was to implement instruments to measure organizational culture. The Denison Organizational Culture Survey was chosen as the main instrument due to its focus on cultural traits that lead to and/or explain organizational performance. The psychometric properties of the Icelandic version have been published previously in two studies both using exploratory factor analysis. The first study was conducted in a sample of 393 participants from six Icelandic companies. The sample that was used is a part of the same database as used in the current study, but it has been enlarged since then. Results showed that the 60 items loaded on three factors. Factor analysis of 15 items within each factor did not reveal a clear three factor structure except for consistency (Bjarnadóttir, 2010). The second study consisted of 226 employees from seven Icelandic companies. Factor analysis of all 60 items revealed two factors. The first factor represented of empowerment of employees, consistency and adaptability and the second factor consisted of almost all of the mission items, one third of items within adaptability as well as all items within the sub-factor coordination and integration that belongs to consistency. The investigator proposed that the factor analysis results were perhaps different because all items were only administered in Icelandic but not Icelandic and English as the former study and the current study (Norðdahl, 2010).

Previous studies on the Icelandic version of the survey were conducted with a small sample and showed contradictory results. The aim of this study is primarily to study the factor structure of the survey with confirmatory factor analysis. The following research questions have been designed.

1. Is the factor structure within each factor compatible with the original version?
2. Is the factor structure of all 60 items compatible with the original version?

Moreover, a traditional psychometric evaluation will be conducted as well as comparing the means and variation between the Icelandic sample and the original one.

2. Method

The data is derived from a total of 1,132 participants in 13 different Icelandic firms. The largest group consisted of employees in telecommunication (27.8%, n=337), followed by 14.8% (n=168) working in financial services. Other sectors comprising between 5-10% of the sample were cleaning services, soft drink production, energy, printing services, health care manufacturing, security, automobile dealing and pharmaceutical. Advertisement comprised of 1.9% (n=22) of the sample. Males were 59.3% (n=658), females 40.7% (n=452) and 22 participants did not report their gender.

As mentioned in introduction the survey consists of 60 items that are divided into four factors. Each factor consists of three sub-factors. Involvement consists of 1) empowerment, 2) team orientation and 3) capability development. Consistency includes 1) core values, 2) agreement and 3) coordination and integration. The sub-factors of adaptability are 1) creating change, 2) customer focus and 3) organizational learning.

The last factor consists of 1) strategic direction and intent, 2) goals and objectives and finally 3) vision. Responses are measured on a 5-point Likert scale that ranges from 1=strongly disagree to 5=strongly agree. Eight items are negatively worded, and are reversed in the analysis. The survey includes seven additional items that measure organizational effectiveness; 1) sales/revenue growth, 2) market share, 3) profitability/ROA, 4) quality of goods and services, 5) new product development, 6) employee satisfaction and 7) total organizational effectiveness.

A traditional psychometric evaluation was conducted such as calculating internal consistency (Chronbach's alpha), item-total correlation and correlation between factors and sub-factors respectively. Moreover, confirmatory factor analysis was conducted with the aid of EQS 6.2 (Bentler & Wu, 2005; Byrne, 2006). Method of estimation was maximum likelihood (ML), which is widely used, and provides robust parameter estimates (Anderson & Gerbing, 1988; Chou & Bentler, 1995). Several goodness-of-fit indices have been designed to assess the fit between data and structure (Hu, Bentler, & Hoyle, 1995; Shevlin, Miles, Davies, & Walker, 2000). First, *Satorra-Bentler* (S-B) chi-square that provides a scaling correction for the chi-square statistics if assumptions about distribution are violated. Data in this study were not normally distributed when assessed with the Mardia index (Bentler & Wu, 2005). Results indicate unacceptable goodness-of-fit if the p-value is low ($p<.05$). However it is quite common that the index reports unacceptable fit although data and structure are highly compatible. Therefore, other indices should be reported as well (Bentler & Wu, 2005; Byrne, 2006; Floyd & Widaman, 1995). In this study, the following goodness-of-fit indices were used. CFI (*comparative fit index* (Bentler, 1990)), NNFI (*non-normed fit index*) which incorporates a correction for non-normal distribution (Bentler & Bonett, 1980), GFI (*goodness-of-fit* (Jöreskog & Sörbom, 1989)), AGFI (*adjusted-goodness-of-fi*t (Jöreskog & Sörbom, 1996)) and RMSEA (*root mean square error of approximation* (Browne, Cudeck, Bollen, & Long, 1993; Steiger & Lind, 1980)). Results from CFI, GFI and AGFI range from 0 to 1 , whereas $\geq.90$ is deemed acceptable fit. NNFI can be higher than 1, but $\geq.90$ is deemed acceptable. RMSEA has repeatedly shown high sensitivity of unacceptable factor structure and $\leq.05$ indicates a good fit, an acceptable fit is between .05-.08 but everything above .10 is highly unacceptable (Browne, et al., 1993).

