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**A Psychometric Assessment of the Irish Civil Service
Employee Engagement Scale**

Thesis presented by

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Master of Philosophy

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Declaration

This is to certify that the work I am submitting is my own and has not been submitted for another degree, either at University College Cork or elsewhere. All external references and sources are clearly acknowledged and identified within the contents. I have read and understood the regulations of University College Cork concerning plagiarism and intellectual property.

Abstract

This study takes a quantitative approach with the aim to understand whether the employee engagement scale applied in the Civil Service Employee Engagement Survey (CSEES) is an appropriate psychometric measure of employee engagement in the Irish Civil Service. For the purposes of this study, an appropriate employee engagement scale is defined as one that is psychometrically valid, reliable and robust and can provide meaningful quantitative insights into the Irish Civil Service population.

The analysis in this study provides insights into psychometric properties of the CSEES employee engagement scale are investigated through the application of several robust psychometric statistical methods. The descriptive statistics and antecedent analysis are reviewed and assessed for the capacity to provide meaningful insights for the Irish Civil Service. The primary focus of the study is the psychometric analyses of the CSEES employee engagement measure. and the antecedents of employee engagement in the Irish Civil Service by grade, gender, and length of service.

The CSEES is a census survey with over 60,000 responses across the three iterations of the survey that are available for research purposes. The employee engagement scale used within the CSEES is a modified form of the Utrecht Work Engagement Scale (UWES) (Schaufeli & Bakker, 2004). Psychometric and statistical methods applied are measures of association including Pearson's correlation coefficients, measures of internal consistency including Cronbach's alpha, McDonald's omega and Fornell- Larcker criterion, measures of dimensionality and

structure including exploratory and confirmatory analysis and measures of cumulative modelling including multilinear regression analysis, item response theory and differential item functioning. The amount of research of employee engagement within the public sector (Vigoda-Gadot et al., 2013) and the psychometric research of employee engagement scales across all sectors, both at an organisational and demographic level (Bailey et al., 2017) is limited (Kulikowski, 2017). This study contributes to this novel intersection of the research area.

The study finds that the CSEES employee engagement scale is psychometrically robust and provides useful insights into the employee engagement of the Irish Civil Service. It is an appropriate measure of employee engagement and identifies five findings of note suggesting further development and research on the CSEES employee engagement would be worthwhile.

Firstly, the CSEES employee engagement scale is a robust, valid, and reliable measure of employee engagement in the Irish Civil Service. All items in the scale performed very well when different psychometric methods were applied, apart from one which was “At my work I always persevere, even when things do not go well”.

Secondly, IRT analysis suggests that the employee engagement scores in the CSEES may be overinflated, with low to moderate item discrimination and difficulty inherent in the CSEES employee engagement scale. This result suggests that civil servants with lower or more varied employee engagement levels can achieve high employee engagement scores in the CSEES.

Thirdly, the CSEES employee engagement scale is unidimensional, in contrast to the UWES which was developed as a multidimensional or three factor scale (Schaufeli & Bakker, 2002). The CSEES employee engagement scale contains items from two of the three UWES dimensions, including dedication and vigour items but not absorption items.

Fourthly, the differential item functioning (DIF) analysis found that no DIF effect was likely in the items. However, nominal variation in the outputs by gender suggest that some DIF effect may exist by gender.

Fifthly, meaningfulness was the antecedent with the highest strength of association with employee engagement by grade, gender, and length of service by a sizeable margin. The top five antecedents by demographic comprised of six other attitudinal scales including organisational support and job skills match.

Although this study does find the CSEES employee engagement scale to be appropriate, a review of the CSEES employee engagement scale is recommended, potentially reducing the number of items, and including items with higher levels of discrimination and more moderate and varied levels of difficulty. Given the small number of antecedents of employee engagement by demographic, the survey itself could also be reduced in scale without any loss of information or relevant insights. This approach would reduce response burden for those surveyed and result in a more accessible survey with an accurate view of the employee engagement of Irish civil servants.

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Introduction

The Civil Service Employee Engagement Survey (CSEES) is a large scale no-change survey of the Irish Civil Service with 26,795 responses in 2020 and 63,679 total responses across the 2015, 2017 and 2020 iterations of the survey. The CSEES was also administered in September 2023, but the dataset was not yet available for research purposes. The research question underpinning this research asks if the employee engagement scale used in the CSEES is an appropriate measure of employee engagement in the Irish Civil Service. As the appropriateness of the CSEES employee engagement scale is quite a broad question, this study defines appropriate as it being psychometrically valid, reliable and robust and providing meaningful quantitative insights into the Irish Civil Service population. The study also contributes to wider discussions about the measurement of employee engagement in organisations, both public and private.

The psychometric techniques applied in this study assess the validity, reliability, and internal consistency of the CSEES employee engagement scale, a modification of the Utrecht Work Engagement Scale (UWES) (Schaufeli & Bakker, 2004). The methods applied include measures of association, measures of internal consistency, measures of dimensionality and structure, and measures of cumulative modelling. The analysis also provides insights into the structure and functioning of the CSEES employee engagement scale while providing recommendations on potential improvements to the CSEES employee engagement scale and associated future surveys.

In addition, descriptive statistics are presented about the Irish Civil Service population in order to understand if meaningful insights result from the analysis. These include the response rates of the CSEES which demonstrate the representivity of the achieved responses and the employee engagement scores of the CSEES respondents. These statistics are presented by gender, grade, and length of service of civil servants. These were the demographics of most relevance and reflect the demographics of note in official publications based on the CSEES (Government of Ireland, 2016, 2018, 2021). The antecedent analysis is used both as a tool to assess psychometric aspects of the scale, and to impart insights into the antecedents of employee engagement for civil servants.

The analysis in this study primarily uses the 2020 CSEES dataset as it is the most representative of the Civil Service population by gender, grade and length of service, that is available for research purposes. The 2017 and 2020 survey datasets are generally representative of the Civil Service population. Although the 2015 dataset is incorporated into this study, it is less representative of the Civil Service population due to the lower response rate achieved in the 2015 iteration.

The CSEES employee engagement scale was developed, piloted and implemented by the Central Statistics Office (CSO) and the Department of Public Expenditure and Reform (DPER) in collaboration with Dublin City University (DCU). It incorporates six items from the 17-item Utrecht Work Engagement Scale (UWES) (Schaufeli & Bakker, 2004). Items from the vigour and dedication dimensions of the UWES are included in the CSEES employee engagement scale while items from the absorption dimension are not. Although not directly, the CSEES includes the

absorption dimension of the UWES in the well-being scale items. These items are not a focus of this study.

The CSEES employee engagement scale is a modification of the UWES, a work engagement scale. The definitions of work engagement and employee engagement can be ambiguous with the different terminology, such as work engagement and employee engagement used interchangeably (Truss et al., 2013) often while the same constructs are used in the underlying analysis (Zahari & Kaliannan, 2022). For the most part, the term employee engagement is applied in this study while work engagement is referenced where appropriate.

Four general approaches to work engagement exist; the needs-satisfying approach posited by Kahn (1990), the satisfaction-engagement approach posited by Harter et al. (2002), the multidimensional approach outlined by Saks (2006) which is a similar but expanded version of Kahn's needs-satisfying approach (Kahn, 1990) and the burnout-antithesis approach where work engagement and burnout are distinct but negatively related concepts (Maslach & Leiter, 1997). The UWES is underpinned by the burnout-antithesis approach. The UWES also assumes that work engagement is a psychological state, rather than trait or behaviour (Schaufeli & Bakker, 2004) and is related to the Job-Demands Resources (JD-R) model (Bakker & Demerouti, 2007). Work engagement is defined by Schaufeli et al. (2001, p.3) as a "positive, fulfilling, work-related state of mind that is characterized by vigour, dedication, and absorption. Rather than a momentary and specific state, engagement refers to a more persistent and pervasive affective-cognitive state that is not focused on any particular object, event, individual, or behaviour." This is the

definition of employee engagement used in this study, given the scale used within the CSEES, but differing approaches to work and employee engagement do exist.

A key aspect of this study is the psychometric interrogation of the CSEES employee engagement scale, including its factorial validity, internal consistency and robustness. The CSEES employee engagement scale has not been tested in other countries. However, multiple studies have found that the UWES has factorial validity, internal consistency, and test-retest reliability (Kulikowski, 2017; Schaufeli & Bakker, 2004; Schaufeli et al., 2019). The UWES also maintains this efficacy and psychometric robustness when the number of items within the scale are reduced, as seen with UWES-17, UWES-9 and UWES-3 (Schaufeli et al., 2019). These results are encouraging with respect to the CSEES employee engagement scale, a reduced and modified version of the UWES-17 scale. The dimensionality of the UWES scale is considered to be a unidimensional construct or a three-factor scale with three highly correlated dimensions of dedication, vigour and absorption, dependent on the research source (Kulikowski, 2017). In studies that apply item response theory (IRT) to the UWES, it is found to be a reliable scale with some challenges (de Bruin, 2013). The UWES scale provides little information on people with higher levels of engagement and also has difficulty in differentiating people with very high or very low levels of engagement (Shimazu et al., 2012; Simbula et al., 2013).

As a construct, Banihani et al. (2013) found that work engagement is potentially gendered, with organisations designed in such a way to allow men to experience higher levels of work engagement. Hinzmann et al. (2013) found that newly hired staff had the highest level of engagement. No studies were found that explicitly

referenced the work engagement within a public service which would be an applicable comparison to the Irish Civil Service grade structure.

This study follows a traditional research study structure, with a literature review, methods, findings, and discussion chapter. The structure of the literature review includes an overview of engagement and the UWES, an overview of the psychometric methods applied to the UWES and employee engagement and the Irish Civil service, positioning this study within the current research. The methods chapter expands on the psychometric methods used in the analysis, providing a summary of the relevant methods. The methods applied include measures of association, measures of internal consistency, measure of dimensionality and structure and measures of cumulative modelling which are applied to the CSEES datasets in this study. The specific techniques applied to the data were Pearson's correlation coefficient, Cronbach's alpha, McDonald's omega, Fornell- Larcker Criterion, exploratory and confirmatory factor analysis, IRT, DIF and multiple linear regression analysis. The findings chapter is divided into two sections. The first section contains the results of the psychometric methods applied to the CSEES data. The second section expands on the descriptive statistics on the demographic make-up of the Irish Civil Service population, the response rates of the CSEES for each iteration and a breakdown of the employee engagement scores of the demographics of interest (gender, grade, and length of service) across survey iterations.

The discussion chapter then brings together the literature review, methods and findings chapters to summarise the study and to discuss the results and study

limitations. Directions of future research and a closing statement are also included in this chapter.

This study aims to evaluate whether the employee engagement scale used in the Civil Service Employee Engagement Survey (CSEES) is an appropriate measure of employee engagement within the Irish Civil Service. The CSEES employee engagement scale's appropriateness was measured in two ways; by assessing the psychometric robustness of the CSEES employee engagement scale, and by investigating the insights that can be provided on the employee engagement of certain cohorts of civil servants within the Irish Civil Service through descriptive statistics and antecedent analysis.

Although the psychometric assessment of the scale is the primary focus of this study, the descriptive statistics and antecedent analysis by demographic cohort form a significant part of it. The descriptive statistics antecedent analysis outlines the levels and antecedents of employee engagement by gender, grade and length of service. The trends found in this further analysis add to the assessment of the appropriateness of the measure, both by potentially generating meaningful insights and also adding a form of validation or plausibility assessment to the results. The study offers a significant contribution to the understanding of employee engagement in the Irish Civil Service and also provides further avenues of potential research.

Literature Review

The OECD (2015) has found that engaged public service employees are critical in successfully managing change in the public sector, enhancing service orientation, and ensuring customer satisfaction. A public servant's engagement enhances their sense of well-being, commitment, and motivation to the organisation. Studies in the private sector show work engagement is the most robust predictor of performance outcomes (Christian et al., 2011). Studies have highlighted that the extent of the research on work engagement in the public sector is limited (Borst et al., 2020; Fletcher et al., 2020; Vigoda-Gadot et al., 2013).

The literature review is divided into three sections which align to the lines of inquiry underpinning the research. The first section is an overview of employee engagement with a focus on UWES, the scale upon which the CSEES employee engagement scale was based. This section lays the foundation of understanding the concept of work or employee engagement and the relationship to the associated measurement scales, adding context to the assessment of the CSEES employee engagement scale as an appropriate measure of employee engagement.

The second section investigates the internal structure, dimensionality, and validity of the CSEES employment engagement scale by reviewing the relevant research on the UWES, upon which the CSEES scale is based. This section adds context to the findings resulting from the psychometric methods applied to the CSEES employee engagement scale in this study, highlighted similarities and dissimilarities between the findings of this study and previous research on UWES.

The third section outlines research on employee engagement by gender, grade and length of service or tenure. This adds context to the findings resulting from the descriptive and antecedent analysis of the CSEES employee engagement scale which is used to understand if the findings about Irish civil servants are meaningful and align to previous research.

An overview of the research on the Irish Civil Service is also included in the third section, providing the reader with background on the structure of the Irish Civil Service. The Irish Civil Service is a subset of the Irish Public Service and comprises of departments and organisations that work directly with government or carries out specific functions for the state. The Irish Public Service includes a broader range of public servants who are paid for by the state and include teachers, gardai, regional councils and other organisations. The wider Public Service were not included in the CSEES or this study.

The CSEES employee engagement scale is based on the Utrecht Work Engagement Scale (UWES) (Schaufeli & Bakker, 2004). The UWES was developed assuming that work engagement is the opposite of burnout and is related to the Job-Demands Resources (JD-R) model (Bakker & Demerouti, 2007). The CSEES employee engagement scale was developed and tested by the Central Statistics Office (CSO) in collaboration with Dublin City University (DCU) and the Department of Public Expenditure and Reform (DPER). It includes six items in total, with five items from the UWES-9 scale (Schaufeli et al., 2006) and one item 'At my work I always persevere, even when things do not go well' from the UWES-17 scale (Schaufeli & Bakker, 2004). Two of the three dimensions of the UWES (dedication

and vigour) are included in the CSEES employee engagement scale while the absorption dimension is excluded from the scale.

The CSEES is a survey of all civil servants in Ireland. It was commissioned by the Civil Service Management Board (CSMB) and implemented under Action 25 of the Civil Service Renewal Plan in 2014 (Government of Ireland, 2014). Within the People Strategy for the Civil Service 2017-2020 (Government of Ireland, 2016), the CSEES was a key employee engagement measure under the “be an employer of choice” strategic priority. A sub strategy of this policy requires that results from the CSEES are used to drive higher staff engagement. The CSEES is also referenced in the Civil Service Renewal 2030 Strategy under an ‘open and accountable Civil Service’ (Government of Ireland, 2021). The aim of the CSEES is to measure and evaluate four outcomes: employee engagement, well-being, coping with change and commitment to the organisation. The survey was unchanged across all iterations, apart from a COVID-19 related module in 2020 and minor changes to the demographic questions for each iteration. Three iterations of the CSEES took place in September 2015, 2017, and 2020 and are included in this research. A fourth iteration of the survey took place in September 2023, which is not included, as the data was not yet available for research purposes.

Other engagement scales could have been used in the CSEES, including the Job Engagement Scale (May et al., 2004), the Intellectual, Social, Affective Scale (ISA Engagement Scale) (Soane et al., 2012) and the Employee Engagement Scale (Shuck et al., 2016). Systematic reviews have found the UWES to be the most cited scale with 86% of academic research incorporating the UWES (Bailey et al., 2017). A

meta-analytic path model which examined the incremental validity of work engagement recommended that the UWES be used to measure work engagement as it is a “quick and efficient way of assessing a key predictor of employee effectiveness” (Mackey et al., 2017, p.116).

There is an increasing focus on quantitative analysis of employee engagement. A systematic literature review by Zahari and Kaliannan (2022) on antecedents of work engagement found that the number of quantitative research papers on work engagement increased considerably from 2020. However, the number of quantitative psychometric research projects on employee engagement in public sectors at a large scale remains quite limited (Borst et al., 2020; Fletcher et al., 2020; Vigoda-Gadot et al., 2013). Kulikowski (2017) found only 21 studies of both public and private sectors in a systematic review of research on the validity of the UWES. Only four studies were found which incorporated differential item functioning (DIF) and the UWES (Domínguez-Salas et al., 2022; Hong Goliath-Yarde & Roodt, 2011; Song et al., 2020; Zhu, 2018). The lack of large-scale quantitative research specific to work engagement and public service does make comparisons between the findings of this research and the relevant literature challenging. This highlights the potential contribution of this study to an aspect of employee engagement where further research is needed, strengthening the study's contribution to current literature, both in assessing the appropriateness of the use of a modified UWES and as a repository of demographic insights into employee engagement.

Overview of Engagement and the UWES

Work engagement was first introduced by Kahn (1990) in his paper on personal engagement and disengagement in the workplace. In the need-satisfying approach posited by Kahn, engagement is the simultaneous employment and expression of a person's preferred self in task behaviours that promote connections to work and to others, personal preference, and active role performance. Human resource management circles have a longstanding interest in work engagement, with an emphasis on how the development of workforce strategies, involving people management and the identification of specific mechanisms, can result in improved organisational performance outcomes (Delbridge and Keenoy, 2010).

Work engagement is said to be related to but distinct from other measures in organisational behaviour (Saks, 2006). The definition of engagement can be ambiguous, with a range of terms and associated definitions, including engagement, work engagement, employee engagement, personal engagement, and organisational engagement used interchangeably (Truss et al., 2013). However, researchers tend to use the UWES instrument to measure the work engagement or employee engagement construct quantitatively, regardless of the term used (Zahari & Kaliannan, 2022).

Employee engagement is the term used in this study, aligning to the CSEES definition of employee engagement which "...measures the sense of energy, connection and fulfilment civil servants have with their work" (Government of Ireland, 2016, p.16). The CSEES engagement scale is a subset of the UWES, a work engagement scale (Schaufeli & Bakker, 2004). Work engagement is defined by

Schaufeli et al. (2001, p.3) as a “positive, fulfilling, work-related state of mind that is characterized by vigour, dedication, and absorption. Rather than a momentary and specific state, engagement refers to a more persistent and pervasive affective-cognitive state that is not focused on any particular object, event, individual, or behaviour.” This is the definition of work engagement used in this study, given the scale used within the CSEES, but differing approaches to work engagement do exist.

Four approaches to work engagement are generally considered within the literature (Schaufeli & Bakker, 2022):

- 1) The needs-satisfying approach as defined by Kahn (1990) where personal engagement is the employment and expression of one’s preferred self in task behaviours.
- 2) The burnout-antithesis approach where work engagement and burnout are distinct, negatively related concepts (Maslach & Leiter, 1997). The UWES is underpinned by this approach.
- 3) The satisfaction-engagement approach which is primarily used in non-academic settings and refers to “an individual’s involvement and satisfaction with as well as enthusiasm for work” (Harter et. al, 2002, p.269).
- 4) The multidimensional approach defined by Saks (2006) which is similar to Kahn (1990) but also includes role performance at work and distinguishes between work engagement and organisational engagement.

Macey and Schneider (2008) developed a measure of engagement which considered state, trait, and behavioural engagement to be related and act as a sequence of dependent and independent variables within a more general model of engagement. Trait engagement is engagement as a personal disposition to have a positive outlook and tendency to higher levels of engagement which can then be reflected in state engagement where state engagement is a psychological state incorporating involvement, commitment, attachment, and mood (Macey & Schneider, 2008). State engagement is reflected in behavioural engagement which involves discretionary effort and specific in-role behaviours (Erickson, 2005; Towers-Perrin, 2003).

Work engagement as a trait was explored further by Macey and Schneider (2008), proposing that it comprised of various facets including trait positive affectivity, proactive personality, autotelic personality and conscientiousness. This suggests that people with this trait are adaptive, and experience work in positive, active and energetic ways. However, trait engagement is likely a distal rather than proximal cause of engagement behaviour (Kanfer, 1990).

Work engagement as a psychological state has received the most attention in academic research, with Schaufeli and Bakker (2004) defining engagement as a positive, fulfilling, work-related psychological state of mind. They propose that engagement is not a momentary and specific state, but rather, is a more persistent psychological way of being that is not focused on any specific object, event, individual or behaviour. Schaufeli et al. (2002) were critical of the view of engagement as a momentary state of mind due to the lack of focus on the

consequential behaviour which can result from this position. Work engagement as a psychological state, with specific antecedents and outcomes, can be superior to other approaches as it allows researchers to recognise underlying motivational processes, and apply and test hypotheses, such as the similarities and dissimilarities of work engagement with other related concepts (Schaufeli et al., 2002). The interpretation of work engagement as a psychological state does lead to the possibility that the measurement of work engagement can be affected by external factors including short term work experiences and more transitory moods (Sonnentag et al., 2010).

Work engagement as a psychological state was developed in part from the JD-R model (Bakker & Demerouti, 2007). The JD-R model is a linear model that assumes that employees are driven to optimise their situation and respond in rational ways to a limited range of aspects of work which allow them to optimise their situation (Bailey et al., 2017). These aspects of work include autonomy, task significance and feedback and are posited to result in increased work engagement when optimised (Hackman & Oldman, 1976). Within the JD-R model, job resources gain their motivational potential when employees are in high demand jobs, where they are motivated to actively learn and develop skills (Bakker & Demerouti, 2007). However, the JD-R model assumes that employees are primarily driven to rationally optimise their situation and may not consider contextual factors, interpersonal relationships and emotional or irrational responses within the workplace (Bailey et al., 2017). The JD-R model also may not address power and politics under which the control of demands and resources are held by others (Fineman, 2006).

A critical review of the JD-R model (Schaufeli & Taris, 2013) found that the model is open and heuristic with challenges associated with defining job demands, job resources and any overlap between the concepts. The model also has limitations with respect to the role of personal resources and reciprocal causation. However, Schaufeli and Taris (2013) did find positive aspects to the model including its non-limitative nature which allows for the model to be tailored to organisational needs, the inclusion of negative and positive outcomes and its generality which allows the JD-R model to complement other approaches to work engagement. This flexibility, although lacking specificity, is very beneficial for the CSEES as it allowed for the constructs included in the CSEES to be tailored to the Irish Civil Service, with constructs of interest being included in the survey while considered relevant to the JD-R model.

The association between the JD-R model and the specific organisational structure, resources and demands are a further consideration, with several phenomenon, including bureaucracy and red tape being specific to public service organisation. Higher levels of engagement result from satisfaction with work related resources rather than organisation related resources for public servants. Relevant work related resources include autonomy, colleague support, and job content are found for public servants (Borst et al, 2019). Reflecting this, the antecedent analysis in this study found meaningfulness, job skills match, competence to be significant antecedents of employee engagement across all cohorts analysed. Organisational support was also found to be a significant antecedent of employee engagement, converse to the findings of Borst et al (2019).

The emphasis on resource-based views of organisations (Barney, 1991), where human resources are key to leverage competitive advantage, has increased the popularity of work engagement within organisations to improve organisational performance (Schaufeli & Taris, 2014). Higher levels of work engagement have been shown to be significantly positively correlated to a range of personal and organisational outcomes including task performance (Leung et al. 2011; Yeh et al., 2012), job performance (Yalabik et al., 2013), organisational citizenship behaviour (Rich et al., 2010), positive health outcomes (Freeney & Fellenz, 2013), life satisfaction (Shimazu et al., 2012), turnover intentions (Agarwal et al., 2012; Soane et al., 2012) and organisational commitment (Wefald et al., 2011).

The UWES manual defines work engagement as a positive, fulfilling, work-related state of mind and comprising of three dimensions (Schaufeli & Bakker, 2004). The dimensions of work engagement (Schaufeli & Bakker, 2014, p. 5) are as follows:

- 1) Vigour is characterised by “high levels of energy and mental resilience while working, the willingness to invest effort in one’s work, and persistence even in the face of difficulties”.
- 2) Dedication is characterised by “feelings of a sense of significance, enthusiasm, inspiration, pride, and challenge”.
- 3) Absorption is characterised by “being fully concentrated and deeply engrossed in one’s work, whereby time passes quickly, and one has difficulties with detaching oneself”.

Within the CSEES, employee engagement is defined as measuring ‘the sense of energy, connection and fulfilment civil servants have with their work’ (Government of Ireland, 2016), aligning to the UWES definition.

The UWES was originally developed by Schaufeli and Bakker (2004) as a 17-item scale (UWES-17). A shortened version of the scale was developed in 2006 called UWES-9, which reduced the scale to nine items. The reduction did not decrease the efficacy of the scale, with factor validity, internal consistency and test-retest reliability being maintained (Schaufeli et al., 2006). An ultra-short scale with three items (UWES-3) was developed in 2019 and was also found to be a reliable and valid indicator of work engagement that can be used as an alternative to the longer version (Schaufeli et al., 2019).

The CSEES employee engagement scale includes six items from the UWES scale. The UWES items included in the CSEES employee engagement scale have the same wording as UWES apart from one. The item, ‘At my work, I feel bursting with energy’ from UWES becomes ‘At my work, I feel full of energy’ in the CSEES employee engagement scale. Table 1 outlines the items in all four scales: UWES-17, UWES-9, UWES-3 and the CSEES employee engagement scale. For simplicity, the UWES wording has been used for the items. Five of the six items used for the CSEES are included in the UWES-9 scale. Two of the three items in the UWES 3-item scale are included in the CSEES employee engagement scale. The ‘At my work I always persevere, even when things do not go well’ item is in the UWES-17 scale but not the UWES-9 scale.

Table 1

UWES and CSEES Employee Engagement Statements

Dimension	UWES Item Wording	UWES-17	UWES-9	UWES-3	CSEES
Absorption	Time flies when I am working	X			
Absorption	When I am working, I forget everything else around me	X			
Absorption	I feel happy when I am working intensely	X	X		
Absorption	I am immersed in my work	X	X	X	
Absorption	I get carried away when I am working	X	X		
Absorption	It is difficult to detach myself from my work	X			
Dedication	I find the work that I do full of meaning and purpose	X			
Dedication	I am enthusiastic about my job	X	X	X	X
Dedication	My job inspires me	X	X		X
Dedication	I am proud of the work that I do	X	X		X
Dedication	To me, my job is challenging	X			
Vigour	At my work, I feel bursting with energy	X	X	X	X
Vigour	At my job, I feel strong and vigorous	X	X		
Vigour	When I get up in the morning, I feel like going to work	X	X		X
Vigour	I can continue working for very long periods of time	X			
Vigour	At my job, I am very resilient, mentally	X			
Vigour	At my work I always persevere, even when things do not go well	X			X

Salanova and Schaufeli (2008) suggest that absorption should be considered a consequence of work engagement, similar to the concept of flow (Csikszentmihalyi, 1990) rather than dimension of work engagement, with vigour and dedication as core dimensions of work engagement. However, this seems to be a singular approach within the literature.

The CSEES includes the absorption component of the UWES in the well-being scale items which is not a focus of this study. The six vigour and dedication items are the only items in the CSEES employee engagement scale. Within the UWES,

absorption is characterised by 'being fully concentrated and happily engrossed in one's work, whereby time passes quickly, and one has difficulties with detaching oneself from work' (Schaufeli & Bakker, 2004, p. 5). Within the CSEES, well-being is defined as measuring 'the extent to which civil servants feel they can realise their own potential and cope with the normal stresses of life' (Government of Ireland, 2021, p.16). Although these definitions are not directly comparable, the items within the CSEES well-being scale incorporates items referencing concentration on and enjoyment of work and coping with work problems.

Three main criticisms have been levelled at UWES (Schaufeli & Bakker, 2022). The first relates to UWES as a unique construct, arguing that it overlaps with burnout (Cole et al., 2011) and that it has strong correlations with job attitudes, including job satisfaction, job involvement and organisational commitment (Christian et al., 2011). This approach makes it very challenging to differentiate between work engagement, satisfaction, and commitment (Meyer, 2017). Secondly, UWES has been challenged for not having a firm theoretical basis. It was created inductively through interviews, with the assumption that work engagement is the positive antipode of burnout (Schaufeli & Bakker, 2022). Thirdly, the factor validity and factorial invariance of the UWES has been questioned, with no absolute consensus on the three-factor structure and the factorial invariance of the UWES construct (Kulikowski, 2017).

Criticisms of the conceptual framework and the dimensionality of the UWES must be a consideration in the interpretation of the findings of this study. However, as UWES is the most widely cited scale in the literature (Bailey et al., 2017) and has

been shown to withstand a reduction in the number of items within the measure, this study assumes that the CSEES employee engagement scale, a modified six-item UWES, is likely a robust measure.

A consensus has not emerged on how work engagement scores are presented (i.e., as an index score or other scale) or what constitutes high or low work engagement. No literature was found that explicitly discussed this concern. The CSEES (Government of Ireland, 2016), the Northern Ireland Civil Service Survey (NISRA, 2019) and the UK People Survey (Cabinet Office, 2012) use an index score method, from zero to one hundred but do not define high or low employee engagement.

The UWES manual (Schaufeli & Bakker, 2004) uses a scale from zero to six, reflecting the seven response options in the applied Likert scale. The scores are calculated by taking the mean scale score of all responses. The scores are categorised into five categories: 'Very high', 'High', 'Average', 'Low' and 'Very low'. The categories are applied based on the location of scores with specific percentiles. For example, 'Very high' is categorised as a score higher than or equal to the 95th percentile of scores within the specific data set. Thus, the categorisation of the score is based on the dataset itself. The lack of distinct thresholds and definitions of levels of engagement makes direct comparison of categorised work engagement scores between studies using this approach very challenging, if not impossible. However, it does strengthen the case for the use of cumulative modelling, such as item response theory (IRT) and Rasch modelling, which places the person and item on the same logit scale.

This section provided a brief summary of the origins of work or employee engagement, the differing definitions and conceptual approaches to it and a more detailed examination of UWES, the scale underpinning the CSEES employee engagement scale. Work engagement is challenging to measure for a variety of reasons; there is no agreed definition, there are a range of conceptual frameworks and no agreement on whether work engagement is a state, trait or behaviour or a combination thereof. There are also questions as to whether work or employee engagement is a unique construct distinct from other concepts, such as burnout. Layered onto this is the challenge in choosing a quantitative psychometric scale which can be mapped onto a chosen definition of engagement to appropriately measure the levels of engagement of a specific population.

Despite the complexities, work engagement is considered to be a valuable concept to measure. A pragmatic approach is to use the best possible scale based on current research. The UWES, although predetermined for this research, meets this requirement for the CSEES. It is the most cited scale, and it has flexibility, both in the conceptual framework which underpins it (JD-R model) and in the maintained robustness of the scale when the number of items were reduced, from 17 items to three items. Based on the literature, the CSEES scale as a modification of the UWES, is likely to be an appropriate scale for the measurement of employee engagement in the Irish Civil Service, warranting the further psychometric and statistical analysis undertaken in this study.

Psychometric Assessment of the UWES

Whether the CSEES employee engagement scale is an appropriate measure of employee engagement for the Irish Civil Service is the question underpinning this study. The question is answered quantitatively, primarily through the application of psychometric statistical techniques to the CSEES employee engagement scale. This section is a review of literature which has applied psychometric techniques within their analysis, with a focus on literature specific to the UWES.

Cronbach's alpha and McDonald's omega are used to estimate reliability in this study. Cronbach's alpha is the most cited measure when assessing the reliability of a scale with 90% of studies analysed by McNeish (2018) using this measure. However, Cronbach's alpha has limitations, primarily in how it is interpreted, and thus applied. One misinterpretation is that a high Cronbach's alpha score implies unidimensionality, when unidimensionality is an underlying assumption of Cronbach's alpha and thus is not evidence of unidimensionality. Cronbach's alpha also requires that all items be equivalent and measure the underlying latent trait equally, which is unlikely to be the case (Graham, 2006). McDonald's omega does not require these underlying assumptions (Hayes & Coutts, 2020). IRT assesses the validity of the CSEES scale by assessing the ability, discrimination, and difficulty of the scale at an item level. The dimensionality of UWES has been much debated, given that Schaufeli and Bakker (2004) developed the UWES to include the three dimensions of vigour, dedication and absorption with a high level of correlation between the dimensions. Schaufeli and Bakker (2022) proposed that a three-factor structure is superior to the one-factor structure when assessing scale validity of UWES using factor analysis (Schaufeli & Bakker, 2022) while also considering the

UWES to be a unitary scale with three different yet closely correlated dimensions. They recommended that the total score of all dimensions of UWES could be used as an indicator of work engagement regardless of whether the UWES is found to be unidimensional or multidimensional.

Kulikowski (2017) evaluated 21 studies that looked at the factorial validity of UWES using factor analysis. Only one study failed to confirm the factorial validity of the one-factor or three-factor construct of UWES. Of the remaining 20 studies, the factorial validity of UWES as a one-factor construct was found to be superior in six studies and the three-factor construct was found to be superior in a further six studies. The remaining eight studies concluded that the one-factor and three-factor constructs could be considered equivalent. Where multiple factors were found, the correlations between the factors were high and greater than or equal to 0.8 for all studies reviewed.

Additional studies reviewed the three-factor structure of UWES in longitudinal and country comparison studies. Regarding the longitudinal study, Seppälä et al. (2009) analysed data on a cohort of dentists, which had two measurement points across three years. The three-factor structure was invariant across the two measurement points investigated by Seppälä et al. (2009) and high rank order stabilities were found for UWES using structural equation modelling (SEM). In addition, the three-factor structure of UWES was found to be invariant across several countries internationally (Llorens et al., 2006; Schaufeli et al., 2002). These studies found that although the three-factor structure remains the same internationally, the values for the factor loadings and correlations of the latent

factors can differ across countries. Seppälä et al. (2009, p. 476) found that “(..) work engagement can be considered as both a one-dimensional and as a three-dimensional construct, depending on the research process”, agreeing with the findings of Hallberg and Schaufeli (2006), Littman-Ovadia and Balducci (2013) and Kulikowski (2019).

In Kulikowski’s (2017) systematic review of research on the factorial validity of the UWES, the cohorts within each study were not large, with a median sample size of less than 500 for the 21 studies reviewed. Five studies had a sample size greater than 1,000 while an additional five studies had a sample size of less than 300. The appropriate sample size for exploratory factor analysis has been much discussed, with sufficient minimums ranging from 50 observations (Sapnas & Zeller, 2002) to 300 observations (Tabachnick & Fidell, 2001). Comrey (1973) considered a sample size of 100 as poor, 200 as fair, 300 as good, 500 as very good, and 1000 or more as excellent for exploratory factor analysis. Differences in minimums are dependent on the data itself and outputs of the factor analysis (de Winter et al., 2009). The 2020 CSEES dataset has over 23,000 observations.

This study considers both a one-factor structure and three-factor structure underlying the UWES as equally valid. However, a one-factor or unidimensional approach is incorporated into the analysis for two reasons. Firstly, the CSEES employee engagement scale includes only two of the three dimensions of the UWES and secondly, regression analysis is best suited to a unidimensional scale due to the high level of correlation between the possible three dimensions.

Measure invariance refers to whether a scale or instrument is interpreted in the same way across different cohorts (Putnick & Bornstein, 2016). Measure invariance was not found in a study of UWES and work engagement in the South African police force (Storm & Rothmann, 2003) or between different occupational groups such as Dutch (Schaufeli & Bakker, 2004) and Japanese (Shimazu et al., 2010) white collar employees and health care professionals, Spanish workers, and students (Schaufeli et al., 2002), and Finnish health care workers, educators, and white- and blue-collar workers (Seppälä et al., 2009).

