From fun-lovers to institutionalists: uncovering pluralism in IT occupational culture

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Abstract

Purpose – The study aims to explore whether there is diversity of occupational culture among IT workers. Prior work conceptualizes IT occupational culture (ITOC) as based around six distinctive values (ASPIRE) but has not explored whether there is variation in ITOC.

Design/methodology/approach – Survey data from 496 New Zealand IT workers was used to create factors representing IT occupational values based on the ASPIRE tool. Hierarchical cluster analysis and discriminant analysis were applied to identify distinctive segments of ITOC.

Findings – Four ITOC segments were identified: fun-lovers, innovators, independents and institutionalists. These differed in the relative emphasis ascribed to the ITOC values with each segment being distinguished by 1–2 dominant values. Segment membership varied according to level of responsibility and birth country. Institutionalists and innovators had higher concern about organizational and IT issues than fun-lovers and independents. Job satisfaction was lowest among innovators and highest along institutionalists.

Research limitations/implications – This study challenges the concept of a unified ITOC, suggesting that ITOC is pluralistic. It also theorizes about interactions between ITOC, individual motivation and values and national culture.

Practical implications – Management needs to be cognizant of the fact that IT occupational culture is not homogeneous and different IT occupational segments require unique management approaches, and that their own values may not match those of others in IT work. By understanding ITOC segments, managers can tailor support, assign tasks appropriately and design teams to optimize synergies and avoid conflict.

Originality/value – This study reveals the existence of ITOC segments and theorizes about the relationship of these to innovation-orientation, job satisfaction, individual motivation, work styles and national culture. The combination of cluster and discriminant analysis is a valuable replicable inductive method that is underrepresented in Information Systems (IS) research.

Keywords Culture, Survey, Perception, Individual, Profiling, Empirical study, Survey data, IS professionals, Inductive research, Cross-cultural issue

Paper type Research paper

Introduction

Occupation has been described as a more important driver of workplace behavior than either country or organization (Schein, 2010, 2015a). In the twenty-first century, as the IT industry

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has matured, technology has advanced, and the use of IT has become more critical to organizational success, researchers have become increasingly interested in the occupational culture of IT workers. Research into IT occupational culture (ITOC) [1] is based around identifying, measuring and understanding the occupational culture of IT workers. This line of research aims to reveal the shared meanings and expected behaviors of IT workers and to consider the impact of these on organizational outcomes such as IT success and failure (Jacks and Palvia, 2011).

According to the ITOC perspective, IT workers across different organizations share a broad yet distinctive set of occupational values. Various studies have explored the nature of ITOC (e.g. Fagnot *et al.*, 2007; Guzman and Stanton, 2004, 2009; Guzman *et al.*, 2004; Jacks and Palvia, 2014; Jacks *et al.*, 2018; Ramachandran and Rao, 2006; Rao and Ramachandran, 2011; Sato *et al.*, 2018). Research to date has focused on identifying and understanding ITOC as an occupation-wide commonality: a shared culture comprising values and ideology that makes IT workers distinctive. For example, ITOC has been used to help explain the common problem of friction between IT workers and non-IT managers (Jacks *et al.*, 2018). At the same time, the question of whether there is differentiation within ITOC, i.e. whether there are subsets of occupational culture among IT workers, has not been investigated. This study aims to address this question.

A number of research trends make it timely and important to investigate whether there is diversity in occupational culture among IT workers. Three decades ago, Orlikowski and Boroudi (1988) argued that IT employees should be conceptualized as an occupational group, rather than as members of a profession, due to the large span and scope of work involved. Today, the span and scope of IT work is significantly more pronounced. Recent years have witnessed exponential advances in enabling technologies and their application (Butler, 2016). As a result, new skillsets have evolved, and new roles are constantly being added to the IT repertoire. Many of today's in-demand jobs (such as business intelligence architect, machine learning designer, DevOps engineer and IoT specialist) did not exist a decade ago. Further, many of today's IT-related roles exist outside of IT departments. These roles may require a combination of IT skills and domain knowledge (Kaarst-Brown and Guzman, 2005). Alongside new IT roles, many organizations must maintain the traditional skillsets required to run legacy systems. For example, around eighty percent of the US Federal Government's $90 billion IT investment in 2019 was devoted to operating and maintaining IT investments, including legacy systems (USGAO, 2019). The banking industry, expected to be an early adopter of artificial intelligence, is also known for its reliance on legacy systems. There is, therefore, an increasing inclusiveness in who is counted as IS personnel (Niederman *et al.*, 2016).

In addition, globalization has created a highly mobile IT workforce, and immigration is addressing IT skills shortages in some countries. At the same time, the IT workforce is becoming more fluid and temporary in work arrangements. In a US-based survey, 68% of employers agreed that, by 2025, the majority of the IT workforce will be employed through agile, temporary arrangements, rather than in permanent full-time positions (Randstad, 2016).

In combination, these changes have resulted in an IT workforce that is more diverse in skills, inter-generational make-up and expectations about work than ever before. This raises the question of whether a unified view of ITOC can present the full picture of contemporary IT workers' occupational values. Is there cultural complexity in ITOC? Are there recognizable occupational subcultures among IT workers? If so, how can this be conceptualized at the level of the IT occupation? These questions have important implications. The existence of organizational subcultures has been long associated with the potential for conflict, which can be magnified by a lack of understanding. In a world where IT-related success is increasingly critical, it is therefore important to identify whether there are differences within ITOC and to

understand the nature of any such differences. If ITOC is pluralistic rather than unified, this would present new issues for managers and researchers.

Studies in the occupational culture of police suggest that there may be promise in such an exploration. Police culture was traditionally depicted as being universal, but recent research has challenged this view, conceiving of it as being variable and fractured (Nickels and Verma, 2008). For example, Cochran and Bromley (2003) used cluster analysis and discriminant analysis to identify three types of law enforcement orientations among sheriff deputies, while Paoline (2004) applied cluster analysis to identify seven distinct groups of police officers. Our study was motivated by curiosity about whether complexity and fragmentation may apply in the case of ITOC, given the significant IT workforce changes that are noted above.

Based on the discussion above, this study addresses the following questions: (1) Do distinct occupational values-based groups (ITOC subsets) of IT workers exist? And (2) If so, what are the characteristics of such groups and how do they differ among themselves? To answer these questions, this study employs a three-step process of factor analysis, cluster analysis and discriminant analysis to analyze survey data from nearly 500 IT workers in New Zealand. Occupational culture is seen as a global phenomenon (Schein, 2015b) and forty-five percent of this study's respondents were born outside of New Zealand, providing a culturally diverse sample.

The next section reviews the relevant literature, followed by the presentation of the study design and method. Next, the findings are presented and their implications are discussed.

Literature review

Culture is based around the shared values, meanings, practices and norms of groups (Gallivan and Srite, 2005). A culture is underpinned by a system of collectively held values (Hofstede, 1980; Kluckhohn, 1951) or ideologies (Trice, 1993) which differentiate it from other cultures. Studies of culture aim to understand a culture's distinctive attributes, the interaction of cultures and/or subcultures and the implications of this for organizations, notably when issues arise from cultural conflicts.

Culture research in information systems

In the IS discipline, the dominant research focus has been on two levels of culture: national culture and organizational culture. Studies focusing on *national culture* generally apply taxonomies of value dimensions to the IS context, such as Hofstede's (1980, 2011), Schwarz's (1999), Hall and Hall's (1990) and the GLOBE (House *et al.*, 2004) dimensions to help explain IS outcome differences confronting organizations that span countries. Critics have, however, voiced concern that it is simplistic to equate a person's culture with that of his or her birth country (Gallivan and Srite, 2005; Myers and Tan, 2002), or see IT as driving cultural convergence (Salehan *et al.*, 2018).

IS studies of *organizational culture* aim to identify the beliefs and values shared by members of an organization (or a subset thereof) and to understand how these affect the ways in which information technologies are developed, adopted, used and perceived. Organizational culture can contribute to the success, or otherwise, of IT implementations and barriers to adoption can arise when there is a poor fit between the system and organizational culture (Fink, 1998; Kayas *et al.*, 2008). Organizational culture is strongly intertwined with technology and information (Gallivan and Srite, 2005; Heinzl and Leidner, 2012; Jacks and Palvia, 2014; Lawrence, 2013; Leidner, 2010; Leidner and Kayworth, 2006; Tams, 2013).

IT occupational culture

In addition to the national and organizational culture research directions, a third stream of IS culture research is focused on understanding the nature of ITOC, which is the focus of the present study (e.g. Guzman and Stanton, 2004, 2009; Guzman *et al.*, 2004; Jacks and Palvia, 2014; Jacks *et al.*, 2018; Ramachandran and Rao, 2006, 2011; Zhao and Srite, 2020). This line of research is concerned with identifying the profession-wide *occupational culture* of IT workers, rather than cultures and subcultures that exist within organizations (Abubakre *et al.*, 2017; Kaarst-Brown, 2004; Kaarst-Brown and Robey, 1999; Leidner, 2010; Nord *et al.*, 2007; Ravishankar *et al.*, 2011).