3. Results

Descriptive statistics of items, internal consistency and item-total correlation is reported in table 1a and table 1b.

Table 1a. Items' descriptive statistics, item-total correlation and internal consistency of factors and sub-factors

Factor	Sub-factor	Item no.	Item-total correlation	Mean	SD
Involvement α = .93	Empowerment α = .84	1	.62	3.64	0.97
		2	.66	3.43	1.02
		3	.62	3.38	1.02
		4	.57	3.70	0.96
		5	.67	3.42	1.08
	Team Orientation α = .87	6	.63	3.28	1.15
		7	.66	3.58	1.01
		8	.70	3.55	1.09
		9	.64	3.51	1.05
		10	.66	3.41	0.94
	Capability Development α = .77	11	.64	3.72	1.02
		12	.67	3.49	1.03
		13	.60	3.25	1.14
		14	.71	3.68	1.09
		15	***.29***	3.46	1.11
Consistency α = .89	Core values α = .68	16	.66	3.56	1.04
		17	***.23***	3.44	0.91
		18	.70	3.63	1.00
		19	.31	3.58	1.08
		20	.48	3.74	1.09
	Agreement α = .80	21	.67	3.83	1.07
		22	.59	3.71	1.01
		23	.69	3.50	0.93
		24	.44	3.60	1.01
		25	.65	3.47	1.02
	Coordination & Integration α = .79	26	.60	3.44	0.94
		27	.57	2.96	1.04
		28	.61	3.14	0.96
		29	.46	3.45	1.16
		30	.69	3.32	0.90

Table 1b. Items' descriptive statistics, item-total correlation and internal consistency of factors and sub-factors

Factor	Sub-factor	Item no.	Item-total correlation	Mean	SD
Adaptability α = .87	Creating Change α = .69	31	.48	3.21	1.03
		32	.54	3.61	1.05
		33	.63	3.60	1.01
		34	.32	3.35	1.01
		35	.58	3.35	0.94
	Customer Focus α = .68	36	.53	3.40	0.94
		37	.44	3.29	0.94
		38	.55	3.52	1.04
		39	.42	3.63	1.13
		40	.37	3.58	1.16
	Organizational Learning α = .76	41	.60	4.05	0.97
		42	.59	3.25	1.17
		43	.50	3.27	1.07
		44	.59	3.93	0.95
		45	.66	3.50	1.09
Mission α = .93	Strategic Direction & Intent α = .84	46	.64	4.27	0.91
		47	.52	3.89	0.90
		48	.74	4.00	0.92
		49	.65	4.11	0.95
		50	.47	3.83	1.24
	Goals & Objectives α = .86	51	.67	3.70	0.94
		52	.73	3.80	0.97
		53	.61	3.86	0.97
		54	.64	3.90	1.02
		55	.66	3.41	0.98
	Vision α = .81	56	.69	3.45	0.99
		57	.70	3.80	1.02
		58	.31	2.99	1.09
		59	.72	3.60	0.96
		60	.68	3.77	0.90

Results showed good internal consistency for all the factors. All sub-factors showed acceptable to good internal consistency, except core values within consistency and creating change and customer focus within adaptability. Their internal consistency was marginally acceptable.