Measure invariance can also be assessed using uniform and non-uniform differential item functioning (DIF). Uniform DIF occurs when the probability of endorsing an item is greater for one group across all levels of ability. For non-uniform DIF, the probability of endorsing an item, can differ between groups dependent on the level of ability (Zumbo, 1999).

Four papers were found that applied DIF to the UWES (Domínguez-Salas et al., 2022; Hong Goliath-Yarde & Roodt, 2011; Song et al., 2020; Zhu, 2018). Domínguez-Salas et al. (2022) studied a cohort of Spanish healthcare workers and found that DIF was suggested for gender for three of the nine items in UWES-9 scale, one of which was included in the CSEES employee engagement scale; 'At my work, I feel bursting with energy'. Song et al. (2020) applied UWES-17 on a cohort of South Korean workers in the private sector and found DIF suggested by gender for nine of the 17 items. Four of the items are in the CSEES employee engagement scale; 'I am enthusiastic about my job', 'At my work, I feel bursting with energy', 'When I get up

in the morning, I feel like going to work’, and ‘At my work I always persevere, even when things do not go well’.

Goliath-Yarde and Roodt (2011) applied DIF to a UWES-17 response dataset of ICT professionals in South Africa. DIF was applied to the three dimensions of vigour, dedication and absorption using ordinal logistic regression analysis by differing demographics, including gender, length of service and position in the company. They found uniform and non-uniform DIF was suggested for different cultural or ethnic groups, but not for the other demographic cohorts, including gender. Zhu (2018) did not find uniform nor non-uniform DIF by gender for a sample of US professionals across different industries. The author found that women endorsed a higher score than men for “When I wake up in the morning, I feel like going to work”, but the magnitude was trivial and could be ignored.

IRT is known as latent trait theory or item characteristic curve theory (Lord et al., 1968; Rasch, 1960). IRT is widely used in the assessment of items which measures a latent trait of interest such as intelligence or employee engagement. The assumption of UWES is that work engagement is a psychological state (Schaufeli & Bakker, 2004) while IRT investigates latent traits. A tension exists in framing employee engagement as a latent trait in order to apply IRT but as the CSEES is a single point in time survey, it is challenging to assess if the employee engagement measured within the data is a state or trait of the civil servants who responded to the survey. A longitudinal study of Dutch public servants using a JD-R model found that those with proactive personalities experienced increased work engagement over the period of research, suggesting that traits impact engagement levels and

the changes over time underscore a state-like aspect of engagement (Dikkers et al., 2010).

IRT has been applied in several studies using UWES. Using the dataset which was sourced from the research by Goliath-Yarde and Roodt (2011), the dimensionality of UWES-17 was analysed by de Bruin et al. (2013) using the IRT Rasch model. de Bruin et al. (2013) found that UWES-17 should be considered unidimensional with a summative global score given across the items rather than applying separate scores related to the three dimensions of dedication, vigour, and absorption. The IRT analysis also demonstrated the UWES-17 scale yields very reliable scores. It is an 'excellent scale with very strong measurement properties' (de Bruin et al., 2013, p.7).

However, respondents in de Bruin et al. (2013) did not use the 7-point Likert scale as expected, with a low frequency of responses in the 'Almost Never', 'Rarely' and 'Sometimes' response categories. The response categories were maintained and not collapsed in the analysis. Following from this, IRT analysis of the UWES data found that UWES provides 'relatively little information in the upper ranges of the trait (where most of the persons are located)' (de Bruin, 2013, p.6). The test information curves showed that the respondents with the smallest standard error, resulting in the most information, were located in the lower range of the person distribution. Simbula et al. (2013) found that respondents to the Italian version of the UWES-17 scale had clustered results that would consider them to be average engaged or highly engaged, reflecting this finding. Shimazu et al. (2012) found that UWES-9 had difficulty in differentiating workers with extremely low levels of

engagement using IRT on a Japanese cohort. The same study applied IRT to a Dutch cohort who were asked the UWES-9 statements and found that UWES-9 had difficulty in differentiating workers with high levels of engagement. They posited that lack of measurement accuracy for the Japanese cohort was possibly due to a tendency of Japanese workers not to express a more positive stance with respect to engagement. Song et al. (2020) found that the UWES-17 scale met the requirements of content validity using a Rasch model but did query the item fits of “At my work I always persevere, even when things do not go well” and “It is difficult to detach myself from my job”. Song et al. (2020) also queried the substantive validity of the UWES-17 scale due to a low level of discrimination seen in the model, with UWES-17 considered to be unlikely to correctly measure the engagement of workers with above average levels of engagement.

Although de Bruin (2103) acknowledged that measurement disturbance will occur when empirical data is used, three UWES-17 items did not fit the IRT model to a degree that was considered consequential. These three items were within the absorption dimension of UWES (“When I am working, I forget everything else around me”, “I get carried away when I’m working” and “It is difficult to detach myself from my job”). Thus, de Bruin contended that the absorption dimension does not fit the unidimensional UWES and should not be considered a core component of work engagement.

A systematic literature review by Zahari and Kaliannan (2022) on antecedents of work engagement, found that most studies focused on individual factors such as job design-related, leadership and organisational and team factors. The JD-R

framework was incorporated in most studies and 41 of the 48 studies used UWES. Several limitations were found in the studies reviewed. Many of the studies were cross sectional, resulting in correlational rather than causational relationships between work engagement and the antecedents. Convenience sampling was applied in many studies, lacking representivity of the population. The self-reporting nature of the scales used, such as UWES, may result in common method bias and variance. It was also noted that most studies do not distinguish by employee demographics in the analyses.

Many methods can be applied in assessing the psychometric properties of a scale. This section provides an overview of the concepts and methods underpinning the psychometric assessment of a scale, including reliability, validity, internal structure and dimensionality relevant to this study. The literature provided a consistent set of methods which could be applied in this study, with assessment of correlations, Cronbach's alpha, factor analysis, regression analysis, DIF and IRT appearing regularly in the research.

UWES was originally developed as a three-factor scale with a high level of correlation between the three dimensions of vigour, dedication and absorption (Schaufeli & Bakker, 2004). In studies reviewed in this literature review, the UWES was generally found to have strong reliability and validity. However, the internal consistency of the UWES has been questioned, with its unidimensionality or multidimensionality dependent on the study.

The position of this study is that both a one-factor or three-factor scale is valid, but that a one-factor or unidimensional scale is most appropriate for the statistical

methods to be applied, including IRT and regression analysis. Studies highlighted in this literature review using IRT questioned the discrimination of the various items within the UWES, with the scale being less useful for individuals at the upper end of engagement. Studies in this literature review also queried the degree to which some items fit the IRT model. The likelihood of DIF by demographic also varied from study to study.

This review found the volume of research on the psychometric properties of UWES to be limited, especially for datasets of large scale and in the public sector. Despite this, the literature generally finds UWES to be a robust and valid measure of engagement although the potential impact of sample size within the literature was highlighted using Kulikowski's (2017) review of the factorial validity of the UWES, with smaller samples giving less robust results. The impact of sample size in potential analyses highlights the significant value of analysing the CSEES employee engagement scale, with over 60,000 observations across the three iterations of the survey.

Employee Engagement and the Irish Civil Service

This section aims to review employee engagement from a demographic and organisational perspective, highlighting research relevant to the public service, gender, grade and tenure of length of service, providing context to the findings of this study, especially those related to the summary statistics and antecedent analysis. The volume of research and meta-analyses of engagement that place engagement within specific sectors, such as the public sector, is limited (Borst et al., 2020; Fletcher et al., 2020; Kernaghan, 2011; Vigoda-Gadot et al., 2013). Thus, this study is well-positioned to address a gap in the current literature, strengthening the contribution and relevance of the research.

Studies in the private sector show work engagement as a robust predictor of performance outcomes (Christian et al., 2011). Borst et al. (2020) argue that work engagement is more highly correlated to other job-related attitudinal constructs for public sector employees than for private sector employees. Work engagement is possibly the answer to performance enhancement in the public service as work engagement is positively related to good service provision, the improvement of client satisfaction and quality of service (Vigoda-Gadot et al., 2013).

The relationship between work engagement and job performance is also a consideration when looking at the appropriateness of an employee engagement scale within a public service context. Two meta-analyses of the link between work engagement and job performance by Corbeanu and Iliescu (2023) and Neuber et al. (2021) found that the three facets of work engagement (vigour, dedication and absorption) were positively associated with task performance, with work

engagement being a protective factor that promotes well-being and leads to better performance. Neuber et al. (2021) did that highlight task performance is not equivalent to job performance, as it does not consider contextual performance. However, research has found a positive link between contextual performance and work engagement (Christian et al. 2011, Demerouti et al., 2015, Mackay et al. 2017), apart from Reig-Botella et al. (2024) who found that absorption was detrimental to contextual performance.

Distinct characteristics are associated with public sector organisations and their employees, with public servants being intrinsically motivated by the job rather than extrinsically motivated with work-related resources (Buelens & Van den Broeks, 2007). Pro-social or public service driven values and motives (de Simone et al., 2016) and intrinsic and autonomous motivational factors (Tadic et al., 2017) are linked with higher levels of engagement (Fletcher et al., 2020). Borst et al. (2020) found that the link between engagement and the attraction and commitment dimensions of public service motivation (PSM) (Rainey, 1982) were higher for those in institutions with a fixed and limited contact with a broad range of service users. The link between the compassion dimension of PSM and engagement was higher for those with an intense and longer contact with specific service users, such as schools and hospitals. Fletcher et al. (2020) found that engagement in the public sector differs from the private sector in its motivational implications with the importance of drivers differing between public and private sector workers. They also highlighted that the public sector itself is not a homogenised sector where an uncritical application of research findings can be applied.

The Civil Service in Ireland has a unique culture and organisational design in comparison to its private sector counterparts in the country. This must be a consideration in any contextual analysis of the employee engagement of Irish civil servants. Within this research, the contextual considerations are implicit, with the impact of the culture and organisational design of the Irish Civil Service inherent to the data and associated analysis. However, this research does aim to add contextual understanding of employee engagement by interrogating the CSEES data by gender, grade and length of service through regression analysis and cross tabulation of index scores.

On gender, Banihani et al. (2013) found that work engagement could be gendered, as men and their characteristics are valued and regarded as more useful than women and their characteristics. They concluded that organisations are designed so that it is easier for men to experience psychological meaningfulness, safety, and availability than for women. They also noted that engagement may not always be considered a positive term, especially for those with family responsibilities. Crompton et al. (2007) observed that work engagement is significantly impacted by the differences in the roles and experiences of men and women in the home and at work. Song et al. (2020) found that women scored more highly in the absorption items of the UWES than men, positing that women are required to employ high engagement strategies due to more limited working hours as a result of family commitments. The Irish Civil Service has a range of family friendly policies which may lessen the impact of the family responsibilities in the work environment including work sharing, blended working, shorter working year, and paid maternity leave (Government of Ireland, 2023).

Tenure refers to the length of service in a role or organisation (McEnrue, 1988). In the CSEES, length of service is defined as the total length of time that a civil servant is employed within the Civil Service rather than at a specific grade within the Civil Service. Hinzmann et al. (2019) observed that those recently hired had the highest level of work engagement, with levels of work engagement decreasing after six months of employment until the end of their employment within the organisation. Dongrey & Rokade (2019) also found that employment engagement is inversely related to length of tenure, with those with the shortest tenure having higher levels of engagement.

On grade, the structure of the Irish Civil Service is narrow graded with a hierarchy of general service, technical and specialist grades. The Civil Service grade structure is a framework for managing pay and mapping career paths across all departments and offices. Most civil servants are in the general service grades. Within these common general grades, the same transparent pay ranges and incremental payments apply (O’Riordan, 2008). The awarding of increments is subject to certain criteria but are rarely withheld. Thus, the Irish Civil Service awards increments based on length of service rather than performance. The Irish Civil Service is a career-based organisation, with the expectation that civil servants will remain in the Irish Civil Service for their working life. In the past, there were few options to enter the Irish Civil Service mid-career. Civil servants would enter at the start of their career and at entry level i.e., Clerical Officer or graduate grade i.e., Administrative Officer. This recruitment approach has changed, and open competitions now allow for entry to the Civil Service at all grades within the Irish Civil Service. Once recruited, civil servants are generally placed in positions

somewhat at the will of the organisation. Roles and responsibilities are assessed at a grade level rather than individual level. This allows for consistent decisions to be made on job grades and rates of pay (O’Riordan, 2008). However, there is significant variation in business needs, grade structure and location of Civil Service Departments and Offices (Government of Ireland, 2023).

In addition to permanency, the Irish Civil Service provides a range of initiatives which allow for a work life balance that are not always offered in the private sector. Flexible working options have been available to some Irish civil servants since the 1960’s. Although not available to all civil servants, arrangements currently include flexitime and flexi-leave work sharing, shorter working year, and career breaks. There are also provisions for different types of leave, such as bereavement, marriage, paternity, parental, and carer’s leave (Government of Ireland, 2023). A hybrid model of working from home and office has since become an operational reality since the COVID-19 pandemic. There is also a centralised Civil Service employee assistance service which offers support to all civil servants. Staff mobility, which allows for the transfer of civil servants between departments and regions is also available. Further education can be funded by the relevant department or office, such as the refund of fees scheme in the CSO, which is funding this research.

The intention of this section of the literature review was to discuss the research on engagement within the public sector and by differing demographics which include grade, gender and length of service, providing context to assessment of the appropriateness of the employee engagement scale via the insights gained from the summary statistics and antecedent analysis. Differences by gender and length of

service were found in the limited number of studies reviewed. The limited body of research on employee engagement and the public sector was highlighted. Within the research available, public sector employees were found to have differing motivations for work engagement than private workers with work engagement more highly correlated to other job-related attitudinal constructs for public sector employees than private sector employees. This demonstrates the value in including antecedent analysis in this study. The overview of the Civil Service in Ireland, with a traditional, narrow graded structure, low churn and a variety of work supports including hybrid working and family friendly policies provides context to the further research in this study.

Conclusion

Employee or work engagement is complex. There are various definitions, theoretical frameworks and psychometric scales available which may overlap with other job-attitudinal concepts. The volume of contextual research, specific to work or employee engagement and the public sector is limited. Research using large scale datasets with multiple iterations is especially limited.

The UWES is the scale underpinning the CSEES employee engagement scale. There are several criticisms of UWES. It was developed from interviews rather than a firm theoretical framework. There are concerns with its alignment with the JD-R model. There is discussion around the possible unidimensionality or multidimensionality of the scale and there are concerns regarding IRT discrimination and difficulty for some UWES items.

However, the UWES is the most cited measure of work engagement within the academic literature (Bailey et al., 2017). UWES is flexible, maintaining internal consistency and validity as a three-item, nine-item, or 17-item scale. This is encouraging when analysing the appropriateness of the CSEES employee engagement scale, a modified six-item version of the UWES. A range of psychometric statistical methods that appear in the literature are also applied in this research, including the assessment of correlations, Cronbach's alpha, factor analysis, regression analysis, DIF and IRT. This supplies a solid framework of psychometric statistical methods to apply in this study, and guidance on the potential findings, and their similarities and dissimilarities to the prevailing research.

The lack of large-scale quantitative research specific to employee engagement for public service cohorts and at a demographic level within organisations does make comparisons between the findings of this study and the current literature challenging. It also highlights the valuable contribution that this study can make to the current literature.

Methods

Research Design

The research design for the current study is quantitative and non-experimental, using the CSEES which is a secondary data source. It is a large cross-sectional dataset gathered across four iterations: 2015, 2017, 2020 and 2023. Data was available for research purposes from the first three iterations of the survey: 2015, 2017 and 2020. The survey was a no-change survey, with a consistent questionnaire design across iterations. Most of the statistical analysis undertaken focuses on the CSEES employee engagement scale, and the six associated items, but the other relevant scales, and associated items were included in the research. Items excluded were demographic variables including organisation name, and scales related to civil service renewal projects.

The quantitative methods applied to the data included measures of association, measures of internal consistency, measure of dimensionality, measures of cumulative modelling and descriptive statistics. The CSEES was a census survey of all civil servants in the Irish Civil Service in 2015, 2017 and 2020. The survey was a no-change survey with minor amendments were made to the demographics and departmental structure questions in each iteration of the survey. In 2020, an additional module was included with COVID-19 items on working from home. Nominal recoding of the data was undertaken, including further grouping of demographic data for statistical disclosure control purposes and the application of descriptive labels to some numerical data.

Data Source

The CSEES was a census survey of all civil servants in the Irish Civil Service in 2015, 2017, 2020 and 2023. Approximately 40,000 active civil servants were invited to complete each iteration of the CSEES survey in 2015, 2017 and 2020. The survey is a census rather than a sample survey as it was sent to all active civil servants. In 2015, there was a 39% response rate, equivalent to 15,519 completed responses. In 2017, there was a 56% response rate, equivalent to 21,365 completed responses. In 2020, there was a 65% response rate, equivalent to 26,795 completed responses. The CEES data from all three iterations of the survey were incorporated into this study, amounting to 63,679 responses.

The increase in response rates in 2017 and 2020 from 2015 resulted in a more representative sample across the Civil Service. The 2017 and 2020 survey datasets can be seen as generally representative of the Civil Service and by grade, gender, and length of service. The 2015 dataset is incorporated into this research but is less representative of the Civil Service population due to the lower response rate.

For this study, the data was segmented by grade, gender, and length of service as these demographics were found to be most relevant in the development of the CSEES and were included in previous publications by the Government of Ireland (2021). Age and length of service were strongly correlated in the data, so age was not included in this study. Other demographic items collected, but not applied in this research, included focus of work, geographic region, department headquarters, working hours and contract type, which are relevant at an organisational level. The

data could not be segmented by organisational level for this study for confidentiality reasons.

The CSEES was a single mode survey, with the survey responses gathered using an online survey platform, apart from a very small number of paper-based surveys in 2015. It was a computerised self-administered survey (CSAQ) where respondents are self-guided (Fielding et al., 2016). The online link was not indexed but could be accessed using any browser, including browsers outside of Civil Service networks. The survey was voluntary and as accessible as possible, including the use of screen readers and colleagues helping in completing the questionnaire where required. The survey was provided in both Irish and English.

The CSEES was developed and tested by the Central Statistics Office (CSO), the Department of Public Expenditure and Reform (DPER) in collaboration with Dublin City University (DCU). It was developed by DPER, CSO and DCU. The Civil Service Management Board (CSMB) tasked the CSO with administering the CSEES in 2015, 2017, 2020 and 2023. The CSMB is the data controller for the CSEES while the CSO was the data processor under GDPR. The data for the CSEES was collected by the CSO.

The CSEES included statements across over twenty themes, including meaningfulness, organisational support, well-being and coping with change. The CSEES employee engagement scale in the survey incorporates six items from the 17-item UWES work engagement scale (Schaufeli & Bakker, 2004). Items from the vigour and dedication dimensions of the UWES are included in the CSEES employee engagement scale while items from the absorption dimension are not. Although not

directly, the CSEES includes the absorption dimension of the UWES in the well-being scale items. These items are not a focus of this study.

In collaboration with the CSO, the Department of Public Expenditure and Reform (DPER) published three survey reports for the Civil Service population. These reports included key findings and insights reflecting the overarching Civil Service human resources frameworks, the index scores for each scale, regression analysis for the employee engagement, commitment to the organisation, well-being and coping with change scales and cross tabulations of employee engagement scores by grade, gender, and length of service.

Some of the same methods in the DPER publications were applied and expanded upon in this study, including descriptive statistics, Pearson's correlation coefficients, Cronbach's alpha, exploratory and confirmatory factor analysis, and regression analysis. In this study, the data is further segmented by demographic variable for most of the research methods. Additional research analyses and methods were applied in this study, including McDonald's omega, Item Response Theory (IRT) and differential item functioning (DIF).

The survey was designed to ensure the confidentiality of the respondent. The survey contained responses to the items, demographic data, and some log-based data such as time stamps and IP addresses. The IP addresses were wiped by the CSO before the data was processed and fully anonymised.

Procedures

Several quantitative psychometric techniques were applied to the CSEES data in order to assess the appropriateness of the CSEES employee engagement scale as a measure of employee engagement in the Irish Civil Service. These techniques included:

- Investigating the internal consistency and reliability of the CSEES employee engagement scale using Pearson's correlation coefficients, Cronbach's alpha, McDonald's omega, and exploratory factor analysis (Brown, 2015).
- Applying confirmatory factor analysis, a form of structural equation modelling (SEM) to evaluate and confirm the exploratory factor analysis model which posited employee engagement as the underpinning latent trait of the CSEES employee engagement items (Foster et al., 2006).
- Using Item Response Theory (IRT) to investigate the characteristics of the items within the CSEES employee engagement scale. IRT aims to establish the relationship between latent variables and their manifest variables. IRT models examine the overall response patterns across all the items under consideration. (de Ayala, 2009).
- Applying differential item functioning (DIF) methods to the CSEES employee engagement items to evaluate whether the items are measuring employee engagement differently for different cohorts or if differences between cohorts are a result of true differences in levels of employee engagement (Brown, 2015).
- Applying multiple linear regression to estimate the antecedents of employee

engagement for cohorts of interest (Field, 2013). Antecedents are the attitudinal measures that influence the employee engagement scores of respondents.

- Using a variety of descriptive statistical methods to tabulate CSEES employee engagement scores of civil servants by grade, gender and length of service. T-tests were also applied to assess the statistical significance of any differences found (Field, 2013).

Measures of Association

Measures of association refer to a range of statistical methods that quantify the strength and direction of relationships between variables, enabling comparison between different groups. Pearson's correlation coefficients (Pearson, 1895), a measure of linear association, were calculated for the three CSEES datasets to examine the relationships between the CSEES employee engagement scale and other measures in the datasets. The correlation coefficients were also used to explore whether items are so highly correlated that they should be merged to make a single measure, such as the employee engagement scale.

Measures of Internal Consistency

Measures of internal consistency include reliability and validity. Reliability is a way to assess the amount of random and systematic error inherent in a scale and the associated results, with a more reliable scale being one in which the results aim to be precise and as free from measurement error as possible and thus is the ratio of true score variance to observed score variance (Mead, 2019). The reliability of a scale is not an inherent property of the scale but is the interaction of the scale, the population using the scale and the circumstances under which the scale is

administered. Reliability evaluates the results rather than the instrument itself (Gronlund & Linn, 1990). Examples of methods used to assess different types of reliability are Pearson's correlation, Cronbach's alpha and McDonald's omega which look at the internal consistency of a scale. Reliability and the next concept, validity, are related with the higher the reliability, the higher the possible maximum validity.

Cronbach's alpha and McDonald's omega are used to estimate reliability in this study. Cronbach's alpha is the most cited measure when assessing the reliability of a scale with 90% of studies analysed by McNeish (2018) using this measure.

However, Cronbach's alpha has limitations, primarily in how it is interpreted, and thus applied. One misinterpretation is that a high Cronbach's alpha score implies unidimensionality, when unidimensionality is an underlying assumption of Cronbach's alpha and thus is not evidence of unidimensionality. Cronbach's alpha also requires that all items be equivalent and measure the underlying latent trait equally, which is unlikely to be the case (Graham, 2006). McDonald's omega does not require these underlying assumptions (Hayes & Coutts, 2020). IRT assesses the validity of the CSEES scale by assessing the ability, discrimination, and difficulty of the scale at an item level.

Cronbach's alpha is a classical test theory (CTT) method developed by Lee Cronbach (1951). It measures the internal consistency and reliability among a group of items that are combined to form a single scale, such as employee engagement. Cronbach's alpha reflects how well the different items complement each other in their measurement of different aspects of a measure. It assumes that each item measures the underlying trait equally well, which is not always true. Cronbach's

alpha is interpreted like a correlation coefficient where values ³ 0.70 indicate a strong result.

Two versions of the Cronbach's alpha can be calculated: the raw and standardised alpha. The standardised alpha is based upon item correlation. The stronger the items are inter-related, the more likely the test is consistent. The raw alpha is based upon item covariance. Variance is a measure of the spread of the distribution of a single variable. Covariance is a measure of the distributions of two variables. The higher the correlation coefficient is, the higher the covariance is. The raw alpha is sensitive to differences in the item variances, which is an issue when items are structured differently e.g., if there had been a mixture of dichotomous and multi-point scales in the survey (Fielding, 2017). This was not an issue for this research, with the uniform seven-point Likert scales being used for the CSEES employee engagement scale and five-point Likert scale for the other CSEES items. Thus, the raw alpha coefficients were used. The summed covariance formula is as follows where V is variance, C is covariance, and n is the number of items in the scale. Note that this is the population variance, not sample variance:

$$\alpha = \frac{n}{n-1} \left(\frac{\sum_i \sum_j C_{ij}}{V_i} \right)$$

Like Cronbach's alpha, McDonald's omega is a measure of the internal consistency, reliability, and factor saturation of a scale. McDonald's omega is a more general form of reliability estimation in comparison to Cronbach's alpha. There is research to suggest that McDonald's omega is preferable to Cronbach's alpha in the assessment of latent traits, as it does not require unidimensionality of

the latent trait, tau equivalence, equal factor loadings or uncorrelated errors (Hayes & Coutts, 2020). However, the procedure to calculate McDonald's omega is more complex than for Cronbach's alpha. The calculation of factor loadings and error variances from factor analysis being a requirement prior to the estimation of McDonald's omega. These are not a prerequisite in calculating Cronbach's alpha.

The omega function in the R package, psych, was applied to generate McDonald's omega for this study (Revelle, 2022). SAS procedures were applied for all other methods. The psych package generates McDonald's omega by using Revelle's omega total (McNeish, 2018) among other measures. The omega function applies exploratory factor analysis and estimates McDonald's omega. Maximum likelihood estimation is also applied in the function.

Validity evaluates whether the results of a scale are accurate and measures what it claims to measure within a specific population and situation (Landy, 1986). The assessment of the validity of psychometric constructs, such as employee engagement, can be challenging as it is dependent on the definition of engagement underpinning the scale and is not a directly observable phenomenon (Streiner & Norman, 2008). There are several types of validity, including criterion validity (Kane, 2001), content validity (Ebel, 1961), construct validity (Cronbach & Meehl, 1955). These three types of validity were originally considered the trinitarian view of validity (Landy, 1986). Additional subtypes of validity testing have been further developed, resulting in a hypothesis approach to validation, where the validation approaches used are specific to the scale and associated population being measured (American Educational Research Association et al., 1999).

Content validity examines the degree to which the items within a scale are relevant to and representative of the attribute being assessed. Content validation relies on a panel of experts to assess the scale and involves a range of qualitative and quantitative approaches in the assessment. Face validity assesses if a scale measures what it intends to measure, at face value. Although different to content validity, face validity uses a similar assessment approach to content validity, with the involvement of a panel of experts in the design. The content validity and face validity of the UWES and CSEES measures is assumed due to the extensive use of the UWES (Bailey et al., 2017) and the development process involved in the CSEES survey with involvement of the Central Statistics Office, Dublin City University and the Department of Public Expenditure and Reform and the piloting of the CSEES employee engagement scale prior to implementation.

Construct validity evaluates how well a scale measures the construct it was designed to evaluate. Factor analysis and IRT are used to assess construct validity and factorial validity in this study.

Measures of Dimensionality and Structure

Factoral validity is a form of construct validity and looks at the extent that the latent underlying structure of a scale can be determined by investigating the relevant items within a scale. If the factoral validity is confirmed, then the scale will have an internal structure that is either unidimensional or multidimensional. A unidimensional internal structure requires the relevant items to align to a single factor. A multidimensional scale will form multiple factors that cohere around each dimension but are also significantly correlated to each other. This can be assessed using factor analysis.

There are two aspects to factor analysis: exploratory factor analysis and confirmatory factor analysis. Exploratory factor analysis explores possible factors or latent structures within a dataset by generating a model while confirmatory factor analysis validates the latent structures found by assessing the goodness of fit of the proposed exploratory factor model. For each iteration of the CSEES, the datasets were split into two equally sized random samples using a survey selection method in SAS. The first sample was used for exploratory factor analysis while the second sample was used for confirmatory factor analysis. This segmentation approach is recommended by Anderson and Gerbing (1988) as an approach to validate a chosen factor analysis model.

Factor analysis is a CTT method which is widely used in psychology and the social sciences. Factor analysis was developed by Spearman (1904) with the aim to explore and discover the latent measures or dimensions underlying a dataset. Factor analysis attempts to explain the maximum amount of common variance in a correlation matrix using the smallest number of explanatory measures or factors

(Field, 2016). Royce (1963) defined a factor as a dimension or measure which is a condensed item of a set of variables. More precisely, a factor is a measure operationally defined by its factor loadings. The factor loadings are the correlations of a variable with a factor. The mathematical function for a factor is:

$$x = \mu + \Lambda\xi + \delta$$

Or:

Variables=Variable Means + (Loadings X Common Factor) + Unique Factor

The factor analysis model is a linear model, which uses the loadings as weights and contains an error term, δ , the unique factor. Once a factor exists, and estimated using the equation above, it should then be possible to estimate a person's score on a factor, based on their scores for constituent variables. These are known as factor scores (Kline, 1994). Not all factors found will be retained. The process of deciding how many factors to keep is called extraction. Eigenvalues are used to assess this. Eigenvalues are a special set of scalars associated with a linear system of equations. The eigenvalue associated with a variate indicates the substantive importance of the factor. Therefore, only factors with large eigenvectors are kept. The convention is to keep factors where the eigenvalue is greater than one, known as Kaiser's criterion. However, this is dependent on the data (Foster et al., 2006). For this study, a minimum eigenvalue of one was assumed.

After extraction, factor rotation can be used to calculate the degree to which the variables load onto the chosen factors and hence provide a clean structure. Most

variables will have high loadings on the most important factor and small loadings on the remainder. This can make interpretation difficult, so rotation is used to discriminate between the factors. If factors are visualised as an axis along which variables are plotted, then factor rotation rotates these axes so that variables are loaded maximally to one factor. There are two types of rotation; orthogonal rotation which rotates factors while keeping them independent and oblique rotation which allows factors to correlate (Kline, 1994).

Various numbers of factors were assessed; by examining the scree plots, using the minieigen option to select factors with eigenvalues over one, and using the percent option to select factors that accounted for a certain proportion of common variance. The matrix of the rotated factors was also examined to identify cases of item crossloading, i.e., where an item loaded at 0.32 or higher onto more than one factor (Taherdoost et al., 2012) and to see how the variable blocks corresponded to the factors identified.

The term discriminant validity was created by Campbell and Fiske (1959) who presented a technique based on the concept that tests can be invalidated by too high correlation between unrelated tests. This was developed further by Fornell and Leckner (1981), with a rule for measuring discriminant validity specific to structural equation modelling. This rule posited that discriminant validity between two scales would hold if the average variance extracted (AVE) for both scales is greater than the squared factor correlation between the scales.

Measures of Cumulative Modelling

The CSEES employee engagement scale measures the attitudinal states of civil servants but does not provide insight into how to improve or maintain employee engagement. Multiple linear regression was applied to determine which of the CSEES measures had the strongest association with, or are antecedents of, the CSEES employee engagement scale. Multiple linear regression is an extension of simple regression, in which an outcome is predicted by a linear combination of two or more predictor variables (Field, 2016). The formula of the model is as follows, where Y is the outcome, X denotes each predictor variable, b is the regression coefficient associated with the predictor variable and e is the error term. The value of the outcome when all predictors are zero is b_0 .

$$Y = b_0 + b_1X_1 + b_2X_2 \dots + e_i$$

The factor scores generated from the factor analysis on the CSEES datasets were used as the variables in the regression analysis rather than the index scores. The factor analysis method used for the study is a principal factor analysis method using a squared multiple correlation for estimations. The output from the principal factor analysis shows the strength of the relationships between the measures, and the dominant association is used to group the items into factors. However, most items will also have weak associations with other factors. The weak associations between items and other factors mean that the index scores are a slightly uncertain representation of the real opinion about that measure because of the small influences of other factors in the items. As these influences are very small, only the items with the strongest relationships to each other are grouped into scales. The weak relationships between some items could affect the reliability of the regression

analysis when the index scores are used. Therefore, the factor scores were used in the regression analysis in this study. This approach takes account of the weak relationships between items and measures and ensures that scores for each factor are minimally correlated with each other.

IRT is also known as latent trait theory or item characteristic curve theory (Lord et al., 1968; Rasch, 1960). IRT is widely used in the assessment of test items, where an item measures a latent trait of interest such as intelligence or employee engagement. Latent traits are intuitively understood but not directly observable. IRT aims to establish the relationship between latent variables and their manifest variables using data collected in surveys and tests. IRT models examine the overall response patterns across all the items.

Unlike CTT, where the focus is at a test level and the trait of interest would be measured as a sum of a person's scores on the items on a test, the focus of IRT is at an item level and how a person scored on the item. The parameter estimates in IRT also transcend the sample of people used in their estimation. This is not the case for CTT (de Ayala, 2009).

To measure how much of a latent trait or ability a person has, a scale of measurement must exist. The creation of a scale of measurement, where a numerical value is assigned to a personal trait, can be a technically challenging task. To overcome this, an arbitrary underlying scale of measurement is often created. The amount of a latent trait that a person has is known as their ability in IRT. The scale therefore measures a person's ability. IRT also looks at the difficulty of the

items themselves and does not assume that each item is equally difficult. The difficulty of the item is incorporated into the overall measurement scaling.

As the items of interest in IRT are often test items, the scoring of an item is usually dichotomous. An incorrect answer gives a score of zero and a correct answer gives a score of one. Simpler IRT models using dichotomous responses are described first in this chapter. As the CSEES employee engagement scale is polytomous, with multiple ordered Likert scale response options to each item, the IRT polytomous generalised partial credit model which was applied in this research (Brown, 2015).

The item characteristic curve (ICC) is a key measure of IRT. It is a cumulative form of the logistic function. An item characteristic curve is a logistic function which graphs a person's ability (known as θ) against the probability of a correct score $P(\theta)$ on an item, in the case of a dichotomous model. For typical items, the probability of a correct answer will be higher for people of high ability and lower for people of low ability. If $P(\theta)$ is plotted as a function of ability, a smooth S-shaped curve is the result (de Ayala, 2009). The item characteristic curve does not assess the validity of an item in measuring ability. IRT also makes the following assumptions:

- Monotonicity indicates that as the ability level on the x-axis is increasing, the probability of a correct response on the y-axis also increases. With monotonicity, the probability cannot both increase and decrease as ability level increases.

- Unidimensionality assumes that there is one dominant latent trait being measured by an item and that this trait is the driving force for the responses observed for each item in the measure.
- Local Independence assumes that responses given to the separate items in a test are mutually independent given a certain level of ability.
- With invariance, the item parameters can be estimated from any position on the item characteristic curve. Accordingly, the parameters can be estimated of an item from any group of subjects who have answered the item. The estimates are not dependent on the sample used.

There are three parameters of an item characteristic curve that are used to describe it and are incorporated to different extents in the IRT models: difficulty, discrimination and guessing (de Ayala, 2009).

The difficulty of an item describes where it functions along an ability scale. An item of low difficulty functions well among the low ability respondents while an item of high difficulty functions well among the high ability respondents. Item difficulty is also known as item location. A model which allows difficulty to have various values and sets discrimination and guessing to a fixed value of one is known as a one-parameter logistic (1PL) model.

