PILOT PROGRAM: A REPLICATION STUDY OF PROCEDURAL JUSTICE AND DISTRIBUTIVE JUSTICE EXOGENOUS VARIABLES AFTER 36 YEARS

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ABSTRACT

A replication study was conducted in 2023, based on an original study published in 1987. The main focus of the replication effort was to see if current data and statistical processes, supported by modern computer programming, to include R and R Studio, would effectively replicate the Table 1 of an original study, focused on exogenous variables related to the concepts of procedural justice and distributive justice. Methods included applications of data science, visualization, parallel analysis (PA), primary component analysis (PCA), exploratory factor analysis (EFA), and testing for Cronbach's Alpha. This pilot program was successful, yet there were some lessons learned toward informing best practices, that will build toward a complete replication study in future years.

KEYWORDS: Procedural Justice, Distributive Justice, Labor Relations, Employee Relations, Human Resources Management.

INTRODUCTION

A major disruption in the US workforce, associated with the COVID-19 pandemic, was the "Great Resignation" phenomenon, which has received significant attention. This phenomenon, whose moniker was coined by Anthony Klotz, involves record rates of job quitting during the pandemic (Klotz, et, al, 2020). As noted by Klotz , return-to-office mandates, attractive job offers from competing employers, and revelations about better work–life balance have motivated a "record-breaking departure from jobs in a shockingly small window of time. According to a global survey of 4,000 companies and more than 9 million employee records, a recent study found that resignations increased the fastest among millennial employees (i.e., those between 30 and 45 years

of age). These resignations have also been attributed to people making changes to their work–life balance (Miller, A., Jhamb, S., 2022). There could also be critical factors that also create reasons for employees to leave in the form of a lack of HRM Systems that provide employee protections or having a "voice" in what they accomplish or how they perform their work, how employees are evaluated and rewarded for that work, what protections they might have from unjustified discipline up to and including terminations of their jobs (Miller, A., Jhamb, S., 2022).

A study on the future of work explored the potential effect of the COVID-19 pandemic on "American 'workism,'" observing that, compared with men, women are leaving the workforce more rapidly and in larger numbers for a variety of reasons, including gaining access to childcare and providing care for family. However, research conducted prior to the pandemic shows that hires, job openings, and quits all reached new highs in 2018. This finding certainly challenges that the Great Resignation could be attributed for this entire turnover up to and during the pandemic. This phenomenon of historical employee turnover demands empirical investigation that would determine the major causes of this attrition. One could surmise there were other forces working to cause employees to leave their jobs in record numbers (Miller, A., Jhamb, S., 2022).

The construct of fairness in the employee work environment has been a constant thread in the research as it relates to why people resigned their employment and sought better working conditions as noted in the literature (Klotz, et, al, 2020). Coupled with the Great Resignation some of the most dramatic recent union wins have occurred such as the first Starbucks stores where unionization votes succeeded in 2021, and where the warehouse employees who created the Independent Amazon Labor Union famously won an election in April 2022. Research into the analysis of the reasons provided for the need for such unionization determined the lack of fairness and the need for a "voice" in the work environment and the working conditions including wages, benefits, and work hours, among similar factors (Milkman and van der Naald, 2022).

The Great Resignation along with increased unionization actions indicate there are reasons for both that have almost identical desired outcomes for employees and that is the protection of procedural and distributive justice in the workplace (Klotz, et, al, 2020).

Given that U.S. employees see the need for employee protections as stated here and the lack of those protections presently creates the need for research into what is being provided by their employers in the form of employee fairness systems. What this research will examine is do Procedural and Distributive Justice Systems in US organizations exist or in their absence determine if they could be a major reason to provide employee protections that might deter unionization as well as reduce the causes for the Great Resignation that continues in the U.S. in the form of employee actions such as turnover, employee performance, and perceived fairness within their organizations. This is a brief summary of the problem that we are studying and why this is an important topic to be studied and conduct research on. The purpose is to determine what, if anything is being done to provide employees with protections that unions historically have provided. The approach to this study, to create a baseline toward further extensive work with a future full replication study in this area, is this pilot program replication study, to determine if we could replicate results, in the form of a comparison today, of an original Table 1, focused on

exogenous variables from a study on procedural justice and distributive justice, published in 1987 (Alexander and Ruderman, 1987), or 36 years prior to this study.

LITERATURE REVIEW

One of the earliest research studies on employee protectionism was conducted by Barnard (1938) who identified employee fairness as one of the fundamental bases of cooperative action in organizations in his research. Most of the original research on fairness, whether conducted in controlled laboratory or in actual industrial settings, has provided some disproportionate emphasis to questions on distributive justice which created, underestimated, and ignored the role of procedural justice in social behavior in private organizations in the U.S. (Alexander and Ruderman, 1987).

Work environment fairness is a concern of most employees in their personal lives (Miller, 2001), as well as during their careers at work. Organizational Justice (also known as Organizational Fairness) is composed of three types of justice, which include, Procedural Justice, Distributive Justice and Interactional Justice (Cohen-Charash and Spector, 2001). This study is focused on Procedural and Distributive Justice, which focuses on the perceptions an employee has concerning the policies and procedures administered by an organization that impact them (Konovsky, 2000; He et al., 2014). Research has shown that Procedural Justice is a factor that motivates employee cooperative behavior and enhances job-related performance (Aryee et al., 2004; Cohen-Charash and Spector, 2001; He et al., 2014). Distributive Justice, however, refers to the fairness of outcomes employees receive (Adams, 1965; Cropanzano et al., 2002) and this is critical to how employees react if there are no protective systems in place.

What is Procedural and Distributive Justice?

Two dimensions of workplace justice are distributive and procedural. Distributive justice describes the distribution of resources and the criteria used to determine outcomes of resource allocation decisions. In contrast, procedural justice is concerned with the extent to which perceptions about the fairness of outcomes in organizations are based on the processes and procedures used to determine these outcomes (Folger & Greenberg, 1985).

The study of Distributive Justice Focuses on the fairness of rewards (or punishments) issued to an employee by their employer. The study of Procedural Justice focuses on the fairness of the rules and procedures by which the rewards are distributed. In work environments this could be described as the allocation of tasks as part of the overall job itself, as well as the rewards or punishments that come with the successful completion and attainment of meeting the job goals which must be considered in examining Procedural and Distributive Justice of Fairness. The distinction made between Procedural and Distributive Justice can be defined as those processes (means) and outcomes (ends). In order for one to understand the role of Perceived Fairness or judgments of justice in human interaction, there must be an examination process of means as well as outcomes. This would be required of these perceptions in the study of organizations of all sizes (Alexander and Ruderman, 1987).