Item reliability was evaluated by item-total correlation. All items showed acceptable correlation (r≥.30) (Brooks & Kutcher, 2001; Fabrigar, Wegener, MacCallum, & Strahan, 1999) except item no 15 "*Problems often arise because we do not have the skills necessary to do the job*" and item no 17 "*There is a characteristic management style and a distinct set of management practices*". As mentioned in introduction, item no. 15 correlated below acceptable range in Denison et al. (2006). However it was decided to withhold these items in further analysis. The internal consistency of the sub-factor derived from item no. 15 was within an acceptable range, and the item's content is highly compatible with the sub-factor. Item no. 17 was also used in further analysis. However the item should be reviewed in forthcoming studies.

Confirmatory factor analysis was first conducted on 15 items within each factor of the DOCS. Two structures were compared in each turn. Three factors compared to one individual factor. In all cases, three factor model showed superior goodness of fit except the structures in mission showed similar goodness of fit. Thus, goodness of fit is only reported for the three factor model of each factor (See table 2).

Table 2. Results of first-order confirmatory factor analysis on items within the four factors of the DOCS.

	Involvement	Consistency	Adaptability	Mission
Chi-square	546.581*** (df=87)	801.098*** (df=87)	749.505*** (df=87)	1003.030*** (df=87)
CFI	.949	.886	.865	.913
NNFI	.939	.862	.837	.895
GFI	.932	.906	.907	.888
AGFI	.906	.870	.871	.846
RMSEA	.070	.087	.085	.099
95% CI[1]	.064-.075	.082-.093	.079-.090	.094-.105

*** p<.001.
df=degrees of freedom
[1] 95% Confidence Interval

Goodness of fit indices was deemed satisfactory for the involvement structure but below or marginally acceptable for the factor structure of consistency, adaptability and mission.

Second confirmatory factor analysis was conducted on all 60 items of the DOCS by comparing three different models. First second-order factor structure whereas each item loaded on its sub-factor and each sub-factor loaded on its factor. Second a four factor structure whereas 15 items on each factor where grouped together. Confirmatory factor analysis creates several constraints. One critical constraint concerns the risk of automatic inacceptable goodness of fit when dealing with large and complicated models that require excessive parameter estimation (indicated by a large number of degrees of freedom). The factor structure of the Denison Organizational Culture Survey is complicated and consists of a large number of parameters. These kinds of models may be rejected because of statistical limitation but not incompatibility between data and a priori structure. One method to overcome the problem is to group items together in a composite score or parcels and to use these composite scores as the basis of the analysis. Beside the advantage in reducing the number of parameters to be estimated, response bias in individual items is reduced (Floyd & Widaman, 1995; Kishton & Widaman, 1994; Little, Cunningham, Shahar, & Widaman, 2002; Yuan, Bentler, & Kano, 1997). Thus for the third structure it was decided to group five items of each sub-factor together in a composite score. A necessary requirement for grouping is an acceptable internal consistency of items grouped together. Nine of the 12 sub-factors showed acceptable internal consistency as reported in table 2. The internal consistency of the other three sub-factors was marginally acceptable (.67-.69) so they were grouped together as well. The factor structure consisted of four factors with three composite scores of sub-factors (See table 3).

Table 3. Results of confirmatory factor analysis on all 60 items on the DOCS comparing three different models

	Item - Sub-factor - factor	item-factor	Sub-factor - Factor
Chi-square	6039.079*** (df=1770)	6830.548*** (df=1704)	216.838*** (df=48)
CFI	.864	.839	.982
NNFI	.857	.833	.976
GFI	.803	.781	.963
AGFI	.787	.765	.940
RMSEA	.052	.056	.061
95% CI[1]	.050-.053	.055-.057	.052-.069

*** p<.001.
df=degrees of freedom
[1] 95% Confidence Interval

Results of the two first models indicate inacceptable goodness-of-fit for all indices except RMSEA. This was expected due to an excessive number of parameters that needed to be estimated. The third model had much lower number of parameter estimation (df=48), and all indices showed acceptable goodness of fit.