Occupational cultures are distinctive clusters of ideologies, beliefs, values, forms and various practices that emerge among, and are shared by, those in that occupation (Trice, 1993). They arise from the shared experiences (educational, personal and work-based), mutual support and affiliation of individuals who work in an occupation and share similar ideologies and ways of expressing these ideologies in language and behavior (Guzman *et al.*, 2008; Hanan and Zainal, 2012; Hansen, 1995; Hofstede, 1997; Trice and Beyer, 1984). Occupational cultures are considered a global phenomenon in that members of an occupation are trained "in the same way to the same skill set and values" across the globe (Schein, 2015b, p. 14). IT work can be seen as a particularly globalized occupation.

The terms IT occupational culture and IS occupational culture are used somewhat interchangeably in the IS literature: Guzman *et al.* (2004), Ramachandran and Rao (2006) and Jacks and Palvia (2014) apply the former term, while Guzman *et al.* (2008) employ the latter. ITOC is defined as "a web of occupationally-shared values based on shared language, shared history and shared context that are unique to the IT occupation" (Jacks and Palvia, 2014, p. 4). The IT occupation comprises "the workers who design, build, and manage application systems, who introduce them and other related IT into organizational environments, who operate, maintain, extend, and manage the IT, and who provide training, documentation, and support for the organizational context in which these systems are embedded" (Niederman *et al.*, 2016, p. 29).

An occupation has its own distinct culture if it has seven characteristics: (1) esoteric knowledge and expertise, (2) extreme or unusual demands, (3) consciousness of kind, (4) pervasiveness, (5) favorable self-image and social value in tasks, (6) primary reference group and (7) abundance of cultural forms (Trice, 1993). Studies by Guzman *et al.* (2008, 2004), Guzman and Stanton (2004, 2009) and Ramachandran and Rao (2006) found that IT work meets these criteria. IT workers place a relatively low value on their role in a hierarchy and on having large numbers of rules, while valuing a fluid division of labor. They are also likely to feel that managers and end-users have unrealistic expectations (Ramachandran and Rao, 2006). Building on Trice (1993), Guzman *et al.* (2008) proposed a framework with nine aspects of ITOC (see p. 45). Guzman and Stanton (2009) streamlined this to develop an ITOC framework of six dimensions: (1) esoteric knowledge and expertise, (2) extreme and unusual demands, (3) consciousness of kind, (4) IT pervasiveness (worker relationships extend into private lives), (5) favorable self-image/pride and (6) abundance of cultural forms (language and shared stories).

Recently, researchers have created measurable value dimensions that are specific to ITOC (Jacks and Palvia, 2011, 2014; Jacks *et al.*, 2018). Based on interviews with 25 experienced IT workers, Jacks *et al.* (2018) identified six value themes: (1) autonomy in decision-making, (2) structure in environment, (3) precision in communication, (4) innovation in technology, (5) reverence for technical knowledge and (6) enjoyment at the workplace (abbreviated with the acronym ASPIRE). These were developed into an instrument and evaluated using a survey of 524 respondents. (In factor analysis of the survey results, the structure in environment and precision in communication constructs loaded on a single factor.) Based on the results, the authors describe ITOC ideology as follows: *"IT is an occupation that expects a high level of personal autonomy, is intolerant of any*

ambiguity in both communication and work structure, craves the opportunity to create and innovate, respects intelligence over authority, and strongly desires enjoyable elements of play in the work environment" (p. 108).

Although ITOC research has focused on identifying the common characteristics and values that unite those in the IT occupation, Jacks *et al.* (2018) suggest that there may be important differences within ITOC. The question of whether such differences exist has not been previously examined. As noted earlier, significant changes in what constitutes IT work and in the diversity of the IT workforce make it important to consider whether a unified view of ITOC can present the full picture of contemporary IT workers' occupational values.

Methodology

The study employed a three-step process of factor analysis, cluster analysis and discriminant analysis to analyze survey data collected from IT workers in New Zealand. The data were collected in late 2016 as part of a larger study, the World IT Project (Palvia *et al.*, 2017, 2018, 2020). The survey population was drawn from a cross-section of larger organizations (those with a minimum of 10 IT employees). The sampling process involved mapping a list of New Zealand's main IT employers (The CIO 100) to target industry areas (identified using GDP statistics) and sharing a survey link with IT workers in these organizations. In total, 516 completed responses were received. All responses were manually reviewed for accuracy, outliers and repetitive answers (i.e. when a respondent selected the same value for multiple questions in a row). No outliers or repetitive answers were identified. However, 20 responses had a missing value for one or more items in the ASPIRE scale, and these entries were removed from the dataset. Thus, the final dataset included 496 valid data points.

As shown in Table 1, most respondents had a bachelor's degree or more (67%), twenty or more years of overall work experience (61%) and ten or more years of IT experience (75%). Most worked full-time (93%), were IT department employees (86%) and were not part of management (62%). Overall, 28% of responses came from female IT workers. Compared to

Characteristics	*N*	%	Characteristics	*N*	%
Education			*Years of work experience*		
High school or less	93	19	0–4 Years	19	4
Associate degree	88	18	5–9 Years	49	10
Bachelor's degree	239	48	10–19 Years	123	25
Master's degree	71	14	20–29 Years	151	30
Ph.D	5	5	30 + Years	154	31
Years of IT experience			*Organizational location*		
0–4 years	49	10	IT department employee	426	86
5–9 years	73	15	IT worker in non-IT dept.	7	1
10–19 years	178	36	Contract employee	39	8
20–29 years	125	25	Consultant	16	3
30 + years	71	14	Vendor employee	8	2
Work			*Position*		
Mostly full time	459	93	Not part of management	306	62
Mostly part time	21	4	In lower management	71	14
Mostly over time	16	3	In middle management	64	13
Sex			In senior management	55	11
Male	355	72			
Female	141	28			

Table 1.
Sample composition

male IT employees who responded, female respondents had significantly less IT experience, with 28% of them having twenty or more years of IT experience, compared to 44% of the male respondents. There were no other statistically significant differences between male and female respondents in any of the variables shown in Table 1 (based on chi-square tests, $p < 0.05$).

The survey included the ITOC scale used by Jacks *et al.* (2018) (see Appendix). This scale conceptualizes ITOC as being comprised of six constructs, each measured using multiple items. The constructs are: autonomy in decision-making, structure in environment, precision in communication, innovation in technology, reverence for technical knowledge and enjoyment at the workplace (ASPIRE). Factor analysis using principal components with varimax rotation was used to confirm that items loaded on the expected constructs and to remove items with low loadings or high cross-loadings. Factor loading plots were examined for low loadings and high cross-loadings, and four items were dropped. Three of these four items were also dropped by Jacks *et al.* (2018). Unlike Jacks *et al.* (2018), it was not necessary to collapse the structure in environment and precision in communication constructs. All six of the original ASPIRE dimensions were therefore retained, with the rotated factor loadings shown in Table 2. All remaining items loaded cleanly on the intended factor, with the lowest loading on any factor being 0.47, which is statistically significant with this sample size (Hair *et al.*, 1998, p. 112). Although the ASPIRE scale was developed in the US context, the fact that the six originally conceptualized dimensions were confirmed with a New Zealand sample

Table 2.
Factor loadings

Item	Autonomy in decision-making	Structure in environment	Precision in communication	Innovation in technology	Reverence for technical knowledge	Enjoyment at the workplace
AUT1	*0.65*	0.11	0.03	0.08	0.09	0.08
AUT2	*0.70*	−0.09	0.09	0.11	0.17	0.07
AUT3	*0.65*	0.03	−0.01	0.11	0.01	0.19
AUT4	*0.65*	−0.12	0.04	0.09	−0.16	0.18
STR1	0.02	*0.59*	0.10	0.12	−0.12	−0.02
STR2	−0.07	*0.58*	0.12	−0.04	0.11	0.07
STR3	−0.15	*0.60*	0.19	0.14	−0.07	0.11
STR4	−0.02	*0.74*	0.10	0.06	0.06	0.02
STR5	0.13	*0.69*	0.14	0.07	0.14	0.01
STR6	0.08	*0.47*	0.23	0.04	0.22	0.00
PRE2	0.04	0.26	*0.68*	0.06	0.03	0.03
PRE3	0.08	0.18	*0.83*	0.06	0.04	0.05
PRE4	0.09	0.21	*0.68*	0.06	0.09	0.15
PRE5	−0.06	0.34	*0.53*	0.13	0.17	0.10
INN1	−0.01	0.06	0.00	*0.69*	−0.00	0.17
INN2	0.03	0.11	0.09	*0.74*	−0.01	0.18
INN3	0.12	0.16	0.03	*0.69*	0.11	0.12
INN4	0.16	0.09	0.02	*0.72*	0.15	0.02
INN5	0.28	−0.04	0.25	*0.61*	0.09	0.06
REV1	−0.02	−0.06	0.23	0.31	*0.53*	−0.05
REV2	0.17	−0.22	0.31	0.25	*0.57*	0.02
REV3	0.03	0.20	−0.01	0.01	*0.78*	0.19
REV4	0.04	0.26	−0.02	−0.02	*0.75*	0.22
ENJ1	0.08	0.00	0.02	0.10	0.03	*0.85*
ENJ2	0.10	0.08	0.11	0.18	−0.03	*0.77*
ENJ3	0.15	−0.05	0.18	−0.00	0.06	*0.75*
ENJ4	0.07	0.15	−0.04	0.11	0.18	*0.64*
ENJ5	0.23	0.03	0.07	0.18	0.15	*0.52*

demonstrates that it generalizes to the New Zealand IT context. One reason for this may be that the New Zealand IT workforce is strongly internationalized. For example, 45% of the New Zealand IT workers surveyed in this study were born outside of New Zealand. Foreign-born IT workers are also very prevalent in the USA. As of 2014, nearly three-quarters (74%) of people between 24 and 44 working in math and computing jobs in Silicon Valley were born outside of the US (Massaro, 2016). The ASPIRE tool has previously been successfully applied to study IT professionals in Japan, a country more culturally distant from the US than New Zealand (Sato *et al.*, 2018). As noted earlier, Schein has suggested that occupational cultures "are global to the extent that members are trained in the same way to the same skill set and values" (2015b, p. 14). Thus, IT work can be seen as a particularly global occupation.