Procedural Justice is directly associated with the concept of workplace fairness. This relationship is particularly relevant to the perceived fairness and transparency of the procedures used in decision-making (Karkoulian et al., 2016). Studies have shown a direct relationship between fairness and favorable employee outcomes, such as innovative work behaviors (Khaola and Coldwell, 2019), job satisfaction (Quratulain et al., 2019; Choi, 2011; Rubin, 2009), intrinsic motivation (Oh and Lewis, 2009) and organizational commitment (Cohen-Charash and Spector, 2001; Rubin, 2009; Quratulain et al., 2019). Therefore, an absence of Procedural Justice or fairness could lead to unethical or harmful behaviors, such as employee retaliation (Skarlicki et al., 2008), employee revenge (Jones, 2009) and counterproductive work behaviors (Afghan et al., 2018). Gharbi, et al, (2022) found that Procedural Justice is necessary for any organization and when it is lacking it is one of the major causes for turnover.

Studies have shown that leaders with characteristics that reflect or enhance other-serving motives such as agreeableness, conscientiousness (Mayer, Nishii, Schneider, & Goldstein, 2007), moral identity (Brebels et al., 2011), status (Blader & Chen, 2012), and empathy (Cornelis, van Hiel, De Cremer, & Mayer, 2013) are relatively likely to serve the needs of their followers by enacting procedural justice. Other studies suggest that leaders enact procedural justice if they perceive their followers to have needs for control and belongingness (Cornelis, van Hiel, & De Cremer, 2012; Cornelis et al., 2013; Hoogervorst, De Cremer, & van Dijke, 2013). Finally, research shows that leaders enact procedural justice to facilitate organizational effectiveness because it stimulates employee compliance (Scott, Garza, Conlon, & Kim, 2014; Zhao, Chen, &Brockner, 2015).

In public sector and civil service positions, management since the seventies have sought to provide new flexibilities for their managers, particularly in relation to performance management of employees. General Statues passed by many U.S. states have been consistent with this trend. County and state employees report these managerial flexibilities are designed in decreasing perceptions of fairness. At the federal level, personnel reforms in the U.S. Department of Defense have also sought to increase managerial discretion. The leadership of the Department of Defense identified employee perceptions of fairness as key to the successful implementation of the evaluation and performance systems. The U.S. Office of Personnel Management surveys covering a 10-year period were analyzed with results indicating that managers' and employees' perceptions of procedural justice were different over that time period and these perceptions changed in different ways in response to the reforms (Rubin and Weinberg, 2016).

Research also indicates that a high measure of Procedural Justice provides two vital indicators about group memberships. That individual members are valued and respected and feel pride in the group as a whole (Lind and Tyler, 1988). Therefore, when employees feel they are treated fairly as a group, those individuals are more willing to accept any decisions and outcomes that affect the group and procedures they must follow. They will comply with group rules and laws, they will identify more closely their status as an employee and group member and help the group and other group members perform at high levels (Restubog et al., 2008; Tyler et al., 1996; He et al., 2014)

As early as 2005, inequality was reaching its peak before the Great Recession, and that highly unequal balance between worker and employer continues to grow at an even faster pace today. So,

the question of what would create support from the public and from workers in times of sharp inequality is timely and worth considering (Fiorito and Padavic, 2022). Consistent with other Procedural Justice theoretical studies, researchers have suggested that greater autonomy leads to greater commitment and improved performance (Mumford & Henshall, 1979; Mumford et al., 1983; Ives & Olson, 1984; Hunton, 1996 a,b; Hunton& Beeler, 1997; Hunton& Price, 1997; Moore, 2000; Ahuja & Thatcher, 2005).

Hunton& Price's (1997) experiments supported procedural justice theory to autonomy and employee commitment. Mirchandani and Lederer's (2014) research also supported a direct correlation between Procedural Justice and autonomy as a direct mediator to employee commitment and loyalty which directly leads to reduced employee turnover for organizations.

How does Distributive and Procedural Justice Systems Exist in Unionized Organizations?

In a union work environment, workplace justice is established through the contractual grievance and arbitration procedures. The importance of the grievance system in union member relations was highlighted by Gordon and Fryxell (1993). They claimed that a union's relationship with its members is tied much more closely to procedural and distributive justice systems afforded by its representation in the grievance system than by any other type of benefit provided in the collective bargaining agreement (p. 251). The outcomes of workplace justice therefore supported and protected by a contractual grievance and arbitration system have been examined based on union employees and their attitudes toward employee protections (Gordon and Fryxell, 1993). Procedural justice has been shown to be more strongly related to union attitudes by employees than distributive justice (Clark, Gallagher, & Pavlak, 1990; Eaton, Gordon, & Keefe, 1992; Fryxell & Gordon, 1989) Why has private sector union participation fallen away so much in the United States since the late 1950's? Schaller (2022) examined National Labor Relations Board (NLRB) representation elections and his research provides evidence that import penetration accounts for approximately 40 percent of the decline in union formation for U.S. manufacturing. This estimate translates to 4.6 percent of the decline in private sector union density. This is driven by trade with low-income countries and, to some extent, other high-income countries. China, with their strong import growth since 2000, accounts for about 12 percentage points of the total decline.

So, the decline in unionization has not come from a lack of desire for employees to receive fairness and justice from employers. This is evident with the unionization of retail giants such as Starbucks and Amazon. The National Labor Relations Board reported a 57% increase in union election petitions filed during the first six months of fiscal year 2021 (Gallup, 2022).

Those union campaigns indicated the reasons for the need for unions and why they were important to employees were better pay and benefits (65%) and employee rights and representation (57%). More than a third of union members cite job security (42%) and better pension and retirement benefits (34%) as reasons for joining a labor union. Meanwhile, about one in four list improving the work environment (25%) and fairness and equality at work (23%) (Gallup, 2022).

A recent study by Gallup (August 30, 2022), shows seventy-one percent of Americans now approve of labor unions. Although statistically similar to last year's 68%, it is up from 64% before the

pandemic and is the highest Gallup has recorded on this measure since 1965. The National Labor Relations Board reported a 57% increase in union election petitions filed during the first six months of fiscal year 2021.