Discrimination describes how well an item can differentiate between respondents of differing ability and can be thought of as a measure of reliability as understood in CTT. This property is reflected in the steepness of the item characteristic curve in its middle section. The steeper the curve, the better the item can discriminate between people of differing abilities. A model which allows

difficulty and discrimination to have various values and sets guessing to a fixed value of one is a two-parameter logistic (2PL) model. The 2PL model is applied in this study.

Guessing accounts for the possibility of a person guessing a correct answer. A model which allows difficulty, discrimination and guessing to have various values is a three-parameter logistic (3PL) model. Guessing is not included in this study.

The CSEES responses to items are polytomous and ordered, with a seven-point Likert scale for the CSEES employee engagement items. Like the IRT models described in previous sections, 2PL polytomous models assess item functioning using item discrimination and item difficulty parameters. The model that is selected for the CSEES analysis is the generalised partial credit model (GPCM). The GPCM is an extension of the Rasch model (Muraki, 1992). The partial credit model allows for partial credit for responses in contrast to a binary correct/incorrect model as described in dichotomous IRT models. The GPCM contains multiple point levels, starting at zero, and with boundaries between each response category. The GPCM model incorporates a series of 2PL models, assuming the probability of selecting a particular response category over the previous category is governed by the 2PL model. In addition, the GPCM model does not require item discrimination to be equal across items.

The IRT model applied to the CSEES employee engagement items evaluates the latent trait underpinning the employee engagement items, adding to the findings of other methods such as factor analysis. IRT also demonstrates how the items function for respondents, whether the items are difficult and the probability of answering the items in a certain way based on ability. For the CSEES, an item has a

low level of difficulty if a respondent with low ability (or a low level of employee engagement) has a relatively high level of employee engagement score for that item.

Differential Item Functioning (DIF) is a suite of techniques which assess differences in responses to items between groups (e.g., gender) while controlling for the level of a latent trait that a respondent possesses (e.g., employee engagement). DIF occurs if respondents within groups with the same overall scores have a different probability of giving a certain response to an item (Zhang, 2015). There are two types of DIF: uniform DIF and non-uniform DIF. In uniform DIF, an item uniformly favours one group over another, across all levels of ability. In non-uniform DIF, the direction of the difference changes as the ability changes. For example, an item showing non-uniform DIF by gender may favour females at certain levels of employee engagement and males at other levels of employee engagement.

An important distinction is benign versus adverse DIF (Breslau et al., 2008). Benign DIF occurs when the probabilistic differences found are as a result of a real difference in the underlying trait between the two groups. Adverse DIF occurs when the differences found are due to issues with the measurement process, such as interpretation of words in items, which can result in probabilistic differences between groups that are not related to the underlying trait between the two groups. The distinction between benign and adverse DIF within a dataset is challenging to assess quantitatively and is not assessed in this study.

There are three approaches generally used to assess DIF: logistic regression (Swaminathan & Rogers, 1990), IRT and the generalised Mantel-Haenszel procedure (Holland & Thayer, 1988). The SAS proc genmod function, which fits generalised linear models, was used for the DIF analysis of the six CSEES employee engagement items by gender, grade, and length of service. The generalised Mantel-Haenszel procedure is effective for evaluating uniform DIF for dichotomous items between groups. It is not included in this study as the employee engagement items are polytomous. The logistic regression procedure and IRT DIF can detect both uniform and non-uniform DIF for dichotomous and polytomous items. IRT DIF can also model differences in discrimination and item difficulty.

The odds ratios give an indication on whether uniform DIF is seen in the dataset. The odds ratios for this study were created using a logistic regression model. All odds ratios were adjusted for the covariates included in the logistic regression model.

Likert Scale and Index Method

The Likert scale was first developed by Rensis Likert (1932) to identify people's attitudes by applying a metric scale to the responses. Likert scales are generally used as responses to attitudinal items in surveys measuring a single unidimensional concept. It is a bipolar scaling method, which can record positive, neutral, and negative responses. In some cases, the neutral option is removed. It is also a summative and ordinal scale, where the value can be given to the responses and sums or means assigned as the results.

The CSEES uses the same seven-point Likert scale for the employee engagement items that is also used for the UWES-9 scale (Schaufeli & Bakker, 2004). The remainder of the items in the CSEES used a five-point Likert scale. Within the DPER CSEES publications (Government of Ireland, 2016, 2018, 2021), an index method was applied to CSEES employee engagement items, creating a single score for employee engagement and the other scales. This index scale approach was also applied in this study. The index score was calculated as the mean score across the seven response categories where “Never” is equivalent to 0, “Almost never, a few times a year or less” is equivalent to 16.7, “Rarely, once a month or less” is equivalent to 33.3, “Sometimes, a few times a month” is equivalent to 50, “Often, once a week” is equivalent to 66.7, “Very often, a few times a week” is equivalent to 83.4 and “Always, every day” is equivalent to 100. The employee engagement index is then calculated as the mean employee engagement score in the Civil Service or relevant cohort. This method can result in potential smoothing of responses, where extreme responses are averaged to a neutral response for the entire cohort.

An underlying assumption of the CSEES is that respondents answer the items truthfully and without bias. However, there are three known types of biases which can occur with Likert scale responses: central tendency bias, acquiescence bias and social desirability bias (Pimental, 2019). With central tendency bias, respondents tend to choose the middle responses and avoid extreme response choices. With acquiescence bias, respondents tend to agree with the item given. With social desirability bias, respondents may respond more positively than truthfully, putting a subject, group, or organisation in a more favourable light. Awareness of these

types of biases must be a factor in the interpretation of the analysis in this study but are challenging to estimate quantitatively.

Summary or descriptive statistics were created for both the CSEES datasets and the Civil Service population as a whole. This provided a contextual overview of the levels of employee engagement for different demographics within the Civil Service. T-tests were also applied to assess the statistical significance of any differences between CSEES employee engagement scores. A 2-sample t-test for independent samples with the assumption of equal variance was applied in this study (Field, 2013). This t-test is used in cases where the data is not longitudinal and there is similar variance seen in the scores in each iteration of the dataset. The p value from the t-tests can be read as a percentage likelihood, with a p-value of 0.05 indicating that the difference is statistically significant with a 95% confidence interval.

Ethical Considerations

Ethical approval was given under CSO policies and guidelines, and informed consent was given, both for the collection of the data for survey publication purposes and for further research purposes. The CSO followed all requirements under the General Data Protection Regulation (GDPR) and internal CSO policies and frameworks in gathering and publishing the data. The same approach was followed for this research. Authorisation has been given for the use of the data for research purposes by the respondent, the survey owners (CSMB) and the CSO.

Although the data does not contain primary identifiers (name, address etc), there are secondary variables, where combined, can identify respondents. These are considered confidential. To maintain the confidentiality, the data was held at the CSO. The CSO's Statistical Disclosure Control Policy (CSO, 2018) is applied to this study. All outputs were reviewed by a Senior Statistician within the CSO to ensure the validity and confidentiality of the data from this research prior to submission to UCC. The UCC ethics process was also undertaken in the development of this research. The ethics application was approved by the UCC Ethics Committee.

The CSEES was developed with the confidentiality of respondents as a priority. It was designed so that survey responses could not be directly attributed to a respondent. As a result, the survey datasets across the three iterations cannot be analysed longitudinally. However, multiyear comparative tables are included in the study as the population can be considered quasi-longitudinal due to the low level of churn of the population (Government of Ireland, 2021).

Conclusion

The intention of this research is to provide a clear quantitative assessment of the appropriateness of the employee engagement scale in measuring employee engagement in the Civil Service using several robust psychometric and statistical methods.

The first objective is to assess if a latent trait does exist that combines the six employee engagement items to form an employee engagement scale. The methods that add to this understanding of an underlying latent trait are Cronbach's alpha, McDonald's omega, exploratory and confirmatory factor analysis and IRT.

The second objective is to evaluate the relationship of this latent trait, if it exists, with the other measures within the CSEES. Pearson's correlation coefficient and regression analysis are used for this, assessing the relationship between measures using correlation coefficients and multiple linear regressions.

The third objective is to understand how the items themselves behave and can be interpreted. IRT and DIF are used here. IRT allows you to assess the level of difficulty of an item and the abilities or levels of employee engagement of the underlying population of civil servants by assessing the level of discrimination of an item. An item with a high level of discrimination would allow you to accurately measure the levels of employee engagement of respondents of all levels of ability or employee engagement. DIF then evaluates whether there is bias inherent in the item wording that would result in respondents scoring differently regardless of level of ability.

Finally, the analysis includes a breakdown of the employee engagement scores and regression analysis by grade, gender and length of service. The intention here is to evaluate the measures' ability to create meaningful insights on the employee engagement of the Civil Service population, and thus the appropriateness of its use within the Irish Civil Service.

Findings

The research question underpinning this study asks whether the employee engagement scale applied in the Civil Service Employee Engagement Survey (CSEES) is an appropriate measure of employee engagement for the Irish Civil Service. For the purposes of the study, an appropriate scale is one that is psychometrically valid, robust and reliable, and results in meaningful insights about Irish civil servants. Only quantitative methods are applied in the study.

To evaluate the appropriateness of the scale, the methods are primarily applied to the six employee engagement items in the 2020 CSEES dataset. However, some analyses are also applied to the employee engagement items in all three iterations of the survey (2015, 2017 and 2020) and to the majority of the datasets, including other relevant items and scales within the survey. The iteration of the survey and items included in each analysis is signposted in each section. The chapter is divided into two sections. The first section outlines the psychometric analysis of the CSEES employee engagement scale, analysing the scales psychometric appropriateness as a measure of employee engagement. The second section gives an overview of the demographics of Irish Civil Service and the CSEES respondents using descriptive statistics by grade, gender, and length of service and answering whether the analysis results in meaningful insights into the Irish civil service.

Psychometric Analysis of the CSEES Employee Engagement Scale

Several methods were applied in the psychometric analysis of the CSEES employee engagement scale, with techniques including measures of association such as the Pearson's correlation coefficient, measures of internal consistency such

as Cronbach's alpha, and McDonald's omega, measures of dimensionality and structure such as exploratory and confirmatory factor analysis, as well as measures of cumulative modelling such as item response theory (IRT), regression analysis and measures of differential statement functioning (DIF).

Measures of Association

Pearson correlation coefficients for each pair of scales for the 2015, 2017 and 2020 CSEES datasets were generated to examine the relationships between the scales to employee engagement and is ordered by the strength of association of the scales to employee engagement in the 2020 dataset (Table 2). The correlation coefficients were used to identify potential scales that are strongly associated with the employee engagement scale and to explore whether any scales were so highly correlated that they should be merged to make a single factor or scale. The correlation coefficients for each scale were similar in each iteration of the survey, apart from commitment to the organisation in 2015. Meaningfulness had the highest correlation coefficient to employee engagement, reflective of the antecedents of the regression analysis outlined in a later section. Pay and job demands had the lowest correlation coefficients in all iterations of the survey.

Table 2

Pearson's correlations coefficients for employee engagement in comparison to the other scales for 2015, 2017 and 2020

Scales	2015	2017	2020
Meaningfulness	0.71	0.69	0.68
Well-Being	0.65	0.64	0.64
Commitment to the Organisation	0.31	0.61	0.62
Job Skills Match	0.62	0.59	0.59
Citizen Impact	0.49	0.49	0.48
Organisational Support	0.49	0.49	0.48
Leadership	0.44	0.44	0.44
Career Development and Mobility	0.45	0.45	0.44
Innovative Climate	0.42	0.41	0.41
Learning and Development	0.43	0.42	0.41
Coping with Change	0.37	0.39	0.40
Manager Career Support	0.38	0.38	0.38
Autonomy	0.42	0.4	0.36
Involvement Climate	0.34	0.36	0.36
Competence	0.31	0.31	0.36
Social Support	0.36	0.36	0.35
Performance Standards	0.35	0.36	0.35
Public Perception of the Civil Service	0.27	0.3	0.28
Job Demands	0.14	0.19	0.22
Your Pay	0.18	0.17	0.16

Note: Scales are ordered by the 2020 strength of association with employee engagement

Measures of Internal Consistency

Cronbach's alpha is a measure of internal consistency of items. This measure is applied to a group of items that are thought to measure different aspects of the same concept. It measures internal consistency reliability among a group of items that are combined to form a single construct. Cronbach's alpha reflects how well the different items complement each other in their measurement of different aspects of the same variable. It is interpreted like a correlation coefficient where ≥ 0.7 is good. In all iterations of the CSEES, the Cronbach's alpha for the six employee engagement items was 0.90. Table 3 outlines the consistency of the Cronbach's

alpha for all scales in the 2015, 2017 and 2020 CSEES datasets. All were greater than 0.7 apart from commitment to the organisation in 2015 and personal responsibility in all iterations. Commitment to the organisation includes three negatively worded items which may have had impact in 2015, while personal responsibility only includes two items.

Table 3

Cronbach's Alpha for CSEES Scales 2015, 2017 and 2020

Scales	2015	2017	2020
Employee Engagement	0.9	0.9	0.9
Commitment to the Organisation	0.56	0.85	0.86
Well-being	0.78	0.79	0.8
Coping with Change	0.76	0.78	0.77
Autonomy	0.93	0.92	0.92
Meaningfulness	0.94	0.94	0.93
Competence	0.91	0.89	0.91
Citizen Impact	0.95	0.95	0.95
Job Demands	0.85	0.86	0.86
Job Skills Match	0.81	0.83	0.83
Personal Responsibility	0.65	0.65	0.62
Manager Career Support	0.94	0.94	0.94
Social Support	0.87	0.87	0.87
Leadership	0.93	0.93	0.94
Organisational Support	0.92	0.92	0.92
Learning and Development	0.86	0.87	0.87
Career Development and Mobility	0.86	0.86	0.87
Your Pay	0.9	0.9	0.89
Performance Standards	0.88	0.88	0.88
Innovative Climate	0.9	0.9	0.9
Involvement Climate	0.85	0.86	0.88
Public Perception of the Civil Service	0.95	0.95	0.95

McDonald's omega measures the reliability of a scale and is a general form of reliability estimation. There is research that suggests McDonald's omega is preferable to Cronbach's alpha in the assessment of latent traits, as McDonald's

omega does not require unidimensionality of the latent trait, tau equivalence or equal factor loadings or uncorrelated errors (Hayes & Coutts, 2020). Only employee engagement items were included in the calculation of McDonald's omega, in contrast to the computation of Cronbach alpha which included all relevant items in the CSEES.

The factor analysis used in the generation of McDonald's omega was minimal residual factor analysis to one factor from the R psych package (Table 4). Minimal residual factor analysis is an unweighted least squares solution that can be used when the matrix is singular. It does not require the prior estimation of communality values.

Total omega evaluates the joint reliability of factors, without differentiating between the sources of variance of the general or specific factors (which is a bi-factor model), while the hierarchical omega coefficient is used to correctly estimate the reliability of the general factor, whilst controlling for the variance of the specific factors (Green & Yang, 2015). The values for McDonald's omega, including omega hierarchical and omega total are high for the employee engagement scale (Table 4), indicating that the different items complement each other well in their measurement of different aspects of employee engagement construct.

Table 4

CSEES McDonald's Omega and Cronbach's Alpha for all the CSEES items using R

Psych Package, 2020

Coefficient	Value
Alpha	0.9
Guttman.6	0.89
Omega Hierarchical	0.89
Omega H asymptotic	0.96
Omega Total	0.93

Table 5 outlines the factor loadings for the factors used in the assessment of McDonald's omega. Only factor loadings greater than 0.2 are included in the table. G is the global factor, h^2 is communality and u^2 is uniqueness. The global factor is similar for all items, apart from 'At my work I always persevere, even when things do not go well'.

Table 5

Factor Loadings for the CSEES 2020 Employee Engagement Items using R Psych

CSEES Employee Engagement Item	G	F1	F2	h^2	u^2	p^2
I am enthusiastic about my job	0.86			0.74	0.26	0.99
At my work I always persevere, even when things do not go well	0.45		0.59	0.55	0.45	0.37
At my work, I feel full of energy	0.84	0.54		1	0	0.7
My job inspires me	0.88			0.78	0.22	0.99
When I get up in the morning, I feel like going to work	0.83			0.7	0.3	0.99
I am proud of the work that I do	0.77			0.62	0.38	0.95

Measures of Dimensionality and Structure

Exploratory and confirmatory factor analysis was incorporated in the development of the CSEES initially, with a minimum of five items included in each scale. This aligned to recommendations of a minimum of five or six items per factor by Tabachnick and Fidell (1996) and ensures that there are sufficient items so that correlations, and the associated factors can be revealed. The only exception was the personal responsibility scale where only two items were included.

Factor analysis is a classical test theory (CTT) method used to group a large number of observable variables into a smaller number of latent factors. In this study, the six items in the employee engagement scale would be expected to be grouped into a single latent variable, measuring each respondent's employee engagement. Factor analysis requires at least 300 observations. This criterion was easily satisfied given the size of the CSEES datasets. Factor analysis requires an initial estimate of communalities, i.e., the proportion of variance of a variable that is error free and shared with other variables. The multiple squared correlation method was used for this study.

The 2020 CSEES data (n=26,796), was randomly split into two samples using a survey selection method in SAS. The datasets included only relevant psychological constructs from the CSEES. The first sample (n=13,398) was used for the exploratory factor analysis while the second sample (n=13,398) was used for the confirmatory factor analysis. This approach to divide the dataset into two for the exploratory and confirmatory factor analysis was developed by Anderson and Gerber (1988) as an approach to validate the factor analysis. It is only appropriate when the segmented dataset is sufficient for factor analysis.

The exploratory factor analysis found that the engagement items did generally work together in the intended scales, with all items in a scale loading onto the same factor apart from the item, ““At my work I always persevere, even when things do not go well”. To allow for better interpretation of the factor structure, factors were rotated. The aim of factor rotation is to have each variable load on the fewest factors with the highest loadings possible. Due to the likelihood that the some of the latent factors would be somewhat correlated with each other, seen from examining the Pearson correlation coefficients in Table 2, oblique rather than orthogonal rotation of the factors was applied.

The resultant factors assessed by examining the scree plot, the application of a minimum threshold of one to the eigenvalues and varying the minimum proportion of common variance required for the chosen factors. The matrix of the rotated factors was examined to identify cases of item crossloading, i.e., where an item loaded at 0.3 or higher onto more than one factor and to see how the scales corresponded to the factors identified. Further modifications to the numbers of factors were made using the NFACTORS option within SAS to arrive at 16 factors.

The rotated factor pattern matrix for employee engagement is provided in Appendix 3. The employee engagement scale loaded onto a single factor, factor 2, in all iterations of the survey. The exception was “At my work I always persevere, even when things do not go well” in 2020 where the item also loaded onto factor 6, the same factor as some well-being and coping with change items (Table 6). In 2015 and 2017, this item only appeared on factor 2, as the factor loadings for factor 6 did not meet the threshold for inclusion in those years.

Table 6

Rotated Factor Loadings on Factor 6 including employee engagement item, 2020.

Scale	Item	Factor Loading
Engagement	At my work I always persevere, even when things do not go well.	0.3
Well-being	I can cope with work problems	0.35
Well-being	I have confidence in myself	0.32
Coping with Change	When change happens in the department, I react by trying to manage the change rather than complain about it	0.67
Coping with Change	When changes are announced, I try to react in a problem-solving way	0.65
Coping with Change	When change occurs in the department, it causes me stress	0.38
Coping with Change	I think I cope with change better than most	0.53
Coping with Change	I embrace change in the department	0.64

The rotated factor loadings of the employee engagement items remained stable from iteration to iteration of the survey. “At my work I always persevere, even when things do not go well” has comparably lower factor loadings than the other items across all iterations of the survey.

Table 7

Employee Engagement Rotated Factor Loadings on Factor 2 for the six CSEES employee engagement items, 2015, 2017 and 2020.

Item Description	2015	2017	2020
I am enthusiastic about my job	0.75	0.75	0.76
At my work I always persevere, even when things do not go well	0.37	0.37	0.37
At my work, I feel full of energy	0.70	0.70	0.71
My job inspires me	0.75	0.75	0.76
When I get up in the morning, I feel like going to work	0.70	0.67	0.70
I am proud of the work that I do	0.65	0.69	0.67

The rotated factor matrix for all factors highlights some potential problems with identifying the job design factors as latent factors. Leadership, organisational support, performance standards, innovative climate, and involvement climate items loaded onto the same factor. This indicates that these measures are closely related and could be measuring the same measure. However, it is not uncommon in exploratory factor analysis, with a large number of items and latent factors, that some distinct measures can appear to be the same. The later confirmatory factor analysis examined this in more detail, checking whether these measures are distinct.

The exploratory factor analysis residual error correlations for 2020 (Table 8) do indicate that there may be noise or variation which is not captured by the model. The residual error correlations are in a similar rang for all items, apart from “At my work I always persevere, even when things do not go well”.

Table 8

Employee Engagement Residual Correlations for the six CSEES employee engagement items, 2020.

Item	Residual Error Correlations
I am enthusiastic about my job	0.29
At my work I always persevere, even when things do not go well	0.72
At my work, I feel full of energy	0.32
My job inspires me	0.25
When I get up in the morning, I feel like going to work	0.35
I am proud of the work that I do	0.39

Confirmatory factor analysis is used to evaluate the fit of the models chosen in exploratory factor analysis. In confirmatory factor analysis, a model is constructed which incorporates the hypothesised factor structure and compares the data against that model to evaluate the goodness of fit (Foster et al., 2006). Confirmatory factor analysis can evaluate how well a model fits the data but cannot confirm if the chosen model is optimal. It is unlikely that the optimum model of best fit will be found. However, to alleviate concerns regarding the confirmatory model being the best fit, several iterations of exploratory and confirmatory factor analysis were run, with amends each time to optimise the models and find the best goodness of fit metrics. The confirmatory factor analysis SAS procedure also runs iteratively to find a satisfactory model. No restrictions were applied to the procedure, and this was to optimise the possibility of selecting the model of best fit.

The fit of the confirmatory model is confirmed or rejected by assessing the resulting fit statistics. The fit statistics for this model are shown in Table 9. The first measure of fit is the Chi-Square statistic $\chi^2 (1, N=22,663) = 83,155.09, p>0.001$. However, where large numbers of observations are used in the model, the Chi-Square statistic is almost always statistically significant, so this result is not very useful.

The Standardised Root Mean Square Residual (SRMR) is another absolute measure of fit and is defined as the standardised difference between the observed correlation and the predicted correlation. A value less than 0.08 is generally considered a good fit. Here the statistic produced by the model is 0.06 indicating that the proposed model fits the data well.

The Root Mean Square Error of Approximation (RMSEA) is also an absolute measure. Standard cut-offs of acceptable fit for this statistic are either 0.08 or 0.10 with 0.05 indicating a good fit and 0.01 an excellent one. The result for this analysis is 0.0382 indicating a good fit. The upper and lower 90% confidence intervals for this estimate are also produced by this model. Here they are 0.038 and 0.0384 respectively. The narrow width of this confidence interval shows the precision of this estimate and provides extra assurance that the model fits well. The Probability of Close Fit (PCLOSE) is related to the RMSEA. This measure provides a one-sided test of the null hypothesis is that the RMSEA equals 0.05. Not surprisingly given the RMSEA value in this case, this test is positive (PCLOSE=1) confirming a good fit.

There are several incremental fit indices output by the confirmatory factor analysis, the Bentler Comparative Fit Index, the Bentler-Bonett or Normed Fit Index (NFI) and the Tucker Lewis Index or Non-Normed Fit Index (NNFI). For each of these statistics, a value between 0.90 and 0.95 is now considered acceptable, while above 0.95 is good, and below 0.90 is considered to be a poor fitting model. In this case, the Bentler Comparative Fit Index is 0.9096, the Normed Fit Index (NFI) is 0.9047 and the Non-Normed Fit Index (NNFI) is 0.9033, and so each of the values is in the acceptable range. A more detailed table on the fit statistics can be found in Appendix 3.

The items in the final model aligned to the expected factors and scales with some exceptions, the resulting partial correlations resulted in movement between scales or deletion of a small number of items. These items were unrelated to employee engagement.

Table 9*CSEES Confirmatory Factor Analysis Goodness of Fit Statistics for all items, 2020*

Fit Statistics	Value
Number of Observations	22,830
Number of Variables	101
Baseline Model Chi-Square	1,723,092
Baseline Model Chi-Square DF	5,050
Pr > Baseline Model Chi-Square	<.0001
Chi-Square	150,287.5
Chi-Square DF	4,696
Pr > Chi-Square	<.0001
Root Mean Square Residual (RMR)	34.0889
Standardized RMR (SRMR)	0.0556
Goodness of Fit Index (GFI)	0.86
Adjusted GFI (AGFI)	0.8464
Parsimonious GFI	0.7997
RMSEA Estimate	0.0369
RMSEA Lower 90% Confidence Limit	0.0367
RMSEA Upper 90% Confidence Limit	0.037
Probability of Close Fit	1
Akaike Information Criterion	151,197.5
Bentler Comparative Fit Index	0.9153
Bentler-Bonett NFI	0.9128
Bentler-Bonett Non-normed Index	0.9089
Bollen Normed Index Rho1	0.9062
Bollen Non-normed Index Delta2	0.9153
James et al. Parsimonious NFI	0.8488

The discriminant validity of the scales within the CSEES were also calculated using the Fornell-Larcker Criterion, with the employee engagement scale as the dependent variable within the calculation, and all other scales as the independent variables, rather than a general matrix of all scales. Table 10 demonstrates that discriminant validity does hold between employee engagement and the other scales within the survey, as the squared latent variable correlations are smaller than the average variance extracted (AVE) in all cases, apart from the AVE for well-being. For discriminant validity to hold, the squared latent variables correlations must be

smaller than both relevant AVEs. This demonstrates that the scales within the CSEES are independent of the employee engagement scale, and also points to an association between employee engagement and well-being, and employee engagement and meaningfulness, given the higher squared latent variable correlations between these scales.

Table 10

CSEES Fornell- Larcker Criterion for all CSEES items, 2020

x	y	Fornell- Larcker Criterio n	Latent Variable Corrs (squared)	AVE x	AVE y
Employee Engagement	Commitment to the Organisation	TRUE	0.44	0.67	0.53
Employee Engagement	Well-being	TRUE	0.57	0.67	0.52
Employee Engagement	Coping with Change	TRUE	0.20	0.67	0.41
Employee Engagement	Autonomy	TRUE	0.16	0.67	0.81
Employee Engagement	Meaningfulness	TRUE	0.54	0.67	0.83
Employee Engagement	Competence	TRUE	0.14	0.67	0.71
Employee Engagement	Citizen Impact	TRUE	0.25	0.67	0.87
Employee Engagement	Job Demands	TRUE	0.01	0.67	0.51
Employee Engagement	Job Skills Match	TRUE	0.43	0.67	0.59
Employee Engagement	Manager Career Support	TRUE	0.17	0.67	0.79
Employee Engagement	Social Support	TRUE	0.14	0.67	0.62
Employee Engagement	Leadership	TRUE	0.23	0.67	0.75
Employee Engagement	Organisational Support	TRUE	0.29	0.67	0.74
Employee Engagement	Learning and Development	TRUE	0.22	0.67	0.62
Employee Engagement	Career_ Development and Mobility	TRUE	0.24	0.67	0.49
Employee Engagement	Your Pay	TRUE	0.03	0.67	0.70
Employee Engagement	Performance Standards	TRUE	0.16	0.67	0.61
Employee Engagement	Innovative Climate	TRUE	0.21	0.67	0.65
Employee Engagement	Involvement Climate	TRUE	0.15	0.67	0.62
Employee Engagement	Public Perception of the Civil Service	TRUE	0.09	0.67	0.88

Measures of Cumulative Modelling

Item response theory (IRT) is a family of statistical models which aim to explain the relationship between latent traits, such as employee engagement, and the observed responses, or responses to the CSEES employee engagement items. IRT uses a cumulative modelling approach (de Ayala, 2009). The primary aim of the IRT analysis is to understand the relationship between the employee engagement items and the employee engagement latent construct. The secondary aim of this analysis is to evaluate how the CSEES survey responses are interpreted by IRT. An example of this is how IRT can interpret the level of construct saturation or difficulty of an item, and the level of the latent trait, or ability, that a respondent requires to score highly.

The generalised partial credit model (GPCM) is the IRT model used in this study. The GPCM is a series of dichotomous Rasch models. It was developed for situations where item responses are contained in two or more ordered categories. In this study, there are seven possible ordinal response options. Item response options are conceptualised as a series of ordered steps where respondents receive partial credit for successfully completing a step. Steps correspond to the various levels of performance needed to complete an item, in this case the seven polytomous response options under employee engagement.

SAS was used to create the GPCM. With SAS, this model assumes that items are ordinal-categorical with at most 19 levels. There were 26,796 observations read into the model and 26,774 observations used (Table 11). The marginal maximum

likelihood method was the chosen estimation method used as it numerically integrates out the individual person parameters.

Table 11

CSEES IRT Modelling Information 2020

Modelling Information	
Link Function	Logit
Response Model	Generalized Partial Credit
Number of Items	6
Number of Factors	1
Number of Observations Read	26,796
Number of Observations Used	26,774
Estimation Method	Marginal Maximum Likelihood

The employee engagement index score data is included in the IRT model with the Likert scale of each observation transformed to an applicable value from one to one hundred. The employee engagement item identification numbers (Q6_1_r to Q6_6_r) are referenced in figures, instead of the item description.

Approximately 90 iterations in the Quasi Newton optimisation technique were applied to find the optimal model. The convergence criterion was satisfied.

Goodness of fit statistics for the GPCM can be found in Table 12. For Log Likelihood, which measures the likelihood of the estimates, a higher value is better. The Akaike information criterion (AIC) is a mathematical method for evaluating how well a model fits the data it was generated from. The Bayesian information criterion (BIC) is related to AIC but penalises model complexity with resultant higher values and is also used to determine the best fit for the data. The relative values for AIC and BIC are high. A smaller value of AIC and BIC indicates a good fit. The Likelihood Ratio (LR) Chi-Square test assesses how likely it is that an observed distribution is due to

chance and is based on the ratio of the observed to the expected frequencies. A higher value on this statistic is better. The LR Chi-Square DF is the degrees of freedom of the number of independent pieces of information on a statistic.

Table 12

CSEES Model Fit Statistics, 2020

Fit Statistic	Value
Log Likelihood	-194,183.6873
AIC (Smaller is Better)	388,451.3747
BIC (Smaller is Better)	388,795.5725
LR Chi-Square	30,303.0889
LR Chi-Square DF	117,606

The items in Table 13 are ordered as presented in the CSEES survey. Based on the index scores, respondents answered most positively to “At my work I always persevere, even when things do not go well” and “I am proud of the work that I do”. Similarly, the item, “My job inspires me” has been responded to positively but less so than all other items. The adjusted item total correlations are greater than 0.7 for all items apart from “At my work I always persevere, even when things do not go well”. This is reflective of the higher index score seen for this item.

Table 13*CSEES Employee Engagement Item Descriptive Statistics 2020*

Item	Description	Index Score	Adjusted Item-Total Correlations
Q6_1_r	I am enthusiastic about my job	77	0.8
Q6_2_r	At my work I always persevere, even when things do not go well	88	0.5
Q6_3_r	At my work, I feel full of energy	68	0.8
Q6_4_r	My job inspires me	64	0.8
Q6_5_r	When I get up in the morning, I feel like going to work	69	0.8
Q6_6_r	I am proud of the work that I do	82	0.7

Eigenvalues are used to assess the dimensionality of a dataset, finding the number of potential factors, or latent traits, shown in the dataset. The eigenvalues of the polychoric matrix can be used to assess the number of factors. Polychoric correlations are better suited to the CSEES data as it assumes that the data contains ordinal responses that are created by two latent continuous variables (Kolbe et al., 2021). Within the model, the first eigenvalue accounts for 72% of the variance (Table 14). This suggests that there is only one dominant factor and that a unidimensional model is reasonable.

Table 14*CSEES Eigenvalues of the Polychoric Correlation Matrix, 2020*

Eigenvector	Eigenvalue	Difference	Proportion	Cumulative
1	4.34	3.65	0.72	0.72
2	0.69	0.35	0.12	0.84
3	0.34	0.09	0.06	0.90
4	0.25	0.06	0.04	0.94
5	0.19	0.01	0.03	0.97
6	0.18		0.03	1.00

The GPCM produces parameter estimates, including standard error and t-test calculations. The parameter or step estimates are the values across the ability scale where each response category is considered equally likely by the model boundaries. This is demonstrated on the item characteristic curve (ICC) which is a key construct of IRT. An ICC is a logistic function which graphs a person's latent trait or ability, in this case, employee engagement, (known as θ), against the probability of endorsing an item or $P(\theta)$, in the case of a dichotomous model. For typical items, the probability of a correct answer will be higher for people with higher levels of the construct and lower for people with lower levels of the construct. If $P(\theta)$ is plotted as a function of the construct, a smooth S-shaped curve is the result.

For the GPCM, where there are multiple responses possible, the model allows for partial credit for responses in contrast to a binary correct/incorrect model. The GPCM incorporates a series of ICCs, and series of dichotomous models, with multiple point levels, starting at zero, and with boundaries between each response category. The y-axis shows the probability of a response while the x-axis shows the amount of the latent trait, employee engagement, that a respondent possesses.

There are seven response categories applied to the CSEES employee engagement items resulting in six step or threshold points between these response categories. It is these threshold values, or steps, which are the parameters that are measured by IRT. By looking at the position of these steps on the x-axis and y-axis, the probability of a respondent's score moving from one response option to the next response option (e.g., "Rarely" to "Sometimes") can be referenced against the amount of the trait, employee engagement, that a respondent must have to receive that score.

The slope demonstrates the level of discrimination that can be determined by the overall model. A higher slope value indicates that the probability of a certain response changes rapidly as the level of employee engagement increases. A high slope value indicates that the model can discriminate between those with higher and lower employee engagement levels more easily. The converse is true for a lower slope value, where the probability of a score slowly increases as the employee engagement levels increase.