To explore whether there were distinct subsets of IT occupational culture within the sample, cluster analysis was conducted to segment IT workers based on their factor scores, using hierarchical clustering (Ward's method with squared Euclidian distance). While there are a variety of ways to group or segment people, cluster analysis has the benefit of doing so organically based on data rather than on pre-conceived ideas of what distinguishes people from one another. Clustering factor scores is also advantageous because it standardizes variables and removes potential problems resulting from multicollinearity (Saunders, 1980). The clusters identified in cluster analysis-based segmentation studies are not based on *a priori* classifications but are identified inductively via replicable statistical processes. Cluster analysis is an inductive exploratory method that uncovers hidden structures without aiming to determine reasons for these structures. It is closer to hypothesis-generating than testing (Gallestey, 2019). For these reasons, prior studies have used cluster analysis to reveal distinct segments of police occupational culture (Cochran and Bromley, 2003; Paoline, 2004).

To determine the optimum number of clusters, solutions ranging from two to eight clusters were tested. The goal of this step was to identify clusters that maximized similarity within and differentiation between clusters, while having few yet balanced clusters to make them practically and conceptually useful. The resulting coefficients, presented in Table 3, show the squared Euclidian distances between the last two clusters that joined. This can be thought of as a proxy for similarity within clusters. It is an inherent property of cluster analysis that this distance reduces as the number of clusters increases, but within the range of 2–8 clusters there is no point at which the rate of reduction is such that it strongly suggests a particular number of clusters, hence the need for testing to determine the optimal solution.

F-values from analysis of variance (ANOVA) for testing differences between clusters on each of the factors were all significant at $p < 0.001$ except for the autonomy in decision-making factor with two clusters, which was significant at $p < 0.005$. These results demonstrated good differentiation between clusters in terms of mean values for the factors in all solutions between 2 and 8 clusters. The mean *F*-value across the six factors was greatest for the four-cluster solution, so that solution had the best average differentiation. The four-cluster solution also had the most balanced clusters, with a 1.5 ratio between the largest cluster size and the smallest cluster size, compared to ratios ranging from 2.2 to 4.3 for the other solutions. Therefore, the four-cluster solution was selected because it differentiated between clusters well (based on *F* statistics derived from ANOVA comparing the mean factor scores across clusters) and produced well-balanced clusters.

The four-cluster solution was then refined using discriminant analysis. This is a common method of validating initial clusters (Punj and Stewart, 1983) because hierarchical cluster analysis does not redistribute observations among clusters once they have been assigned even if movement in the cluster centroids would make them fit better in other clusters. The dependent variable in the discriminant analysis was the initial cluster membership. The independent variables were the factor scores used to form the clusters. Prior probabilities for the group sizes were weighted based on the size of the clusters derived from the cluster analysis. All three canonical discriminant functions were highly significant.

Table 3.
Summary of cluster analysis results

			ANOVA *F*-values ($p < 0.001$ except for the autonomy factor with 2 clusters, which is $p < 0.005$.)						
Number of clusters	Size ratio	Coef-ficient	Autonomy in decision-making	Structure in environment	Precision in communication	Innovation in technology	Reverence for technical knowledge	Enjoyment at the workplace	Mean *F* value
8	4.3	1,907	31.0	43.3	40.7	27.9	25.5	80.0	41.4
7	2.3	1,984	35.5	49.8	35.5	24.8	18.5	90.5	42.4
6	3.5	2,078	38.3	37.9	55.7	23.5	19.1	107.0	46.9
5	3.5	2,187	37.0	41.1	58.6	19.8	15.9	134.1	51.1
4	1.5	2,328	24.7	39.6	43.0	26.5	20.9	171.5	54.4
3	2.3	2,512	17.5	56.0	37.9	34.4	27.0	106.8	46.6
2	2.2	2,724	9.9	21.1	49.9	33.2	32.4	139.8	47.7

Table 4 shows the coefficients, correlations between the factors and the discriminant functions and eigenvalues for each discriminant function. The enjoyment at the workplace factor was most strongly associated with the first factor, which also explains the most variance. The structure in environment, innovation in technology and reverence for technical knowledge factors were most strongly associated with the second discriminant function. The autonomy in decision-making and precision in communication factors were most strongly associated with the third discriminant function.

ANOVA was used to compare the mean factor scores for the resulting four segments. *F*-values ranged between 20 and 263, and all were significant at $p < 0.001$ (see Table 5).

ANOVA and chi-square statistics [2] were then used to compare the four segments on other variables of interest that were included in the World IT Project questionnaire, such as level of seniority, country of origin, perceived importance of organizational issues and perceived importance of IT issues. The results of these comparisons are discussed in the next section.

Since segments were identified using factor scores, and the cluster analysis procedure is intended to group similar observations, the segments should differ on the ITOC dimensions. Factor analysis creates factor scores with an overall mean of zero and a standard deviation of one. Figure 1 shows the mean factor score, or in other words the average number of standard deviations from the overall mean, for each group.

Results

The analysis outlined above identified four distinctive cultural segments of IT workers, termed as fun-lovers, innovators, independents and institutionalists (see Figure 1). The fun-lovers segment is so-named because it had an average score on the enjoyment at the workplace factor that was significantly greater than those of the other segments. The innovators segment had a score for the innovation in technology factor that was significantly greater than those of other segments together with a significantly lower-than-average score for the structure in environment factor. The independents segment was characterized by its high score on the autonomy in decision-making factor together with a higher-than-average factor score for precision in communication. The independents segment

	Function		
	1	2	3
Discriminant function coefficients			
Autonomy in decision-making	0.108	0.308	0.640
Structure in environment	−0.006	0.770	−0.243
Precision in communication	0.320	0.177	0.785
Innovation in technology	0.221	−0.647	0.169
Reverence for technical knowledge	−0.385	0.512	0.033
Enjoyment at the workplace	0.980	0.142	−0.214
Correlations between factors and discriminant functions			
Autonomy in decision-making	0.054	0.208	0.508*
Structure in environment	−0.003	0.559*	−0.208
Precision in communication	0.173	0.131	0.683*
Innovation in technology	0.110	−0.440*	0.135
Reverence for technical knowledge	−0.186	0.338*	0.026
Enjoyment at the workplace	0.860*	0.170	−0.301
Eigenvalue	1.332	0.709	0.451
% of variance	53.5	28.5	18.1

Note(s): *Largest absolute correlation between each variable and any discriminant function

Table 4. Discriminant coefficients, correlations and eigenvalues

Table 5.
ANOVA *F* values for overall differences in mean factor scores between the final segments

	Autonomy in decision-making	Structure in environment	Precision in communication	Innovation in technology	Reverence for technical knowledge	Enjoyment at the workplace
Mean factor scores: fun-lovers (n = 114)	−0.160	0.270	−0.200	−0.140	−0.250	1.340
Mean factor scores: innovators (n = 98)	−0.360	−0.890	−0.120	0.740	−0.490	−0.220
Mean factor scores: independents (n = 126)	0.670	0.050	0.810	0.050	0.170	−0.080
Mean factor scores: institutionalists (n = 158)	−0.200	0.320	−0.430	−0.400	0.340	−0.770
F	30.784	42.675	51.456	32.557	19.682	263.475
Sig	0.000	0.000	0.000	0.000	0.000	0.000

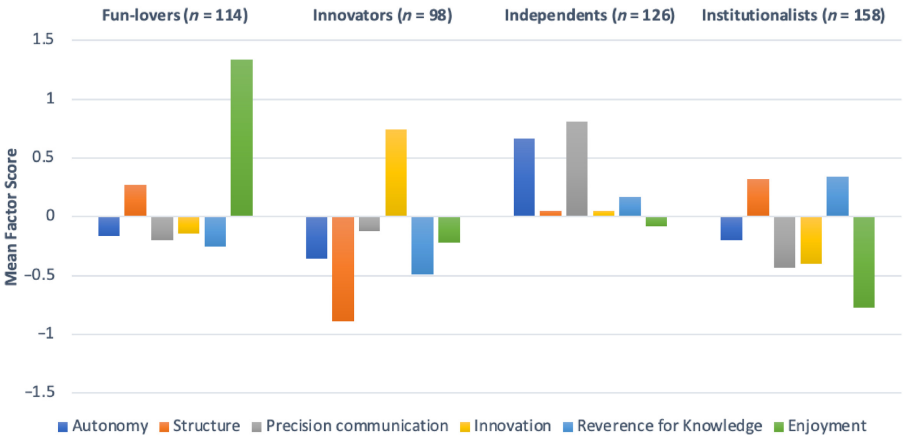


Figure 1.
Mean factor scores by segment

was characterized by its high score on the autonomy in decision-making factor together with a higher-than-average factor score for precision in communication. This segment is called independents because of the high value it placed on autonomy, a feature of work which is potentially facilitated by precision in communication (for example, it is easier to work independently on tasks when colleagues and clients communicate their expectations clearly). These values in tandem may emphasize a desire for tighter control – control over the environment and control over language. The final segment is called institutionalists because of the high value it placed on institutional structures (such as having clearly defined roles and responsibilities, enforcing rules and sticking to original project plans) and reverence for technical knowledge (i.e. being valued for their intelligence and increasing technical knowledge), as reflected in higher-then-average factor scores for these dimensions. This

combination of values suggests that they are likely to value strong institutions which are characterized by corresponding values that emphasize stability and tradition. Institutionalists also placed a lower value on enjoyment at the workplace, innovation and precision in communication than the other three segments.