Figure 1

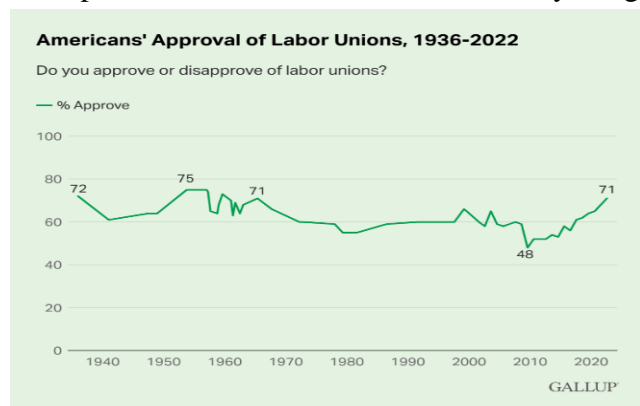Gallup Annual Work and Education Survey, August 1-23, 2022

As stated in the literature, unionization attempts are on the rise greater than at any time in the past sixty years due to the lack of Procedural and Distributive Justice Systems provided by organizations.

One of the areas of this research ties the nonexistence of Procedural and Distributive Justice Systems to potentially why there has been a marked increase in successful union organizing drives that recently occurred at both Starbucks and Amazon, as well as in other organizations. Why is there a need for unions there? What caused employees to join unions especially at Starbucks since they have always touted having a "family" work environment?

Current research on Procedural and Distributive Justice Systems in U.S. organizations is sparse. Therefore, a complete picture of Procedural and Distributive Justice Systems or their equivalent in employee fairness requires studying how the enactment of procedural justice can serve the self-interests of organizations in lieu of unionization attempts. Leaders of modern organizations would find this of business interest, toward sustaining their workforce in a positive manner. To address this research gap, we will further the research conducted by Alexander and Ruderman (1987), with our pilot program replication study.

This research contributes to the existing literature in the following ways: it will provide an examination of how Procedural and Distributive Justice Systems can neutralize employee's desires to unionize; it will provide evidence of how Procedural and Distributive Justice Systems can reduce employee turnover and improve employee performance; it can provide HRM with processes to address employee complaints, and it may help resolve issues over employee discipline and terminations.

The following conceptual model of the research, based on the literature review, is provided.

Figure 2
Initial Conceptual Model of this Research Study
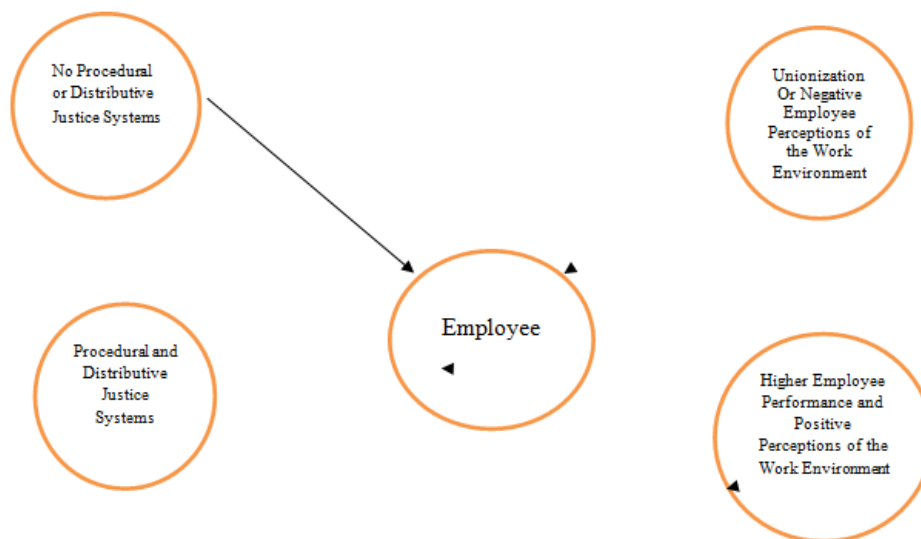
Methodology
Procedure
A questionnaire was administered, in 2023, to collect baseline data for this pilot program replication study assessing employee perceptions of personnel and work environment procedures. Respondents were informed about the survey and the purposes of the study prior to the survey administration. Questionnaires were administered to respondents both in person as well as by internet using email from the researchers. Survey respondents were assured that their responses would be kept confidential. Participation in the survey was voluntary.

Survey Instrument
They survey is taken from the work done by Alexander and Ruderman (1987) as well as from the original study conducted by Michigan Organizational Assessment Questionnaire (MOAQ) developed by Cammann et al., (1983).

The validity and reliability of this survey questionnaire has been confirmed in multiple studies. Included in the survey questionnaire were questions about both specific processes and general attitudes about work. The items on the survey were measured on 7-point scales with Likert-type response options. Sixteen questions of the items in the overall questionnaire were analyzed in this investigation.

There were questions about certain features of the how employees perceived fairness in treatment (procedural justice) in this study and their general attitudes about their treatment at work. Only a small portion of the items included in the original questionnaire were analyzed in this investigation.

One type of scale was used, measures of procedural and distributive fairness. This was the main area of replication for the study, and a comparison of the 1987 results will be provided with our 2023 results, within Table 1 in this report.

Fairness Measures (predictor or independent variables) used questions about the distributive and procedural aspects of various work activities and policies constituted the measures of fairness. These are the x-variables, or exogenous variables, at the core of this study.

Some items were taken from the Michigan Organizational Assessment Questionnaire (MOAQ, Cammann et al., 1983). Other items came specifically from the study conducted by Alexander and Ruderman (1987).

Demographics

The real-world sample for this 2023 study included n = 119 participants. The following characteristics and demographic groupings are in alphabetical order. By age, our groups included 2 participants within the 18-25 age group, 19 between 26-30 age group, 8 between 31-35 age group, 10 between 36-40 age group, 11 between 41-45 age group, 17 between 46-55 age group, 12 between 51-60 age group, 19 between 56-60 age group, 12 between 61-65 age group, and 9 between 66-99 age group. By ethnicity, our participants included self-identification within the follow groups: American Indian (2), Asian (4), Black (6), Hispanic (10), and White (97). By gender, self-identification included: Female (72), Male (45), and Nonbinary (2). Marital status was self-reported as: Married (61), other (26), and Single (32).