Next the correlation between factors was calculated (see table 4). The correlation was in most cases high that indicates little divergence between factors.

Table 4. Correlation matrix for the four factors of the DOCS.

	1	2	3	4
1.Involvement	1			
2.Consistency	0,80	1		
3.Adaptability	0,73	0,78	1	
4.Mission	0,68	0,75	0,76	1

All correlation coefficients significant p<.001.

The Culture and Effectiveness Model describes that the four factors of the survey are interconnected by two different axis (Denison, 1990; Denison, et al., 2006). First, external versus internal focus and second, flexible versus stable orientation. Each factor is compatible with two other factors either due to external vs. internal focus or flexible vs. stable orientation but it is incompatible with the third factor. For example, adaptation relates to mission through external focus and involvement through flexible orientation but it is not compatible with consistency (internal focus and stable orientation). Thus, it is expected that each factor correlates more strongly with two compatible factors but less with the incompatible factor. This was evaluated statistically by comparing correlation coefficients of each factor with related factors with coefficient between same factor and an unrelated factor. The method of Meng et al. (1992) was used to evaluate statistical significant differences between correlation coefficients. If the correlation of related factors turns out to be higher, than the correlation of unrelated factors then it indicated convergent and divergent validity of the respective factor. Results showed significantly higher correlation for related factors, than unrelated factor for involvement and mission, but not for adaptation and consistency. This indicates acceptable convergent and divergent validity for involvement and mission but not for adaptation and consistency. Correlation between sub-factors is shown in table 5.

Table 5. Correlation matrix for the 12 sub-factors of the DOCS.

	1	2	3	4	5	6	7	8	9	10	11	12
1.Empowerment	1											
2.Team Orientation	.81	1										
3.Capability Development	.75	.75	1									
4.Core Values	.63	.63	.60	1								
5.Agreement	.68	.66	.67	.65	1							
6.Coordination & Integration	.63	.65	.62	.56	.69	1						
7.Creating Change	.59	.63	.61	.51	.62	.62	1					
8.Customer Focus	.52	.53	.56	.46	.56	.57	.64	1				
9.Organizational Learning	.63	.60	.65	.59	.69	.67	.66	.65	1			
10.Strategic Direction & Intent	.53	.51	.56	.56	.61	.55	.56	.49	.64	1		
11.Goals & Objectives	.59	.61	.60	.58	.65	.62	.65	.58	.71	.77	1	
12.Vision	.59	.59	.62	.54	.66	.64	.63	.53	.69	.74	.82	1

All correlation coefficients significant p<.001.

Convergent and divergent validity of the sub-factors was also evaluated by comparing the correlation coefficients of sub-factors within the same factor vs. correlation coefficients of sub-factors within other factor. For involvement and mission, correlation coefficients between sub-factors were significantly higher than the correlation coefficients between sub-factors of other factors. For adaptation and consistency only half of the correlation coefficients between sub-factors within the same factor were significantly higher than coefficients of sub-factors within other factors. This indicates acceptable convergent and divergent validity for sub-factors of involvement and mission but in a less degree for adaptation and consistency.

The mean and standard deviation of each factor and sub-factor in the Icelandic sample can be viewed in table 6 and compared to the sub-factors from Denison et al. (Denison, et al., 2006) but not the factors as they were not reported.

Table 6. Mean and SD of factors and sub-factors comparison between Iceland and the original version of the DOCS.

	Iceland			Denison, et al. (2006).		
	N	Mean	SD	Mean	SD	t-value
Involvement	1,087	3.50	0.75			
Empowerment	1,121	3.52	0.80	3.31	0.71	8.834***
Team Orientation	1,112	3.47	0.86	3.40	0.77	2.586**
Capability Development	1,107	3.53	0.79	3.41	0.69	4.897***
Consistency	1,084	3.49	0.63			
Core Values	1,108	3.59	0.69	3.50	0.66	4.343***
Agreement	1,113	3.61	0.76	3.22	0.66	17.275***
Coordination & Integration	1,113	3.26	0.75	3.03	0.73	10.384***
Adaptability	1,065	3.50	0.62			
Creating Change	1,104	3.42	0.68	3.10	0.69	15.653***
Customer Focus	1,097	3.48	0.69	3.37	0.69	5.462***
Organizational Learning	1,104	3.60	0.75	3.13	0.71	20.522***
Mission	1,068	3.75	0.72			
Strategic Direction & Intent	1,111	4.01	0.79	3.41	0.82	24.971***
Goals & Objectives	1,107	3.73	0.80	3.47	0.69	10.763***
Vision	1,092	3.52	0.75	3.30	0.67	9.768***