Means for each factor score for each segment are shown in Figure 1. Independent sample *t*-tests were used to check for *segment-by-segment differences* in mean scores on each of the factors between each pair of segments. The factors that most strongly discriminate among segments are enjoyment at the workplace, innovation in technology and precision in communication, each of which differ significantly (at $p < 0.05$) for five of the six segment pairs. Among the different segment pairs, those that are most different from each other are the innovators versus the independents, the institutionalists versus the independents and the institutionalists versus the innovators. Each of those pairings differs significantly from one another (at $p < 0.05$) on five of the six factors. Those are shown in Table 6. As noted in Table 5, the *overall differences* in means across all segments on all factors were tested based on ANOVA and were all significant.

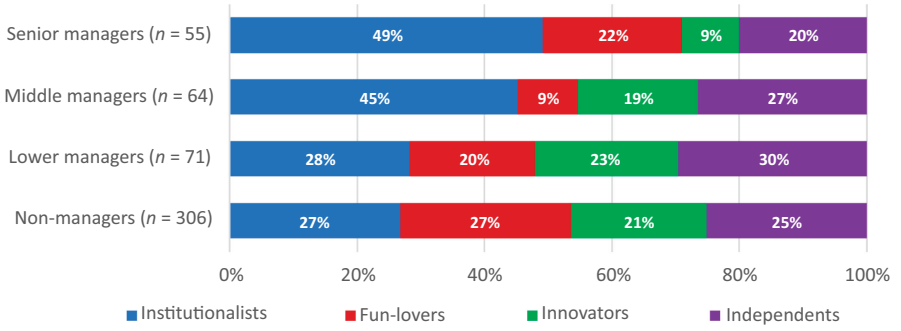
The rich dataset (a 160-item survey) allowed us to look for whether there were associations between the identified clusters and a range of other factors. There were no statistically significant differences in segment memberships based on gender, age, education, total years of work experience, or years of IT work experience (based on chi-square tests, $p < 0.01$). There were also no statistically significant differences in segment memberships based on perceived organizational culture (adhocracy, clan, hierarchy or market cultures); White *et al.* (2003), organization size, IT strategy and generic business strategy. Further, there were no statistically significant differences in segment membership among people who worked in the three major types of organizations from which there were enough respondents to compare (educational, government and financial). However, significant differences were identified relating to management level, IT role and country of origin. Segments also varied in their reported job satisfaction and career plans and the level of importance they placed on organizational and IT issues. These findings are reported below and revisited in the discussion section.

Figure 2 shows segment membership by the level of managerial responsibility. As noted in the figure, there are statistically significant differences (based on chi-square tests $p < 0.05$) between how non-managers are distributed across the segments, how non-managers are distributed compared to senior managers, and how lower managers are distributed compared to senior managers. Middle managers and senior managers were more represented in the institutionalists segment (i.e. a greater proportion of middle managers and senior managers were institutionalists than were non-managerial contributors or lower-level managers) whereas a greater proportion of lower-level managers and non-managerial contributors were innovators (the difference is statistically significant based on a chi-square test, $p < 0.01$). The proportion of people at each level who were independents varied less across levels than for the other segments, with between 20 and 30% of people at each level being independents. This suggests that membership in the independents segment may be personality-driven and therefore persistent even as people rise within organizations.

To explore whether there were associations between IT role and segment membership, survey participants' roles were collapsed into categories with 20 or more people before checking to see if segment membership differed by role. As shown in Figure 3: (1) those working in consulting, management/strategy, operations and testing roles were disproportionately likely to be institutionalists; (2) those who were programmers and those working in application support, and analysis and design roles were disproportionately likely to be fun-lovers; (3) application support people, project managers and testers were disproportionately likely to be innovators; and (4) systems administrators were

Table 6. Independent sample *t*-test results for differences in mean factor scores between each pair of segments

		Institutionalists v. fun-lovers	Institutionalists v. innovators	Institutionalists v. independents	Fun-lovers v. innovators	Fun-lovers v. independents	Innovators v. independents
Autonomy in decision-making	*t*	−0.388	1.450	−7.825	1.641	−6.595	−8.062
	Sig	0.698	0.148	0.000	0.102	0.000	0.000
Structure in environment	*t*	0.442	10.508	2.481	9.410	1.850	−8.507
	Sig	0.659	0.000	0.014	0.000	0.066	0.000
Precision in communication	*t*	−2.146	−2.883	−12.092	−0.610	−8.524	−8.091
	Sig	0.033	0.004	0.000	0.543	0.000	0.000
Innovation in technology	*t*	−2.230	−9.811	−4.393	−6.575	−1.648	5.777
	Sig	0.027	0.000	0.000	0.000	0.101	0.000
Reverence for technical knowledge	*t*	4.912	6.725	1.525	1.753	−3.539	−5.482
	Sig	0.000	0.000	0.128	0.081	0.000	0.000
Enjoyment at the workplace	*t*	−26.549	−6.680	−9.612	17.877	18.312	−1.773
	Sig	0.000	0.000	0.000	0.000	0.000	0.078



Tests for differences by level	Chi-square	Sig.
All levels	**23.961**	**0.004**
Non-managers v. lower managers	1.651	0.648
Non-managers v. middle managers	13.002	0.005
Non-managers v. senior managers	12.177	0.007
Lower managers v. middle managers	5.497	0.139
Lower managers v. senior managers	8.184	0.042
Lower managers v. middle managers	5.591	0.133

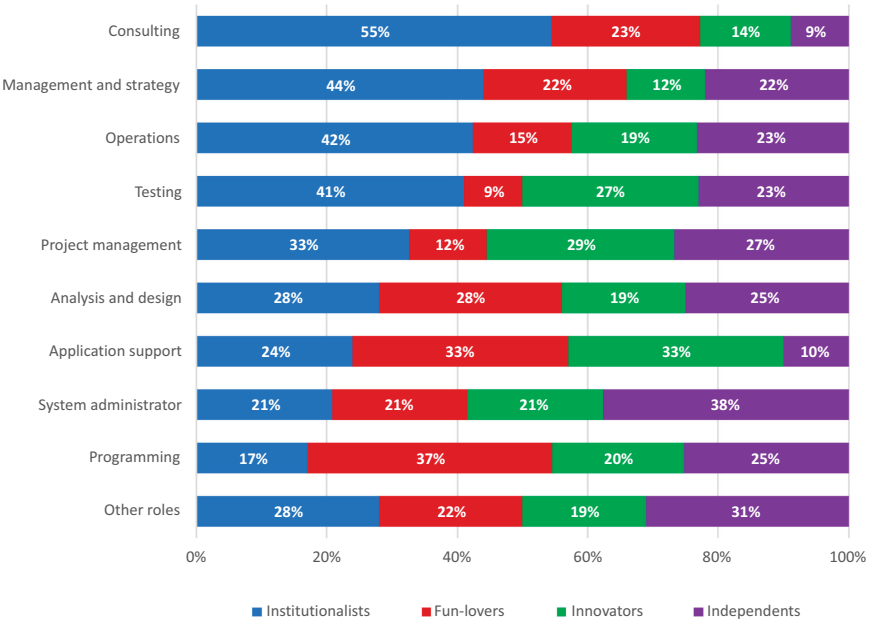
Figure 2.
Segment membership by level

disproportionately likely to be independents. These differences are statistically significant based on a chi-square test, $p < 0.05$.

Many of New Zealand IT workers are immigrants so it is not surprising that 45% of the survey respondents were born outside of New Zealand. (In comparison, 25% of New Zealand's overall population is overseas-born [3]). There was a sufficient number of individuals born in the UK (61), India (36), South Africa (18) and the Philippines (16) to compare these groups to one another and to those born in New Zealand [4]. As shown in Figure 4, there was variation in segment membership by country of origin, with fun-lovers being disproportionately from New Zealand and the UK; institutionalists being disproportionately from New Zealand, the UK and South Africa; and innovators being disproportionately from the Philippines and India (this difference is statistically significant based on a chi-square test, $p < 0.01$). The independents were more evenly distributed amongst the four countries; however there was a greater proportion of them in The Philippines and New Zealand than in the other countries.