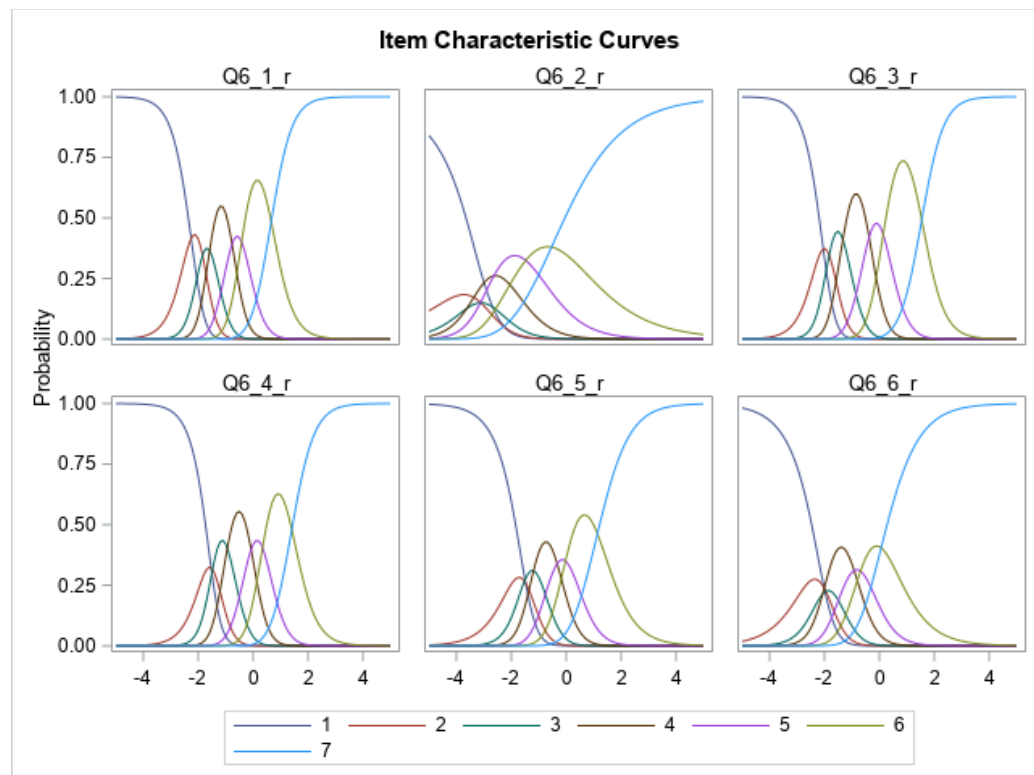
The slopes of the parameter estimates for the six employee engagement items range from 0.72 to 2.74 for the items (Table 15). The item with the lowest slope value is for "At my work I always persevere, even when things do not go well", indicating that this item is unlikely to discriminate well between respondents with moderate to high level of employee engagement, aligning with the high score seen for this item. The items, "I am enthusiastic about my job", "At my work, I feel full of energy" and "My job inspires me" with slopes of 2.74, 2.64 and 2.56 respectively, have a moderate ability to discriminate well between respondents with moderate to high level of employee engagement.

The item parameter estimates are boundaries between the ICCs and are measured along the ability scale. This scale can range from $\pm$ infinity. However, for the model used in this study, the range is between -4 to +4, with -4 indicating a very low level of employee engagement and +4 indicating a very high level of employee engagement. This can be interpreted in much the same way as a z-score scale. As the range of ability is between -4 and +4, a series of steps for an item that are on the lower end of the scale indicate that the probability of a respondent scoring highly only requires a moderate to high level of employee engagement.

An item is better at discriminating between individuals when the curves associated with the response categories are peaked and dispersed across all levels of the latent trait. For example, an item with high discrimination would have six peaks dispersed from low levels of the latent trait to high levels of the latent trait. For the employee engagement items within the CSEES, the construct (or location) parameter estimates range from -2.36 to 1.47 indicating a low to moderate ability to discriminate between individuals. The difficulty of an item describes where the item functions along the ability scale thus, difficulty is a location index shown here as construct or location parameter estimates. Discrimination describes how well an item can differentiate between examinees having abilities below the item location and those having abilities above the item location and is assessed by examining the ICC curves.

All employee engagement items have a moderate to low difficulty level, with step 6 for all items between -0.64 and 1.47, indicating that respondents may have a neutral to high level of employee engagement, in order for the probability to answer “Always” to the item to be the highest probability.

On the ICC, the y-axis demonstrates the probability of response based on the level of ability of the respondent, while the x-axis shows level of that ability (Figure 1). Visually, the ICCs are very similar for all items, apart from Q6_2_r “At my work I always persevere, even when things do not go well”. The response categories are ordered as expected, with the curves for the lower value response categories to the left of the ability scale. For all items, the probability of is highest for the response category, “Always”.

Figure 1*CSEES Item Characteristic Curves 2020*

For Q6_1_r, “I am enthusiastic about my job”, the probability of answering “Never” for respondents with very low employee engagement levels is close to 1 (Table 15). This probability decreases rapidly, to the first step, at -2.36, which indicates the threshold at which the probability of a response of “Almost Never” becomes higher than a response of “Never”. The highest probability of responding “Never” is approx. 0.4, indicating that it’s not a very likely response. The steps between the four response categories, “Rarely”, “Sometimes” and “Often” and “Very often” are very close, with thresholds ranging from -1.84 to -0.44. From “Almost Never” onwards, the probabilities of selecting the response categories trend upwards, with one exception. At its peak, the probability of selecting “Sometimes” is over 0.6 at its peak, higher than both “Rarely” and “Often” response

categories, which are both less than 0.4 at their peak. The step between “Very Often” and “Always” is at 0.66, indicating that a high level of employee engagement is not required to respond to positively to this item. The slope for this item is 2.74, indicating that the item has a moderate ability to discriminate between respondents with differing levels of employee engagement.

For Q6_2_r “At my work I always persevere, even when things do not go well”, the very low item difficulty is reflected in the ICC, with probabilities, although small, seen for response categories of “Almost Never”, “Rarely” and “Sometimes” for those with the lowest levels of employee engagement. The probability of answering “Never” for respondents with very low employee engagement levels is never higher than 0.4. The step between “Often” and “Very Often”, at 0.69, indicates that employee engagement scores are high at low levels of the employee engagement trait. At -0.64, the probability of choosing a response category of “Always” increases from a probability of over 0.4 and tends towards 1. The slope for this item is 0.72 indicating that the item has a very low ability to discriminate between respondents with differing levels of employee engagement. This item has the lowest levels of difficulty and discrimination across all of the CSEES employee engagement items.

For, Q6_3_r “At my work, I feel full of energy”, the item difficulty is low. The first step estimate, between “Never” and “Almost Never” is at -2.17, with the probability of selecting “Never” being close to 1 when the trait value is less than -3. The steps between the remaining response categories are more evenly spread than seen previously, with the step between “Almost Never” and “Rarely” at -1.99 and the step between “Often” and “Very Often” at 0.08. The peaks of the probabilities of

selecting the response categories increase as the trait value increases, with the exception of “Often” which has a lower peak probability than “Sometimes”. At 1.47, the probability of choosing a response category of “Always” increases from a probability of over 0.5 and tends towards 1. The slope for this item is 2.64, indicating that the item has a moderate ability to discriminate between respondents with differing levels of employee engagement.

Similarly, the item difficulty is low for Q_4_r “My job inspires me”. The first step estimate, between “Never” and “Almost Never” is at -1.74, with the probability of selecting “Never” being close to 1 when the trait value is less than -2. The steps between the remaining response categories are more spread further along than seen previously, with the step between “Almost Never” and “Rarely” at -1.64 and the step between “Often” and “Very Often” at 0.24. The peaks of the probabilities of selecting the response categories increase as the trait value increases, with the exception of “Often” which has a lower peak probability than “Sometimes”. At 1.29, the probability of choosing a response category of “Always” increases from a probability of over 0.5 and tends towards 1. The slope for this item is 2.56, indicating that the item has a moderate ability to discriminate between respondents with differing levels of employee engagement.

For Q6_5_r “When I get up in the morning, I feel like going to work”, the item difficulty is higher than seen in previous items, although similar curves are seen for other items. For Q6_5_r “When I get up in the morning, I feel like going to work”, the first step estimate between “Never” and “Almost Never” is at -1.74, with the probability of selecting “Never” being close to 1 when the trait value is less than -2.5. The steps between the remaining response categories are spread further along,

with the step between “Almost Never” and “Rarely” at -1.69 and the step between “Often” and “Very Often” at -.01. The peaks of the probabilities of selecting the response categories increase as the trait value increases, with the exception of “Often” which has a lower peak probability than “Sometimes”. At 1.09, the probability of choosing a response category of “Always” increases from a probability of just under 0.5 and tends towards 1. The slope is 1.97 indicating that the item has a moderate ability to discriminate between respondents with differing levels of employee engagement.

For Q6_6_r “I am proud of the work that I do”, the item difficulty is lower than seen in previous items, apart from Q6_2_r “At my work I always persevere, even when things do not go well”. The first step estimate, between “Never” and “Almost Never” is at -2.16, with the probability of selecting “Never” being close to 1 when the trait value is less than -3. The steps between the remaining response categories are more contracted than other items, with the step between “Almost Never” and “Rarely” at -2.19 and the step between “Often” and “Very Often” at -0.002. The peaks of the probabilities of selecting the response categories increase as the trait value increases, with the exception of “Often” which has a lower peak probability than “Sometimes”. At 0.02, the probability of choosing a response category of “Always” increases from a probability of just under 0.5 and tends towards 1. The slope is 1.49 indicating that the item has a moderate ability to discriminate between respondents with differing levels of employee engagement.

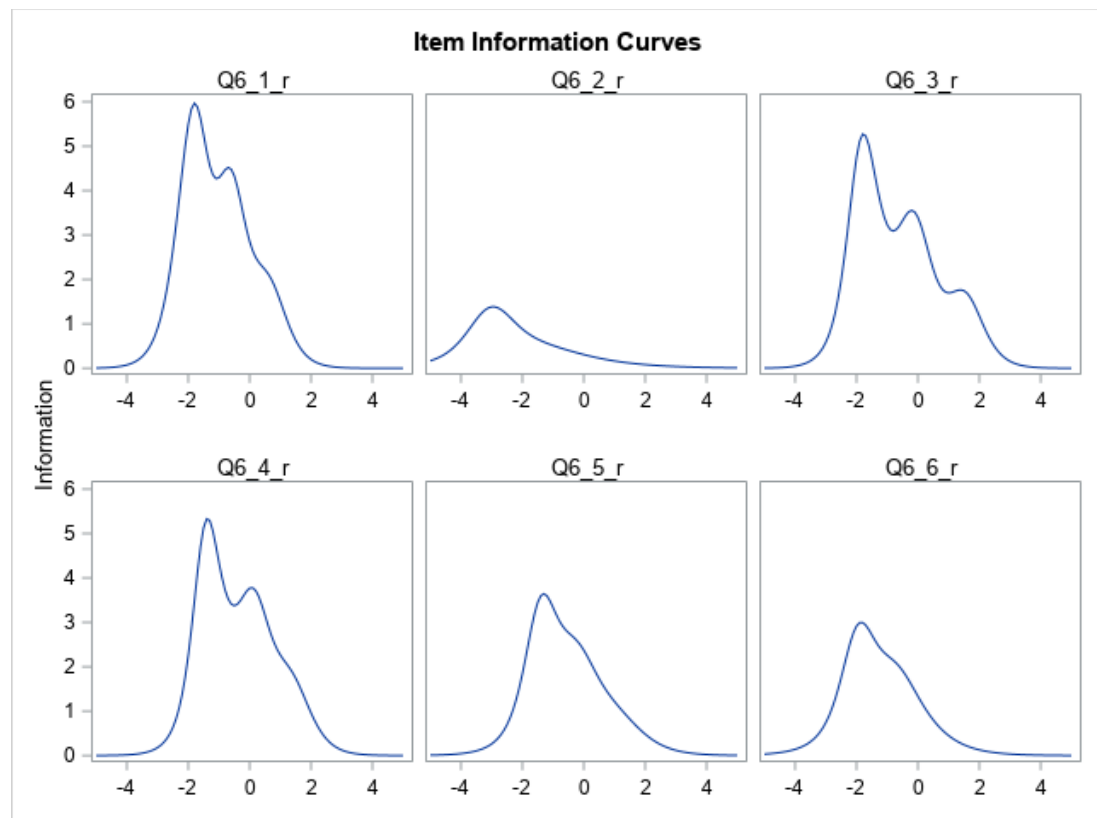
Table 15*IRT Parameter Estimates by CSEES Employee Engagement Item 2020*

Parameter	Q6_1_r - I am enthusiastic about my job			Q6_2_r - At my work I always persevere, even when things do not go well			Q6_3_r - At my work, I feel full of energy		
	Estimate	Standard Error	P> t	Estimate	Standard Error	P> t	Estimate	Standard Error	P> t
Step 1	-2.36	0.04	<.0001	-0.19	0.33	<.0001	-2.17	0.03	<.0001
Step 2	-2.01	0.03	<.0001	-0.23	0.26	<.0001	-1.99	0.02	<.0001
Step 3	-1.67	0.02	<.0001	-0.25	0.15	<.0001	-1.47	0.02	<.0001
Step 4	-0.85	0.01	<.0001	-0.69	0.06	<.0001	-0.53	0.01	<.0001
Step 5	-0.45	0.01	<.0001	-0.69	0.03	<.0001	0.08	0.01	<.0001
Step 6	0.65	0.01	<.0001	-0.64	0.02	<.0001	1.47	0.01	<.0001
Slope	2.74	0.04	<.0001	0.72	0.01	<.0001	2.64	0.04	<.0001

Parameter	Q6_4_r - My job inspires me			Q6_5_r - When I get up in the morning, I feel like going to work			Q6_6_r - I am proud of the work that I do		
	Estimate	Standard Error	P> t	Estimate	Standard Error	P> t	Estimate	Standard Error	P> t
Step 1	-1.75	0.02	<.0001	-1.74	0.03	<.0001	-2.16	0.06	<.0001
Step 2	-1.64	0.02	<.0001	-1.7	0.02	<.0001	-2.19	0.05	<.0001
Step 3	-1.09	0.01	<.0001	-1.33	0.02	<.0001	-2.06	0.03	<.0001
Step 4	-0.24	0.01	<.0001	-0.53	0.01	<.0001	-1.08	0.02	<.0001
Step 5	0.23	0.01	<.0001	-0.09	0.01	<.0001	-0.81	0.02	<.0001
Step 6	1.29	0.01	<.0001	1.09	0.01	<.0001	0	0.01	0.4326
Slope	2.56	0.04	<.0001	1.97	0.03	<.0001	1.49	0.02	<.0001

Item information curves (IIC) show how much information about the latent trait ability is contained within an item. IICs peak at the difficulty value, with less information at ability levels farther from the difficulty estimate. An item which is not endorsed as frequently relative to the other response options will provide very little information about respondents with low levels of employee engagement because the item is already too hard. Conversely, very easy items will provide little information about persons with high employee engagement levels.

The IICs for the CSEES employee engagement items indicate that the items are comparably easy, providing low to moderate information about persons with high employee engagement levels. The IICs peak at -2 for all items, apart from Q6_2_r “At my work I always persevere, even when things do not go well” indicating that the information gleaned from this item is low for all parts of the relevant IIC (Figure 2). Multiple peaks are seen for the IICs for Q6_1_r “I am enthusiastic about my job”, Q6_3_r “At my work, I feel full of energy” and Q6_4_r “My job inspires me”, which is possible for polytomous items.

Figure 2*CSEES Item Information Curves 2022*

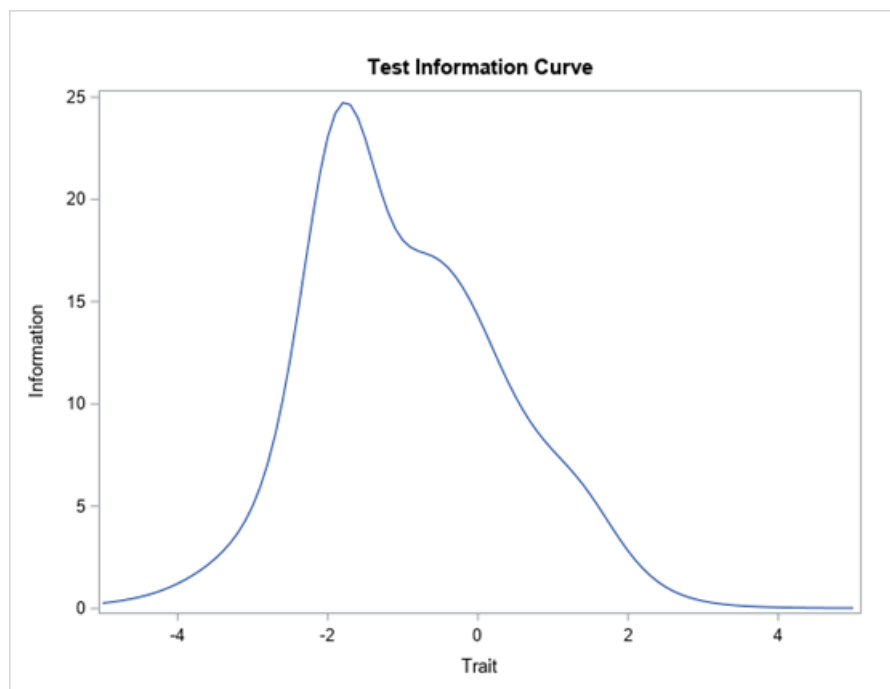
The test information curve shows how much information about the latent trait ability is contained within all items combined. The test information curve aggregates the IICs across all the items and demonstrates how well the test measures the latent trait at various levels of the attribute. Similar to IICs, a test information curve peaks at the overall difficulty value for all items, or the point where the item has the highest discrimination, with less information at ability levels farther from the difficulty estimate.

For the six employee engagement items, the test information curve peaks at just greater than -2, indicating that only a moderate level of the trait, employee

engagement, is required to respond positively to the items (Figure 3). The items are unlikely to provide information about persons with high employee engagement levels as the discrimination is low.

Figure 3

CSEES Test Information Curve for the six employee engagement items, 2020



Differential item functioning (DIF) is a suite of techniques which evaluate differences in responses to items between groups (e.g., gender) while controlling for levels of the construct. DIF occurs if respondents within a group with the same overall employee engagement scores have a different probability in giving a certain response to an item (Zhang, 2015). There are three approaches generally used to assess DIF: logistic regression (Swaminathan & Rogers, 1990), IRT and generalised Mantel-Haenszel (Holland & Thayer, 1988). The proc genmod function in SAS was

used for the DIF analysis of the six employee engagement items and the three demographic variables of interest, gender, grade, and length of service. The `proc genmod` function includes logistic regression and the generalised Mantel-Haenszel procedure. The generalised Mantel-Haenszel procedure is effective for uniform DIF for dichotomous items between groups. The logistic regression procedure and IRT DIF can detect both uniform and non-uniform DIF for dichotomous and polytomous items. IRT DIF can also model differences in discrimination and item difficulty.

The odds ratios were created using a logistic regression model. The odds ratios give an indication of whether uniform DIF is seen in a dataset. All odds ratios were adjusted for the covariates included in the logistic regression model. Odds ratios close to one indicate that uniform DIF likely does not occur within an item. The odds ratios were obtained by exponentiating the estimate within the logistic model. For a one unit change in the predictor variable, the odds ratio for a positive outcome was expected to change by the respective coefficient, given the other variables in the model are held constant.

Table 16 shows that the odds ratio for all item effect combinations is close to one. This indicates that uniform DIF may not occur in any of the models. There is a larger nominal range of estimates for the models including gender. Thus, identifying a marker for a potential issue associated with gender and these items. The odds ratio estimates code favoured females over males with a lower value for males and higher value for females.

Table 16

Odds Ratio Estimates and Profile-Likelihood Confidence Intervals by Demographic for the Employee Engagement Items

Item	Effect	Estimate	95% Confidence Limits	
I am enthusiastic about my job	Gender	0.96	0.91	1.01
At my work I always persevere, even when things do not go well	Gender	0.69	0.65	0.72
At my work, I feel full of energy	Gender	1.08	1.03	1.14
My job inspires me	Gender	1.20	1.15	1.27
When I get up in the morning, I feel like going to work	Gender	1.22	1.16	1.28
I am proud of the work that I do	Gender	0.97	0.92	1.03
I am enthusiastic about my job	Grade	0.99	0.98	1.00
At my work I always persevere, even when things do not go well	Grade	1.01	1.00	1.02
At my work, I feel full of energy	Grade	1.00	0.99	1.00
My job inspires me	Grade	1.01	1.00	1.01
When I get up in the morning, I feel like going to work	Grade	0.98	0.97	0.99
I am proud of the work that I do	Grade	1.00	0.99	1.00
I am enthusiastic about my job	Length of Service	1.00	0.99	1.01
At my work I always persevere, even when things do not go well	Length of Service	0.98	0.97	0.99
At my work, I feel full of energy	Length of Service	1.01	1.00	1.02
My job inspires me	Length of Service	1.04	1.03	1.06
When I get up in the morning, I feel like going to work	Length of Service	1.03	1.02	1.04
I am proud of the work that I do	Length of Service	0.96	0.95	0.97

For this study, the logistic regression was applied to a sub-set of the CSEES data which only included the six employee engagement item scores and demographic variables of interest. As the data is ordinal, a cumulative logit model was applied, using the Newton-Raphson method of maximum the likelihood. The models were generated for each item and demographic variable combination. In each model, an increasing number of predictors are included. The item then shows DIF if the model fit statistic is improved as the predictors are added to the models.

Three models for each item-demographic combination were run, with 54 models in total. Increasing numbers of predictors were included in each of the three

models. The item showed DIF if the model fit statistic, minus two times the log of the likelihood (-2LogL), improved as predictors were added. The first model included the six employee engagement item score variables. The second model included the six employee engagement item score variables and the demographics of interest: gender, grade, and length of service. The third model included the total item score, six employee engagement item score variables, the demographics of interest and the demographic variable with an employee engagement item score by demographic interaction variable. The smaller the value of -2LogL , the better the fit of the model. The uniform DIF was assessed by calculating the difference between the -2LogL of the first and second models and comparing this to the Chi square statistic. Non-uniform DIF was evaluated by calculating the difference between the -2LogL of the second and third models and comparing this to the Chi square statistic. When comparing the models, none met the requirements to indicate that uniform or non-uniform DIF might exist. In the cases where DIF may have occurred, based only on larger nominal values, the Chi square statistic was less than the difference of -2LogL between the relevant models and the p value was greater than 0.05 for that Chi square statistic.

Table 17 shows the values of G^2 which is the difference between the -2LogL values of the relevant models. The largest difference is seen for models including Model 1. This is as a result of the inclusion of the demographic variables into Model 2 and 3, indicating that the inclusion of the demographic variable improved the fit of the models and indicates a potential relationship between gender and the responses to the employee engagement items.

Table 17

Difference in the non-significant-2LogL values for the Employee Engagement DIF Models by Demographic

Item	Demographic	Model 2 - Model 1	Model 3 - Model 2	Model 3 - Model 1
I am enthusiastic about my job	Gender	-480.37	- 11.57	- 491.94
At my work I always persevere, even when things do not go well	Gender	-773.57	- 0.08	- 773.65
At my work, I feel full of energy	Gender	-555.22	- 19.71	- 574.94
My job inspires me	Gender	-619.50	- 5.83	- 625.32
When I get up in the morning, I feel like going to work	Gender	-661.28	- 11.25	- 672.53
I am proud of the work that I do	Gender	-498.47	- 0.92	- 499.39
I am enthusiastic about my job	Grade	-303.10	- 3.12	- 306.22
At my work I always persevere, even when things do not go well	Grade	-347.07	- 1.46	- 348.53
At my work, I feel full of energy	Grade	-311.60	- 3.23	- 314.83
My job inspires me	Grade	-310.99	- 0.31	- 311.31
When I get up in the morning, I feel like going to work	Grade	-362.83	- 1.29	- 364.13
I am proud of the work that I do	Grade	-320.52	- 1.80	- 322.32
I am enthusiastic about my job	Length of Service	-152.26	- 1.15	- 153.40
At my work I always persevere, even when things do not go well	Length of Service	-197.49	- 2.95	- 200.43
At my work, I feel full of energy	Length of Service	-182.08	- 0.54	- 182.62
My job inspires me	Length of Service	-252.56	- 2.67	- 255.23
When I get up in the morning, I feel like going to work	Length of Service	-225.83	- 1.37	- 227.20
I am proud of the work that I do	Length of Service	-227.49	- 0.67	- 228.16

While the employee engagement scores demonstrate the employee engagement of civil servants, they do not demonstrate what can be done to improve employee engagement. Regression or antecedent analysis was used to explore this. The employee engagement factor scores were used as the dependent variables and the factor scores of the other scales are used as independent variables in a multiple linear regression, also known as antecedent analysis. The multiple linear regression model produces a coefficient of the relationship between each of the scales within the model with the employee engagement scale and

identifies the extent that each of these scales is associated with employee engagement. The five scales with the highest association with employee engagement are identified as the antecedents of employee engagement. The analytical framework of regression analysis theorises that improving respondents' scores on the antecedents will have a positive impact on engagement.

The CSEES was designed with four scales considered as outcomes which are the dependent variables in a multiple linear regression: employee engagement, commitment to the organisation, well-being and coping with change. The remainder of the scales are independent variables in these models. This approach is followed in this research, with commitment to the organisation, well-being and coping with change being excluded from the models used to generate the antecedents of employee engagement.

The 2020 CSEES dataset was used for the regression analysis. In each of the regression models, the demographic variables of gender, grade and length of service were initially forced into the models. The remaining demographic variables were excluded, since there was no apparent correlation between the other demographic variables and employee engagement, and age was highly correlated with length of service, so only one of these variables was necessary.

Controlling demographic variables are necessary because some of the variation in employee engagement may be due to differences between respondents of different grade, gender, or length of service. Without including these variables, the variation, which is actually due to grade for example, might appear to be due to differences in scores on different scales. If the demographic variables were not

found to be significant as per a t-test in the initial model, they were removed one by one and only significant demographic variables were retained in the model. The demographic variables included in the final model have been reported, along with the antecedents for each model.

Figure 4 shows the antecedents of employee engagement and the associated scale scores from the 2020 CSEES dataset. The darker squares indicate the scales with the stronger association with employee engagement with the coefficients included in each square. Each of the five scales; meaningfulness, job skills match, organisational support, competence, and leadership were identified by the model as a predictor or antecedents of employee engagement. All are significant at the $p=0.01$ level. The five antecedents and their position, or strength of association, with employee engagement remains unchanged across the three iterations of the survey, apart from leadership and competence, which switched positions in 2020.

Figure 4

CSEES Antecedents of Employee Engagement, 2020

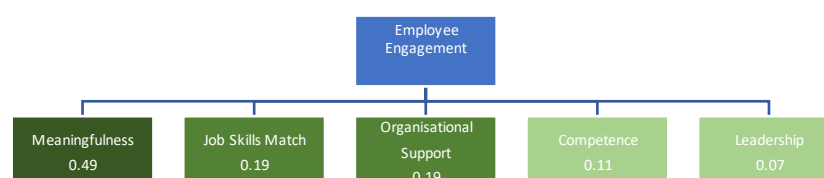


Table 18 displays the five scales ordered from highest to lowest correlation to employee engagement. Meaningfulness is the antecedent with the highest strength of association, which means that increasing scores for this scale will have the biggest effect on employee engagement scores. Leadership has a lower strength of association, which means that increasing scores for this scale will still increase employee engagement scores, but not to the same extent.

Table 18

CSEES Antecedent Coefficients' Impact on Employee Engagement, 2020

Antecedent	Score	Coefficient	T-Value	Prob > t
Meaningfulness	69	0.49	89.08	<.0001
Job Skills Match	62	0.19	30.9	<.0001
Organisational Support	54	0.18	24.99	<.0001
Competence	79	0.11	24.71	<.0001
Leadership	59	0.07	10.61	<.0001

The model R-squared for employee engagement, i.e., the proportion of variance in employee engagement explained by the model, is $R^2 = 0.71$, $F(1, 20,202) = 5,382$, $p < 0.0001$ (Table 19). This indicates that the model is working strongly, and actions which improve scores for the five antecedents will have a high impact on employee engagement.

Table 19

CSEES Antecedent Analysis by Gender Model Statistics, 2020

Demographic Variable	Score	No of Obs	Model R-square	F-value	p-value
Overall	75	20,202	0.71	5,382.20	<.0001
Male	73	8,116	0.74	2,931.40	<.0001
Female	76	12,230	0.68	3,206.50	<.0001

Gender and length of service were found to be significant controlling variables within the model, with males being less engaged than females, while engagement levels drop with increasing length of service (Table 20). Female and Length of Service: Less than 10 Years are the reference observations for each variable; thus, no coefficients, t-values or probabilities are applied to these observations.

Table 20

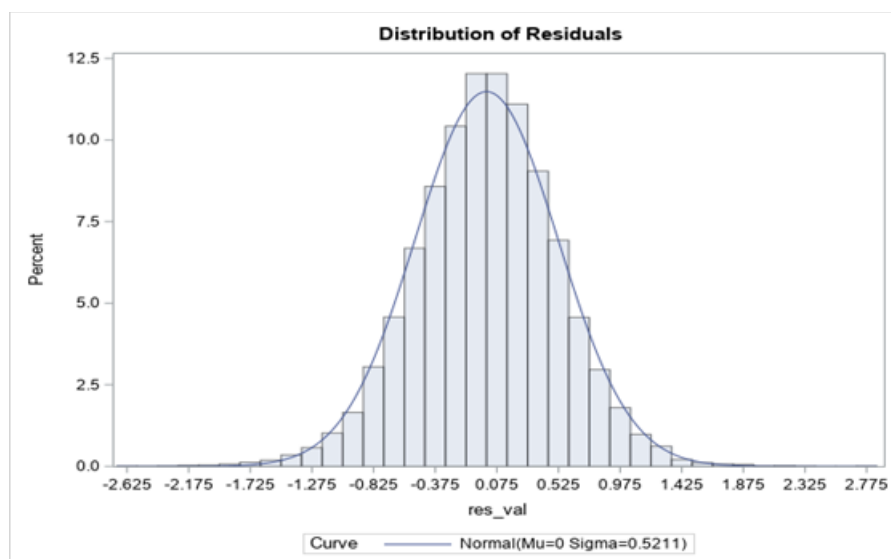
CSEES Antecedent Controlling Demographic Variables, 2020

Variable	Coefficient	T-Value	Prob > t
Gender Male	-0.09	-11.82	<.0001
Gender Female			
Length of Service: 10 to 20 Years	-0.12	-12.75	<.0001
Length of Service: 20 to 30 Years	-0.12	-11.28	<.0001
Length of Service: Greater than 30 Years	-7.31	-0.081	<.0001
Length of Service: Less than 10 Years			

The Kolmogorov-Smirnov test for normality of the residuals from this model indicates that the residuals are not normally distributed (KS = 0.015, $p < 0.01$). However, this test is not reliable for large sample sizes (here $n=20,202$). A histogram of the residuals indicates that they are normally distributed (Figure 5).

Figure 5

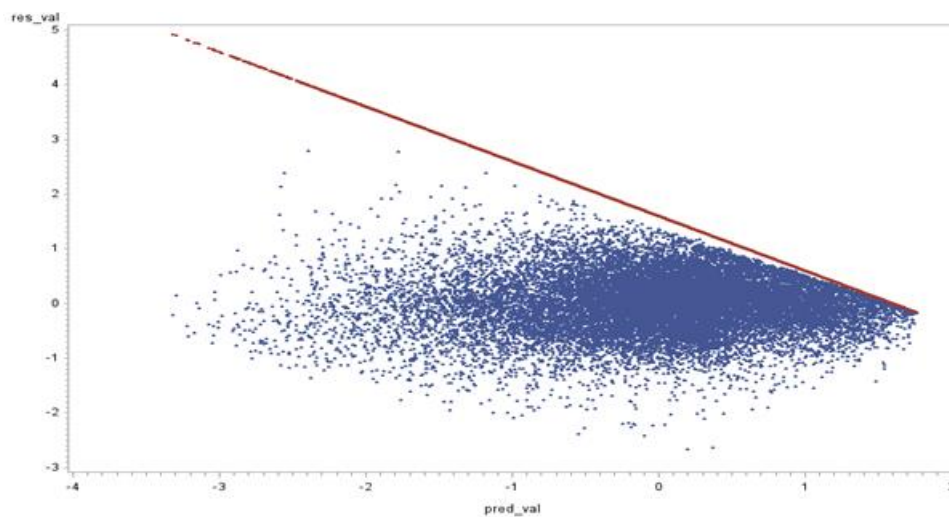
CSEES Regression Analysis Distribution of Residuals Histogram, 2020



A plot of residuals versus predicted values shows a cloud of points with no particular pattern, other than the upper bound, showing that there is no obvious bias in the model. Each plot of residuals shows an apparent upper bound (Figure 6). This is a result of the scale variables being discrete.

Figure 6

CSEES Regression analysis Distribution of Residuals Plot, 2020



In addition to including the demographic variables into the overall regression analysis model, models were also created with data subset by grade, gender, and length of service. It was found that meaningfulness was the first antecedent of employee engagement across all grades, genders, and lengths of service (Table 21). The strength of association of meaningfulness to employee engagement and therefore its ability to predict employee engagement, was far higher than for other scales to employee engagement across all of the demographic models.

Organisational support and job skills match were the second, third or fourth antecedents across all demographic models apart from the model for the Directors, Assistant Secretary General and above grade. The remaining scales considered to be antecedents of employee engagement varied by demographics with citizen impact, competence, innovative climate, job demands, leadership, manager career support, public perception of the Civil Service, learning and development, career development, involvement climate, social support and autonomy being in the top five of antecedents of employee engagement across the models.

For the regression models by gender, there were 12,230 observations for females and 8,116 observations for males. The antecedents of employee engagement were the same for both genders apart from citizen impact as the fifth antecedent for males and leadership as the fifth antecedent for females. Length of service was a controlling variable for both genders, indicating that length of service has an impact on employee engagement by gender.

There is a relatively high strength of association between employee engagement and meaningfulness for females and males. The second and third antecedents, job

skills match and organisational support, also have similar coefficients for both genders, being a moderate to low predictor of employee engagement for both genders. Competence is a low predictor of employee engagement for both genders. The fifth antecedents, leadership for males and citizen impact for females, are both a low predictor of employee engagement.

Length of service was divided into four time periods for the regression analysis models: less than 10 years, 10 to 20 years, 20 to 30 years and over 30 years of service. The prefer not to say category was not included in the analysis. The number of responses in this category were comparatively low.

Meaningfulness was the first antecedent and job skills match and organisational support were the second or third antecedent of employee engagement across all lengths of service. Competence was an antecedent of employee engagement for all lengths of service at the fourth or fifth position. Leadership was an antecedent of employee engagement for civil servants with less than 10 years of service and more than 30 years of service. Citizen impact was an antecedent of employee engagement for civil servants with 10 to 20 years' experience. Manager career support was an antecedent of employee engagement for civil servants with 20 to 30 years of service.

The antecedents of employee engagement by grade show more variation than by gender or length of service. There are a range of possible reasons for this; the roles, responsibility, seniority and pay at each grade are very different, there is a varied gender and length of service split by grade and there is a large variance in the size of each cohort within each grade. The service officers, industrial grades and

other staff grades were not included in the analysis as there was not sufficient observations within these cohorts to meet the thresholds for the antecedent analysis. The 'Prefer not to say' category was excluded from the demographic analysis. The number of responses in this category were comparatively low.

Meaningfulness is the first antecedent of employee engagement across all grades included in the analysis. The strength of association of meaningfulness to employee engagement and therefore its ability to predict employee engagement, was far higher than other scales across all of the models. Organisational support and job skills match were antecedents in all models apart from the Director, Assistant Secretary General and above grade. The Director, Assistant Secretary General and above grade model is also comparably weaker than the other models due to the small number of observations in the model. Organisational support and job skills match were the second, third or fourth antecedents across all grade models apart from the model for Directors, Assistant Secretary General and above and Assistant Principals. Job skills match was the third antecedent in most models, with organisational support showing more variance in position, being the second, third or fourth antecedent within the models.