Sample

The demographics of this group were diverse in many ways. Unlike the original study, which focused on "approximately 2800 federal government employees" (Alexander and Ruder man, 1987), our participants were from unique organizations, locations, and backgrounds. For the purpose of Table 1, the original study narrowed the group down, via random down-sampling to 930 participants. This was due to the high cost and lack of availability of computational power required of the calculations for the study, at the time the original study was conducted. This modern study, while having the benefit of much more powerful computational power and a much lower comparative price, with increased availability, also had time and financial constraints. As such, to match the 930 participants, random up-sampling with replacement was utilized. Two box plots were created and compared to ensure our 930 simulated samples had similar characteristics as our 119 participants.

Methodology Literature

The process of learning and exploring the methods required to replicate the 1987 study took approximately 6 months of research, conducted between January to June 2023. This was an extensive effort, and included learning about structural equation modeling, exploratory structural equation modeling, exploratory factor analysis, confirmatory factor analysis, factor analysis, parallel analysis, primary component analysis, and latent growth models. While not all of these methods were utilized in this study, awareness of the methods and interconnections was required to ensure tasks or items were not missed in replicating the prior study. In essence, awareness of the

full context of this area of study and approach to science was a priority prior to running the actual data toward replication. Additionally, prior skills in R programming were utilized, however new packages and functions were discovered for application in the coding that supported the statistical effort of the study, toward replication of Table 1.

A full literature review of the methodology effort is beyond the scope of this study. However, documentation of the important literature is important, toward potential replication of this 2023 study, in the future. As such, the 42 items in this area are well documented in the reference list. Special thanks and gratitude goes to Johnny Lin, PhD who has significant talent as both a scientist and teacher. To see the four courses from Dr. Lin (three with video recordings), see the reference list (Lin, J. 2021a, 2021b, 2021c, and 2021d). Additionally, the tutorial on Exploratory Factor Analysis (EFA) and Cronbach's Alpha, found on GitHub by Wan Nor Arifin (2017) was of much beneficial utility.

Computational Software

The integrated development environment (IDE) of RStudio 2023.03.1 Build 446 was utilized with the R Programming Language Version 4.3.0 (2023-04-21) -- "Already Tomorrow".

Packages utilized include pysch version 2.3.3 as well lavaan 0.6-15. Also, in a supportive role the packages of tidy verse, performance, data wizard, correlate, and fact extra were used in the study for either computation or visualization. These are the only packages used other than those included with Base R, as an intentional effort was made to minimize the packages used; they were only selected if essential to the study and the associated methodology workflow.

Methodology Workflow

The methodology workflow was planned out to focus on the minimal accurate steps required to replicate Table 1 of the original 1987 study, given the collection of data and modernization of computational power available in 2023. As an overview, using R code, this includes the main workflow steps of: factorability, determining the correlation matrix, parallel analysis (PA), primary component analysis (PCA), exploratory factor analysis (EFA), and testing Cronbach's Alpha. Aspects of data science and visualization were utilized as appropriate within the code.

Factorability

The data were tested for factorability. This initial assessment of the factor structure of the dataset included three main tests: the Kaiser-Meyer-Olkin (KMO) test, the Bartlett's test of sphericity, and a test to ensure positivity for the determinant. The KMO test for overall measure of sampling adequacy indicated that the dataset was appropriate in structure for factor analysis, with (KMO = 0.77). Bartlett's test of sphericity was conducted and suggested that there was sufficient correlation in the data for factor analysis with Chi Square = 847.79 with 120 degrees of freedom, and $p < 0.001$ as results. The determinant did test positive with 0.00051 as the result.

Correlation Matrix

The research team discussed how correlation matrix, as an artifact of the full dataset, was not necessarily published in the past as an element of scientific reproducibility within a report. Due to

the competitive nature of science and publication, as well as the aspect of high cost, as example thousands of dollars per hour for computational resources in the 1980s, it was common for past papers to not publish their correlation matrix. Of course, as part of this, it does make it difficult to build and test past models now. In the spirit of reproducibility we provide our 2023 correlation matrix, related to our simulated dataset with n = 930. The correlation matrix follows below.

Figure 3

Correlation Matrix (Symmetrical) for 2023 Replication Study (n = 930)
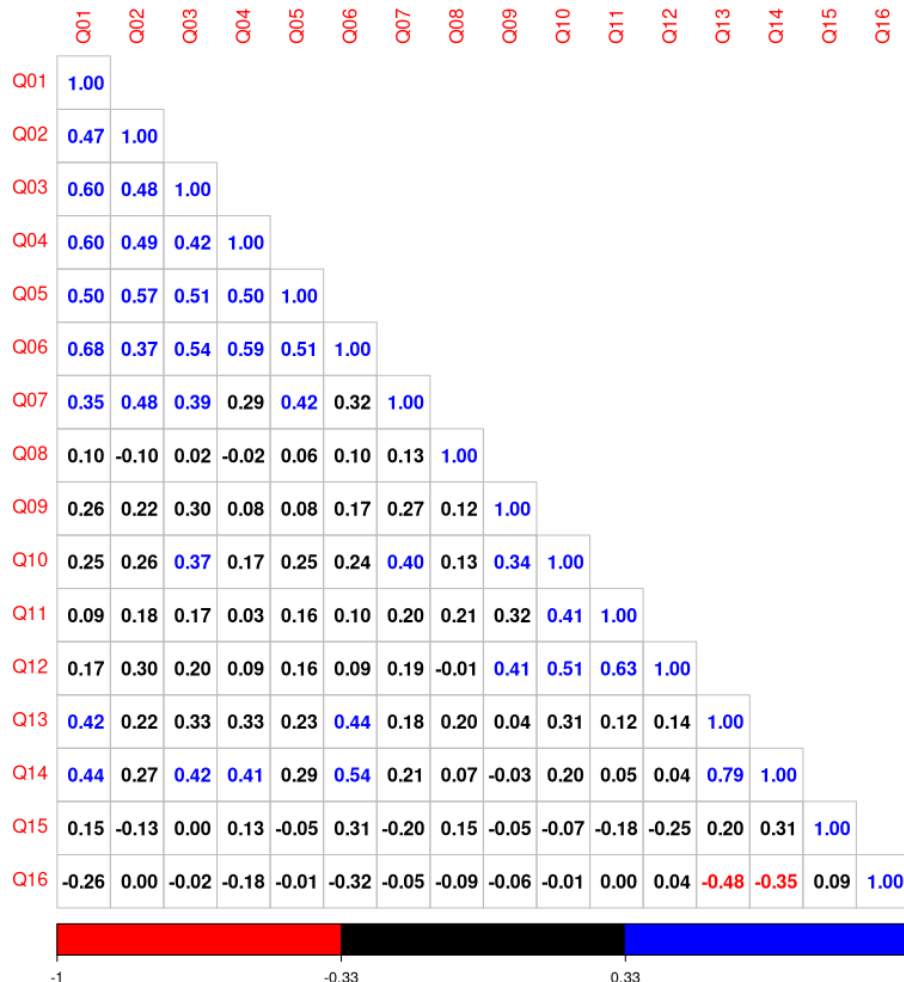
Parallel Analysis (PA)