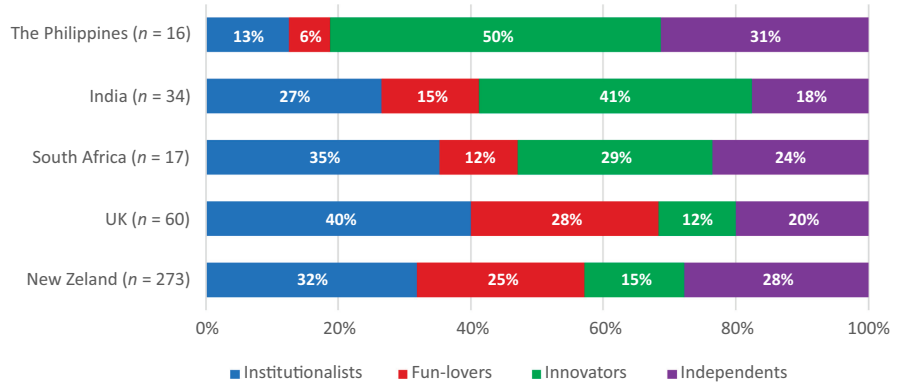
The analysis also found statistically significant associations between segment memberships and job satisfaction and career plans, as shown in Table 7. On average, job satisfaction was highest among institutionalists and lowest among innovators (based on agreement with the statement "In general, I like working here" and disagreement with the statement that "In general, I do not like my current job"). This difference is backed up by responses to the statement: "I will take steps during the next year to secure a job outside the IT field", which had the greatest average agreement from innovators. Innovators also agreed more strongly than members of other segments with the statement : "I am concerned that my job may be outsourced soon." (All differences are significant based on ANOVA F statistics, $p < 0.05$.)

Further, there were statistically significant differences among segments on items measuring sense of personal accomplishment, with independents agreeing less than members of other segments with the statements: "I feel I'm making an effective contribution



Tests for differences by role	Chi-square	Sig.		Chi-square	Sig.
All roles	**43.790**	**0.022**			
Consulting v. management and strategy	2.081	0.556	Operations v. programming	7.579	0.056
Consulting v. operations	2.337	0.505	Operations v. other roles	2.168	0.538
Consulting v. testing	4.000	0.261	Testing v. project management	0.502	0.918
Consulting v. project management	6.930	0.074	Testing v. analysis and design	6.006	0.261
Consulting v. analysis and design	5.680	0.128	Testing v. application support	5.263	0.154
Consulting v. application support	4.795	0.187	Testing v. system administrator	3.964	0.265
Consulting v. system administrator	8.521	0.036	Testing v. programming	8.616	0.035
Consulting v. programming	11.784	0.008	Testing v. other roles	3.470	0.325
Consulting v. other roles	7.398	0.060	Project management v. analysis and design	5.311	0.150
Management and strategy v. operations	1.299	0.729	Project management v. application support	6.548	0.088
Management and strategy v. testing	4.406	0.221	Project management v. system administrator	3.206	0.361
Management and strategy v. project management	8.467	0.037	Project management v. programming	10.928	0.012
Management and strategy v. analysis and design	4.152	0.245	Project management v. other roles	3.964	0.265
Management and strategy v. application support	8.764	0.033	Analysis and design v. application support	3.547	0.315
Management and strategy v. system administrator	6.239	0.101	Analysis and design v. system administrator	2.043	0.563
Management and strategy v. programming	12.082	0.007	Analysis and design v. programming	2.519	0.472
Management and strategy v. other roles	6.167	0.104	Analysis and design v. other roles	1.268	0.737
Operations v. testing	0.720	0.868	Application support v. system administrator	5.332	0.149
Operations v. project management	1.371	0.712	Application support v. programming	3.399	0.334
Operations v. analysis and design	2.412	0.491	Application support v. other roles	5.895	0.117
Operations v. application support	4.925	0.177	System administrator v. programming	2.864	0.413
Operations v. system administrator	3.278	0.351	Programming v. other roles	6.171	0.104

Figure 3.
Segment membership by role



Tests for differences by country of origin	Chi- square	Sig.
All Countries	**33.026**	**0.001**
New Zealand v. UK	2.681	0.443
New Zealand v. India	14.406	0.002
New Zealand v. The Philippines	15.071	0.002
New Zealand v. South Africa	3.450	0.327
UK v. India	11.376	0.010
UK v. The Philippines	15.512	0.001
UK v. South Africa	4.305	0.230
India v. The Philippines	2.721	0.437
India v. South Africa	0.992	0.803
The Philippines v. South Africa	3.109	0.375

Figure 4.
Segment membership by country of origin

to what this organization does", "In my opinion, I do a good job", and "At my work, I feel confident that I am effective at getting things done." In other words, the independents did not seem to feel that they had achieved their potential at their workplace.

Perhaps the most striking differences among segments were in terms of how their IT workers perceived the importance of different organizational and technology issues. The World IT Project survey asked them to rate the importance of eighteen organizational issues on a 5-point Likert scale, where 5 is very important. While the rank-ordering was fairly similar across segments, the mean ratings differed significantly (based on ANOVA F statistics, $p < 0.05$) for all eighteen issues because of varying levels of importance ascribed to the issues by members of the different segments. Notably, institutionalists and innovators ascribed more importance than the other segments to most of the issues (see Table 8).

A similar pattern held for how the segments perceived the importance of different technology issues (on a 5-point Likert scale, where 5 is very important), with institutionalists and innovators tending to rate most issues as more important, on average, than members of the other two segments. Once again, as shown in Table 8, there were statistically significant differences (based on ANOVA F statistics, $p < 0.05$) in mean importance ratings across segments for all sixteen technology issues. While innovators and institutionalists shared stronger levels of concern about both organizational and technology issues, their contrasting sets of ITOC values suggest that they might respond to these concerns in different and possibly conflicting ways. This is discussed later.

Job satisfaction	Institutionalists	Fun-lovers	Innovators	Independents	Anova *F*	Sig
In general, I like working here	1.68	1.91	1.93	1.85	3.355	0.019
In general, I do not like my current job	4.23	4.03	3.89	4.13	3.378	0.018
I will take steps during the next year to secure a job outside the IT field	4.1	4.32	3.92	4.02	3.973	0.008
Personal accomplishment	**Institutionalists**	**Fun-lovers**	**Innovators**	**Independents**	**Anova *F***	**Sig**
I feel I'm making an effective contribution to what this organization does	1.78	1.93	1.79	2.02	4.180	0.006
In my opinion, I do a good job	1.7	1.72	1.71	1.87	2.800	0.040
At my work, I feel confident that I am effective at getting things done	1.85	1.96	1.83	2.03	2.817	0.039
Scale						
1 = Strongly agree						
2 = Agree						
3 = Neither agree nor disagree						
4 = Disagree						
5 = Strongly disagree						

Table 7.
Job satisfaction and personal accomplishment by segment

Discussion

This study investigated whether occupational subcultures exist among New Zealand IT workers. It analyzed data from a survey that applied the ASPIRE scale. This scale measures a set of six occupational cultural value dimensions that have been found to characterize the IT profession in studies of US, Japan and other countries (Jacks *et al.*, 2018; Sato *et al.*, 2018; Palvia *et al.*, 2017). All six value dimensions were confirmed in factor analysis of the New Zealand data, further corroborating the international generalizability of the scale. The study broke new ground by applying an inductive clustering method to reveal four distinct value-based segments among New Zealand IT workers. These segments (fun-lovers, independents, innovators and institutionalists) differed in the relative emphasis ascribed to the six occupational values (ASPIRE). Each segment had distinctive combinations of these values and was distinguished by having one or two dominant ITOC values (see Table 9).

As noted earlier, the clustering method used in data analysis was inductive and employed an algorithmic method to reveal naturally occurring clusters of values. It is therefore useful to draw on prior theoretical literature to examine the nature of these clusters and explore possible reasons for their existence. This section does this, drawing on McClelland's (1961) achievement motivation theory and Kirton's (1976, 2003) adaption-innovation theory. This section also discusses possible interactions between professional values, individual motivation and work styles and IT roles that may help explain differentiation in ITOC. Further, possible interactions between segment membership and national culture are considered, based on associations identified in the analysis. The overall aim is not to argue that the particular segments identified in this study will be necessarily found in all other countries, but rather to demonstrate that differentiation in ITOC is an expected phenomenon