Other scales that were antecedents within the grade regression models were leadership, competence, manager career support, career development and mobility and citizen impact. Competence was seen in all models apart from the Director, Assistant Secretary General and above grade model. Leadership was included in the models for the Assistant Principal, Administrative Officer, and Clerical Officer grades. Job demands is an antecedent in the regression models for Principal

Officers and Clerical Officers. Citizen impact is an antecedent in the Principal Officer, Administrative Officer, Higher Executive Officer, and Executive Officer models. Manager career support is an antecedent in the Assistant Principal model. Career development and mobility is the second antecedent in the Director, Assistant Secretary General and above model.

The number of observations in the models ranged from 155 for the Director, Assistant Secretary General and above grade to 5,919 observations for the Clerical Officer grade. All models reliably predict employee engagement apart from the model for the Director, Assistant Secretary General and above grade. Gender and length of service were controlling variable in all models, apart from the Director, Assistant Secretary General and above and Administrative Officer models. Both of these models had no controlling variables.

Table 21*CSEES 2020 Regression by Gender, Grade and Length of Service*

Demographic Variable	No of Obs	Model R-square	F-value	p-value	Controlling variables
Gender					
Male	8,116	0.74	2,931.40	<.0001	Length of Service
Female	12,230	0.68	3,206.50	<.0001	Length of Service
Grade					
Director, ASG and above	155	0.79	79.2	<.0001	None
Principal Officer	1,155	0.78	455.2	<.0001	Gender, Length of Service
Assistant Principal	2,912	0.71	808.4	<.0001	Gender, Length of Service
Administrative Officer	871	0.73	255.1	<.0001	None
Higher Executive Officer	3,569	0.7	929.5	<.0001	Gender, Length of Service
Executive Officer	5,081	0.7	1,329.30	<.0001	Gender, Length of Service
Clerical Officer	5,919	0.69	1,481.10	<.0001	Gender, Length of Service
Length of Service					
Less than 10 years	8,525	0.72	2,674.00	<.0001	Gender and Grade
10 to 20 years	4,922	0.72	1,565.20	<.0001	Gender
20 to 30 years	3,764	0.69	1,052.50	<.0001	Gender
Greater than 30 years	3,135	0.67	790.4	<.0001	Grade and Gender

Table 22

CSEES Regression and Antecedent Analysis by Gender, Grade and Length of Service, Antecedent 1 and 2

Demographic Variable	Antecedent 1	Coefficient t	T-Value	Prob > t	Antecedent 2	Coefficient	T-Value	Prob > t
Gender								
Male	Meaningfulness	0.47	51.72	<.0001	Organisational Support	0.26	17.52	<.0001
Female	Meaningfulness	0.48	66.21	<.0001	Job Skills Match	0.2	26.26	<.0001
Grade								
Director, ASG and above	Meaningfulness	0.56	8.42	<.0001	Career Development	0.3	7.46	<.0001
Principal Officer	Meaningfulness	0.43	17.05	<.0001	Organisational Support	0.25	14.18	<.0001
Assistant Principal	Meaningfulness	0.52	37.74	<.0001	Leadership	0.15	9.09	<.0001
Administrative Officer	Meaningfulness	0.48	17.24	<.0001	Job Skills Match	0.19	7.22	<.0001
Higher Executive Officer	Meaningfulness	0.43	30.16	<.0001	Organisational Support	0.24	23.24	<.0001
Executive Officer	Meaningfulness	0.47	39.55	<.0001	Organisational Support	0.24	26.11	<.0001
Clerical Officer	Meaningfulness	0.49	47.78	<.0001	Job Skills Match	0.22	18.85	<.0001
Length of Service								
Less than 10 years	Meaningfulness	0.49	61.07	<.0001	Organisational Support	0.2	18.22	<.0001
10 to 20 years	Meaningfulness	0.44	36.24	<.0001	Organisational Support	0.24	27.31	<.0001
20 to 30 years	Meaningfulness	0.52	39.35	<.0001	Organisational Support	0.2	15.91	<.0001
Greater than 30 years	Meaningfulness	0.49	32.73	<.0001	Job Skills Match	0.19	11.6	<.0001

Table 23

CSEES Regression and Antecedent Analysis by Gender, Grade and Length of Service, Antecedent 3, 4 and 5

Demographic Variable	Antecedent 3	Coeff	T-Value	Prob > t	Antecedent 4	Coeff	T-Value	Prob > t	Antecedent 5	Coefficient	T-Value	Prob > t
Gender												
Male	Job Skills Match	0.17	36	<.0001	Competence	0.11	11.17	<.0001	Citizen Impact	0.08	15.71	<.0001
Female	Organisational Support	0.17	18.3	<.0001	Competence	0.09	16.11	<.0001	Leadership	0.07	8.14	<.0001
Grade												
Director, ASG and above	Job Skills Match	0.18	2.48	0.014								
Principal Officer	Job Skills Match	0.22	8.2	<.0001	Citizen Impact	0.1	5.1	<.0001	Competence	0.08	4.18	<.0001
Assistant Principal	Job Skills Match	0.14	10.4	<.0001	Competence	0.11	8.56	<.0001	Manager Career Support	0.1	13.19	<.0001
Administrative Officer	Citizen Impact	0.13	6.05	<.0001	Organisational Support	0.13	3.89	0.0001	Leadership	0.11	3.35	8E-04
Higher Executive Officer	Job Skills Match	0.19	13.5	<.0001	Competence	0.09	9.02	<.0001	Citizen Impact	0.09	8.37	<.0001
Executive Officer	Job Skills Match	0.19	15.1	<.0001	Competence	0.09	10.84	<.0001	Citizen Impact	0.06	6.1	<.0001
Clerical Officer	Organisational Support	0.18	12.9	<.0001	Leadership	0.11	12.52	<.0001	Competence	0.08	5.6	<.0001
Length of Service												
Less than 10 years	Job Skills Match	0.17	19.1	<.0001	Competence	0.11	17.06	<.0001	Leadership	0.07	6.49	<.0001
10 to 20 years	Job Skills Match	0.23	18.6	<.0001	Competence	0.07	8.25	<.0001	Citizen Impact	0.07	7.79	<.0001
20 to 30 years	Job Skills Match	0.17	11.1	<.0001	Competence	0.1	9.13	<.0001	Manager Career Support	0.07	6.36	<.0001
Greater than 30 years	Organisational Support	0.15	7.82	<.0001	Competence	0.12	9.77	<.0001	Leadership	0.08	4.61	<.0001

The Irish Civil Service Population CSEES and Employee Engagement Scores

This section provides an overview of the demographics of Irish Civil Service and the CSEES respondents and the employee engagement scores using descriptive statistics by grade, gender, and length of service. In 2020, the Civil Service population included approximately 40,000 civil servants in 50 departments and offices across Ireland and overseas. Almost two thirds of civil servants were female and were disproportionately represented in administrative and lower management grades. The Irish Civil Service has a very low level of churn in comparison to the private sector (Government of Ireland, 2020) with 83% to 92% of civil servants staying within the Civil Service from 2006-2018. Higher churn was seen in the later years of that period and may have been due to the increased employment of temporary Clerical Officers with no permanent contracts. Thus, the population changes across the survey iterations are primarily due to new hires, retirements, and internal promotions. There is no way to track specific civil servants across the iterations of the CSEES.

The Irish Civil Service is grade structured, comprised of general, specialist and technical grades. Figure 7 outlines the grade structure and order of seniority in the Civil Service (Public Jobs, n.d.). Not all civil servants would hold the job titles outlined in the figure. Where this is the case, these civil servants are included in the analysis under the equivalent grade.

Figure 7

Irish Civil Service Grade Structure by seniority and approximate % proportion of total Irish Civil Service in 2020

Secretary General : Head of one of the Government Departments, reporting to the minister (<1%)	
Assistant Secretary : Head of Division within one of the Government Departments (<1%)	
Principal Officer : Head of Unit or Function within a Government Departments or one of its subsidiaries (4%)	
Assistant Principal : Senior Manager within a Government Departments or one of its subsidiaries (13%)	
Administrative Officer : Manager/Team Leader with a focus on policy within a Government Departments or one of its subsidiaries (7%)	Higher Executive Officer : Manager/Team Leader within a Government Departments or one of its subsidiaries (14%)
Executive Officer : Supervisor within a Government Departments or one of its subsidiaries (24%)	
Clerical Officer : Administrator within a Government Departments or one of its subsidiaries (35%)	

There was an increase in the intake of new civil servants in the 2015-2022 period with the proportion of civil servants with less than 10 years of service increasing from 28% to 41%. This increase is reflected in the total increase in the Civil Service population. Conversely, it is expected that approximately 10,000, or 25% of civil servants are due to retire between 2022 and 2027 (Government of Ireland, 2017).

Traditionally, civil servants could only enter the Civil Service at certain grades with open competitions for recruitment to the entry level grades including Clerical Officer, Executive Officer, and Administrative Officer grades. The Social Partnership Agreements, Sustaining Progress and Towards 2016 Report (Department of the Taoiseach, 2016) then made provision for open recruitment to other Civil Service grades under the themes of public service modernisation. This expanded the options available to new entrants to the Civil Service.

Table 24 shows the Civil Service population by grade in September 2015, 2017, and 2020 (Government of Ireland, 2021). Between 2015 and 2020, the number of civil servants increased by 19%. Although the population increased, the proportion of civil servants at each grade remained steady with a 2% or less change in the proportion of total civil servants at each grade between 2015 and 2020. The percentage change varies by grade. Higher Executive Officer and Executive Officer grades demonstrated a similar percentage increase during the period (20% and 21% respectively). There was a larger percentage increase at Assistant Principal (42%) and Administrative Officer (33%) grades. A smaller proportional increase is seen at Clerical Officer grade (12%) and a decrease at service officer grade(-14%). This indicates that hiring was focused on the more senior grades during the 2015-2020 period, but this did not have a significant impact on the proportions of each grade within the Civil Service.

Table 24

Total Civil Service Population by Grade and Year, 2015, 2017, 2020

Grade	Civil Service Population			Proportion of the Total CS Population			% Change from 2015 of Total CS Population	
	Sep-15	Sep-17	Sep-20	Sep-15	Sep-17	Sep-20	Sep-17	Sep-20
Director, ASG and above	273	273	299	1%	1%	1%	0%	10%
Principal Officer	1,279	1,359	1,611	4%	4%	4%	6%	26%
Assistant Principal	3,620	4,073	5,133	11%	11%	13%	13%	42%
Higher Executive Officer	4,592	4,939	5,500	14%	14%	14%	8%	20%
Administrative Officer	2,095	2,367	2,791	6%	7%	7%	13%	33%
Executive Officer	7,895	8,306	9,578	24%	23%	24%	5%	21%
Clerical Officer	12,302	12,954	13,760	37%	37%	35%	5%	12%
Service Officer	1,248	1,181	1,072	4%	3%	3%	-5%	-14%
Grand Total	33,311	35,489	39,756				7%	19%

The Irish Civil Service is predominantly female. However, there was a higher percentage increase in males versus females in the Civil Service between 2015 and 2020 (Table 25). The slower increase in the percentage of females may correspond with the proportional decrease of civil servants within the less senior grades during the same period, given that females are disproportionately represented in the less senior grades.

Table 25

Total Civil Service Population, Proportion and Proportion Change by Gender, 2015, 2017 and 2020

Gender	Sep-15	Sep-17	Sep-20
Male	12,521	13,569	15,460
Female	20,783	21,883	24,284
Grand Total	33,304	35,452	39,744
Proportion of Total Civil Service			
Male	38%	38%	39%
Female	62%	62%	61%
Proportion Change on 2015 of Total Civil Service			
Male		8%	23%
Female		5%	17%
Grand Total		6%	19%

Overall, the gender split in the Civil Service has remained steady. When delving into gender by grade, Table 26 shows that there has been a consistent increase in the proportion of females versus males at the Administrative Officer grade and above. This is most prominent at the Principal Officer grade, where the proportion of females increased from 37% in 2015 to 46% in 2020. In contrast, 71% of Clerical Officers were female in 2020, a decrease from 76% in 2015. There were 9,790 female Clerical Officers in 2020, accounting for 25% of the Civil Service population.

The proportion of males at each grade increased for Service Officers and Clerical Officers between 2015 and 2020 (2% and 5% respectively). Director, Assistant Secretary General and above, Principal Officers and above and Service Officers were the only grades with more males than females in 2020.

Table 26

Total Civil Service Population Proportion and Proportion Change by Grade and Gender – 2015, 2017 and 2020

Proportion of Gender by Grade	2015		2017		2020	
	Male	Female	Male	Female	Male	Female
Director, ASG and above	71%	29%	68%	32%	64%	36%
Principal Officer	63%	37%	59%	41%	54%	46%
Assistant Principal	53%	47%	51%	49%	48%	52%
Higher Executive Officer	42%	58%	42%	58%	41%	59%
Administrative Officer	53%	47%	52%	48%	52%	48%
Executive Officer	35%	65%	37%	63%	37%	63%
Clerical Officer	24%	76%	26%	74%	29%	71%
Services Officer	61%	39%	62%	38%	63%	37%
Grand Total	38%	62%	38%	62%	39%	61%
Proportion Change on 2015			2015 vs 2017		2017 vs 2020	
	Male	Female	Male	Female	Male	Female
Director, ASG and above			-3%	3%	-8%	8%
Principal Officer			-4%	4%	-8%	8%
Assistant Principal			-2%	2%	-5%	5%
Higher Executive Officer			0%	0%	-2%	2%
Administrative Officer			-1%	1%	-1%	1%
Executive Officer			1%	-1%	2%	-2%
Clerical Officer			2%	-2%	4%	-4%
Services Officer			1%	-1%	2%	-2%
Grand Total			1%	-1%	1%	-1%

Length of service measures how long civil servants have been in the Civil Service rather than at a particular grade. A notable change can be seen in the profile of civil servants by length of service between 2015 and 2020, with the proportion of civil servants with less than 10 years of service increasing from 28% in 2015 to 41% in

2020, a 74% increase on 2015 (Table 27). This reflects the overall increase in the number of civil servants in the Civil Service between 2015 and 2020. For those with more than 10 years of service, the total numbers of civil servants are steady with the population in each category differing by less than 1,000 civil servants between 2015 and 2020, reflecting a low level of churn.

Table 27

Civil Service Population by Length of Service – 2015, 2017 and 2020

Length of Service	Civil Service Population			Proportion of the Total Civil Service Population			Proportion Change from 2015	
	Sep-15	Sep-17	Sep-20	Sep-15	Sep-17	Sep-20	Sep-17	Sep-20
Less than 10 years	9,417	11,195	16,381	28%	32%	41%	19%	74%
10 to 20 years	10,493	11,223	10,404	32%	32%	26%	7%	-1%
20 to 30 years	6,090	5,659	6,500	18%	16%	16%	-7%	7%
Greater than 30 years	7,308	7,410	6,421	22%	21%	16%	1%	-12%
Grand Total	33,308	35,487	39,706				7%	19%

It is important to compare the CSEES response rates with respect to several features within the Civil Service population. It highlights two elements: the size of the CSEES datasets and the increasing representivity by demographic of the CSEES datasets between 2015 and 2020. The survey is a census rather than a sample survey as it was sent to all active civil servants.

- ☐ In 2015, there was a 39% response rate, equivalent to 15,519 responses.
- ☐ In 2017, there was a 56% response rate, equivalent to 21,365 responses.
- ☐ In 2020, there was a 65% response rate, equivalent to 26,795 responses.

This amounted to 63,679 responses across the three iterations. The increase in response rates in 2017 and 2020 from 2015 resulted in a more representative sample, across grades, gender, lengths of service and organisations within the Irish Civil Service. The 2017 and 2020 surveys can be seen as generally representative at a Civil Service, organisation, grade, gender, and lengths of service level. The 2015 dataset is incorporated into this research but is less representative of the Civil Service population due to the lower response rate.

Table 28 outlines the estimated response rates at grade, gender, and length of service for the three iterations of the CSEES. As highlighted previously, there is a discrepancy between the total Civil Service population as per DPER and the CSEES. However, the demographic proportions are valid.

There was a higher response rate from males in comparison to females across all three iterations of the CSEES with the gap between genders narrowing from the first iteration in 2015 with a 7% difference, to the 2020 iteration with a 1% difference (Table 28). This is reflective of the response rates at a grade level, with those in the less senior grades generally having lower response rates.

Administrative Officers are the only exception to this trend, with consistently lower response rates, at less than 40%. The response rates for differing lengths of service were consistent across all iterations, apart from those with 20 to 30 years of service in the 2020 CSEES, with a higher response rate than the other length of service cohorts. Service officers have had a particularly low response rate and are a comparatively small cohort. They are not included in the grade based analysis in this study due to the size of the cohort.

Table 28

Estimated Response Rates for Grade, Gender, and Length of Service – 2015, 2017 and 2020

	2015		2017		2020	
	Total Response s to CSEES	Estimated Response Rate by CS Populatio n	Total Response s to CSEES	Estimated Response Rate by CS Populatio n	Total Response s to CSEES	Estimated Response Rate by CS Populatio n
Gender						
Male	5,850	47%	7,939	59%	9,891	64%
Female	8,396	40%	11,711	54%	15,403	63%
Grade						
Director, ASG and above	162	59%	191	70%	185	62%
Principal Officer	833	65%	1,122	83%	1,397	87%
Assistant Principal	1,876	52%	2,595	64%	3,510	68%
Higher Executive Officer	2,633	57%	3,410	69%	4,331	79%
Administrative Officer	422	20%	705	30%	1,043	37%
Executive Officer	3,384	43%	4,664	56%	6,213	65%
Clerical Officer	4,234	34%	6,058	47%	7,422	54%
Service Officer	78	6%	98	8%	116	11%
Length of Service						
Less than 10 years	3,758	40%	6,147	55%	10,461	64%
10 to 20 years	4,908	47%	6,584	59%	6,296	61%
20 to 30 years	2,682	44%	3,215	57%	4,799	74%
Greater than 30 years	3,350	46%	4,235	57%	4,121	64%

In the official CSEES publications (Government of Ireland, 2016, 2018, 2021), the employee engagement score was calculated as the average index score for each respondent across the seven response options on the seven-point Likert scale (Likert, 1932). This approach is replicated in this study for coherence with previous CSEES publications and for ease of interpretation.

There were 24 scales included in the CSEES across the three iterations of the survey. Three of these scales relate to Civil Service initiatives rather than attitudinal scales and are excluded from the analysis where the full datasets are applied in the

analysis. The full list of items within the CSEES scales are in Appendix 1. Table 29 shows a steady increase or maintenance of scores across the majority of scales between the 2015 and 2020 iterations of the survey, apart from social support which decreases by one point in the 2020 iteration of the survey and competence which decreases by one point between the 2015 and 2017 iterations. Scales with lower scores in 2015 tended to have a higher point increase in 2017 and 2020. Job demands and involvement climate are an exception to this trend.

Table 29

CSEES Scale Scores and Difference in Scores, 2015, 2017 and 2020

Scale	2015	2017	2020	2015-2017 Change	2017-2020 Change	2015-2020 Change
Competence	80	79	79	-1	0	-1
Well-being	75	75	76	0	1	1
Employee Engagement	70	72	75	2	3	5
Citizen Impact	68	70	73	2	3	5
Coping with Change	69	71	72	2	1	3
Social Support	70	72	71	2	-1	1
Meaningfulness	65	67	69	2	2	4
Manager Career Support	56	61	64	5	3	8
Job Skills Match	58	60	62	2	2	4
Autonomy	59	61	61	2	0	2
Learning and Development	52	58	61	6	3	9
Leadership	50	55	59	5	4	9
Commitment to the Organisation	48	54	58	6	4	10
Innovative Climate	45	49	55	4	6	10
Job Demands	51	52	54	1	2	3
Organisational Support	44	49	54	5	5	10
Career Development and Mobility	44	50	53	6	3	9
Performance Standards	44	48	53	4	5	9
Your Pay	42	46	52	4	6	10
Public Perception of the Civil Service	33	38	44	5	6	11
Involvement Climate	36	38	41	2	3	5

Reviewing the employee engagement scores by grade, gender, and length of service in the Civil Service provides demographic insights into the level of employee engagement of civil servant cohorts across the three iterations of the CSEES. T-tests are also included and indicate whether the differences between the employee engagement scores by iteration and cohort are statistically significant.

Employee engagement had similar, positive scores across all grades, genders and lengths of service and iterations of the survey. In 2020, apart from the Director, Assistant Secretary General and above grade (M=88), the employee engagement scores ranged from 72 to 76 for all cohorts. The standard deviation of the scores were similar across most grades apart from for Director, Assistant Secretary General and above (SD=12).

It would be expected that those at more senior grades would have a higher employee engagement score than those at less senior grades. This is seen for the upper and middle management grades which are from Director, Assistant Secretary General and above to Administrative Officer. For these grades, the employee engagement scores slightly decrease as the level of seniority decreases (Table 30). Clerical Officers are an exception to this trend, with a higher score in 2020 than seen for more senior grades. It is noted that within grades with small numbers of respondents, the scores would be more sensitive to individual responses.

The employee engagement score of civil servants by length of service is equal and highest for those with less than 10 years of service and those with more than 30 years of service (M=76) (Table 30). Employee engagement scores were at their lowest for those at mid-career with 10 to 30 years of service (M=72). The standard deviation of the mean is similar for all lengths of service.

Table 30*CSEES Employee Engagement Scores by Gender, Grade and Length of Service 2020*

Category	N	Score	95% CL Score		Std Dev	Std Err
Gender						
Female	15,113	76	76	76	17	0.1
Male	9,745	74	73	74	18	0.2
Grade						
Director, ASG and above	183	88	86	90	12	0.9
Principal Officer	1,376	76	75	77	18	0.5
Assistant Principal	3,462	76	75	76	16	0.3
Higher Executive Officer	4,259	74	74	75	17	0.3
Administrative Officer	1,025	74	73	75	17	0.5
Executive Officer	6,110	73	73	74	18	0.3
Clerical Officer	7,278	75	75	76	18	0.2
Length of Service						
Less than 10 years	10,335	76	76	77	17	0.2
10 to 20 years	6,191	72	72	72	18	0.2
20 to 30 years	4,706	74	73	74	18	0.3
Greater than 30 years	4,011	76	76	77	17	0.3

The employee engagement score comparisons and associated t-tests analysis by gender and length of service for the 2020 CSEES are outlined in Table 31.

Differences by gender and length of service are statistically significant for all comparisons apart from those with less than 10 years compared to those with greater than 30 years of service where there is no mean difference between scores.

Table 31*CSEES Employee Engagement T-tests by Gender and Length of Service 2020*

Comparison Demographics		Mean Difference	DF	t Value	Pr > t
Gender					
Female	Male	2.3	19,598	9.9	<.0001
Length of Service					
Less than 10 years	10-20 years	4.3	12,506	15.1	<.0001
Less than 10 years	20-30 years	-1.4	6,316	2.73	0.0063
Less than 10 years	Greater than 30 years	0	7,432	-0.1	0.9222
10-20 years	20-30 years	-1.5	10,239	-4.31	<.0001
10-20 years	Greater than 30 years	-4.3	8,987	-12.34	<.0001
20-30 years	Greater than 30 years	-2.8	8,608	-7.69	<.0001

More variance in employee engagement scores is seen by grade. Table 32 shows the employee engagement scores by grade and the differences between 2015, 2017 and 2020. As noted previously, employee engagement scores tend to be higher for those in more senior grades. The employee engagement scores by grade increased for all grades between 2015 and 2020. When reviewing the differences in scores between the survey iterations, those at a more senior grade tended to have the majority of any increase in scores between 2015 and 2017. For those at less senior grades, the converse is true with the increases mainly between 2017 and 2020. Overall, those in less senior grades saw a higher increase in scores between 2015 and 2017. The increasing representivity of the CSEES data is a consideration here, with those at less senior grades more evenly represented in 2017 and 2020.

Table 32

Employee Engagement Scores and Differences by Grade, CSEES 2015, 2017 and 2020

Grade	2015	2017	2020	2015/2017 Difference	2017/2020 Difference	2015/2020 Difference
Director, ASG and above	87.3	87.9	88	0.6	0.1	0.7
Principal Officer	76.2	75.5	76.4	-0.7	0.9	0.2
Assistant Principal	73.6	75.4	75.6	1.8	0.2	2
Administrative Officer	71.2	73.2	73.8	2	0.6	2.6
Higher Executive Officer	70.3	71.7	74.1	1.4	2.4	3.8
Executive Officer	67.8	71	73.1	3.2	2.1	5.3
Clerical Officer	67.2	71.1	75.2	3.9	4.1	8

The following tables (Tables 33 through 38) show the employee engagement scores by grade in more detail, comparing the employee engagement scores by grade and across iterations of the survey. These tables provide meaningful insights into the grade cohorts and their employee engagement in the Civil Service.

The employee engagement score of Principal Officers remained relatively static across the three iterations of the survey (Table 33). The difference between Principal Officer employee engagement scores and the scores of all other grades decreased between 2015 and 2020, indicating that the employee engagement scores of all other grades did increase in comparison to Principal Officer scores. The employee engagement scores for Principal Officers and Assistant Principals were very similar across all survey iterations, with no statistically significant difference seen. In 2020, the difference between Principal Officers and Clerical Officers, the least senior grade, was 1.3 indicating similar levels of employee engagement.

The Assistant Principal employee engagement scores were steady between 2015 and 2020, with a small increase seen, from 73.6 to 75.6 (Table 34). A consistent 3.3 point difference in employee engagement scores was seen between Assistant Principals and Higher Executive Officers in 2015 and 2017. This decreased to a 1.5 point difference in 2020 as Higher Executive Officers score increased at a higher rate than Assistant Principals. The difference between the 2020 Assistant Principal and Clerical Officer scores was not statistically significant.

The Administrative Officer employee engagement scores increased by 2.6 points between 2015 to 2020 (Table 35). In 2020, the differences between Administrative Officers and Executive Officers and Higher Executive Officers scores were not statistically significant.

The employee engagement score for Higher Executive Officers increased by 3.8 points between 2015 and 2020 resulting no statistical difference between the scores in 2020 (Table 36). Higher Executive Officers had a similar score to Administrative Officers in 2020. The difference between Higher Executive Officer and Executive Officer scores in 2020 was 1.1. There was a 2.6 difference for these grades in 2015. Clerical Officers had a higher score than Higher Executive Officers in 2020, with Clerical Officers at 75.2 in comparison to Higher Executive Officers at 74.1. The difference between Assistant Principal and Higher Executive Officer scores decreased from 3.3 in 2015 to 1.5 in 2020.

The Executive Officer employee engagement scores increased from 67.8 in 2015 to 73 in 2020 (Table 37). The Executive Officer and Clerical Officer scores were equivalent in 2015 and 2017, with no statistically significant difference seen

between them. In 2020, the Executive Officer score was 2.1 points lower than the Clerical Officer employee engagement score.

The Clerical Officer employee engagement scores saw the largest increase of any grade between 2015 and 2020, with an eight point increase (Table 38). Clerical Officers had the lowest employee engagement score across all grades in 2015 and 2017. In 2020, the scores of Administrative Officers, Executive Officers and Higher Executive Officers were lower than those of Clerical Officers.

The insights gained from the summary statistics and antecedent analysis of the CSEES employee engagement scale, both across demographics and years of the survey, do indicate that the CSEES employee engagement scale is an appropriate measure of employee engagement for the Irish Civil Service, as it provides granular meaningful insights that can be utilised by the Irish Civil Service.

Table 33*Employee Engagement Score Comparison for Principal Officers (PO) – CSEES 2015,2017 and 2020*

Year	Primary Grade and Score		Comparison Grade and Score		Mean Difference	t Value	Pr > t
2015	Principal Officer	76.2	Director, ASG and above	87.3	-11.1	-10.52	<.0001
2017	Principal Officer	75.5	Director, ASG and above	87.9	-12.4	-11.07	<.0001
2020	Principal Officer	76.4	Director, ASG and above	88.0	-11.5	-11.35	<.0001
2015	Principal Officer	76.2	Assistant Principal	73.6	2.6	3.44	0.0006
2017	Principal Officer	75.5	Assistant Principal	75.4	0.1	0.12	0.9074
2020	Principal Officer	76.4	Assistant Principal	75.6	0.8	1.4	0.1605
2015	Principal Officer	76.2	Higher Executive Officer	70.3	5.9	7.97	<.0001
2017	Principal Officer	75.5	Higher Executive Officer	71.7	3.8	5.72	<.0001
2020	Principal Officer	76.4	Higher Executive Officer	74.1	2.3	4.11	<.0001
2015	Principal Officer	76.2	Administrative Officer	71.2	5	4.55	<.0001
2017	Principal Officer	75.5	Administrative Officer	73.2	2.3	2.6	0.0094
2020	Principal Officer	76.4	Administrative Officer	73.8	2.6	3.59	0.0003
2015	Principal Officer	76.2	Executive Officer	67.8	8.5	11.44	<.0001
2017	Principal Officer	75.5	Executive Officer	71.0	4.6	6.99	<.0001
2020	Principal Officer	76.4	Executive Officer	73.0	3.4	6.22	<.0001
2015	Principal Officer	76.2	Clerical Officer	67.2	9	12.51	<.0001
2017	Principal Officer	75.5	Clerical Officer	71.1	4.4	6.87	<.0001
2020	Principal Officer	76.4	Clerical Officer	75.2	1.3	2.36	0.0186

Table 34*Employee Engagement Score Comparison for Assistant Principal (AP) – CSEES 2015,2017 and 2020*

Year	Primary Grade and Score		Comparison Grade and Score		Mean Difference	t Value	Pr > t
2015	Assistant Principal	73.6	Director, ASG and above	87.3	-13.7	-14.75	<.0001
2017	Assistant Principal	75.4	Director, ASG and above	87.9	-12.4	-12.42	<.0001
2020	Assistant Principal	75.6	Director, ASG and above	88.0	-12.3	-13.26	<.0001
2015	Assistant Principal	73.6	Principal Officer	76.2	-2.6	-3.44	0.0006
2017	Assistant Principal	75.4	Principal Officer	75.5	-0.1	-0.12	0.9074
2020	Assistant Principal	75.6	Principal Officer	76.4	-0.8	-1.4	0.1605
2015	Assistant Principal	73.6	Higher Executive Officer	70.3	3.3	5.99	<.0001
2017	Assistant Principal	75.4	Higher Executive Officer	71.7	3.3	5.99	<.0001
2020	Assistant Principal	75.6	Higher Executive Officer	74.1	1.5	4.02	<.0001
2015	Assistant Principal	73.6	Administrative Officer	71.2	2.4	2.44	0.0148
2017	Assistant Principal	75.4	Administrative Officer	73.2	2.2	3.04	0.0024
2020	Assistant Principal	75.6	Administrative Officer	73.8	1.8	3.05	0.0023
2015	Assistant Principal	73.6	Executive Officer	67.8	5.8	10.69	<.0001
2017	Assistant Principal	75.4	Executive Officer	71.0	4.5	10.53	<.0001
2020	Assistant Principal	75.6	Executive Officer	73.1	2.6	7.35	<.0001
2015	Assistant Principal	73.6	Clerical Officer	67.2	6.4	12.27	<.0001
2017	Assistant Principal	75.4	Clerical Officer	71.1	4.4	12.27	<.0001
2020	Assistant Principal	75.6	Clerical Officer	75.2	0.5	1.39	0.1642

Table 35

Employee Engagement Score Comparison for Administrative Officer (AO) – CSEES 2015,2017 and 2020

Year	Primary Grade and Score		Comparison Grade and Score		Mean Difference	t Value	Pr > t
2015	Administrative Officer	71.2	Director, ASG and above	87.3	-16.1	-13.12	<.0001
2017	Administrative Officer	73.2	Director, ASG and above	87.9	-14.6	-12.8	<.0001
2020	Administrative Officer	73.8	Director, ASG and above	88.0	-14.2	-13.64	<.0001
2015	Administrative Officer	71.2	Principal Officer	76.2	-5	-4.55	<.0001
2017	Administrative Officer	73.2	Principal Officer	75.5	-2.3	-2.6	0.0094
2020	Administrative Officer	73.8	Principal Officer	76.4	-2.6	-3.59	0.0003
2015	Administrative Officer	71.2	Assistant Principal	73.6	-2.4	-2.44	0.0148
2017	Administrative Officer	73.2	Assistant Principal	75.4	-2.2	-3.04	0.0024
2020	Administrative Officer	73.8	Assistant Principal	75.6	-1.8	-3.05	0.0023
2015	Administrative Officer	71.2	Higher Executive Officer	70.3	0.9	0.89	0.3749
2017	Administrative Officer	73.2	Higher Executive Officer	71.7	1.6	2.19	0.0286
2020	Administrative Officer	73.8	Higher Executive Officer	74.1	-0.3	-0.54	0.5919
2015	Administrative Officer	71.2	Executive Officer	67.8	3.4	3.53	0.0004
2017	Administrative Officer	73.2	Executive Officer	71.0	2.3	3.28	0.0011
2020	Administrative Officer	73.8	Executive Officer	73.1	0.8	1.32	0.1866
2015	Administrative Officer	71.2	Clerical Officer	67.2	4	4.17	<.0001
2017	Administrative Officer	73.2	Clerical Officer	71.1	2.2	4.17	<.0001
2020	Administrative Officer	73.8	Clerical Officer	75.2	-1.3	-2.34	0.0197

Table 36

Employee Engagement Score Comparison for Higher Executive Officer (Higher Executive Officer) – CSEES 2015,2017 and 2020

Year	Primary Grade and Score		Comparison Grade and Score		Mean Difference	t Value	Pr > t
2015	Higher Executive Officer	70.3	Director, ASG and above	87.3	-17	-18.61	<.0001
2017	Higher Executive Officer	71.7	Director, ASG and above	87.9	-16.2	-16.25	<.0001
2020	Higher Executive Officer	74.1	Director, ASG and above	88.0	-13.8	-14.92	<.0001
2015	Higher Executive Officer	70.3	Principal Officer	76.2	-5.9	-7.97	<.0001
2017	Higher Executive Officer	71.7	Principal Officer	75.5	-3.8	-5.72	<.0001
2020	Higher Executive Officer	74.1	Principal Officer	76.4	-2.3	-4.11	<.0001
2015	Higher Executive Officer	70.3	Assistant Principal	73.6	-3.3	-5.99	<.0001
2017	Higher Executive Officer	71.7	Assistant Principal	75.4	-3.7	-5.99	<.0001
2020	Higher Executive Officer	74.1	Assistant Principal	75.6	-1.5	-4.02	<.0001
2015	Higher Executive Officer	70.3	Administrative Officer	71.2	-0.9	-0.89	0.3749
2017	Higher Executive Officer	71.7	Administrative Officer	73.2	-1.5	-2.19	0.0286
2020	Higher Executive Officer	74.1	Administrative Officer	73.8	0.3	-0.54	0.5919
2015	Higher Executive Officer	70.3	Executive Officer	67.8	2.6	4.95	<.0001
2017	Higher Executive Officer	71.7	Executive Officer	71.0	0.7	1.75	0.0805
2020	Higher Executive Officer	74.1	Executive Officer	73.1	1.1	3.12	0.0018
2015	Higher Executive Officer	70.3	Clerical Officer	67.2	3.1	6.36	<.0001
2017	Higher Executive Officer	71.7	Clerical Officer	71.1	0.6	1.51	0.1323
2020	Higher Executive Officer	74.1	Clerical Officer	75.2	-1.1	-3.04	0.0024

Table 37*Employee Engagement Score Comparison for Executive Officer (EO) – CSEES 2015,2017 and 2020*

Year	Primary Grade and Score		Comparison Grade and Score		Mean Difference	t Value	Pr > t
2015	Executive Officer	67.8	Director, ASG and above	87.3	-19.5	-21.43	<.0001
2017	Executive Officer	71.0	Director, ASG and above	87.9	-16.9	-17.18	<.0001
2020	Executive Officer	73.0	Director, ASG and above	88.0	-14.9	-16.23	<.0001
2015	Executive Officer	67.8	Principal Officer	76.2	-8.4	-11.44	<.0001
2017	Executive Officer	71.0	Principal Officer	75.5	-4.5	-6.99	<.0001
2020	Executive Officer	73.0	Principal Officer	76.4	-3.4	-6.22	<.0001
2015	Executive Officer	67.8	Assistant Principal	73.6	-5.8	-10.69	<.0001
2017	Executive Officer	71.0	Assistant Principal	75.4	-4.4	-10.53	<.0001
2020	Executive Officer	73.0	Assistant Principal	75.6	-2.6	-7.35	<.0001
2015	Executive Officer	67.8	Administrative Officer	71.2	-3.4	-3.53	0.0004
2017	Executive Officer	71.0	Administrative Officer	73.2	-2.2	-3.28	0.0011
2020	Executive Officer	73.0	Administrative Officer	73.8	-0.8	-1.32	0.1866
2015	Executive Officer	67.8	Higher Executive Officer	70.3	-2.6	-4.95	<.0001
2017	Executive Officer	71.0	Higher Executive Officer	71.7	-0.7	-1.75	0.0805
2020	Executive Officer	73.0	Higher Executive Officer	74.1	-1.1	-3.12	0.0018
2015	Executive Officer	67.8	Clerical Officer	67.2	0.6	1.15	0.2498
2017	Executive Officer	71.0	Clerical Officer	71.1	-0.1	-0.3	0.7634
2020	Executive Officer	73.0	Clerical Officer	75.2	-2.1	-6.75	<.0001

Table 38*Employee Engagement Score Comparison for Clerical Officer (CO) – CSEES 2015,2017 and 2020*

Year	Primary Grade and Score		Comparison Grade and Score		Mean Difference	t Value	Pr > t
2015	Clerical Officer	67.2	Director, ASG and above	87.3	-20.1	-22.41	<.0001
2017	Clerical Officer	71.1	Director, ASG and above	87.9	-16.8	-17.13	<.0001
2020	Clerical Officer	75.2	Director, ASG and above	88.0	-12.8	-13.99	<.0001
2015	Clerical Officer	67.2	Principal Officer	76.2	-9	-12.51	<.0001
2017	Clerical Officer	71.1	Principal Officer	75.5	-4.4	-6.87	<.0001
2020	Clerical Officer	75.2	Principal Officer	76.4	-1.3	-2.36	0.0186
2015	Clerical Officer	67.2	Assistant Principal	73.6	-6.4	-12.27	<.0001
2017	Clerical Officer	71.1	Assistant Principal	75.4	-4.4	-9.76	<.0001
2020	Clerical Officer	75.2	Assistant Principal	75.6	-0.5	-1.39	0.1642
2015	Clerical Officer	67.2	Administrative Officer	71.2	-4	-4.17	<.0001
2017	Clerical Officer	71.1	Administrative Officer	73.2	-2.2	-2.79	0.0054
2020	Clerical Officer	75.2	Administrative Officer	73.8	1.3	-2.34	0.0197
2015	Clerical Officer	67.2	Higher Executive Officer	70.3	-3.1	-6.36	<.0001
2017	Clerical Officer	71.1	Higher Executive Officer	71.7	-0.6	-1.51	0.1323
2020	Clerical Officer	75.2	Higher Executive Officer	74.1	1	3.04	0.0024
2015	Clerical Officer	67.2	Executive Officer	67.8	-0.6	-1.15	0.2498
2017	Clerical Officer	71.1	Executive Officer	71.0	0.1	0.3	0.7657
2020	Clerical Officer	75.2	Executive Officer	73.0	2.1	-6.75	<.0001

Discussion

Summary

The purpose of this study was to evaluate if the employee engagement scale used by the Civil Service Employee Engagement Survey (CSEES) is an appropriate measure of employee engagement in the Irish Civil Service. A quantitative approach was taken to evaluate the appropriateness of the CSEES employee engagement scale. Psychometric and other statistical techniques were applied to the data to achieve this, focusing on the structure and characteristics of the scale, as well as the potential insights gained from the associated statistical outputs.