More robust than a simple scree plot alone, the use of Parallel Analysis combines the concept of a scree plot with a parallel comparison of eigenvalues from principle components and also eigenvalues from factor analysis. This allows the results of the two plots to be compared, to aid in the determination of the number of factors that should be considered toward building a model from the data. One interesting computational aspect of running PA was that we had to set our options for only one core processor, on our multi-core computer system, for the function fa.parallel() to successfully run; options(mc.cores = 1). The argument of 120 iterations was selected for the fa.parallel() function. The code was run to generate the plot, and then commented out, and all cores

were used for other coding steps, as prior, other than this one function and step of the workflow. The parallel analysis scree plot is included below, and indicates 5 factors as appropriate.

Figure 4

Parallel Analysis Scree Plots

Parallel Analysis Scree Plots
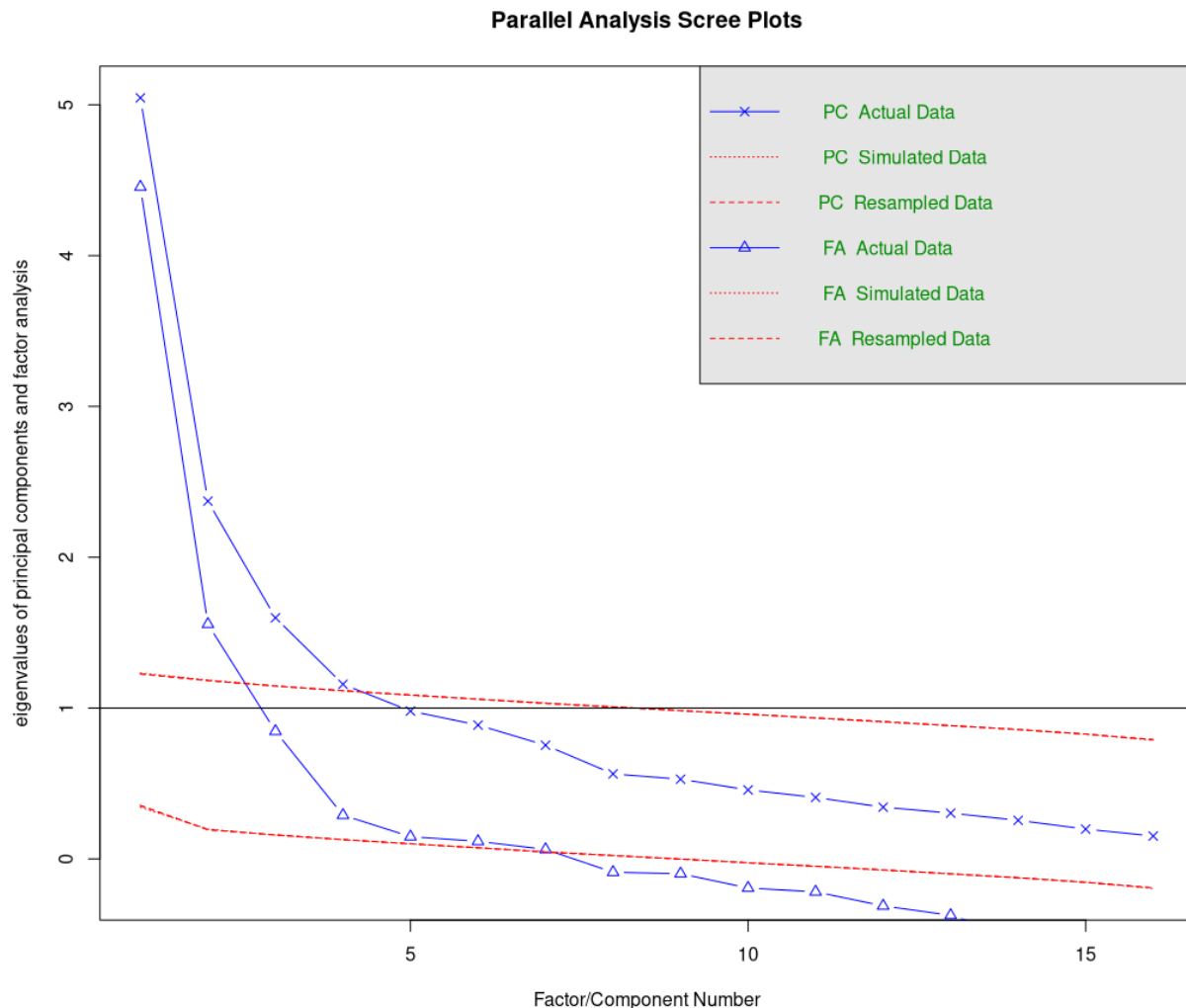
Primary Component Analysis (PCA)

There were no missing values in our dataset. This is important to note, as PCA can be biased due to missing values in the data. PCA was conducted, as well as calculations using cosine squared, Cos2, to measure the contributions of each variable. A BiPlot was constructed to review as vectors, each survey question, in relation to its contribution. The BiPlot considered the first two primary components, as they had the most explain ability of the dataset variation. Primary Components (PCs) are listed in descending order of explain ability with PC1 being the most powerful in comparison, then PC2, and so forth. With the BiPlot, the Y-axis was PC1 (42.9% of the variance explained), and the X-axis was PC2 (24.7% of the variance explained). In this context, the question vectors are plotted in a X-Y graph that explains a total of 67.6 of the dataset variance. Color was then utilized as a scale for the plot, measuring the Cos2 measurements of contribution for each of the variables.