Organizational issues	Institutionalists	Fun-lovers	Innovators	Independents	Anova *F*	Sig
IT reliability and efficiency	3.5	3.5	3.5	3.2	7.193	0.000
Security and privacy	3.4	3.3	3.4	3.1	3.696	0.012
Alignment between IT and business	3.4	3.2	3.3	3.0	7.284	0.000
IT strategic planning	3.3	3.0	3.1	2.8	9.191	0.000
Attracting and retaining IT professionals	3.2	2.9	3.2	2.8	10.522	0.000
Continuity planning and disaster recovery	3.1	3.0	3.2	2.8	5.151	0.002
Knowledge management	3.1	2.9	3.1	2.8	6.015	0.000
Business agility and speed to market	3.0	2.5	2.7	2.7	8.172	0.000
Project management	2.9	2.7	3.0	2.7	5.779	0.001
Enterprise architecture	2.9	2.6	2.9	2.6	3.932	0.009
Business process reengineering	2.8	2.5	2.7	2.4	7.891	0.000
Business productivity and cost reduction	2.8	2.5	2.7	2.5	6.578	0.000
IT service management (e.g. ITIL)	2.7	2.2	2.8	2.4	11.605	0.000
IT cost reduction	2.6	2.2	2.5	2.2	9.406	0.000
Revenue-generating IT innovations	2.6	1.9	2.5	2.3	10.029	0.000
Globalization	2.0	1.3	2.0	1.8	15.184	0.000
BYOD (Bring Your Own Computing Device)	1.9	1.5	1.7	1.7	3.645	0.013
Outsourcing	1.6	1.1	1.7	1.3	8.127	0.000
Technology Issues	**Institutionalists**	**Fun-lovers**	**Innovators**	**Independents**	**Anova *F***	**Sig**
Networks/ telecommunications	3.0	2.5	3.0	2.5	8.578	0.000
Enterprise application integration	2.9	2.5	2.9	2.6	8.468	0.000
Collaborative and workflow tools	2.8	2.7	2.8	2.5	5.626	0.001
Mobile and wireless applications	3.1	2.4	2.7	2.5	17.663	0.000
Business intelligence/ analytics	2.9	2.3	2.7	2.6	10.421	0.000
Virtualization (desktop or server)	2.8	2.3	2.6	2.4	8.679	0.000
Software as a service	2.8	2.3	2.6	2.4	10.241	0.000
Business process management systems	2.7	2.2	2.7	2.3	10.964	0.000
Cloud computing	2.8	2.1	2.5	2.3	14.654	0.000
Customer relationship management (CRM) systems	2.6	2.0	2.4	2.3	8.934	0.000
Big Data systems	2.6	2.1	2.5	2.2	6.851	0.000
Service-oriented architecture (SOA)	2.6	2.1	2.5	2.1	9.282	0.000
Mobile Apps development	2.6	2.0	2.3	2.2	9.055	0.000

(*continued*)

Table 8. Average perceived issue importance by segment

Technology Issues	Institutionalists	Fun-lovers	Innovators	Independents	Anova *F*	Sig
Data mining	2.5	2.0	2.4	2.1	8.526	0.000
Enterprise resource planning (ERP) systems	2.4	1.8	2.3	2.1	8.281	0.000
Social networking/media	2.2	1.3	1.9	1.8	15.404	0.000

Scale

1 = Of no importance
2 = Of little importance
3 = Of moderate importance
4 = Very important
5 = Of most importance

Table 8.

Segment	Dominant Value(s)	A	S	P	I	R	E
Fun-lovers	Enjoyment at the workplace						*E*
Innovators	Innovation in technology				*I*		
Independents	Autonomy in decision-making Precision in communication	*A*		*P*			
Institutionalists	Structure in environment Reverence for technical knowledge		*S*			*R*	

Table 9.
Dominant ITOC value(s) of each segment

and so is likely to be found more widely as an expression of the above interactions. The section also considers implications of the findings for team managers and suggests potentially valuable avenues for further research.

Fun-lovers

Research into ITOC has found that IT workers characteristically value enjoyment at the workplace, such as having fun at work, laughing and joking with others, going out to lunch with co-workers and having variety in daily tasks. This study identified a specific segment of IT workers, fun-lovers that had a significantly higher-then-average score for enjoyment at the workplace than all other ITOC value-based segments. According to McClelland's (1961, 1988) achievement motivation theory, individuals are motivated by the need for achievement, affiliation and power, but each person is primarily motivated by one of these needs: achievement, affiliation, or power. These primary motivators are learned and developed by individuals through their life experiences, including work. Fun-lovers can be seen as having a high affiliation need relative to other segments. Those with high affiliation need enjoy being part of groups, place high value on maintaining friendly relationships with others and work well in roles that require high social interaction (McClelland, 1961, 1988).

This study found that IT employees who worked in roles involving programming, application support and analysis and design were disproportionately likely to be fun-lovers. It is likely that these roles provide opportunities for collaboration that support high affiliation need. The achievement motivation theory posits that experiences are causal factors in the development of motivators; i.e. motivating needs are learned through experience and become self-reinforcing. It follows that certain kinds of IT roles might predispose an IT worker to having more fun at work with others and thereby to attributing high value to these experiences. Working in software development has previously been associated with an emphasis on fun collegial activities (Hunter

et al., 2010; Kociatkiewicz and Kostera, 2003) and fun culture has been found to vary by IT role: a study of software professionals in India reported significant variation in the degree of fun culture experienced by employees based on designation, with higher fun culture reported by software engineers (Bee and Amirtharaj, 2017).

It is interesting that in terms of seniority, fun-lovers were not restricted to lower-level roles: while the majorities were non-managers or low-level managers, 22% of participating senior managers also were fun-lovers. However, only 9% of participating middle managers were fun-lovers. This is an interesting finding. It may be that New Zealand's low level of power distance (Hofstede Insights, 2018) acts as an equalizer that allows collegial fun to persist across tiers of responsibility. It is possible that middle management roles do not cater well for enjoyment values such as variety. It seems likely that the fun-lovers segment would be found in other countries, but perhaps may differ in terms of representation by managerial level. Thus, the career trajectories of fun-lovers would be a valuable area of future study.

Innovators

Prior research into ITOC has found that IT workers characteristically value both innovation in technology (including creativity, new solutions, finding better ways of doing things and playing with new technology) and structure in the work environment (such as clearly defined roles and responsibilities, adherence to standards and project plans and a clear division of labor between teams and between departments (Jacks *et al.*, 2018)). It is notable that the innovators segment identified in this study had both the highest average score for valuing innovation (innovators) and the lowest average score for valuing structure in the work environment.

Theory from the field of cognitive psychology suggests that this is not a surprising combination of values. Kirton's adaption-innovation theory (1976) explains the relationship between problem solving styles and cognitive styles. According to this theory, all individuals are capable of problem solving, but do so in different ways. There is a continuum between two different cognitive styles, adapters and innovators, with a tendency for people to more strongly exhibit one style or the other. Adapters prefer to solve problems by doing things better through existing means, while innovators prefer to solve problems by doing things differently. Notably, Kirton's innovators have a low regard for existing structures and means, tend to challenge rules, restructure problems, introduce new approaches, be less consistent in their approach and be less concerned with group consensus (Kirton, 1976; Stum, 2009). Indeed, to truly innovate, one should challenge the existing structures, rules, responsibilities and status quo. The innovators segment in this study can be seen as strongly fitting Kirton's innovator profile. Given the above theoretical support, it seems likely that the innovators segment of IT workers, those who place high value on innovation and low value on work structures, is not unique to New Zealand, but exists more generally. Further research is needed to bear this out. Similar to fun-lovers, innovators appear to highly value the experiential side of IT work, but their values are based around freedom in the innovation process.

This study also found that innovators placed a significantly higher level of importance on organizational and technological issues than any other segment other than institutionalists. It is possible that innovators attribute a higher value to these issues because such issues provide raw material for problem solving through innovation. It is a notable finding of this study that innovators reported the lowest job satisfaction and the highest intention to seek work outside the IT industry out of all four segments. It is possible that innovators are never satisfied with their current level of achievement and/or that they feel that their present place of employment does not help them fully realize their innovative potential so they cannot reach their professional goal. In the future, it will be critical to ascertain the reason for this.

Turnover intention of IT professionals is a significant area of research interest (Scholtz *et al.*, 2019), so these associations are worthy of future investigation. An area of possible exploration is the degree to which innovators have goal internalization (identification with organizational goals; Menon, 2001; Ertürk and Vurgun, 2015) because goal internalization has been found to correlate negatively with the turnover intention of IT professionals (Ertürk and Vurgun, 2015).

Independents

Research into ITOC has found that IT workers characteristically value autonomy in decision-making (i.e. having freedom to do their jobs, being empowered to make decisions, having flat organizational structures and less bureaucracy and having a high level of access to data) and precision in communication (such as communicating high levels of technical detail, using correct words and communicating specific expectations and timelines). This study identified a specific segment of IT workers, independents, that had significantly higher average scores for both of these dimensions than the other three segments. This may happen because precise communication of requirements facilitates independence in work by reducing the need to seek clarification from co-workers and thus allows individuals to complete IT tasks on their own. As such, to achieve autonomy, IT workers need to have a clear description of their duties which may be achieved through clear communication and having high levels of technical detail.

It is possible that independents have a high achievement need (McClelland, 1961, 1988). McClelland found that people, whose dominant motivator is achievement, value working independently, setting and attaining challenging goals and gaining regular feedback on their accomplishments (McClelland, 1961, 1988). It is notable that independents reported a significantly lower sense of accomplishment at work (Moore, 1997). This finding raises questions about whether managers and colleagues of IT workers with high independence provide sufficient feedback to those people. Independents were distributed somewhat evenly across all levels of managerial responsibility, from non-managers to senior managers. Twenty percent of participating senior managers were independents.

Institutionalists

Research into ITOC has found that IT workers characteristically value structure in the work environment (consistent hardware and software standards, sticking to the original plan, order and clear roles, deadlines and timelines) and reverence for technical knowledge (respect for critical thinking, technical problem-solving skills, learning new skills every day and being recognized for intelligence). This study identified a distinctive segment of IT workers, institutionalists that had higher than-average scores for both of these ITOC dimensions. Institutionalists also had the lowest average score of any segment for valuing enjoyment at the workplace.