There are five key findings from the study.

Firstly, the results do indicate that the CSEES employee engagement scale is a robust, valid, and reliable measure of employee engagement in the Irish Civil Service, based on the psychometric techniques applied to the CSEES.

Secondly, the results of the IRT analysis suggest that the employee engagement scores in the CSEES may be overinflated, with the higher employee engagement scores generated possibly reflecting lower and more varied levels of actual employee engagement of the civil servants surveyed.

Thirdly, although the Utrecht Work Engagement Scale (UWES) (Schaufeli & Bakker, 2004) upon which the CSEES employee engagement scale is based on was developed as a multidimensional scale, the results of this study indicate that CSEES employee engagement scale is unidimensional. Although, it must also be noted that the CSEES employee engagement scale contains only two of the three UWES dimensions: vigour and dedication but not absorption.

Fourthly, although the differential item functioning (DIF) analysis undertaken finds that DIF is unlikely for the CSEES employee engagement items, there was some nominal variation in the results by gender, which indicated that there may be some DIF effect by gender. The results are not conclusive as the results did not meet the thresholds that would indicate DIF. Thus, further interrogation of the data would be recommended.

Fifthly, meaningfulness was the antecedent with the highest strength of association with employee engagement for all demographics analysed by a sizable margin, followed by six other attitudinal scales including organisational support, job skills match and competence. This suggests that a CSEES with fewer attitudinal scales may provide sufficient insights into the employee engagement of Irish civil servants.

Several psychometric techniques were applied to the data, exploring the validity and reliability of the scale using measures of association, internal consistency, dimensionality and structure and cumulative modelling. Methods applied included Pearson's correlation coefficients, Cronbach's alpha, McDonald's omega, exploratory and confirmatory factor analysis, item response theory (IRT), differential item functioning (DIF) and regression analysis. The methods incorporated were based on detailed reviews of the relevant literature where the purpose of the studies was to assess the psychometric properties of UWES (Bailey et al., 2017; Kulikowski, 2017; Schaufeli & Bakker, 2022; Zahari & Kaliannan, 2022).

The results obtained in this study were consistent for each iteration of the survey, with similar findings from the various techniques when applied separately

to the 2015, 2017 and 2020 datasets. The results also became more psychometrically robust from iteration to iteration of the CSEES datasets. This increasing psychometric robustness may be due to the better representation of the survey population and increased response rates between 2015 to 2020. The 2020 dataset was the primary dataset for the study as it was the most recent and largest dataset available, had the highest response rate and was the most representative of the Irish Civil Service population.

Discussion of Results

Overall, the results of this study on the CSEES employee engagement scale align with previous research that confirms that UWES (Schaufeli & Bakker, 2004) is a robust measure of work engagement (Kulikowski, 2017; Schaufeli & Bakker, 2019). The psychometric methods which established the appropriateness of the CSEES employee engagement scale also suggested that the CSEES employee engagement scale was unidimensional.

The inter-item Pearson's correlations were greater than 0.7 for all items, apart from "At my work I always persevere, even when things do not go well" ($r = 0.5$). McDonald's omega and Cronbach's alpha were high for the CSEES employee engagement scale ($\omega = 0.93$, $\alpha = 0.9$).

The six CSEES employee engagement items loaded onto only one factor using exploratory factor analysis apart from one item. The rotated factor loadings of the employee engagement items were greater than 0.7 for all items apart from "At my work I always persevere, even when things do not go well" at 0.37. This item also loads onto a second factor which included well-being and coping with change items. It did not load onto a second factor in the 2015 and 2020 data, as the threshold of 0.3 for the loading was not met. The item, "At my work I always persevere, even when things do not go well" was excluded from UWES-9, unlike the other items. The loading of the item onto a second factor with well-being and coping with change, indicates that the item may not only measure engagement, but also well-being and coping with change. It also indicates the removal of this item is worth further exploration.

The confirmatory factor analysis goodness of fit statistics confirmed the efficacy of the exploratory factor analysis model applied, with the proviso that other unexplored models may theoretically provide a better fit. The IRT item characteristic curves show little overlap between response categories, with the probability by response category positioned as would be expected for an ordinal scale. This indicated that the CSEES employee engagement scale items are well constructed. The first eigenvalue of the IRT analysis accounted for 72% of the variance, suggesting unidimensionality. The exploratory factor analysis residual error correlations do suggest that there is some unexplained variation in the model, especially for the item “At my work I always persevere, even when things do not go well”.

The UWES was developed as a multidimensional scale (Schaufeli & Bakker, 2004), composed of three dimensions: dedication, vigour, and absorption. Since the development of the UWES, studies have been evenly split on whether it can be considered a unidimensional scale, multidimensional scale, or both in tandem (Kulikowski, 2017). The results of this study are consistent with the studies which find the UWES to be unidimensional (De Bruin et al., 2013; Fong and Ho, 2015; Klassen et al., 2012; Shimazu et al., 2008) although the CSEES employee engagement scale does not contain items from the absorption component of the UWES.

The IRT and DIF results highlight characteristics of the scale which should be considered in the interpretation of the study results. The slopes of the item characteristic curves, which are the parameter estimates for item discrimination,

have an acceptable range if the values are between 0.5 and 2 (Hays et al, 2007). For the CSEES employee engagement scale, all items are within or above this range. The item “At my work I always persevere, even when things do not go well” has the lowest slope at 0.72, which is just above the minimum acceptable value, indicating that this item has a low level of discrimination. This followed by “I am proud of the work that I do” and “When I get up in the morning, I feel like going to work” which have acceptable levels of discrimination at 1.49 and 1.97. The items with the highest level of discrimination are “My job inspires me” (2.56), “At my work, I feel full of energy” (2.64) and “I am enthusiastic about my job” (2.74). These items are from both the dedication and vigour dimensions but are arguably more emotive than the other items requiring a certain culture or perception of what is required of a person to be engaged.

For the CSEES employee engagement scale, an item has a low level of difficulty if a respondent with a low actual level of employee engagement is likely to achieve a high employee engagement score for that item. In this study, the range for the parameter estimates used to estimate difficulty are between -4 and +4. The parameter estimates of the CSEES employee engagement items ranged from -2.36 to 1.47. All items tend towards the lower end of the ability scale with the first five steps of all items valued at less than zero. The item “At my work I always persevere, even when things do not go well” has no parameter estimates above zero on the ability scale for the item. The standard errors for the first four parameter estimates of this item are larger than standard errors for the parameter estimates of all other items. The parameter estimates of the remaining five CSEES employee engagement items are located across a similar range of the ability scale. This suggests that the

six CSEES employee engagement items have a low to moderate level of difficulty or construct saturation with “At my work I always persevere, even when things do not go well” having an especially low level of difficulty. Therefore, a respondent is likely to score more highly in the CSEES employee engagement items than their actual level of employee engagement. This may also reflect a social desirability response bias, which is understandable, given that employees are completing the CSEES for their employers. Interestingly, “At my work I always persevere, even when things do not go well” is the only item in the CSEES scale that was excluded from the UWES-9 item scale (Schaufeli & Bakker, 2006) when reduced from the UWES-17 scale (Schaufeli & Bakker, 2004). The especially high score for this item may also reflect a social desirability response bias, with employees unlikely to admit in a work setting, that they do not persevere in challenging situations. The item information curves for all items and the test information curve, an aggregate of the item information curves, establish that the information within the CSEES items is located at the lower end of the distribution with an especially low amount of information for “At my work I always persevere, even when things do not go well”. The item information curves are highest for “I am enthusiastic about my job”, followed by “At my work, I feel full of energy” and “My job inspires me”.

The low to moderate levels of item difficulty and discrimination found in the CSEES employee engagement scale is consistent with previous literature. Previous studies have demonstrated that the UWES has low levels of discrimination and difficulty with respondents clustered at the upper level of the trait with most information located at the lower end of the distribution (de Bruin et al., 2013; Shimazu et al., 2012; Simbula et al., 2013; Song et al., 2020).

Previous research has also shown that the reduction of UWES from a 17 item scale to a three item scale did not have an impact on the validity or reliability of the scale (Schaufeli et al., 2019). The findings of this study reflect this, indicating that a leaner employee engagement scale is likely to remain effective for the Irish Civil Service and reduce response burden. The item “At my work I always persevere, even when things do not go well” is an obvious item for potential exclusion, bearing in mind that sufficient items are required to ensure that the measure has factorial validity. However, none of the current items can effectively measure the employee engagement of civil servants at lower levels of the trait and thus underestimates the number of respondents with lower levels of employee engagement. This again demonstrates that either novel items, or significant rewording, would be necessary to increase the levels of discrimination and ranges of difficulty of the CSEES employee engagement scale in order to adequately measure the engagement of all employees.

The study raises interesting findings with respect to gender. The employee engagement scores of females are consistently higher than males across all grades, lengths of service and iterations of the survey. The consistently higher employee engagement scores for females in the CSEES contradicts the expectations in the literature, where males are considered to have higher levels of employee engagement.

Banihani et al. (2013) found engagement to be gendered, with females less likely to be engaged than males as males are more likely to experience psychological meaningfulness, safety, and availability due to the structure of work

organisations. Bailey et al. (2017) recommends further research on the experience of work engagement by gender and other demographic backgrounds.

Of the four research studies that applied DIF by gender to the UWES, two found DIF suggested by gender (Domínguez-Salas et al., 2022; Song et al., 2021). In the DIF analysis, the odds ratios for all item effect combinations were close to one with larger variation found for gender. The models investigating the difference in the non-significant minus two log likelihood values of the DIF models found a potential relationship between gender and the CSEES employee engagement items. These results indicate that uniform and non-uniform DIF likely do not occur within the employee engagement items. However, there were some indications within the gender combinations that there may be some DIF effect with a larger variation seen in parameter estimates by gender.

An investigation into the reason for the higher employee engagement scores established for women in the CSEES employee engagement scores was outside the scope of this study. A potential reason for the higher engagement of women in the Irish Civil Service may be its family-friendly structure, which may increase women's experience of psychological meaningfulness, safety, and availability. The OECD (2022) found that work-life balance and family friendly initiatives aid in increasing the retention and productivity of women in the public service. It is also possible that the make-up of the Irish Civil Service has an impact on the level of employee engagement, with the majority of Irish civil servants being women. In 2020, 61% of Irish civil servants and 59% of CSEES respondents were women.

The antecedents of employee engagement within the Irish Civil Service were evaluated in this study using regression analysis. All attitudinal measures within the CSEES were included in the regression analysis on the 2020 CSEES data, apart from well-being, commitment to the organisation and coping with change which were originally developed as dependent variables. The regression models were run for the overall Civil Service and by gender, grade, and length of service.

For the overall Civil Service results, the Pearson's correlation coefficients were highest between employee engagement and meaningfulness (0.68) followed by employee engagement and well-being (0.64) and employee engagement and commitment to the organisation (0.62). Within the exploratory factor analysis, items from commitment to the organisation, well-being, meaningfulness, and job skills match loaded onto the same factor as employee engagement. These results indicate that there may be some relationship between employee engagement and these items.

The lowest Pearson correlation coefficients were found between employee engagement and your pay ($r = 0.16$), employee engagement and job demands ($r = 0.22$) and employee engagement and public perception of the Civil Service ($r = 0.22$). The low correlation coefficient between job demands and employee engagement is an interesting finding, given that the Job Demands-Resource (JD-R) model (Bakker & Demerouti, 2006) is the conceptual framework underpinning the UWES. This may be due to the interpretation of job demands within the Irish Civil Service.

The five antecedents of employee engagement with the highest strength of association by gender, grade and length of service were included in the findings. Similar to the employee engagement scores by demographic, there was very little variance in the antecedents of employee engagement by demographic. For all regression models, meaningfulness had the highest strength of association with employee engagement, with a coefficient of 0.4 or greater. Job skills match, organisational support and competence were the next antecedents when ordered by strength of association in almost all of the models by gender, grade and length of service.

Citizen impact, leadership, manager career support and career development and mobility were the remaining measures where the strength of association with employee engagement positioned them in the top five antecedents for the demographic models. Citizen impact is an antecedent in just over half of the models. Leadership is an antecedent in the models for males, administrative officers, clerical officers and those at the start and end of their careers. Manager career support is an antecedent in the models for the assistant principal grade and those with 20 to 30 years of service. Career development and mobility is an antecedent of employee engagement for the Director, Assistant Secretary General and above grades only, the most senior grades in the Civil Service.

These results indicated that a policy focus on these seven measures - meaningfulness, organisational support, job skills match, competence, leadership, manager career support and citizen impact, with a specific focus on meaningfulness, is likely to have a substantial impact on employee engagement.

This is regardless of the gender, grade, and length of service of the civil servants, indicating that initiatives focusing on the antecedents of employee engagement would not need to be tailored by cohort. These findings significantly contribute to the policy and practicalities of implementing initiatives designed to improve engagement within the Civil Service.

Only seven attitudinal measures were found to be within the top five antecedents of employee engagement for all cohorts reviewed, with 17 attitudinal measures included in the models for consideration. This indicates that the number of items and measures in future iterations of the CSEES could be reduced, with many of the measures incorporated in the survey having little to no impact on employee engagement. Thus, a leaner version of the CSEES would still generate the insights required.

The antecedents of employee engagement in the CSEES are reflective of previous research which finds that higher levels of work engagement are positively related to a range of personal and organisational outcomes (Leung et al., 2011; Steele et al., 2012; Yeh, 2012). The relationship between employee engagement and meaningfulness may be reflective of research which finds the public servants are to have more pro-social or public service driven values and motives (de Simone et al., 2016). Also, Kahn (1990) argues that individuals become engaged through three psychological states: meaningfulness, safety, and availability.

In addition to the findings by gender previously outlined in this chapter, there were meaningful findings by grade and length of service. The employee engagement scores for all civil servants were similar by grade and length of service.

However, some differences were found. Civil servants who were mid-career, with 10 to 30 years of service, had a lower level of employee engagement than those at the start and end of their careers. This extends the understanding of engagement within the literature with respect to levels of engagement at different points in a career. It may be specific to civil servants, but further research is warranted to understand why engagement is highest at the start and end of a career.

The finding, that civil servant's level of engagement increases towards the end of their career, contrasts with the results of a study by Hinzmann et al. (2019), who found that employees had their highest levels of work engagement in the first two years of employment followed by a consistent decrease in their levels of employee engagement until the end of their career. In the 2020 CSEES, those at the most senior role in the Civil Service, assistant secretary and secretary general grades and above, had much higher employee engagement scores, at 88, than all other grades in the Irish Civil Service. For all other grades, the 2020 employee engagement scores were similar, ranging from 73 to 75. Interestingly, the rate of increase of employee engagement between 2015 and 2020 was higher for those in less senior roles, although they did start at a lower base. Comparable literature outlining the employee engagement scores of employees by grade was not found. Literature comparing the levels of seniority of employees within an organisation to their responses to the UWES was found, which either considered length of service to equate to level of seniority (Hinzmann et al., 2019) or only flagged supervisor level as a yes/no option (Goliath-Yarde & Roodt, 2011).

Contributions of this study

This study contributions to the work engagement literature can be divided into three thematic strands: expanding on the understanding of the psychometric aspects of the CSEES scale and the UWES, contributing to the contextual understanding of work engagement within the public service and contributing to the implementation of policy initiatives related to work engagement by providing evidence based insights into the engagement of Irish civil servants.

The psychometric component of this study provides several contributions to the literature. that the study suggests the six CSEES employee engagement items have a low to moderate level of difficulty, inferring that the estimates of employee engagement calculated using the CSEES employee engagement scale and UWES may be overinflated due to the construct saturation of the scale. Misleading conclusions may occur if the estimates are be grouped into low, medium and high levels of engagement, given the potential overinflation of the scores. At an item level, this finding is especially apparent for the item “At my work I always persevere, even when things do not go well”.

The study found that the CSEES items do not sufficiently discriminate across true levels of engagement of employees, with the levels of engagement for those with a low true level of engagement being especially hard to ascertain. It is recommended that a review of the wording and emphasis of the items is undertaken, in order to increase their discrimination. In addition, any grouping of estimates into levels of engagement should be described in the context of the degree of discrimination and difficulty of the items for the cohort surveyed.

The results of this study are also consistent with the studies which find the UWES to be unidimensional (De Bruin et al., 2013; Fong and Ho, 2015; Klassen et al., 2012; Shimazu et al., 2008), in contrast the multidimensional assumption when the scale was first developed (Schaufeli & Bakker, 2004). the CSEES employee engagement scale does not contain items from the absorption component of the UWES. This finding contributes to the overarching understanding of the dimensionality of the UWES scale, although the exclusion of the absorption component of the UWES scale in the CSEES scale must be a consideration of this finding. With respect to constructs related to employee engagement, the findings from the Pearson's correlation coefficients and factor loadings are consistent with the regression analysis, with well-being, meaningfulness and job skills match consistently emerging as highly correlated to, loaded onto the same factors as, or antecedents of engagement. The low correlation of job demands is especially of note given the relationship between UWES and the JD-R model. The consistency of the findings across the different statistic methods, and the consistency across demographic cohorts, offer new insights into the elements that contribute to engagement, which are currently not found in the literature.

This study also found that civil servants who were mid-career had a lower level of employee engagement than those at the start or end of their careers. This differs from what is found in the literature currently, with the expectation that engagement is highest at the start of a career and then decreases as tenure or length of service increases (Dongrey & Rokade, 2019 ; Hinzmann et al., 2019). This finding may be specific to civil servants, but further research is warranted to

understand why engagement is highest at the start or end of the career of Irish civil servants.

Within this study, the employee engagement scores of females are consistently higher than males across all grades, lengths of service and in each iteration of the survey analysed. This is in contrast to the current understanding within the literature, with men expected to have consistently higher levels of engagement (Banihani et al., 2013). The consistently higher levels of engagement for women may be as a result of the work-life balance, family friendly policies and demographics of the Irish Civil Service, but further research is recommended to understand the underlying reasons for this difference. The DIF analysis demonstrates a larger nominal range for nominal range of estimates for the models that include gender. Although not statistically significant, this does identify a marker for a potential issue associated with gender and the CSEES items. This may factor into the higher levels of engagement seen for women.

From a policy perspective, the regression analysis results indicate that a policy focus on these seven measures - meaningfulness, organisational support, job skills match, competence, leadership, manager career support and citizen impact, with a specific focus on meaningfulness, is likely to have a substantial impact on employee engagement. This is regardless of the gender, grade, and length of service of the civil servants, indicating that initiatives focusing on the antecedents of employee engagement would not need to be tailored by cohort. These findings significantly contribute to the policy and practicalities of implementing initiatives designed to improve engagement within the Civil Service.

Study Limitations

There are at least three potential limitations concerning the results of this study. Firstly, the data is secondary data and was not developed for this research. Secondly, the CSEES employee engagement scale is a subset of the UWES. Therefore, results from the psychometric analysis of the CSEES employee engagement scale may not be directly comparable to the previous literature on the UWES. Thirdly, within the UWES literature there is no consistency on how the analysis is approached and presented within the relevant studies, making comparison across the literature challenging.

The CSEES is a secondary data source which was created and implemented prior to this research. Priority was given to the confidentiality of participants in the design of the CSEES. As a result, the data cannot be interrogated longitudinally as participants are not identifiable across the three years of the survey. This limits the capacity to assess if change in results across the three iterations is due to changes in the population or other factors. It also limits the assessment of the relationship between employee engagement and associated measures in regression analysis. However, the CSEES datasets can be considered quasi-longitudinal with a low level of churn in the population across the three iterations. Other limitations often seen with secondary data research are not a concern here; the quality of the data is high; the dataset has a high level of completeness; it is very relevant to the research question and is timely.

Although the results of this research support the unidimensionality of the CSEES employee engagement scale, the differences between the structure of the CSEES

scale and UWES must be a consideration when comparing the results of this study to the literature on the dimensionality of the UWES.

The UWES is the most cited scale across the literature (Bailey et al., 2017) allowing for comparison of the findings of this study against the much of the quantitative research on work engagement scales. The UWES is likely to be universally applicable with no measure invariance (Storm & Rothmann, 2003) but it must be acknowledged that the survey questionnaires, versions of the UWES, populations, psychometric methods, the models applied within each research study and the focus applied to the results within publications will differ, sometimes significantly from research study to research study. This makes direct comparison of results within the academic literature challenging when compared to the results of this study which uses the CSEES employee engagement scale, a further modification of the UWES (Schaufeli & Bakker, 2004).

In addition, there is research highlighting concerns about how employee engagement results are presented, with little consistency across papers in the definitions and thresholds for high and low engagement (Bakker & Schaufeli, 2022) as well as the use of several methods to present the data including indices and means across different ranges. The index score applied in this study is reflective of the method applied in the CSEES (Government of Ireland, 2016), the UK People Survey (Cabinet Office, 2012) and the Northern Ireland Civil Service People Survey (NISRA, 2019). None of these surveys apply a threshold or level of engagement to the results. In the UWES manual (Bakker & Schaufeli, 2006) and much of the research, a zero to six scale is applied to calculate the level of employee

engagement, and categorisation of 'low', 'high' etc., is based on percentiles within the specific dataset. No other studies were found that explicitly outlined how the scores were calculated, apart from Willmer et al. (2021) who applied the absolute figures from the UWES manual (Schaufeli & Bakker, 2004) to their research. The lack of a consistent approach makes comparison of scores between research studies challenging. In this study, higher or lower levels of employee engagement are used to describe the results, but no specific thresholds are applied. This is a potential avenue for further research, universal classifications of thresholds and definitions of low, medium and high levels of engagement would allow for comparability across studies and reduce the ambiguity around definitions of levels of engagement and impact of antecedents on the level of engagement.

Directions for Future Research

This study does confirm that the CSEES employee engagement scale is an appropriate measure of employee engagement in the Irish Civil Service, both in its psychometric robustness and its ability to provide meaningful insights into employee engagement in the Irish Civil Service.

However, the results do indicate several potential directions for future research. Firstly, the low to moderate item discrimination and difficulty inherent in the CSEES scale does indicate that a review of the items within the CSEES scale and UWES is warranted. An initial recommendation would be to exclude the item “At my work I always persevere, even when things do not go well’ from the scale. Beyond this recommendation, development of additional items for the CSEES employee engagement scale with higher levels of difficulty and discrimination would be recommended to accurately capture the levels of employee engagement for a population with differing and lower levels of the trait. Additional items would need to be tested to ensure that they maintain the factorial validity of the CSEES employee engagement scale. If the items were to be included in an updated version of the UWES, there may be a requirement to ensure that the absorption, dedication and vigour domains are maintained, regardless of whether there is a unidimensional or multidimensional requirement of future UWES.

Further investigation of the differential item functioning of the CSEES employee engagement scale items with respect to gender is recommended. The DIF analyses in this study indicate although DIF is not suggested by grade, gender, and length of service for the six employee engagement items, there is more variability in the values by gender. The higher scores for women in the CSEES, contrasting to

previous literature, is also a topic that merits further investigation. This would need to be qualified against more in-depth DIF analysis to understand if a component of the difference in scores by gender is due to the construct bias within the employee engagement items or true differences in employee engagement by gender.

Qualitative research, with further DIF analysis, would also add to this research as it would probe into the reasons for the differences in employee engagement by gender in the Irish Civil Service.

It is recommended that the psychometric analysis applied in this research study is also applied to other constructs of interest in the CSEES. The CSEES was developed with four measures of interest: employee engagement, well-being, commitment to the organisation and coping with change. Well-being is akin to the absorption scale within the UWES. Commitment to the organisation is of interest as it has negatively worded items which potentially led to the exclusion of a portion of the scale in 2015 and coping with change is recognised as a concern for Irish civil servants given the increased pace of change in today's society (Government of Ireland, 2021). The application of IRT and DIF analysis to these measures would be very valuable in gaining further understanding of Irish civil servants. It would also add to the development of future iterations of the CSEES.

In addition, the very high strength of association between meaningfulness and employee engagement for all cohorts indicates that further research would be recommended on the meaningfulness of work in the Irish Civil Service and how to improve it further. The meaningfulness items are "The work I do is very important to me", "My job activities are personally meaningful to me" and "The work I do is

meaningful to me". The overall Civil Service meaningfulness score was 69 in 2020. However, the meaningfulness score was lower for those under 39 ($m=50$), executive officers ($m=54$) and clerical officers ($m=54$) (Government of Ireland, 2021), indicating that focusing on the meaningfulness of work of younger and less senior Irish civil servants would have an impact on overall employee engagement.

Further research on the seven measures that are antecedents for employee engagement by demographic, including more in depth psychometric analysis to understand the items of importance, would be valuable. The application of IRT and DIF to the other measures in the survey would add to insights and also give an indication of the recommendations for the future structure of the CSEES. The longitudinal requirements could be incorporated into future survey designs for the CSEES.

Vigoda-Gadot et al. (2013) consider work engagement is possibly the answer to performance enhancement in the public service with work engagement being positively related to good service provision, the improvement of client satisfaction and quality of service. To boost performance enhancement, the Irish Civil Service could further examine the antecedents of work engagement, including meaningfulness, organisational support and job skills match in order improve employee engagement and thus boost performance and quality of service by default.

Although the antecedent of employee engagement was very similar by grade, gender, and length of service in the CSEES data, the public sector itself is not a homogenised sector and where an uncritical application of research findings can be

applied (Fletcher et al., 2020). This must be a consideration in further analysis.

Other demographics should also be a consideration, including the Department or organisation the civil servant is working in and the type of work they do (e.g., policy or service provision). There may also be a need to differentiate between the age and length of service of civil servants in future analysis and surveys, given that civil servants are joining the Irish Civil Service mid-career unlike in previous years.

The regression analysis also suggests that a reduction in the number of scales within the survey would still reflect employee engagement and the relevant antecedents accurately. This would reduce the response burden and focus the survey, potentially decreasing processing time and allowing for more in depth analysis.

Closing Statement

The CSEES employee engagement scale is an appropriate measure of employee engagement in the Irish Civil Service. It is robust, valid, reliable, and unidimensional. The CSEES employee engagement items have low to moderate levels of difficulty and discrimination, indicating that the items cannot differentiate well between respondents with differing levels of employee engagement, tending to inflate the level of employee engagement of civil servants, with those with moderate levels of engagement scoring more highly on the measure than would be expected. The study found that the item “At my work I always persevere, even when things do not go well” behaved differently than the other items in the CSEES employee engagement scale. Only seven measures had a notable strength of association with employee engagement in the regression models.

The appropriateness of the CSEES employee engagement scale for the Irish Civil Service is also confirmed by the insights gained from the summary statistics and regression analysis, resulting in a more granular understanding of the levels engagement of Irish civil servants and the antecedents of their engagement.

Although the CSEES employee engagement is an appropriate scale for the Irish Civil Service, the findings of this study do support the refinement of the CSEES employee engagement scale and the CSEES, with a potential reduction in the total number of measures within the CSEES and redevelopment of the CSEES employee engagement items to only include items with acceptable levels of difficulty and discrimination. This would result in a more realistic measure of Irish civil servants’ true levels of employee engagement while focusing the survey on the measures most relevant to increasing their employee engagement.

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Appendix 1 Civil Service Employee Engagement Survey Items

The following items were included in the 2015, 2017, 2020 and 2023 Civil Service Employee Engagement Survey. There are 114 items included in the survey analysis. Two items that were excluded from the final dataset as they did not meet the threshold for exclusion. These items are listed under the title 'personal responsibility' and were 'I am held personally responsible for achieving agreed goals and objectives' and 'I am encouraged to set objectives that are reviewed by my immediate manager on a regular basis (at least once a year). One item was removed from the job demands scale as it did not meet requirements. The item was "I don't have enough work to do".

The employee engagement items are a subset of the UWES scale and has seven response categories. These are 'Never', 'Almost never', 'Rarely', 'Sometimes', 'Often', 'Very Often' and 'Always'.

Employee Engagement

This measures the sense of energy, connection and fulfilment civil servants have with their work.

- I am enthusiastic about my job.
- At my work I always persevere, even when things do not go well.
- At my work, I feel full of energy.
- My job inspires me.
- When I get up in the morning, I feel like going to work.

- I am proud of the work that I do.

The remaining scales have five response categories. These are 'Strongly disagree', 'Disagree', 'Neither agree nor disagree', 'Agree' and 'Strongly Agree'.

Commitment to the Organisation

This measures the level of attachment that civil servants have to the Department/Office they work for.

- I would be very happy to spend the rest of my career with the Department.
- I really feel as if the Department problems are my own.
- I do not feel a strong sense of 'belonging' to the Department.
- I do not feel 'emotionally attached' to the Department.
- I do not feel like 'part of the family' at the Department.
- The Department has a great deal of personal meaning for me.

Well-being

This measures the extent to which civil servants feel they can realise their own potential and cope with the normal stresses of life.

- I can concentrate on what I have to do at work.
- I can cope with work problems.
- I have confidence in myself.
- I enjoy my usual work activities.

Coping with Change

This measures the extent to which civil servants feel they can cope with change including managing any negative emotions.

- When change happens in the Department, I react by trying to manage the change rather than complain about it?
- When changes are announced, I try to react in a problem-solving way.
- I embrace change in the Department.
- When change occurs in the Department, it causes me stress?
- I think I cope with change better than most.

Autonomy

This measures the extent to which civil servants feel they have the freedom to influence how they approach their day-to-day work.

- I have significant freedom in determining how I do my job.
- I can decide on my own how to go about doing my work.
- I have considerable opportunity for independence and freedom in how I do my job.

Meaningfulness

This measures the extent to which civil servants feel their work has value, meaning and purpose.

- The work I do is very important to me.
- My job activities are personally meaningful to me.
- The work I do is meaningful to me.

Competence

This measures a civil servants' belief in their ability and skills to carry out the work required in their role.

- I am confident about my ability to do my job.
- I am self-assured about my capabilities to perform my work activities.
- I have mastered the skills necessary for my job.
- I feel competent and fully able to handle my job.

Citizen Impact

This measures the extent to which civil servants feel their work has an impact on the public.

- I feel that my work makes a positive difference in citizens' lives.
- I am very aware of the ways in which my work is benefiting citizens.
- I am very conscious of the positive impact that my work has on citizens.

Job Demands

This measures how demanding civil servants find their work in terms of the content of their work and the time required to complete their work.

- It often seems like I have too much work for one person to do.
- I never seem to have enough time to get everything done in my job.
- The amount of work I'm asked to do is fair.
- There is too much work to do everything well.
- I am given enough time to do what is expected of me in my job.
- The performance standards on my job are too high.

Job Skills Match

This measures how well civil servants feel their skills and abilities are matched to their job.

- I feel that my work utilises my full abilities.
- I feel that my job and I are well matched.
- My job gives me a chance to do the things I feel I do best.
- I feel I have appropriate preparation for the job I now hold.

Manager Career Support

This measures the level of support and development civil servants feel is provided from their immediate manager.

- My immediate manager takes an interest in my career development.
- My immediate manager makes sure I get credit for my achievements.

- My immediate manager gives me helpful feedback to improve my performance.
- My immediate manager provides assignments that give me the opportunity to develop new skills.