[1] 35,474 employees from 160 companies in N-America, Europe and Asia.

The mean difference between the Icelandic sample and the Denison et al. sample was compared with independent sample t-test. In all cases, the Icelandic mean was significantly higher.

4. Discussion

The primary aim of the study was to study the factor structure of the Icelandic version of the Denison Organizational Culture Survey. Main results indicate that the structure is similar as in other versions of the survey (Bonavia, et al., 2009; Denison, et al., 2006) Internal consistency of all factors and nine sub-factors was within an acceptable range. The three remaining sub-factors showed marginally acceptable internal consistency. Two items had unacceptable item-total correlation, item no. 15 and 17. Item no. 15 has previously shown low correlation with the total scale (Bonavia, et al., 2009; Denison, et al., 2006) and item no. 17 has been in the lower range of acceptable item-total correlation (Denison, et al., 2006). It is possible that these items show less covariation across languages. Another explanation is for low item-total correlation is slightly different meaning in the translated version. In the light of the fact that no back translation was done on the Icelandic version it is not inconceivable that the meaning is different. This doubt can be excluded by producing a back translation and/or conducting a differential item functioning analysis by comparing the original version with the Icelandic version (Carter, et al., 2007).

When the factor structure of the four main factors were evaluated individually, a original three factor structure was superior to a one factor structure. However only the three factor structure for the involvement items showed acceptable goodness of fit. Similar factor analysis was not done by Denison et al. (Denison, et al., 2006) but identical results were reported in a Spanish version of the DOCS (Bonavia, et al., 2009). Moreover the factor structure of the whole survey was evaluated by comparing three different models. The first two models that were derived from all the 60 items showed unacceptable goodness of fit.

Excessive number of parameters to be estimated is a probable explanation for these results (Raykov & Marcoulides, 2006). The third model was based on the 12 sub-factors of the DOCS that loaded on its respective factor. This model showed satisfactory goodness of fit. The convergent- and divergent validity of the survey was evaluated by calculating correlation between factors and sub-factors. Overall factors correlated highly but in a less degree than in other studies (Denison, et al., 2006). Moreover involvement and mission showed higher correlation between similar factors than dissimilar but not adaptability and consistency. Same pattern was revealed when correlation between sub-factors within the same factor was compared to correlation to other sub-factors. Sub-factors of involvement and mission correlated stronger with sub-factors within the same factor but not sub-factors within adaptability and consistency. Same analysis has not been done in previous studies of the survey (Bonavia, et al., 2009; Denison, et al., 2006) thus it would be interesting to repeat the analysis in other versions. Overall results indicate satisfactory psychometric properties of the Icelandic version of the survey. Moreover the psychometric properties are similar as in other versions (Bonavia, et al., 2009; Denison, et al., 2006).

The survey could, therefore be used to evaluate organizational culture within Icelandic companies. However, further studies are recommended. For example, the survey was designed originally to measure culture in companies operating in highly competitive markets (Denison, 1984, 1990). Thus, the survey should not be implemented in other sectors that operate differently such as public institutions unless psychometric properties have been reported and compared across different sectors. Data has been collected but it has not been analyzed independently to the knowledge of the authors (Denison, et al., 2006). There exist a study on the Icelandic version of the survey that investigated organizational culture in the University of Iceland that is a state owned university. However no psychometric evaluation was conducted (Björnsdóttir, 2009). Moreover, it is recommended that further studies on its concurrent validity will be conducted. For example by studying the relationship between the survey and other measures of organizational culture, as well as independent measures of organizational performance.

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