Members of the institutionalists segment were disproportionally likely to be middle and senior managers (in management, strategy or operations) and consultants. Middle and senior management roles can be seen as providing suitable opportunities to those who value structure in the workplace and reverence for technical knowledge: leaders rely on work structures to achieve organizational goals while leadership roles provide opportunities for knowledge to be recognized. Institutionalists placed high levels of importance on issues relating to the organization and technology. These can be seen as problems to solve through structured means. Institutionalists therefore can be seen as fitting Kirton's (1976) adapters profile: adapters prefer to seek solutions through means that are tried and understood within existing frameworks (Kirton, 1976). They prefer existing frameworks and structures that are consensually agreed (Buffinton *et al.*, 2002; Stum, 2009). Unlike innovators, they prefer to

solve problems by existing structures and means and therefore value structures. Significantly, institutionalists had the lowest factor score for innovation of any of the segments.

It is notable that institutionalists were found to have the highest level of job satisfaction. Institutionalists may have high goal internalization (internalization of organizational goals; Menon, 2001; Ertürk and Vurgun, 2015), which correlates negatively with the turnover intentions of IT professionals (Ertürk and Vurgun, 2015). Further, institutionalists may be more likely to be motivated by power than other segments: McClelland (1961, 1988) found that individuals with high power motivation enjoy work and value discipline in work. Those with a high *institutional* power need (as distinct from a *personal* power need) enjoy organizing teams to achieve business goals and can be effective managers. These are areas that require further investigation.

Interactions between ITOC segments, individual values and IT roles

The discussion also provides a theoretical basis for suggesting that differentiated segments of IT values exist more widely beyond New Zealand, and that at least some of the segments identified in this study will be found in other countries. Further, the analysis suggests that the differentiated segments of ITOC found in this study may arise, to some extent, from an interplay between IT workers' personal motivations and cognitive styles and ITOC. Which ITOC values matter most (and least) to IT workers is correlated with their motivations (learned needs) and their cognitive styles. This in turn is correlated with their IT roles. McClelland's achievement motivation theory has provided a preliminary theoretical basis for interpreting the associations identified between segment membership and IT role. Achievement motivation theory views people's experiences and motivations as self-reinforcing. It follows that IT role-based experience shapes motivation needs and that individuals consequently value these needs and seek roles that support them. Kirton's adaptation-innovation theory has also been drawn on to help explain the stark differences between the values of ITOC segments and the combination of values exhibited by innovators and institutionalists.

The interactions noted above are consistent with the interactive or layered view of culture (Walsh and Kefi, 2008) in which values from different levels of an individual's cultural context interact (including occupational, national and innate values) to affect attitudes and behaviors. These interactions are undoubtedly complex and provide plenty of ground for further investigation.

Interactions between ITOC and national culture. This study's findings also suggest that there are interactions between ITOC and national culture. New Zealand has a highly multi-national workforce, and 45% of survey participants were born outside of New Zealand. As reported in the findings, this study identified a number of statistically significant associations between ITOC segment membership and country of birth. This suggests that there may be interactions between national culture and the professional values of IT workers. While the nature and reason for these interactions is likely complex and requires further research, Hofstede's theory of national cultural dimensions provides a suitable basis for examining these correlations and suggesting possible lines of inquiry. The discussion below is informed by comparative data from an online calculator that allows cross-country comparisons according to Hofstede's cultural dimensions (Hofstede Insights, 2018). The comparison focuses on the five countries of origin from which statistically significant associations with segment membership could be reported (New Zealand, UK, South Africa, India, the Philippines).

Fun-lovers were found to be disproportionately from New Zealand and the UK. These two countries have the highest scores for indulgence and the lowest scores for power distance out

of the five countries. High indulgence can be seen as conducive with placing a high value on enjoyment at the workplace, while low power distance can be seen as enabling this by removing hierarchical barriers to socializing and having fun with co-workers including both subordinates and supervisors. Enjoyment values are seen as serving individual interests (Schwatz and Bilsky, 1990); so it is also relevant that New Zealand and UK also have the highest scores for individualism.

Innovators were found to be disproportionately from the Philippines and India. This is of interest as prior work suggests that low uncertainty avoidance, low power distance, and high individualism may positively relate to innovation (Rank *et al.*, 2004). New Zealand's relatively high level of individualism may benefit IT workers from low uncertainty avoidance cultures which also have high power-distance and low individualism (such as the Philippines and India) by providing the low power-distance conditions that better enable innovation. If that is the case, then there may be more complex relationships between the national cultures of country of birth, country of work residence and IT occupational values segment membership. Further research is needed to explore whether there are indeed interactions between national culture and ITOC, and how such interactions operate.

Implications for research. This study extends research into ITOC by revealing that IT occupational culture in New Zealand is fragmented, comprising four segments whose members hold distinctive sets of values. The fact that these segments placed different levels of emphasis on the ASPIRE values associated with ITOC is significant, as prior work has viewed ITOC as a unifying phenomenon. Studies have therefore been focused on the potential for tensions in occupational culture to occur between IT workers and non-IT workers, notably those who are managers (Jacks *et al.*, 2018; Rao and Ramachandran, 2011). While prior research has addressed differences between occupational groups, the current research advances the body of knowledge to examine differences within an occupational group. This study indicates that there is also potential for tensions to exist between workers who belong to different ITOC segments, for example, between innovators and institutionalists. This observation has implications for both researchers and managers.

In the earlier discussion, it was proposed that ITOC segments are likely to be found beyond New Zealand due to the likelihood of interactions between ITOC, individual values and IT role. Further, it is suggested that there may be interactions between national cultural values (based on country of birth) and occupational cultural values of IT professionals. As Schein (2015a) has noted, every culture and subculture is nested in larger cultures that influence them .

It seems significant that both fun-lovers and independents appear to place high value on their individual experience of working in IT (having fun and working independently, respectively) while the other two segments, institutionalists and innovators, place higher levels of importance on issues relating to the organization and technology. This raises complex and potentially valuable questions regarding interactions. It suggests that there is value in research exploring the antagonistic and/or symbiotic interactions of those in different segments and the optimal "recipes" for combining them in particular situations. For example, it seems possible that institutionalists, with their concern for power structures and precision in communication, may be well adapted to secure early stage funding for innovation projects and to understanding the value of rolling out and embedding innovations to secure organizational benefits. In turn, this would enable innovators to do what they value most. Thus, explorations at the intersection of IT occupational subcultures, team diversity and team performance would likely lead to valuable insights.

This study also raises interesting issues concerning the possible interaction of national and occupational culture and highlights the distinct potential for clashes to occur at this intersection. New Zealand IT workers who were born in India and the Philippines were disproportionately likely to be in the innovator segment, potentially setting up a cultural

clash (in terms of values or occupational ideology) with New Zealand and UK born colleagues who are disproportionately likely to be in the institutionalist and fun-lover segments. The interaction of the different cultural dimensions (national and occupational culture) is likely to be complex and warrants more investigation, as noted later.

If the segments identified are persistent across countries, it would be useful to investigate whether there are links between segment proportions and IT performance. For example, it is possible that organizations that have a dominant subculture in their ITOC (i.e. where most IT employees are in a single segment) perform best because they do not have to spend time working through internal cultural clashes. In contrast, it is feasible that having more diversity within an organization's ITOC may produce better outcomes because of a greater variety of perspectives being incorporated into solutions. Any relationship between an organization's ITOC diversity and performance may also be moderated by the environment. For example, perhaps having a dominant ITOC subculture works well in stable environments, but more IT cultural diversity works better in highly turbulent contexts.

It would also be valuable to empirically investigate the interaction of national culture and ITOC, together with factors such as managerial role identity. It is notable that New Zealand and UK score significantly higher (75 and 69, respectively) on Hofstede's indulgence factor (i.e. valuing of enjoyment) than India and the Philippines (26 and 42, respectively) according to results generated by the comparative online tool (Hofstede Insights, 2018). This suggests that national cultural origin may create a predisposition toward being a fun-lover (or not). However, it also raises a question as to why institutionalists (who were also disproportionally from New Zealand and UK) scored low on the enjoyment factor, despite these countries having such a relatively high average score for indulgence. Perhaps managerial role identity has greater salience for this group, mitigating against the valuing of enjoyment.

Prior work has proposed that an individual's culture is the result of a complex layering of cultural influences. For example, Straub *et al.* (2002) propose a virtual onion model in which different layers of culture may move in or out from the core to influence an individual's behavior according to circumstances. Similarly, the spinning top model (Jacks *et al.*, 2018), adapted from Walsh and Kefi (2008), proposes multiple layers of cultural influence, including National, Religious, Occupational, Ethnic group, Organizational and Individual Technological. Additional studies, using a range of methods, would be needed to uncover the nature of cultural interactions that contribute to IT occupational subcultures. The relationship between occupational culture and national culture seems to be a complex one, and diverse cultural factors may interact to produce cultural groupings that cannot be explained by the generic construct of ITOC.

Implications for managers. Managers need to be aware that not all IT workers are alike, and that there may be distinctive, non-aligned segments of ITOC within an organization. This means that managers need to be aware of what IT occupational values are important to different members of their teams. With that information, they can be mindful about how to support their subordinates, allocate assignments and identify where ITOC differences may lead to team conflict. This supports Heinzl and Leidner's (2012) argument that cultural intelligence is a key managerial capability for avoiding problems and achieving a suitable fit among individuals, tasks and information technology. There are at least four important propositions for management practice based on the evidence offered in this study.