Social Support

This measures the extent to which civil servants feel they have the opportunities to develop close relationships at work.

- I have the opportunity to develop close friendships in my job.
- I have the chance in my job to get to know my colleagues.
- I have the opportunity to meet with others in my work.
- People I work with take a personal interest in me.
- People I work with are friendly.

Leadership

This measures how civil servants feel about the quality and effectiveness of leadership in the civil service. It also measures views on decision making, vision, values and communications.

- I feel that the Department as a whole is managed well.
- Senior managers in the Department are sufficiently visible.
- I believe that actions of senior managers are consistent with the Department values.

- I believe that senior managers have a clear vision for the future of the Department.
- Overall, I have confidence in the decisions made by the Department senior managers.

Organisational Support

This measures the degree to which employees feel their organisation values their contribution and cares for their well-being.

- The Department cares about my opinions
- The Department cares about my well-being.
- The Department considers my goals and values.
- The Department provides support for me in times of need.

Learning and Development

This measures the extent to which civil servants feel they have sufficient and effective opportunities for learning and development.

- I am able to access the right learning and development opportunities when I need to
- Learning and development activities I have completed in the last 12 months have helped improve my performance.
- There are opportunities for me to develop my career in the Department.

- Learning and development activities I have completed while working for the Department are helping me to develop my career.

Career Development and Mobility

This measures the extent to which civil servants feel there are sufficient opportunities for career development, learning, mobility and promotion in the Civil Service.

- I have opportunities to be moved around various positions so that I can learn a broad range of skills.
- I receive training to keep me up to date with developments in the Department (e.g., new rules, procedures, guidelines, IT systems)
- I receive the training that I need to do my job well.
- I believe that if I perform well I will have the opportunity to be promoted.
- I feel I have all the opportunities I need for promotion
- The Department has a clear and fair promotion process.
- My ability to show leadership is not limited by my grade in the Department.

Your Pay

This measures how civil servants feel about their pay in relation to their efforts and contributions at work and others who are like them.

- I feel that my pay appropriately reflects my performance.
- I am satisfied with the terms and conditions of my employment.

- Compared to people doing a similar job to me, I feel that my pay is reasonable
- Compared to people doing a similar job in the private sector, I feel that my pay is reasonable

Performance Standards

This measures the degree to which civil servants feel performance standards are high and that underperformance is managed effectively.

- Poor performance is effectively addressed throughout the Department.
- Senior managers in the Department are held accountable for achieving results.
- The Department has high performance standards.
- People in the Department are held accountable for achieving goals and meeting expectations.
- The Department measures job performance to ensure all staff are achieving results.

Innovative Climate

This measures the extent to which civil servants feel the organisation supports and encourages them to be innovative.

- New ideas are readily accepted here.
- The Department is quick to respond when changes need to be made.

- Management here are quick to spot the need to do things differently.
- The Department is very flexible: it can quickly change procedures to meet new conditions and solve problems as they arise.
- People in the Department are always searching for new ways of looking at problems.

Involvement Climate

This measures the extent to which civil servants feel that they are involved openly in decision making in their organisation.

- Changes are made without talking to the people involved in them.
- People don't have any say in decisions which affect their work.
- People feel decisions are frequently made over their heads.
- Information is widely shared.
- There are often breakdowns in communication here.

Public Perception of the Civil Service

This measures how civil servants feel they are valued and perceived by the general public.

- I feel that the public value the work the Civil Service does.
- I feel that the public respect the Civil Service for its work.
- I feel that the public appreciate the work of the Civil Service

The following three scales relate to personal identification with the civil service and thoughts on the civil service renewal plan. They are not included in the further key driver analysis.

Awareness of Civil Service Renewal

- I have been made aware that there is a renewal plan for the Civil Service
- I am aware that the Civil Service Renewal Plan will change the way we work.
- There has been good communication in relation to the Civil Service Renewal Plan
- I am optimistic that the Civil Service will change for the better as a result of the Civil Service Renewal Plan

Commitment to Civil Service Renewal

- I believe in the value of the Civil Service Renewal Plan
- The Civil Service Renewal Plan is a good strategy for the Department.
- I recognise that the Civil Service Renewal Plan serves an important purpose.
- The Civil Service Renewal Plan is necessary.

Identification with the Civil Service

- I feel that my values and those of the Civil Service are very similar (e.g., independence, integrity, impartiality, equality, fairness and respect)
- It is important to me that my work aligns with the values and ethos of the Civil Service

- I feel that people in the Department live the values of the Civil Service
- When someone praises the Civil Service, it feels like a personal compliment.
- If a story in the media criticised the Civil Service, I would feel embarrassed.
- When I talk about the Civil Service, I usually say 'we' rather than 'they'.

The survey demographics included in the about you section are as follows:

1. Please indicate your Department/Office:
2. Are you: Male, Female, Prefer not to say?
3. What is your age? 16-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65 and over, Prefer not to say.
4. What is your grade or equivalent? Director, ASG and above, PO, PO equivalent, AP, AP equivalent, AO equivalent, HEO, HEO equivalent, EO, EO equivalent, CO, CO equivalents (support staff), SVO (support staff) equivalent, Industrial, Other, Prefer not to say.
5. How long have you been working in the Civil Service? Less than 1 year, 1 to 5 years, 5 to 10 years, 10 to 15 years, 15 to 20 years, 20 to 25 years, 25 to 30 years, Greater than 30 years, Prefer not to say.
6. Is your work mainly focused on? Policy, Programme implementation, Service delivery, Corporate support (e.g., Finance, HR, IT etc), Direct service to the public (front line), Custodial service, Other, Prefer not to say.

8. What region are you based in? Dublin, Rest of Leinster, Munster, Connaught, Ulster, Outside Ireland, Prefer not to say.
9. Are you based in the Departments headquarters? Headquarters, Other location, Prefer not to say.
10. Do you work: Full time (37 or more hours per week), Part time (less than 37 hours per week), Prefer not to say?
11. Is your contract of employment: Permanent, Temporary or fixed term, Prefer not to say?
12. What is your highest educational qualification? No formal education, Junior certificate (or equivalent), Leaving certificate (or equivalent), Advanced certificate (below degree level), Advanced diploma (below degree level), Primary degree, master's degree, PhD, Prefer not to say.

Appendix 2 Civil Service Roles

The descriptions of the roles and responsibilities of general civil service grades are outlined below. Professional and industrial grades are not included.

Secretary General

The Secretary General is the title typically given to the Head of a Civil Service Department. The Secretary General is responsible for the effective and efficient management of the Department, including particular financial responsibilities as Accounting Officer, providing advice to Ministers, delivering outputs and outcomes, addressing cross-cutting matters and being accountable before Oireachtas Committees as required. As the head of an organisation, the Secretary General is assisted by a senior management team typically known as a Management Board, which acts as a team and a unifying force, providing leadership and direction for the organisation.

Assistant Secretary

Assistant Secretary is the title typically given to the Head of a Division(s) in a Civil Service Department who will also sit on the management board for that department. The Assistant Secretary competency model reflects what is needed to operate effectively in the environment in which public servants and Assistant Secretaries find themselves, in a period of high demand for increased pace of decision making and delivery, increased complexity and volume of demand, fewer resources, increased media and public scrutiny and an ambitious and progressive public service reform programme.

Principal Officer

As senior managers in the Civil Service, Principal Officers have a key role in advising on government policy and have responsibility for its subsequent implementation. Typically, as heads of units or functions, they oversee the implementation of Departments' objectives and are ultimately responsible for providing the leadership required to deliver a responsive and inclusive service. It is

a diverse role which can vary from Department to Department and from post to post. This role would involve acting as a key participant in the senior management process of Departments/Offices with a critical influencing role in implementing or advising on government policy in the economic, financial, international, environmental and/or social arenas. They may have responsibility in areas such as:

- Policy
- Leading large teams of people
- Managing frontline service delivery
- Developing policy and legislation
- Implementing cross-functional initiatives

Furthermore, Principal Officers may be required to act as a representative for your Departments/Offices in the media, at Oireachtas Committees, and may also represent the country at a European and international level.

Assistant Principal

The Assistant Principal is a senior managerial grade in the Civil Service. The role is extremely diverse, citizen driven and very rewarding. The exact nature of the role varies depending on the sector and Department/Office in which the vacancy arises. Assistant Principals are key participants in the senior management process of Departments/Offices with a critical management role in implementing government policy in the economic, financial, international, environmental and/or social arenas. They may have responsibility in areas such as:

- Leading and motivating teams of people
- Analysis of public policy issues
- Provision of advice
- Managing stakeholders
- Delivering programmes
- Management and delivery of services to the citizen

Administrative Officer

The Administrative Officer (AO) grade is the main graduate recruitment grade for the Civil Service. The role could include tasks such as:

- Policy and strategy formulation across the spectrum of economic, financial, international, environmental and social issues.
- Researching and drafting proposals relating to policy issues and legislation.
- Acting as junior managers in Government Departments.
- It provides successful candidates with the opportunity to progress to middle management.

Higher Executive Officer

Higher Executive Officers are a key member of the mid-management team and report to and support an Assistant Principal in pursuit of goals of the organisation. They advise and interact with senior management in respect of their areas of responsibility and play a central role in driving organisational change.

Executive Officer

The Executive Officer (EO) grade is the entry level to junior management in the Civil Service. EOs are employed in all government departments and offices and cover a wide range of roles and activities such as:

- Drafting proposals relating to policy issues and legislation
- Acting as junior managers in government departments
- Dealing directly with the public in support of services provided to them by the Civil Service
- Many other roles and activities

Clerical Officer

The role of Clerical Officer (CO) can vary depending on the employing organisation. The work can involve:

- General clerical work.
- Working as part of a team in delivering important public services.
- Working with latest technology to record and advance services.
- Supporting line-managers and colleagues.
- Communicating and providing a quality public service to the public/customers.

Appendix 3 Additional Tables

Table 38

CSEES Pearson's Correlation Coefficients, 2015

	Engagement	Commitment	WellBeing	Coping_Change	Autonomy	Meaning	Competence	Citizen	Job_Demands	Job_Skills	Manager	Social	Leadership	Org_Support	Learning	Career_Dev	Pay	Performance	Innovative	Involvement	CS_Renewal	Commitment_Change	Public	CS_Identify
Engagement	1.00	0.31	0.65	0.37	0.42	0.71	0.31	0.49	0.14	0.62	0.38	0.36	0.44	0.49	0.43	0.45	0.18	0.35	0.42	0.34	0.31	0.31	0.27	0.45
Commitment	0.31	1.00	0.21	0.19	0.21	0.31	0.09	0.21	0.09	0.27	0.22	0.25	0.30	0.33	0.28	0.31	0.11	0.23	0.27	0.26	0.21	0.17	0.11	0.31
WellBeing	0.65	0.21	1.00	0.44	0.39	0.51	0.54	0.38	0.29	0.53	0.30	0.34	0.34	0.38	0.32	0.33	0.11	0.24	0.31	0.25	0.22	0.23	0.19	0.31
Coping_Change	0.37	0.19	0.44	1.00	0.24	0.29	0.36	0.26	0.16	0.22	0.17	0.20	0.22	0.24	0.22	0.22	0.05	0.10	0.19	0.19	0.25	0.30	0.07	0.29
Autonomy	0.42	0.21	0.39	0.24	1.00	0.43	0.19	0.25	0.15	0.45	0.32	0.26	0.33	0.39	0.34	0.35	0.17	0.21	0.34	0.30	0.24	0.18	0.14	0.26
Meaning	0.71	0.31	0.51	0.29	0.43	1.00	0.27	0.53	0.04	0.63	0.31	0.30	0.35	0.40	0.37	0.37	0.15	0.29	0.34	0.27	0.28	0.29	0.23	0.45
Competence	0.31	0.09	0.54	0.36	0.19	0.27	1.00	0.28	0.14	0.36	0.03	0.17	0.04	0.06	0.05	0.02	-0.07	0.02	0.03	0.01	0.04	0.09	0.04	0.12
Citizen	0.49	0.21	0.38	0.26	0.25	0.53	0.28	1.00	0.01	0.42	0.21	0.25	0.26	0.27	0.26	0.26	0.05	0.22	0.26	0.17	0.17	0.20	0.20	0.34
Job_Demands	0.14	0.09	0.29	0.16	0.15	0.04	0.14	-0.01	1.00	0.12	0.20	0.15	0.26	0.29	0.19	0.21	0.23	0.16	0.21	0.24	0.11	0.12	0.15	0.07
Job_Skills	0.62	0.27	0.53	0.22	0.45	0.63	0.36	0.42	0.12	1.00	0.39	0.33	0.41	0.46	0.45	0.47	0.17	0.33	0.40	0.33	0.26	0.20	0.22	0.35
Manager	0.38	0.22	0.30	0.17	0.32	0.31	0.03	0.21	0.20	0.39	1.00	0.35	0.49	0.55	0.53	0.54	0.20	0.43	0.47	0.40	0.33	0.21	0.16	0.31
Social	0.36	0.25	0.34	0.20	0.26	0.30	0.17	0.25	0.15	0.33	0.35	1.00	0.33	0.40	0.36	0.37	0.18	0.25	0.32	0.25	0.22	0.20	0.15	0.32
Leadership	0.44	0.30	0.34	0.22	0.33	0.35	0.04	0.26	0.26	0.41	0.49	0.33	1.00	0.73	0.59	0.66	0.30	0.66	0.72	0.60	0.44	0.31	0.28	0.44
Org_Support	0.49	0.33	0.38	0.24	0.39	0.40	0.06	0.27	0.29	0.46	0.55	0.40	0.73	1.00	0.64	0.70	0.32	0.60	0.66	0.61	0.44	0.34	0.33	0.44
Learning	0.43	0.28	0.32	0.22	0.34	0.37	0.05	0.26	0.19	0.45	0.53	0.36	0.59	0.64	1.00	0.76	0.30	0.50	0.55	0.48	0.44	0.31	0.24	0.39
Career_Dev	0.45	0.31	0.33	0.22	0.35	0.37	0.02	0.26	0.21	0.47	0.54	0.37	0.66	0.70	0.76	1.00	0.35	0.59	0.63	0.57	0.46	0.33	0.29	0.42
Pay	0.18	0.11	0.11	0.05	0.17	0.15	-0.07	0.05	0.23	0.17	0.20	0.18	0.30	0.32	0.30	0.35	1.00	0.24	0.27	0.27	0.28	0.24	0.28	0.21
Performance	0.35	0.23	0.24	0.10	0.21	0.29	-0.02	0.22	0.16	0.33	0.43	0.25	0.66	0.60	0.50	0.59	0.24	1.00	0.65	0.51	0.37	0.25	0.29	0.41
Innovative	0.42	0.27	0.31	0.19	0.34	0.34	0.03	0.26	0.21	0.40	0.47	0.32	0.72	0.66	0.55	0.63	0.27	0.65	1.00	0.60	0.41	0.29	0.29	0.43
Involvement	0.34	0.26	0.25	0.19	0.30	0.27	-0.01	0.17	0.24	0.33	0.40	0.25	0.60	0.61	0.48	0.57	0.27	0.51	0.60	1.00	0.37	0.24	0.28	0.32
CS_Renewal	0.31	0.21	0.22	0.25	0.24	0.28	0.04	0.17	0.11	0.26	0.33	0.22	0.44	0.44	0.44	0.46	0.28	0.37	0.41	0.37	1.00	0.60	0.21	0.41
Commitment_Change	0.31	0.17	0.23	0.30	0.18	0.29	0.09	0.20	0.12	0.20	0.21	0.20	0.31	0.34	0.31	0.33	0.24	0.25	0.29	0.24	0.60	1.00	0.21	0.40
Public	0.27	0.11	0.19	0.07	0.14	0.23	0.04	0.20	0.15	0.22	0.16	0.15	0.28	0.33	0.24	0.29	0.28	0.29	0.29	0.28	0.21	0.21	1.00	0.23
CS_Identify	0.45	0.31	0.31	0.29	0.26	0.45	0.12	0.34	0.07	0.35	0.31	0.32	0.44	0.44	0.39	0.42	0.21	0.41	0.43	0.32	0.41	0.40	0.23	1.00

Table 39

CSEES Pearson's Correlation Coefficients, 2017

	Engagement	Commitment	WellBeing	Coping_Change	Autonomy	Meaning	Competence	Citizen	Job_Demands	Job_Skills	Manager	Social	Leadership	Org_Support	Learning	Career_Dev	Pay	Performance	Innovative	Involvement	CS_Renewal	Commitment_Change	Public	CS_Identify
Engagement	1.00	0.61	0.64	0.39	0.40	0.69	0.31	0.49	0.19	0.59	0.38	0.36	0.44	0.49	0.42	0.45	0.17	0.36	0.41	0.36	0.29	0.31	0.30	0.46
Commitment	0.61	1.00	0.44	0.28	0.37	0.55	0.15	0.39	0.19	0.49	0.40	0.41	0.55	0.59	0.47	0.53	0.22	0.43	0.50	0.45	0.33	0.29	0.27	0.51
WellBeing	0.64	0.44	1.00	0.46	0.38	0.50	0.53	0.38	0.33	0.51	0.30	0.35	0.34	0.39	0.33	0.34	0.11	0.24	0.32	0.27	0.21	0.23	0.22	0.33
Coping_Change	0.39	0.28	0.46	1.00	0.22	0.30	0.37	0.28	0.19	0.22	0.18	0.22	0.25	0.26	0.23	0.23	0.05	0.12	0.20	0.22	0.24	0.33	0.13	0.30
Autonomy	0.40	0.37	0.38	0.22	1.00	0.42	0.19	0.26	0.16	0.44	0.32	0.26	0.30	0.37	0.31	0.34	0.16	0.20	0.32	0.29	0.22	0.17	0.16	0.26
Meaning	0.69	0.55	0.50	0.30	0.42	1.00	0.28	0.55	0.07	0.61	0.30	0.31	0.34	0.39	0.35	0.36	0.15	0.29	0.33	0.28	0.26	0.29	0.26	0.45
Competence	0.31	0.15	0.53	0.37	0.19	0.28	1.00	0.27	0.14	0.38	0.04	0.18	0.05	0.07	0.05	0.03	-0.06	0.02	0.04	0.01	0.06	0.09	0.07	0.13
Citizen	0.49	0.39	0.38	0.28	0.26	0.55	0.27	1.00	0.03	0.42	0.22	0.27	0.28	0.30	0.28	0.28	0.07	0.25	0.28	0.21	0.19	0.23	0.23	0.38
Job_Demands	0.19	0.19	0.33	0.19	0.16	0.07	0.14	0.03	1.00	0.14	0.22	0.19	0.30	0.32	0.22	0.25	0.22	0.18	0.24	0.27	0.11	0.12	0.15	0.09
Job_Skills	0.59	0.49	0.51	0.22	0.44	0.61	0.38	0.42	0.14	1.00	0.37	0.34	0.39	0.44	0.43	0.46	0.19	0.32	0.39	0.32	0.25	0.20	0.24	0.35
Manager	0.38	0.40	0.30	0.18	0.32	0.30	0.04	0.22	0.22	0.37	1.00	0.35	0.49	0.54	0.53	0.54	0.17	0.43	0.45	0.40	0.29	0.22	0.17	0.31
Social	0.36	0.41	0.35	0.22	0.26	0.31	0.18	0.27	0.19	0.34	0.35	1.00	0.35	0.41	0.38	0.39	0.16	0.25	0.33	0.25	0.22	0.20	0.15	0.31
Leadership	0.44	0.55	0.34	0.25	0.30	0.34	0.05	0.28	0.30	0.39	0.49	0.35	1.00	0.73	0.57	0.64	0.27	0.66	0.70	0.61	0.41	0.34	0.30	0.44
Org_Support	0.49	0.59	0.39	0.26	0.37	0.39	0.07	0.30	0.32	0.44	0.54	0.41	0.73	1.00	0.62	0.69	0.31	0.59	0.66	0.61	0.41	0.35	0.35	0.45
Learning	0.42	0.47	0.33	0.23	0.31	0.35	0.05	0.28	0.22	0.43	0.53	0.38	0.57	0.62	1.00	0.75	0.27	0.49	0.54	0.45	0.40	0.32	0.24	0.38
Career_Dev	0.45	0.53	0.34	0.23	0.34	0.36	0.03	0.28	0.25	0.46	0.54	0.39	0.64	0.69	0.75	1.00	0.35	0.58	0.63	0.55	0.43	0.34	0.30	0.41
Pay	0.17	0.22	0.11	0.05	0.16	0.15	0.06	0.07	0.22	0.19	0.17	0.16	0.27	0.31	0.27	0.35	1.00	0.22	0.26	0.26	0.28	0.22	0.26	0.21
Performance	0.36	0.43	0.24	0.12	0.20	0.29	0.02	0.25	0.18	0.32	0.43	0.25	0.66	0.59	0.49	0.58	0.22	1.00	0.64	0.52	0.34	0.28	0.31	0.41
Innovative	0.41	0.50	0.32	0.20	0.32	0.33	0.04	0.28	0.24	0.39	0.45	0.33	0.70	0.66	0.54	0.63	0.26	0.64	1.00	0.60	0.41	0.31	0.32	0.43
Involvement	0.36	0.45	0.27	0.22	0.29	0.28	0.01	0.21	0.27	0.32	0.40	0.25	0.61	0.61	0.45	0.55	0.26	0.52	0.60	1.00	0.34	0.27	0.30	0.32
CS_Renewal	0.29	0.33	0.21	0.24	0.22	0.26	0.06	0.19	0.11	0.25	0.29	0.22	0.41	0.41	0.40	0.43	0.28	0.34	0.41	0.34	1.00	0.64	0.23	0.41
Commitment_Change	0.31	0.29	0.23	0.33	0.17	0.29	0.09	0.23	0.12	0.20	0.22	0.20	0.34	0.35	0.32	0.34	0.22	0.28	0.31	0.27	0.64	1.00	0.25	0.44
Public	0.30	0.27	0.22	0.13	0.16	0.26	0.07	0.23	0.15	0.24	0.17	0.15	0.30	0.35	0.24	0.30	0.26	0.31	0.32	0.30	0.23	0.25	1.00	0.27
CS_Identify	0.46	0.51	0.33	0.30	0.26	0.45	0.13	0.38	0.09	0.35	0.31	0.31	0.44	0.45	0.38	0.41	0.21	0.41	0.43	0.32	0.41	0.44	0.27	1.00

Table 40

CSEES Pearson's Correlation Coefficients, 2020

	Engagement	Commitment	WellBeing	Coping_Change	Autonomy	Meaning	Competence	Citizen	Job_Demands	Job_Skills	Manager	Social	Leadership	Org_Support	Learning	Career_Dev	Pay	Performance	Innovative	Involvement	CS_Renewal	Public	CS_Identify
Engagement	1.00	0.62	0.64	0.40	0.36	0.68	0.36	0.48	0.22	0.59	0.38	0.35	0.44	0.48	0.41	0.44	0.16	0.35	0.41	0.36	0.32	0.28	0.44
Commitment	0.62	1.00	0.44	0.29	0.34	0.57	0.20	0.38	0.22	0.51	0.41	0.42	0.55	0.59	0.46	0.52	0.22	0.42	0.50	0.44	0.36	0.25	0.50
WellBeing	0.64	0.44	1.00	0.47	0.35	0.49	0.57	0.38	0.33	0.52	0.30	0.34	0.33	0.38	0.32	0.34	0.10	0.24	0.30	0.26	0.23	0.20	0.31
Coping_Change	0.40	0.29	0.47	1.00	0.21	0.30	0.37	0.28	0.21	0.24	0.21	0.19	0.27	0.28	0.24	0.24	0.05	0.17	0.23	0.23	0.19	0.15	0.33
Autonomy	0.36	0.34	0.35	0.21	1.00	0.38	0.20	0.23	0.17	0.43	0.32	0.24	0.29	0.37	0.29	0.33	0.17	0.17	0.32	0.29	0.21	0.14	0.22
Meaning	0.68	0.57	0.49	0.30	0.38	1.00	0.31	0.53	0.09	0.60	0.29	0.30	0.34	0.38	0.33	0.36	0.16	0.27	0.33	0.28	0.28	0.25	0.44
Competence	0.36	0.20	0.57	0.37	0.20	0.31	1.00	0.28	0.16	0.44	0.08	0.22	0.07	0.10	0.10	0.08	-0.04	0.00	0.06	0.03	0.07	0.09	0.15
Citizen	0.48	0.38	0.38	0.28	0.23	0.53	0.28	1.00	0.05	0.41	0.22	0.25	0.28	0.28	0.27	0.28	0.08	0.25	0.29	0.19	0.23	0.23	0.38
Job_Demands	0.22	0.22	0.33	0.21	0.17	0.09	0.16	0.05	1.00	0.19	0.26	0.19	0.32	0.37	0.27	0.30	0.20	0.23	0.27	0.30	0.18	0.15	0.10
Job_Skills	0.59	0.51	0.52	0.24	0.43	0.60	0.44	0.41	0.19	1.00	0.38	0.36	0.38	0.44	0.42	0.45	0.20	0.30	0.38	0.33	0.30	0.22	0.32
Manager	0.38	0.41	0.30	0.21	0.32	0.29	0.08	0.22	0.26	0.38	1.00	0.34	0.48	0.54	0.52	0.54	0.18	0.43	0.45	0.42	0.33	0.18	0.30
Social	0.35	0.42	0.34	0.19	0.24	0.30	0.22	0.25	0.19	0.36	0.34	1.00	0.32	0.39	0.37	0.38	0.16	0.24	0.31	0.23	0.25	0.15	0.29
Leadership	0.44	0.55	0.33	0.27	0.29	0.34	0.07	0.28	0.32	0.38	0.48	0.32	1.00	0.74	0.57	0.64	0.28	0.67	0.70	0.63	0.45	0.30	0.44
Org_Support	0.48	0.59	0.38	0.28	0.37	0.38	0.10	0.28	0.37	0.44	0.54	0.39	0.74	1.00	0.62	0.69	0.31	0.60	0.67	0.65	0.47	0.33	0.44
Learning	0.41	0.46	0.32	0.24	0.29	0.33	0.10	0.27	0.27	0.42	0.52	0.37	0.57	0.62	1.00	0.74	0.29	0.49	0.54	0.48	0.45	0.25	0.38
Career_Dev	0.44	0.52	0.34	0.24	0.33	0.36	0.08	0.28	0.30	0.45	0.54	0.38	0.64	0.69	0.74	1.00	0.36	0.59	0.63	0.58	0.50	0.31	0.41
Pay	0.16	0.22	0.10	0.05	0.17	0.16	0.04	0.08	0.20	0.20	0.18	0.16	0.28	0.31	0.29	0.36	1.00	0.22	0.27	0.29	0.29	0.24	0.19
Performance	0.35	0.42	0.24	0.17	0.17	0.27	0.00	0.25	0.23	0.30	0.43	0.24	0.67	0.60	0.49	0.59	0.22	1.00	0.63	0.55	0.43	0.32	0.42
Innovative	0.41	0.50	0.30	0.23	0.32	0.33	0.06	0.29	0.27	0.38	0.45	0.31	0.70	0.67	0.54	0.63	0.27	0.63	1.00	0.60	0.46	0.31	0.44
Involvement	0.36	0.44	0.26	0.23	0.29	0.28	0.03	0.19	0.30	0.33	0.42	0.23	0.63	0.65	0.48	0.58	0.29	0.55	0.60	1.00	0.40	0.31	0.32
CS_Renewal	0.32	0.36	0.23	0.19	0.21	0.28	0.07	0.23	0.18	0.30	0.33	0.25	0.45	0.47	0.45	0.50	0.29	0.43	0.46	0.40	1.00	0.31	0.38
Public	0.28	0.25	0.20	0.15	0.14	0.25	0.09	0.23	0.15	0.22	0.18	0.15	0.30	0.33	0.25	0.31	0.24	0.32	0.31	0.31	0.31	1.00	0.27
CS_Identify	0.44	0.50	0.31	0.33	0.22	0.44	0.15	0.38	0.10	0.32	0.30	0.29	0.44	0.44	0.38	0.41	0.19	0.42	0.44	0.32	0.38	0.27	1.00

Table 41

CSEES Rotated Factor Loadings, 2015

	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8	Factor9	Factor10	Factor11	Factor12	Factor13	Factor14	Factor15	Factor16
Q6_1_r		0.74642														
Q6_2_r		0.3711														
Q6_3_r		0.69874														
Q6_4_r		0.74829														
Q6_5_r		0.69657														
Q6_6_r		0.64864														
Q7_1_r																
Q7_2_r																
Q7_3_r																0.64988
Q7_4_r																0.64676
Q7_5_r																0.62797
Q7_6_r		0.32209														
Q8_1_r		0.3399														
Q8_2_r				0.40223					0.33561							
Q8_3_r				0.56325					0.30049							
Q8_4_r		0.69863														
Q9_1_r									0.63765							
Q9_2_r									0.63778							
Q9_3_r									0.37118							
Q9_4_r									0.45808							
Q9_5_r									0.61031							
Q11_1_r												0.78588				
Q11_2_r												0.77135				
Q11_3_r												0.7942				
Q12_1_r		0.70433														
Q12_2_r		0.70796														
Q12_3_r		0.72542														
Q13_1_r				0.83763												
Q13_2_r				0.83315												
Q13_3_r				0.75611												
Q14_1_r		0.38169												0.76949		
Q14_2_r		0.33094												0.81246		
Q14_3_r		0.36122												0.81116		
Q15_1_r						0.80692										
Q15_2_r						0.74737										
Q15_3_r						0.80373										
Q15_7_r						0.57653										
Q15_8_r						0.72174										
Q15_9_r						0.34933										
Q16_1_r		0.51212														
Q16_2_r				0.73424												
Q16_3_r		0.64292														
Q16_4_r		0.63035														
Q16_5_r				0.45699												
Q19_1_r		0.32845						0.75277								
Q19_2_r		0.32096						0.75999								
Q19_3_r		0.33637						0.78518								
Q19_4_r		0.32611						0.68296								
Q20_1_r							0.76756									
Q20_2_r							0.79847									
Q20_3_r							0.65692									
Q20_4_r							0.67915									
Q20_5_r							0.56034									
Q21_1_r		0.74803														
Q21_2_r		0.67819														
Q21_3_r		0.72638														
Q21_4_r		0.7375														
Q21_5_r		0.7784														
Q22_1_r		0.61573														
Q22_2_r		0.572														
Q22_3_r		0.61773														
Q22_4_r		0.51797														
Q23_1_r		0.39135				0.5162										
Q23_2_r		0.30684				0.50602										
Q23_3_r		0.42465				0.61871										
Q23_4_r		0.38391				0.59421										
Q25_1_r		0.35111				0.3919										
Q25_2_r		0.43171				0.46993										
Q25_3_r		0.41996				0.46323										
Q25_4_r		0.41206				0.55898										
Q25_5_r		0.41882				0.56665										
Q25_6_r		0.46857				0.42424										
Q25_7_r		0.3932				0.31408										
Q26_1_r										0.81527						
Q26_2_r										0.59694						
Q26_3_r										0.85228						
Q26_4_r										0.81521						
Q27_1_r		0.59191														
Q27_2_r		0.7024														
Q27_3_r		0.67996														
Q27_4_r		0.69183														
Q27_5_r		0.67214														
Q29_1_r		0.5942														
Q29_2_r		0.69229														
Q29_3_r		0.73319														
Q29_4_r		0.70063														
Q29_5_r		0.66979														
Q30_1_r		0.42296														
Q30_2_r		0.43911													0.70645	
Q30_3_r		0.43903													0.71001	
Q30_4_r		0.50462														
Q30_5_r		0.36337														0.36977
Q32_1_r				0.53174												
Q32_2_r				0.57908												
Q32_3_r		0.34754		0.5572												
Q32_4_r				0.57851												
Q33_1_r				0.784												
Q33_2_r				0.77799												
Q33_3_r				0.81063												
Q33_4_r				0.70327												
Q34_1_r																
Q34_2_r											0.83354					
Q34_3_r											0.87688					
Q35_1_r											0.8734					
Q35_3_r														0.47233		
Q35_4_r														0.56654		
Q35_5_r														0.45531		
Q35_6_r		0.50459												0.48215		
Q35_10_r														0.32633		
														0.54218		

Table 42

CSEES Rotated Factor Loadings, 2017

	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8	Factor9	Factor10	Factor11	Factor12	Factor13	Factor14	Factor15	Factor16
Q6_1_r		0.75089														
Q6_2_r		0.3663														
Q6_3_r		0.70048														
Q6_4_r		0.7502														
Q6_5_r		0.67291														
Q6_6_r		0.69102														
Q7_1_r		0.48752														
Q7_2_r		0.30873														
Q7_3_r																0.53736
Q7_4_r		0.33867														0.58418
Q7_5_r	0.32202															0.56206
Q7_6_r		0.41416				0.30561										0.34832
Q8_1_r		0.35038														
Q8_2_r					0.39144			0.33838								
Q8_3_r					0.534			0.30469								
Q8_4_r		0.68459														
Q8_5_r								0.65873								
Q9_1_r								0.65739								
Q9_2_r								0.39303								
Q9_3_r								0.49283								
Q9_4_r								0.63313								
Q9_5_r																
Q11_1_r												0.78762				
Q11_2_r												0.76342				
Q11_3_r												0.80084				
Q12_1_r		0.69822														
Q12_2_r		0.66967														
Q12_3_r		0.7101														
Q13_1_r					0.83304											
Q13_2_r					0.82595											
Q13_3_r					0.73624											
Q14_1_r		0.37746												0.75401		
Q14_2_r		0.34495												0.80135		
Q14_3_r		0.35512												0.79714		
Q15_1_r						0.81108										
Q15_2_r						0.74808										
Q15_3_r						0.79426										
Q15_7_r						0.58542										
Q15_8_r						0.7099										
Q15_9_r						0.36534										
Q16_1_r		0.49123														
Q16_2_r					0.71943											
Q16_3_r		0.61705			0.31857											
Q16_4_r		0.61985														
Q16_5_r					0.46375											
Q19_1_r	0.31097										0.75405					
Q19_2_r	0.31283										0.76197					
Q19_3_r	0.33728										0.77803					
Q19_4_r	0.33767										0.66062					
Q20_1_r							0.76208									
Q20_2_r							0.79981									
Q20_3_r							0.66647									
Q20_4_r							0.67488									
Q20_5_r							0.56069									
Q21_1_r	0.72377															
Q21_2_r	0.64341															
Q21_3_r	0.72138															
Q21_4_r	0.74311															
Q21_5_r	0.76357															
Q22_1_r	0.57394															
Q22_2_r	0.54061															
Q22_3_r	0.57923				0.31173											
Q22_4_r	0.49497															
Q23_1_r	0.37313					0.57618										
Q23_2_r	0.30076					0.56617										
Q23_3_r	0.38761					0.60594										
Q23_4_r	0.35898					0.62837										
Q25_1_r	0.32335				0.38851											
Q25_2_r	0.40217				0.4979											
Q25_3_r	0.39723				0.5119											
Q25_4_r	0.37616				0.54207											
Q25_5_r	0.37429				0.5573											
Q25_6_r	0.43775				0.43366											
Q25_7_r	0.35348				0.33292											
Q26_1_r								0.83581								
Q26_2_r								0.60088								
Q26_3_r								0.85727								
Q26_4_r								0.81073								
Q27_1_r	0.58781															
Q27_2_r	0.69354															
Q27_3_r	0.68557															
Q27_4_r	0.68812															
Q27_5_r	0.6742															
Q29_1_r	0.5492															
Q29_2_r	0.68368															
Q29_3_r	0.70166															
Q29_4_r	0.68585															
Q29_5_r	0.64818															
Q30_1_r	0.41264													0.71009		
Q30_2_r	0.4211													0.71127		
Q30_3_r	0.42309													0.71		
Q30_4_r	0.48276															
Q30_5_r	0.37406														0.41604	
Q32_1_r			0.61552													
Q32_2_r			0.62577													
Q32_3_r	0.33517		0.59017													
Q32_4_r			0.67951													
Q33_1_r			0.7771													
Q33_2_r			0.75707													
Q33_3_r			0.79293													
Q33_4_r			0.68765													
Q34_1_r												0.82417				
Q34_2_r												0.8768				
Q34_3_r												0.88076				
Q35_1_r														0.46475		
Q35_3_r														0.51419		
Q35_4_r														0.41229		
Q35_5_r														0.43971		
Q35_6_r	0.46767													0.36876		
Q35_10_r														0.53892		