The BiPlot, in Figure 5, is included for consideration. It is interesting to note that a line of 142 degrees, as measured from the positive X-axis, would perfectly split the vectors between positively voiced questions and negatively voiced questions from the survey instrument. Likewise, a line of 167 degrees, as measured from the positive X-axis, would perfectly split the vectors between those connected in the original study to participative justice, from those of distributive justice; with the exception of the weak and unusual vector for question 8, (Q08). Also, there are groupings of interest, as related to the original study that include vectors related to subset question sets.

Looking at the traditional quadrants, the upper right or Quadrant 1, is primarily representative of the questions focused on Participation (Q01-Q07). Quadrant 2, likewise, is primarily representative of questions focused on Performance Appraisal Fairness (Q11, Q12). Quadrant 3, other than the Q08 already mentioned, is nearly perfectly defined by Q16 on the negative X-axis, and Q15 very close to the negative Y-axis, focused on the question set from the original study known as Sanctions for Poor Performance. Quadrant 4 is representative of the question set on Promotion-Performance Contingency (Q13, Q14). The positive Y-axis splits Q09 and Q10 between Quadrant 1 and Quadrant 2, on either side of the positive Y-axis, which has a grouping representative of the question set, focused on Appeals Procedure Fairness.

While it is difficult to parse out precise meaning for components or PCs, from Primary Component Analysis (PCA), it is interesting to note that the Y-axis measuring PC2 ranges from termination to remediation. There seems to be a pattern to that spectrum, related to intensity of punishment, as an example. Likewise, PC1, measured along the X-axis, ranges from policy on the right and demotion on the left. While unfortunately that spectrum is less clear, going to the original full questions hints it might have aspects of control within the business work environment. Overall, the BiPlot groups the questions as vectors nearly exactly as the original 1987 study groupings, yet this plot is based on the 2023 data. Also, Q08 seems to be in essence an outlier of some manner.

Figure 5
PCA BiPlot (PC1 and PC2) with Cos2 via Color Scale

Variables - PCA
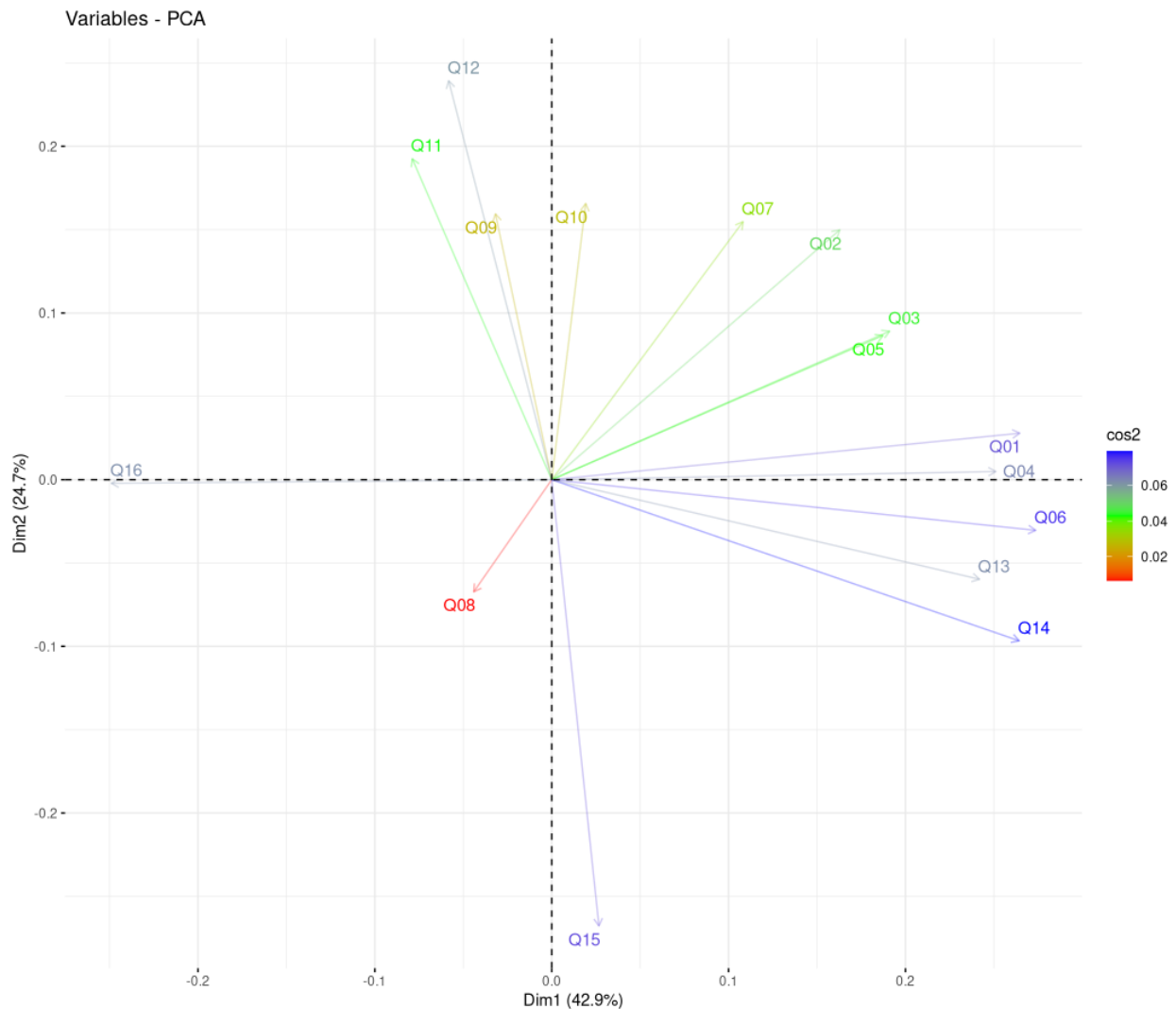
Exploratory Factory Analysis (EFA)

Exploratory Factor Analysis (EFA) was conducted using varimax rotation. The communality estimates were calculated with squared multiple correlations. No row weights were used, as Kaiser Normalization should only be utilized when communalities are high across all items, and in our data, this was not the case. Communalities range from 0.09 to 1.00 for items Q01 to Q16. The results of the EFA were the factor loadings, and represent the 2023 data on the left side of Table 1. It should be noted that the EFA results represented Q08 with only an asterisk, meaning it in essence should be dropped from the model. The exact value for Q08 was 0.16 which was below the cutoff set for our study of 0.4 for factor loading. The original study had a cutoff of 0.3, which we determined unusual after our literature review, as all items with a cutoff in our literature review used 0.4 as a cutoff. As can be observed in Table 1, both studies obtained factor loadings with no overlap, with each item loading on only one factor. For the replication study, the 5 factors explained 59 percent of the total dataset cumulative variation.