(1) Different IT occupational values require different managerial approaches.

The discovery of diversity in ITOC strongly suggests that management approaches should be attuned to the differing values and needs of different segments. For example, when supervising fun-lovers, managers should foster and support opportunities for enjoyment at the workplace, while ensuring that others do not feel excluded (such as innovators who in this

study were disproportionally likely to have been born outside of New Zealand or UK). In managing innovators, managers should be aware that innovators may find an overly structured work environment constraining and look for opportunities to allow them to innovate.

Particular effort may be needed to foster job satisfaction and retention of innovators. Innovators place a strong emphasis on the importance of organizational and IT issues (similar to institutionalists who are disproportionally likely to be middle or senior managers), yet their values suggest that they may seek to solve issues in less structured, more innovative ways than institutionalists. As innovators were found to be more likely dissatisfied and consider leaving IT than workers in the other segments, succession planning should foster diversity in orientation toward how to solve problems. Management of institutionalists, who place a high value on structure in environment and technical knowledge, should support structure and development of knowledge, while encouraging the valuing of differing approaches and perspectives, notably the valuing of innovation. Management of independents should take into account their higher need for a sense of autonomy while leveraging their interest in precision of communication.

(2) Design of group work should bear in mind that ITOC is not uniform.

This study's findings also suggest that group design and task allocation should take into consideration the differing values of individuals, aiming to create synergies and minimize potential for conflict. Just as there may be cultural clashes between IT and other parts of organizations, there may be cultural clashes within the IT group itself and/or among IT workers distributed across organizational divisions.

For example, clashes between institutionalists and innovators could occur given their different perspectives on the importance of structure, innovation and knowledge. Disagreements also seem likely between independents and those in other segments. Independents strongly value autonomy and appear to use precise communication as a means to that end. However, on average, members of the other segments do not perceive either autonomy or precision in communication as being particularly important. Pairing a fun-lover with an independent on a task may create frustration since the fun-lover is more likely to place value on the experience of working together, whereas the independent, who appreciates autonomy, is more likely to want to divide up responsibilities and complete tasks separately.

Of course, there is probably value in having diversity of ITOC within a team. For example, the independents' desire for autonomy and precision communication may make them ideally suited for doing documentation, a task that fun-lovers may not appreciate. In contrast, fun-lovers might enjoy liaising with clients, vendors and other teams, which independents may prefer to avoid.

(3) Innovation management should take account of the values and needs of innovators.

The fact that institutionalists are over-represented in middle and senior management may impact on innovation. Institutionalists (who place a high value on knowledge and structure) may be more likely to offer explanations based on established practice, but such explanations may be less compelling to those in other segments, who are also disproportionately in subordinate positions. (This may be a factor in the dissatisfaction identified among innovators.) To sustain innovation, managers should work to reduce turnover of innovators and also recognize that innovators may share common concerns with institutionalists about organizational and IT issues, while having different ideas about how to perceive and address such issues.

(4) Managers' values may not match those of others in IT work.

Awareness of IT occupational subcultures may also help managers avoid a form of subconscious bias; the tendency by people to favor those who share their values (typically thought of in relationship to ethnicity and gender). In this case, it seems possible that managers would perceive someone who shares their occupational values to be focusing on what really matters and to be desirable to work with and to hire or promote them for those reasons. While this is a natural inclination and may reduce the potential for conflict, it may not lead to the best results for the organization. For example, a fun-loving manager may view an innovator interviewee as over-eager or too intense, but the hiring organization might benefit from those qualities. Managers who are institutionalists may need to think particularly carefully about how to welcome innovators into their organizations. Until research establishes performance differences among occupational subcultures, there is potential for biased decisions.

Limitations

Despite its contribution, this study had several limitations. First, the sample size for this study was nearly 500, greater than that in many survey-based studies. However, no explicit attempts were made to randomize the sample to achieve representativeness, but efforts were made to find respondents from organizations across different industries and regions. Owing to CIOs distributing the surveys to their staff (in order to optimize uptake), the response rate is unknown. Second, data for this research was gathered from New Zealand organizations that had at least ten IT employees. While the data showed distinct IT occupational segments within such organizations, it is possible that these segments do not generalize or are present in different proportions in smaller organizations. Third, the nature of the data collection process favored organizations in which IT workers are concentrated in IT departments as opposed to distributed throughout the organization. Including more distributed IT workers may result in the identification of additional subculture segments. Fourth, the research focused exclusively on IT workers, so it does not show whether or how IT occupational subcultures are similar to or different from subcultures within non-IT occupations. Fifth, because this study relied on self-reported measures, it is possible that social desirability bias (Crowne and Marlowe, 1960; Kwak *et al.*, 2019) affected the findings. Thus, future researchers may employ implicit measures (e.g. see Serenko and Turel, 2019, 2020, 2021). Sixth, owing to the fact that this study was conducted in one country, a larger cross-country project using segmentation would be valuable. The four segments found in New Zealand may be present in other countries as well, but in different proportions. It is also possible that additional ITOC segments will be identified in countries that have a national culture that is quite different from that of New Zealand and/or that have less cultural diversity among their IT worker population. Last, this study used anonymous data from individuals working for different organizations, so it is not possible to comment on the possible interaction of occupational and organizational culture. The survey did not capture information about the length of residency in New Zealand, and it can be argued that with increasing time of residency in another country, the effect of the country of birth is diluted in favor of the country of residency. Thus, assumptions about the national cultural dimensions based on respondents' country of birth need to be made with utmost care.

Conclusion

The prevailing notion in the business world is that IT workers are united by a shared occupational culture and exhibit similar characteristics. While the notion seems to have face validity and is intuitive, it may be overly simplistic and may hide many nuances within the overall IT occupational culture. This study set out to explore whether there is variation in occupational culture among IT workers in New Zealand, using a segmentation methodology

that is rarely used in IS research. The analysis revealed four distinct IT occupational segments among New Zealand IT workers: fun-lovers, innovators, independents and institutionalists. Members of these segments place different emphases on different values as their labels imply. Moreover, significant differences exist among the segments related to management level, IT role and country of origin. Segments also vary in their reported job satisfaction and career plans and the level of importance they place on organizational and IT issues. Management needs to be cognizant of the fact that IT occupational culture is not homogeneous and different IT occupational segments require different management approaches, and that their own values may not match those of others in IT work. Future research should build on these findings to determine whether these segments generalize to other countries and to organizations with different characteristics. Future work should also examine relationships between the distribution of ITOC segments in an organization and intra-organizational conflict and performance of IT teams. Findings from such research would enable those managing IT teams to maximize the potential benefits of IT occupational cultural differences.

Notes

1. As is often the case, we use the terms IS and IT interchangeably.
2. ANOVA was used to compare means across segments for numeric variables such as perceived issue importance, and chi-square was used to make comparisons across segments for categorical variables, such as role and country.
3. Based on the 2013 census http://archive.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-culture-identity/birthplace.aspx
4. There were respondents born in a further 40 countries, but no other countries had a sufficient number to make comparisons.

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Further reading

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Appendix
The ASPIRE scale

Instructions: please indicate your level of agreement with the following statements. Your responses should be based on your own beliefs and values.

Construct	Item	Item description
Autonomy in decision-making	AUT1	Having less bureaucracy for getting approval to take action is...
	AUT2	Having a high level of freedom in order to do my job well is...
	AUT3	Having a "flatter" organizational structure (i.e. fewer layers of management) is...
	AUT4	Empowerment for employees to make decisions independently of management is...
	AUT5*	Having a high level of access to raw data is...
Structure in environment	STR1	Having everyone consistently adhere to hardware and software standards is...
	STR2	Sticking to the original project plan (instead of making last minute change requests) is...
	STR3	Clearly defined job roles and responsibilities are...
	STR4	Enforcing rules is...
	STR5	Orderliness is...
	STR6	Ensuring that timelines and deadlines are reasonable, not rushed, is...
Precision in communication	PRE1*	A high level of technical detail when communicating with others in the organization is...
	PRE2	Using exactly the right words when speaking is...
	PRE3	Precision in communication is...
	PRE4	Communicating specific expectations, instead of general expectations, is...
	PRE5	Communication of precise project timelines is...
Innovation in technology	INN1	Playing with the latest and even unproven technology is...
	INN2	Embracing new technology is...
	INN3	Building clever new solutions is...
	INN4	Showing creativity is...
	INN5	Figuring out a better way to do things is...
Reverence for technical knowledge	REV1	Technical problem solving skills are...
	REV2	Critical thinking skills are...
	REV3	Earning respect based on intelligence is...
	REV4	Being known for my intelligence is...
	REV5*	Learning new skills every day is...
	REV6*	Being motivated to learn new skills on your own is...
Enjoyment at the workplace	ENJ1	Having fun at work is...
	ENJ2	Laughing and joking with others at work is...
	ENJ3	Having a sense of humor is...
	ENJ4	Going out to lunch with my co-workers is...
	ENJ5	Variety in my daily tasks is...

Note(s): *indicates an item that was removed due to low loadings or high cross loadings

Table A1. Items in original ASPIRE scale (5 point Likert-type scale)