Table 43

CSEES Rotated Factor Loadings, 2020

	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8	Factor9	Factor10	Factor11	Factor12	Factor13	Factor14	Factor15	Factor16
Q6_1_r		0.75566														
Q6_2_r		0.36677				0.30411										
Q6_3_r		0.70648														
Q6_4_r		0.75517														
Q6_5_r		0.69911														
Q6_6_r		0.66693														
Q7_1_r	0.31848	0.50051														
Q7_2_r		0.31564							0.42531							
Q7_3_r	0.30806								0.46056							
Q7_4_r		0.34279							0.58523							
Q7_5_r	0.3611								0.48976							
Q7_6_r		0.41946							0.41562							
Q8_1_r		0.36239														
Q8_2_r				0.41047		0.35152										
Q8_3_r				0.56004		0.31929										
Q8_4_r		0.65349														
Q9_1_r						0.66696										
Q9_2_r						0.65138										
Q9_3_r						0.37713										
Q9_4_r						0.52776										
Q9_5_r						0.64226										
Q11_1_r										0.80193						
Q11_2_r										0.79022						
Q11_3_r										0.81429						
Q12_1_r		0.66537														
Q12_2_r		0.63841														
Q12_3_r		0.67381														
Q13_1_r				0.82735												
Q13_2_r				0.82164												
Q13_3_r				0.73942												
Q14_1_r		0.32684										0.7759				
Q14_2_r												0.8205				
Q14_3_r		0.30663										0.82382				
Q15_1_r														0.79348		
Q15_2_r														0.53645		
Q15_3_r														0.76552		
Q15_7_r																
Q16_1_r		0.46014														
Q16_2_r				0.75039												
Q16_3_r		0.55849		0.38815												
Q16_4_r		0.56411		0.32697												
Q16_5_r				0.50326												
Q19_1_r							0.76969									
Q19_2_r							0.76607									
Q19_3_r	0.30739						0.79307									
Q19_4_r							0.69337									
Q20_1_r					0.79925											
Q20_2_r					0.82706											
Q20_3_r					0.70678											
Q20_4_r					0.6689											
Q20_5_r					0.51293											
Q21_1_r		0.75038														
Q21_2_r		0.66986														
Q21_3_r		0.74823														
Q21_4_r		0.76646														
Q21_5_r		0.79122														
Q22_1_r		0.59736														
Q22_2_r		0.5824														
Q22_3_r		0.57761		0.34295												
Q22_4_r		0.51934														
Q23_1_r		0.36693		0.53998												
Q23_2_r				0.54753												
Q23_3_r		0.38004		0.6383												
Q23_4_r		0.33685		0.64681												
Q25_1_r		0.30085		0.39382												
Q25_2_r		0.40725		0.47773												
Q25_3_r		0.38722		0.47717												
Q25_4_r		0.33446		0.60995												
Q25_5_r		0.33839		0.61616												
Q25_6_r		0.41633		0.50125												
Q25_7_r		0.33601		0.38914												
Q26_1_r							0.84184									
Q26_2_r							0.58661									
Q26_3_r							0.85444									
Q26_4_r							0.79435									
Q27_1_r		0.48912													0.4468	
Q27_2_r		0.63947													0.30834	
Q27_3_r		0.61984													0.347	
Q27_4_r		0.5671													0.51561	
Q27_5_r		0.56125													0.48325	
Q29_1_r		0.601														
Q29_2_r		0.70823														
Q29_3_r		0.74381														
Q29_4_r		0.71005														
Q29_5_r		0.67672														
Q30_1_r		0.44894										0.69501				
Q30_2_r		0.46479										0.6887				
Q30_3_r		0.45891										0.69314				
Q30_4_r		0.51111														
Q30_5_r		0.40795														
Q32_1_r															0.72368	
Q32_2_r		0.32682													0.71863	
Q32_3_r															0.34639	
Q34_1_r										0.84196						
Q34_2_r										0.89349						
Q34_3_r										0.89191						
Q35_1_r																
Q35_3_r		0.45699														
Q35_4_r									0.45473							
Q35_5_r									0.35146							
Q35_6_r									0.43324							

Table 44*CSEES Confirmatory Factor Analysis Fit Statistics, 2015*

Fit Summary		
Modeling Info	Number of Variables	109
	Number of Moments	5995
	Number of Parameters	494
	Number of Active Constraints	0
	Baseline Model Function Value	79.6294
	Baseline Model Chi-Square	1016867
	Baseline Model Chi-Square DF	5886
	Pr > Baseline Model Chi-Square	<.0001
Absolute Index	Fit Function	7.9806
	Chi-Square	101912
	Chi-Square DF	5501
	Pr > Chi-Square	<.0001
	Elliptic Corrected Chi-Square	6.8139
	Pr > Elliptic Corr. Chi-Square	1
	Z-Test of Wilson & Hilferty	258.9853
	Hoelter Critical N	712
Parsimony Index	Root Mean Square Residual (RMR)	47.6328
	Standardized RMR (SRMR)	0.0635
	Goodness of Fit Index (GFI)	0.8418
	Adjusted GFI (AGFI)	0.8276
	Parsimonious GFI	0.7868
	RMSEA Estimate	0.037
	RMSEA Lower 90% Confidence Limit	0.0368
	RMSEA Upper 90% Confidence Limit	0.0372
	Probability of Close Fit	1
	ECVI Estimate	8.0586
	ECVI Lower 90% Confidence Limit	7.9775
	ECVI Upper 90% Confidence Limit	8.1404
Incremental Index	Akaike Information Criterion	102900
	Bozdogan CAIC	107076.7
	Schwarz Bayesian Criterion	106582.7
	McDonald Centrality	0.0229
	Bentler Comparative Fit Index	0.9046
	Bentler-Bonett NFI	0.8998
	Bentler-Bonett Non-normed Index	0.898
	Bollen Normed Index Rho1	0.8928
	Bollen Non-normed Index Delta2	0.9047
	James et al. Parsimonious NFI	0.8409

Table 45*CSEES Confirmatory Factor Analysis Fit Statistics, 2017*

Fit Summary		
Modelling Info	Number of Variables	109
	Number of Moments	5995
	Number of Parameters	494
	Number of Active Constraints	0
	Baseline Model Function Value	81.4265
	Baseline Model Chi-Square	1448739.96
		3
	Baseline Model Chi-Square DF	5886
	Pr > Baseline Model Chi-Square	<.0001
Absolute Index	Fit Function	7.7128
	Chi-Square	137226.691
		5
	Chi-Square DF	5501
	Pr > Chi-Square	<.0001
	Elliptic Corrected Chi-Square	6.4113
	Pr > Elliptic Corr. Chi-Square	1
	Z-Test of Wilson & Hilferty	302.39
	Hoelter Critical N	736
	Root Mean Square Residual (RMR)	35.3728
	Standardized RMR (SRMR)	0.0552
	Goodness of Fit Index (GFI)	0.8488
	Adjusted GFI (AGFI)	0.8352
	Parsimonious GFI	0.7933
	RMSEA Estimate	0.0367
Parsimony Index	RMSEA Lower 90% Confidence Limit	0.0365
	RMSEA Upper 90% Confidence Limit	0.0369
	Probability of Close Fit	1
	ECVI Estimate	7.7687
	ECVI Lower 90% Confidence Limit	7.7009
	ECVI Upper 90% Confidence Limit	7.8369
	Akaike Information Criterion	138214.691
		5
	Bozdogan CAIC	142555.252
		4
	Schwarz Bayesian Criterion	142061.252
		4
	McDonald Centrality	0.0247
	Bentler Comparative Fit Index	0.9087
	Bentler-Bonett NFI	0.9053
Incremental Index	Bentler-Bonett Non-normed Index	0.9023
	Bollen Normed Index Rho1	0.8986
	Bollen Non-normed Index Delta2	0.9087
	James et al. Parsimonious NFI	0.8461

Table 45*CSEES Confirmatory Factor Analysis Fit Statistics, 2020*

Fit Summary		
Modeling Info	Number of Variables	109
	Number of Moments	5151
	Number of Parameters	455
	Number of Active Constraints	0
	Baseline Model Function Value	75.4782
	Baseline Model Chi-Square	1723092.289
	Baseline Model Chi-Square DF	5050
	Pr > Baseline Model Chi-Square	<.0001
Absolute Index	Fit Function	6.5832
	Chi-Square	150287.465
	Chi-Square DF	4696
	Pr > Chi-Square	<.0001
	Elliptic Corrected Chi-Square	5.4427
	Pr > Elliptic Corr. Chi-Square	1
	Z-Test of Wilson & Hilferty	316.1704
	Hoelter Critical N	738
	Root Mean Square Residual (RMR)	34.0889
	Standardized RMR (SRMR)	0.0556
Parsimony Index	Goodness of Fit Index (GFI)	0.86
	Adjusted GFI (AGFI)	0.8464
	Parsimonious GFI	0.7997
	RMSEA Estimate	0.0369
	RMSEA Lower 90% Confidence Limit	0.0367
	RMSEA Upper 90% Confidence Limit	0.037
	Probability of Close Fit	1
	ECVI Estimate	6.6232
	ECVI Lower 90% Confidence Limit	6.5678
	ECVI Upper 90% Confidence Limit	6.6789
	Akaike Information Criterion	151197.465
	Bozdogan CAIC	155308.7679
	Schwarz Bayesian Criterion	154853.7679
Incremental Index	McDonald Centrality	0.0412
	Bentler Comparative Fit Index	0.9153
	Bentler-Bonett NFI	0.9128
	Bentler-Bonett Non-normed Index	0.9089
	Bollen Normed Index Rho1	0.9062
	Bollen Non-normed Index Delta2	0.9153
	James et al. Parsimonious NFI	0.8488

Table 46*CSEES Employee Engagement Index Scores and Descriptive Statistics, 2015, 2017, 2020*

Year	Category	No. of Obs.	Score	95% CL Score		Std Dev	Std Err
2015	Male	5,745	68.9	68.3	69.4	20.7	0.3
2015	A: Less than 10 years	3,702	71.1	70.5	71.8	19.8	0.3
2015	B: 10 to 20 years	4,817	67.9	67.3	68.5	20.5	0.3
2015	C: 20 to 30 years	2,616	69.8	69.0	70.5	19.4	0.4
2015	D: Greater than 30 years	3,247	72.5	71.9	73.2	18.9	0.3
2015	A: Director, ASG and above	160	87.3	85.6	88.9	10.5	0.8
2015	C: AP	1,851	73.6	72.8	74.4	17.4	0.4
2015	D: AO	418	71.2	69.4	73.0	18.4	0.9
2015	E: HEO	2,583	70.3	69.6	71.1	18.7	0.4
2015	F: EO	2,710	67.8	67.0	68.5	19.1	0.4
2015	H: CO	4,121	67.2	66.6	67.8	21.1	0.3
2017	Female	11,491	73.6	73.3	73.9	18.0	0.2
2017	Male	7,823	71.3	70.8	71.7	19.5	0.2
2017	A: Less than 10 years	6,065	74.4	74.0	74.9	18.0	0.2
2017	B: 10 to 20 years	6,452	70.2	69.7	70.7	19.2	0.2
2017	C: 20 to 30 years	3,145	71.4	70.8	72.1	18.9	0.3
2017	D: Greater than 30 years	4,155	74.0	74.0	74.9	18.4	0.3
2017	A: Director, ASG and above	189	87.9	86.0	89.8	13.0	0.8
2017	B: PO	1,103	75.5	74.4	76.7	19.7	0.6
2017	C: AP	2,564	75.4	74.8	76.1	16.6	0.3
2017	D: AO	702	73.2	72.0	74.5	17.0	0.6
2017	E: HEO	3,367	71.7	71.1	72.3	18.1	0.3
2017	F: EO	4,578	71.0	70.4	71.5	18.3	0.3
2017	H: CO	5,912	71.1	70.6	71.6	19.8	0.3
2017	Female	11,491	73.6	73.3	73.9	18.0	0.2
2020	Female	15,113	75.7	75.5	76.0	16.9	0.1
2020	Male	9,745	73.5	73.1	73.8	18.3	0.2
2020	A: Less than 10 years	10,335	76.3	76.0	76.6	17.2	0.2
2020	B: 10 to 20 years	6,191	72.0	71.5	72.4	18.1	0.2
2020	C: 20 to 30 years	4,706	73.5	73.0	74.0	17.7	0.3
2020	D: Greater than 30 years	4,011	76.3	75.8	76.8	16.8	0.3
2020	A: Director, ASG and above	183	88.0	86.2	89.7	12.0	0.9
2020	B: PO	1,376	76.4	75.4	77.4	18.3	0.5
2020	C: AP	3,462	75.6	75.1	76.2	15.8	0.3
2020	D: AO	1,025	73.8	72.8	74.9	17.0	0.5
2020	E: HEO	4,259	74.1	73.6	74.6	16.9	0.3
2020	F: EO	3,462	75.6	72.6	73.5	15.8	0.3
2020	H: CO	7,278	75.2	74.7	75.6	18.3	0.2

Table 47

CSEES Employee Engagement Index Scores T-Test Results, 2015, 2017, 2020

Year	Category	Mean Difference	DF	t Value	Pr > t
2020	Female vs Male	-2.3	19,598	9.86	<.0001
2020	10-20 years vs 20-30 years	-1.5	10,239	-4.31	<.0001
2020	10-20 years vs Greater than 30 years	-4.3	8,987	-12.34	<.0001
2020	20-30 years vs Greater than 30 years	-2.8	8,608	-7.69	<.0001
2020	Less than 10 years vs 10-20 years	4.3	12,506	15.1	<.0001
2020	Less than 10 years vs 20-30 years	3.0	6,096	7.34	<.0001
2020	Less than 10 years vs greater than 30 years	0.0	7,432	-0.1	0.9222
2020	Director, ASG and above vs PO	11.5	306	11.35	<.0001
2020	Director, ASG and above vs AP	12.3	216	13.26	<.0001
2020	Director, ASG and above vs AO	14.2	328	13.64	<.0001
2020	Director, ASG and above vs HEO	13.8	214	14.92	<.0001
2020	Director, ASG and above vs EO	14.9	206	16.23	<.0001
2020	Director, ASG and above vs CO	12.8	204	13.99	<.0001
2020	PO vs AP	0.8	2,235	1.4	0.1605
2020	PO vs AO	2.6	2,281	3.59	0.0003
2020	PO vs HEO	2.3	2,192	4.11	<.0001
2020	PO vs EO	3.4	2,000	6.22	<.0001
2020	PO vs CO	1.3	1,932	2.36	0.0186
2020	AP vs AO	1.8	1,579	3.05	0.0023
2020	AP vs HEO	1.5	7,578	4.02	<.0001
2020	AP vs EO	2.6	7,890	7.35	<.0001
2020	AP vs CO	0.5	7,776	1.39	0.1642
2020	HEO vs AO	-0.3	1,548	-0.54	0.5919
2020	HEO vs EO	1.1	10,367	3.12	0.0018
2020	HEO vs CO	-1.0	9,459	-3.04	0.0024
2020	AO vs CO	-1.3	1,377	-2.34	0.0197
2020	EO vs CO	-2.1	13,111	-6.75	<.0001
2020	AO vs EO	0.8	1,421	1.32	0.1866
2017	Female vs Male	-2.3	15,895	8.47	<.0001
2017	10-20 years vs 20-30 years	-1.2	6,326	-2.93	0.0034
2017	10-20 years vs Greater than 30 years	-3.7	9,124	-10.07	<.0001
2017	20-30 years vs Greater than 30 years	-2.5	6,680	-5.75	<.0001
2017	Less than 10 years vs 10-20 years	4.2	12,515	12.66	<.0001
2017	Less than 10 years vs 20-30 years	3.0	6,096	7.34	<.0001
2017	Director, ASG and above vs PO	12.4	355	11.07	<.0001
2017	Director, ASG and above vs AP	12.4	236	12.42	<.0001
2017	Director, ASG and above vs AO	14.6	379	12.8	<.0001
2017	Director, ASG and above vs HEO	16.2	231	16.25	<.0001
2017	Director, ASG and above vs EO	16.9	220	17.18	<.0001
2017	Director, ASG and above vs CO	16.8	217	17.13	<.0001
2017	PO vs AP	0.1	1,808	0.12	0.9074
2017	PO vs AO	2.3	1,646	2.6	0.0094
2017	PO vs HEO	3.8	1,753	5.72	<.0001
2017	PO vs EO	4.6	1,591	6.99	<.0001
2017	PO vs CO	4.4	1,547	6.87	<.0001
2017	AP vs AO	2.2	1,096	3.04	0.0024
2017	AP vs HEO	3.3	4,135	5.99	<.0001
2017	AP vs EO	4.5	5,738	10.53	<.0001
2017	AP vs CO	6.4	4,261	12.27	<.0001
2017	HEO vs AO	1.6	1,060	2.19	0.0286
2017	HEO vs EO	0.7	7,294	1.75	0.0805
2017	HEO vs CO	0.6	7,531	1.51	0.1323
2017	AO vs CO	4.0	535	4.17	<.0001
2017	EO vs CO	0.6	6,190	1.15	0.2498
2017	AO vs EO	2.3	967	3.28	0.0011
2015	Female vs Male	-2.2	11,685	6.46	<.0001
2015	Less than 10 years vs greater than 30	0.5	8,784	1.24	0.2133
2015	10-20 years vs 20-30 years	-1.9	5,621	-3.89	0.0001
2015	10-20 years vs Greater than 30 years	-4.6	7,331	-10.42	<.0001
2015	20-30 years vs Greater than 30 years	-2.8	5,532	-5.47	<.0001
2015	Less than 10 years vs 10-20 years	3.2	8,101	7.38	<.0001
2015	Director, ASG and above vs PO	11.1	377	10.52	<.0001
2015	Director, ASG and above vs AP	13.7	242	14.75	<.0001
2015	Director, ASG and above vs AO	16.1	491	13.12	<.0001
2015	Director, ASG and above vs HEO	17.0	226	18.61	<.0001
2015	Director, ASG and above vs EO	19.5	226	21.43	<.0001
2015	Director, ASG and above vs CO	20.1	212	22.41	<.0001
2015	PO vs AP	2.6	1,500	3.44	0.0006
2015	PO vs AO	5.0	839	4.55	<.0001
2015	PO vs HEO	5.9	1,397	7.97	<.0001
2015	PO vs EO	8.5	1,398	11.44	<.0001
2015	PO vs CO	9.0	1,291	12.51	<.0001
2015	AP vs AO	2.4	598	2.44	0.0148
2015	AP vs HEO	3.3	4,135	5.99	<.0001
2015	AP vs EO	5.8	4,197	10.69	<.0001
2015	AP vs CO	6.4	4,261	12.27	<.0001
2015	HEO vs AO	0.9	565	0.89	0.3749
2015	HEO vs EO	2.6	5,288	4.95	<.0001
2015	HEO vs CO	3.1	5,982	6.36	<.0001
2015	AO vs CO	4.0	535	4.17	<.0001
2015	EO vs CO	0.6	6,190	1.15	0.2498
2015	AO vs EO	3.4	565	3.53	0.0004
2015	Less than 10 years vs 20-30 years	1.4	5,687	2.74	0.0062
2015	Less than 10 years vs greater than 30 years	-1.4	6,895	-2.99	0.0028

Table 48

CSEES Differential Item Functioning using -2LogL Differences, 2020

Item	Demographic	Model	Full Log Likelihood	-2LogL	Note G ² ~ ChiSq	Difference
Q6_1	Gender	Model 1	- 20,690.96	41,381.92	Uniform (Model 2 - Model 1)	- 480.37
Q6_1	Gender	Model 2	- 20,450.77	40,901.55	Non-Uniform (Model 3 - Model 2)	- 11.57
Q6_1	Gender	Model 3	- 20,444.99	40,889.98	Both (Model 3-Model 1) but DF is only 1, needs to be 2	- 491.94
Q6_2	Gender	Model 1	- 23,932.08	47,864.16	Uniform (Model 2 - Model 1)	- 773.57
Q6_2	Gender	Model 2	- 23,545.29	47,090.58	Non-Uniform (Model 3 - Model 2)	- 0.08
Q6_2	Gender	Model 3	- 23,545.25	47,090.51	Both (Model 3-Model 1) but DF is only 1, needs to be 2	- 773.65
Q6_3	Gender	Model 1	- 22,094.54	44,189.08	Uniform (Model 2 - Model 1)	- 555.22
Q6_3	Gender	Model 2	- 21,816.93	43,633.85	Non-Uniform (Model 3 - Model 2)	- 19.71
Q6_3	Gender	Model 3	- 21,807.07	43,614.14	Both (Model 3-Model 1) but DF is only 1, needs to be 2	- 574.94
Q6_4	Gender	Model 1	- 24,768.60	49,537.21	Uniform (Model 2 - Model 1)	- 619.50
Q6_4	Gender	Model 2	- 24,458.86	48,917.71	Non-Uniform (Model 3 - Model 2)	- 5.83
Q6_4	Gender	Model 3	- 24,455.94	48,911.88	Both (Model 3-Model 1) but DF is only 1, needs to be 2	- 625.32
Q6_5	Gender	Model 1	- 25,605.73	51,211.46	Uniform (Model 2 - Model 1)	- 661.28
Q6_5	Gender	Model 2	- 25,275.09	50,550.18	Non-Uniform (Model 3 - Model 2)	- 11.25
Q6_5	Gender	Model 3	- 25,269.47	50,538.93	Both (Model 3-Model 1) but DF is only 1, needs to be 2	- 672.53
Q6_6	Gender	Model 1	- 22,881.05	45,762.09	Uniform (Model 2 - Model 1)	- 498.47
Q6_6	Gender	Model 2	- 22,631.81	45,263.62	Non-Uniform (Model 3 - Model 2)	- 0.92
Q6_6	Gender	Model 3	- 22,631.35	45,262.70	Both (Model 3-Model 1) but DF is only 1, needs to be 2	- 499.39
Q6_1	Grade	Model 1	- 20,690.96	41,381.92	Uniform (Model 2 - Model 1)	- 303.10
Q6_1	Grade	Model 2	- 20,539.41	41,078.82	Non-Uniform (Model 3 - Model 2)	- 3.12
Q6_1	Grade	Model 3	- 20,537.85	41,075.70	Both (Model 3-Model 1) but DF is only 1, needs to be 2	- 306.22
Q6_2	Grade	Model 1	- 23,932.08	47,864.16	Uniform (Model 2 - Model 1)	- 347.07
Q6_2	Grade	Model 2	- 23,758.54	47,517.09	Non-Uniform (Model 3 - Model 2)	- 1.46
Q6_2	Grade	Model 3	- 23,757.81	47,515.62	Both (Model 3-Model 1) but DF is only 1, needs to be 2	- 348.53
Q6_3	Grade	Model 1	- 22,094.54	44,189.08	Uniform (Model 2 - Model 1)	- 311.60
Q6_3	Grade	Model 2	- 21,938.74	43,877.48	Non-Uniform (Model 3 - Model 2)	- 3.23
Q6_3	Grade	Model 3	- 21,937.12	43,874.25	Both (Model 3-Model 1) but DF is only 1, needs to be 2	- 314.83
Q6_4	Grade	Model 1	- 24,768.60	49,537.21	Uniform (Model 2 - Model 1)	- 310.99
Q6_4	Grade	Model 2	- 24,613.11	49,226.21	Non-Uniform (Model 3 - Model 2)	- 0.31
Q6_4	Grade	Model 3	- 24,612.95	49,225.90	Both (Model 3-Model 1) but DF is only 1, needs to be 2	- 311.31
Q6_5	Grade	Model 1	- 25,605.73	51,211.46	Uniform (Model 2 - Model 1)	- 362.83
Q6_5	Grade	Model 2	- 25,424.31	50,848.63	Non-Uniform (Model 3 - Model 2)	- 1.29
Q6_5	Grade	Model 3	- 25,423.67	50,847.34	Both (Model 3-Model 1) but DF is only 1, needs to be 2	- 364.13
Q6_6	Grade	Model 1	- 22,881.05	45,762.09	Uniform (Model 2 - Model 1)	- 320.52
Q6_6	Grade	Model 2	- 22,720.79	45,441.58	Non-Uniform (Model 3 - Model 2)	- 1.80
Q6_6	Grade	Model 3	- 22,719.89	45,439.78	Both (Model 3-Model 1) but DF is only 1, needs to be 2	- 322.32
Q6_1	Length of Service	Model 1	- 20,690.96	41,381.92	Uniform (Model 2 - Model 1)	- 152.26
Q6_1	Length of Service	Model 2	- 20,614.83	41,229.66	Non-Uniform (Model 3 - Model 2)	- 1.15
Q6_1	Length of Service	Model 3	- 20,614.26	41,228.51	Both (Model 3-Model 1) but DF is only 1, needs to be 2	- 153.40
Q6_2	Length of Service	Model 1	- 23,932.08	47,864.16	Uniform (Model 2 - Model 1)	- 197.49
Q6_2	Length of Service	Model 2	- 23,833.33	47,666.67	Non-Uniform (Model 3 - Model 2)	- 2.95
Q6_2	Length of Service	Model 3	- 23,831.86	47,663.72	Both (Model 3-Model 1) but DF is only 1, needs to be 2	- 200.43
Q6_3	Length of Service	Model 1	- 22,094.54	44,189.08	Uniform (Model 2 - Model 1)	- 182.08
Q6_3	Length of Service	Model 2	- 22,003.50	44,007.00	Non-Uniform (Model 3 - Model 2)	- 0.54
Q6_3	Length of Service	Model 3	- 22,003.23	44,006.46	Both (Model 3-Model 1) but DF is only 1, needs to be 2	- 182.62
Q6_4	Length of Service	Model 1	- 24,768.60	49,537.21	Uniform (Model 2 - Model 1)	- 252.56
Q6_4	Length of Service	Model 2	- 24,642.33	49,284.65	Non-Uniform (Model 3 - Model 2)	- 2.67
Q6_4	Length of Service	Model 3	- 24,640.99	49,281.98	Both (Model 3-Model 1) but DF is only 1, needs to be 2	- 255.23
Q6_5	Length of Service	Model 1	- 25,605.73	51,211.46	Uniform (Model 2 - Model 1)	- 225.83
Q6_5	Length of Service	Model 2	- 25,492.82	50,985.64	Non-Uniform (Model 3 - Model 2)	- 1.37
Q6_5	Length of Service	Model 3	- 25,492.13	50,984.26	Both (Model 3-Model 1) but DF is only 1, needs to be 2	- 227.20
Q6_6	Length of Service	Model 1	- 22,881.05	45,762.09	Uniform (Model 2 - Model 1)	- 227.49
Q6_6	Length of Service	Model 2	- 22,767.30	45,534.61	Non-Uniform (Model 3 - Model 2)	- 0.67
Q6_6	Length of Service	Model 3	- 22,766.97	45,533.94	Both (Model 3-Model 1) but DF is only 1, needs to be 2	- 228.16

Table 49

CSEES Differential Item Functioning Model Chi-Squares, 2020

Using Type 3 instead of Type 1	Model 1		Model 2		Model 3	
	Chi-Square	Pr > ChiSq	Chi-Square	Pr > ChiSq	Chi-Square	Pr > ChiSq
Engagement	35267.7	<.0001	34788.3	<.0001	5407.19	<.0001
Gender			2.46	0.117	8.79	0.003
Engagement*Gender					11.57	0.0007
Engagement	8402.02	<.0001	8187.48	<.0001	815.56	<.0001
Gender			204.56	<.0001	11.81	0.0006
Engagement*Gender					0.08	0.7824
Engagement	35157.5	<.0001	34714.1	<.0001	5480.98	<.0001
Gender			8.46	0.0036	24.78	<.0001
Engagement*Gender					19.71	<.0001
Engagement	37827.6	<.0001	37406.5	<.0001	6269.9	<.0001
Gender			51.69	<.0001	15.19	<.0001
Engagement*Gender					5.83	0.0158
Engagement	33987.6	<.0001	33619.5	<.0001	5073.83	<.0001
Gender			57.32	<.0001	24.17	<.0001
Engagement*Gender					11.25	0.0008
Engagement	25424.8	<.0001	25000.2	<.0001	3384.48	<.0001
Gender			1.08	0.2986	1.36	0.2436
Engagement*Gender					0.92	0.3382
Engagement	35267.7	<.0001	35040	<.0001	10114.1	<.0001
Grade			9.61	0.0019	1.09	0.297
Engagement*Grade					3.12	0.0775
Engagement	8402.02	<.0001	8360.79	<.0001	1531.41	<.0001
Grade			6.51	0.0107	3.01	0.0827
Engagement*Grade					1.46	0.2265
Engagement	35157.5	<.0001	34954	<.0001	10259.1	<.0001
Grade			0.98	0.3218	2.37	0.124
Engagement*Grade					3.23	0.0723
Engagement	37827.6	<.0001	37573.9	<.0001	11418	<.0001
Grade			6.37	0.0116	1.15	0.2833
Engagement*Grade					0.31	0.5757
Engagement	33987.6	<.0001	33773.1	<.0001	9615.16	<.0001
Grade			39.73	<.0001	0.05	0.8267
Engagement*Grade					1.29	0.2558
Engagement	25424.8	<.0001	25238.9	<.0001	6462.21	<.0001
Grade			1.45	0.2288	2.48	0.1156
Engagement*Grade					1.8	0.1798
Engagement	35267.7	<.0001	35091	<.0001	9397.99	<.0001
Length of Service			0.02	0.8875	1.16	0.2821
Engagement*Length of Service					1.15	0.2842
Engagement	8402.02	<.0001	8362.57	<.0001	1296.38	<.0001
Length of Service			8.27	0.004	1.08	0.2998
Engagement*Length of Service					2.95	0.086
Engagement	35157.5	<.0001	34981.8	<.0001	9458.25	<.0001
Length of Service			2.32	0.1275	1.11	0.2919
Engagement*Length of Service					0.54	0.4636
Engagement	37827.6	<.0001	37653.4	<.0001	10645.1	<.0001
Length of Service			44.02	<.0001	0.03	0.8518
Engagement*Length of Service					2.67	0.102
Engagement	33987.6	<.0001	33817.2	<.0001	8997.63	<.0001
Length of Service			19.64	<.0001	0.04	0.8509
Engagement*Length of Service					1.37	0.2411
Engagement	25424.8	<.0001	25347.3	<.0001	5472.06	<.0001
Length of Service			42.39	<.0001	0.43	0.5111
Engagement*Length of Service					0.67	0.413

Table 50

CSEES Cochran-Mantel-Haenszel Statistics Based on Table Scores, 2020

Alternative Hypothesis	Item	Demographic	Statistic	DF	Value	Prob
Nonzero Correlation	Q6_1_r	Gender	1	1	90.0665	<.0001
	Q6_2_r	Gender	1	1	190.8015	<.0001
	Q6_3_r	Gender	1	1	0.3079	0.579
	Q6_4_r	Gender	1	1	25.7502	<.0001
	Q6_5_r	Gender	1	1	27.9612	<.0001
	Q6_6_r	Gender	1	1	12.2286	0.0005
	Q6_1_r	Grade	1	1	1.7179	0.19
	Q6_2_r	Grade	1	1	14.8847	0.0001
	Q6_3_r	Grade	1	1	0.6017	0.4379
	Q6_4_r	Grade	1	1	19.7724	<.0001
	Q6_5_r	Grade	1	1	14.0133	0.0002
	Q6_6_r	Grade	1	1	0.1604	0.6888
	Q6_1_r	Length of Service	1	1	0.2111	0.6459
	Q6_2_r	Length of Service	1	1	8.5755	0.0034
	Q6_3_r	Length of Service	1	1	0.0896	0.7647
	Q6_4_r	Length of Service	1	1	33.2167	<.0001
	Q6_5_r	Length of Service	1	1	13.0524	0.0003
	Q6_6_r	Length of Service	1	1	38.7414	<.0001
	Q6_1_r	Gender	2	1	90.0665	<.0001
	Q6_2_r	Gender	2	1	190.8015	<.0001
	Q6_3_r	Gender	2	1	0.3079	0.579
	Q6_4_r	Gender	2	1	25.7502	<.0001
	Q6_5_r	Gender	2	1	27.9612	<.0001
	Q6_6_r	Gender	2	1	12.2286	0.0005
Row Mean Scores Differ	Q6_1_r	Grade	2	17	49.9425	<.0001
	Q6_2_r	Grade	2	17	89.5017	<.0001
	Q6_3_r	Grade	2	17	69.9865	<.0001
	Q6_4_r	Grade	2	17	580.5132	<.0001
	Q6_5_r	Grade	2	17	64.9799	<.0001
	Q6_6_r	Grade	2	17	101.6495	<.0001
	Q6_1_r	Length of Service	2	8	45.3511	<.0001
	Q6_2_r	Length of Service	2	8	46.9046	<.0001
	Q6_3_r	Length of Service	2	8	15.971	0.0428
	Q6_4_r	Length of Service	2	8	104.5131	<.0001
	Q6_5_r	Length of Service	2	8	46.1501	<.0001
	Q6_6_r	Length of Service	2	8	128.0334	<.0001
General Association	Q6_1_r	Gender	3	6	112.9316	<.0001
	Q6_2_r	Gender	3	6	228.6409	<.0001
	Q6_3_r	Gender	3	6	10.5494	0.1033
	Q6_4_r	Gender	3	6	57.9881	<.0001
	Q6_5_r	Gender	3	6	52.483	<.0001
	Q6_6_r	Gender	3	6	40.9177	<.0001
	Q6_1_r	Grade	3	102	283.9194	<.0001
	Q6_2_r	Grade	3	102	240.5536	<.0001
	Q6_3_r	Grade	3	102	224.4187	<.0001
	Q6_4_r	Grade	3	102	760.2802	<.0001
	Q6_5_r	Grade	3	102	241.3334	<.0001
	Q6_6_r	Grade	3	102	295.7729	<.0001
	Q6_1_r	Length of Service	3	48	111.3769	<.0001
	Q6_2_r	Length of Service	3	48	93.8847	<.0001
	Q6_3_r	Length of Service	3	48	93.2874	<.0001
	Q6_4_r	Length of Service	3	48	161.8303	<.0001
	Q6_5_r	Length of Service	3	48	100.8342	<.0001
	Q6_6_r	Length of Service	3	48	190.7204	<.0001