Cronbach's Alpha

The Cronbach's Alpha was determined by each factor separately. This means each factor was correctly assigned its associated subset of question items. Q08 was retained for a proper comparison

to the original study. The alpha for Pay Fairness was unable to be obtained, due to an error made in data collection for those three questions. The reliabilities for each fairness measure, as determined by Cronbach's Alpha is presented in Table 1 above each set of factor loadings.

RESULTS

The primary goal of replicating Table 1 from a study conducted 36 years ago was met. The results of this study are presented in Table 1, with the 2023 replication study on the left, and the 1987 original study on the right. This allows a visual comparison from item to item and factor to factor, as well as the overall pattern of the loadings. The replication was in general very similar with a few deviations. Q08, as has been mentioned several times prior, was a weak outlier in behavior for the replication study. Further, due to the data collection error, Pay Fairness loadings and alpha were not possible to recreate. This was an important lesson learned on instrument creation and replication of a prior study.

Areas where the Cronbach's Alpha were weaker than the original study are due to keeping Q08 in for direct comparison, as well as the factors for Sanctions for Poor Performance being split across two factors in the replication study, versus staying in one factor in the original study. Vectors, or factors, in essence behave like a total closed system across the model. So, the lack or presence of the Pay Fairness vectors could make the difference in the stay together (or not) behavior of the Sanctions for Poor Performance vectors. Further, while both studies assumed orthogonal vectors, meaning no correlation between factors, in reality this is rarely the case.

Table 1

Factor Analysis of Fairness Items (2023 Replication Study vs. 1987 Original Study)

Table 1. Factor Analysis of Fairness Items											
2023 Replication Study						**1987 Original Study**					
	f1	**f2**	**f3**	**f4**	**f5**		**f1**	**f2**	**f3**	**f4**	**f5**
Participation (α = .87)						**Participation (α = .88)**					
Q01	0.73					**Q01**	0.80				
Q02	0.65					**Q02**	0.76				
Q03	0.67					**Q03**	0.75				
Q04	0.68					**Q04**	0.74				
Q05	0.70					**Q05**	0.73				
Q06	0.73					**Q06**	0.67				
Q07	0.49					**Q07**	0.46				
Appeals Procedure Fairness (α = .40)						**Appeals Procedure Fairness (α = .67)**					
Q08		*				**Q08**		-0.57			
Q09		0.51				**Q09**		0.52			
Q10		0.58				**Q10**		0.47			
Performance Appraisal Fairness (α = .77)						**Performance Appraisal Fairness (α = .68)**					
Q11		0.73				**Q11**		0.41			
Q12		0.80				**Q12**		0.33			
Promotion-Performance Contingency (α = .88)						**Promotion-Performance Contingency (α = .80)**					
Q13			0.92			**Q13**			0.82		
Q14			0.75			**Q14**			0.75		
Sanctions for Poor Performance (α = .16)						**Sanctions for Poor Performance (α = .72)**					
Q15			0.72			**Q15**				-0.77	
Q16				0.96		**Q16**				-0.72	
Pay Fairness (α = NA)						**Pay Fairness (α = .83)**					
Q17					NA	**Q17**					0.86
Q18					NA	**Q18**					0.78
Q19					NA	**Q19**					0.67

IMPLICATIONS FOR MANAGEMENT

For over 2,600 years humanity has explore the reality that there are inherent laws behind our observations (Hertog, 2023, pp. 10-12). While not as grand as scientific law, much can be learned between what we observe and what we experience in business. Additionally, the concept of exploratory factor analysis is motivated by the reality that we might be able to determine credible latent (unobserved) variables that connect to items or indicators that we do directly observe, for example via survey questions. Stated differently, we might learn information of additional enrichment from the same survey questions, beyond what they directly ask, by gaining insight to these larger indirect phenomenon's known as latent variables.

Business leaders can use data science and skills in structural equation modeling to further data mine the survey data they already have captured, yet only considered on the surface level. By employing concepts such as EFA, CFA, or SEM they can explore the dataset for a new level of information that in turn could lead to competitive knowledge in the marketplace. Additionally, as exhibited by

the pilot program toward replication of a study from 36 years ago, there is much to be learned via practice, attempts at replication, and building capabilities toward great work effort such as projects of greater scale, based on the baseline of the pilot program. Important lessons can also be learned to prevent mistakes during the actual intended larger study that motivated the pilot program.

LIMITATIONS OF THE STUDY

This team is still learning. As such, while significant effort was put in toward learning these methods, there is still much to learn, and we might find even better methods in the next year prior to launching the full study. As a brief example, similar to the original study, we used the statistical concept of "sampling" in our case, with replacement. There is a full field of study in statistics that focuses on robust methods under conditions of sparse datasets (Hastie, Tibshirani, & Wainwright, M., 2015). Tibshirani and his various co-authors across several significant texts in statistical literature have explored methods known as The Bootstrap or The Lasso. At a later date, as our team learns more, we may choose to utilize these more complex methods as a matter of improved robustness, or out of necessity due to the constraints of sparsity.

One interesting item in this study was question Q08, which stated: "Appealing personnel actions is a waste of time." While this study showed it as ineffective toward our model, it was determined effective toward the original model. In part, this might have been due to the homogenized sample of civil service members working for government agencies having a strong consistent answer to rating this statement on a 7-point scale. While, our current group was diverse, from many backgrounds of life as well as organizations of profession, and as such may have interpreted this statement in many diverse ways. As such, the less consistent rating of this statement would have diffused the power of effectiveness toward modeling for this question. Its vector would get shorter, and rated weaker via Cos2 evaluation. Further, it might be motivated by some confounding factor beyond the scope of this study that differentiated the time period of 1987 with the present of 2023. One credible confounder, as an example, could be the birth of the modern internet in 1995. A pre-internet world might also tend toward homogeneity, while the current internet world, having more access online to divergent points of view, might also have a much more diverse perspective of a simple statement of judgment. Being human, meaning is continually open to interpretation.

OPPORTUNITIES FOR FUTURE RESEARCH

Opportunity for future research was a main motivator of this study. If part of this study could be replicated, and this team learns the skills required to making that occur, it would be worth the time, money, and effort required of the full study being replicated. Of course, the plan to do so will include collecting a completely new dataset from participants that did not participate in this pilot program. Additionally, the goal will be to collect a real-world participant based of no less than n = 930, each with all answers completed (no missing items). This will be the minimum goal. Additionally, this real world data could then be considered a "holdout" group, to be tested against a training group for EFA, and a test group for CFA; and then the holdout group a further final test of our developed model.

The study of latent variables or factors from items or indicators collected as observed variables from a survey instrument, in its own right, does not have to be focused on replication studies. It can

be applied in many other areas of science useful toward business utility. These methods and techniques, to include learning how to code, are recommended to the reader as they consider their own scientific or business pursuits.

CONCLUSION

While there were important lessons learned from this pilot program, it was a success. Table 1 was successfully recreated, and a comparison between the 2023 study and the original 1987 study was possible. Many of the elements of the results were consistent, to include the number of factors, and the pattern of their groupings, with some slight deviation. This is particularly remarkable, as it was conducted without any access to the original dataset, or their correlation matrix, from over 36 years ago. This adds to the credibility of the 1987 study, their results have gained further support by a new independent dataset, modern computational methods, with similar results earned via this replication effort using a much more diverse sample of participants. Further, this research team learned many new skills and methods that will use this pilot program as a baseline toward a full and complete replication in the near future.

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APPENDIX I

MAJOR SURVEY QUESTIONNAIRE FOR PROCEDURAL JUSTICE-

Adapted from The Role of Procedural and Distributive Justice in Organizational Behavior Sheldon Alexander and Marian Ruderman (1987)

SURVEY QUESTIONNAIRE FOR PROCEDURAL JUSTICE

We are conducting a study on Human Resources programs that might be in effect at your organization or possibly those you would like to see implemented that provided equal treatment for all employees and allow employees to have some influence on the treatment they receive.

We would like to know your experiences with how much input you might have on any new policies or procedures effecting employees. This would include decisions on promotions, corrective or disciplinary actions taken, input on how your job is designed and the tasks and work you do, how you are evaluated and how fair and equitable this system is. In general, we are interested in how effective your treatment is an employee.

Each Question has a potential response of Strongly Agree to Strongly Disagree. Please circle that number that best corresponds with your responds with your level of agreement or disagreement with each of the following Questions.

1=Strongly Disagree 2= Disagree 3= Somewhat Disagree 4=Neither Disagree or Agree

5= Somewhat Agree 6=Agree 7= Strongly Agree

We are asking you to please complete this Survey. Your responses are anonymous and we would ask that you do not skip any questions. Thank you for your participation.

SURVEY QUESTIONNAIRE

1.How much say do you have in developing new work rules and procedures?

1	2	3	4	5	6	7
SD	D	SWD	N	SWA	A	SA

2.How much say do you have in setting priorities among tasks to be done?

1	2	3	4	5	6	7
SD	D	SWD	N	SWA	A	SA

3.How much say do you have in deciding how work will be divided among people?

1	2	3	4	5	6	7
SD	D	SWD	N	SWA	A	SA

4.How much say do you have in developing organization policies?

1	2	3	4	5	6	7
SD	D	SWD	N	SWA	A	SA

5.How much say do you have in deciding what you will do day to day?

1	2	3	4	5	6	7
SD	D	SWD	N	SWA	A	SA

6.How much say do you have in buying new equipment?

1	2	3	4	5	6	7
SD	D	SWD	N	SWA	A	SA

7.How much freedom do you have on your job?

1	2	3	4	5	6	7
SD	D	SWD	N	SWA	A	SA

8.Appealing personnel actions is a waste of time.

1	2	3	4	5	6	7
SD	D	SWD	N	SWA	A	SA

9.The Employee Handbook provides for negotiated grievance or complaint procedures to protect employees if they have a formal personnel action against them for poor performance.

1	2	3	4	5	6	7
SD	D	SWD	N	SWA	A	SA

10.When people perform poorly here, they're given a chance to improve their work.

1	2	3	4	5	6	7
SD	D	SWD	N	SWA	A	SA

11.Generally speaking annual performance appraisals are done fairly here.

1	2	3	4	5	6	7
SD	D	SWD	N	SWA	A	SA

12.My last annual performance appraisal rating was about what it ought to have been.

1	2	3	4	5	6	7
SD	D	SWD	N	SWA	A	SA

13.If you performed your job especially well, how likely is it that you will be promoted or get a better job?

1	2	3	4	5	6	7
SD	D	SWD	N	SWA	A	SA

14.If you performed your job satisfactorily, how likely is it that you will be promoted or get a better job?

1	2	3	4	5	6	7
SD	D	SWD	N	SWA	A	SA

15.If l perform poorly, I will lose my job.

1	2	3	4	5	6	7
SD	D	SWD	N	SWA	A	SA

16.I will be demoted or transferred from my position, if I perform my job poorly

1	2	3	4	5	6	7
SD	D	SWD	N	SWA	A	SA

Now, please tell us something about yourself.

Which of the following best describes your gender?

__ Male

__ Female

__I Don't identify as either.

Question Title

Which race or ethnicity best describes you? (Please choose only one.)

___American Indian or Alaskan Native

___Asian / Pacific Islander

___Black or African American

___Hispanic

___White / Caucasian

___Multiple ethnicity/ Other (please specify)

Question Title

What is your marital status?

___ Single

___Married

___Other

Question Title

In which of the following age ranges do you currently fall?

___Under 18

___18-25

___26-30

___31-35

___36-40

___41-45

___46-55

___56-60

___61-65

___66 or older

Question Title

Which of the following best describes the highest level of education you have received?

___Less than high school

___High School Graduate

___Some College or Technical School

___Associates Degree in college (2years)

___Bachelors Degree in college (4 year)

___Masters Degree

___Doctorate

___Professional Degree (MD, JD, CPA)

Question Title

Below are some income categories. Please choose the category that best describes the total annual income of the household. Please include your personal income, as well as the income of others living in the household.

___Less than $14,999

___Between $15,000 and $34,999

___Between $35,000 and $59,999

___Between $60,000 and $99,999

___Between $100,000 and $199,999

___Above $200,000

Thank you again for your time in completing this Survey.