

MODELLING THE 2022 WORK ENVIRONMENT SURVEY RESULTS

The Technical Report



The 2022 Work Environment Survey (WES) and report have been commissioned by the BC Public Service Agency on behalf of the BC Public Service.

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Abstract

This technical report details the statistical analyses supporting the development and subsequent testing of the 2022 BC Public Service Work Environment Survey (WES) employee engagement model. A discussion of the methods leading up to and including the identification of the key drivers of engagement is provided, including a discussion of the sampling implications, data screening steps, preliminary analysis, and driver analysis.

Modelling of the corporate 2022 results was achieved through the confirmation of the pre-existing 2020 structural equation model (SEM). Improvements over the 2020 model were also explored and included the revision of three existing drivers. Direct comparisons were made between the 2022 and 2020 model results, based on the full 'house' model of engagement (consisting of two management drivers, three engagement outcomes and 11 mediating drivers). Finally, consideration was given to the methodological and statistical limitations of the 2022 employee engagement modelling process, as well as the direction of SEM analysis for future iterations.

Introduction

BCPS WES Model Origin

Between 2006 and 2008, BC Stats contracted ERIN Research to develop and maintain a structural equation model (SEM) based on the BC Public Service Work Environment Survey (WES) results. Using WES data collected in 2006, ERIN Research created the initial iterations of two distinct models: a basic model and a comprehensive house model of engagement. The basic model provided a simplified representation of the BC Public Service (BCPS) work environment, with a focus on how perceptions of management drive employee engagement. While the basic model provided a summary representation of the drivers of engagement, the house model offered a more complete depiction of the work environment through the incorporation of several additional drivers.¹ Each additional driver represented a unique workplace function, and when taken in combination with the management focused drivers, formed the underlying foundation and building blocks of the house model of engagement.

After 2006, rather than redeveloping the basic and house models from the ground up, survey results from 2007 and 2008 were fitted by ERIN Research to the existing 2006 models. In the event that the 2006 basic and/or house model ceased to provide a well fitted representation of the BC Public Service work environment, modifications were made to the models' composition of latent variables (both the number and type of observed variables (i.e., survey questions or items) that comprised each latent variable), as well as the structural weights that defined the causal relationships between the latent variables. The overall suite of latent variables however, remained the same across all three years.

In-House Transition

In 2009, BC Stats opted to perform the SEM analysis in-house by implementing a modelling procedure similar to that used by ERIN Research. This process was then repeated by BC Stats for both the 2010 and 2011 surveys cycles. Whereas modifications to the 2009 and 2010 models were limited to the model's indicators and structural weights, the modelling process in 2011 led to a

¹ In SEM, there are certain terms that have similar, if not identical definitions. The term latent variable is one such example, and can sometimes be used interchangeably with the following terms: factor, component, unobserved variable. For the purposes of the current 2022 model, latent variables can be further distinguished as being either the foundational management drivers, the building block (workplace function) drivers, or one of the engagement characteristics (specifically the BC Public Service Commitment outcome latent variable that comprises a third of employee engagement). It should be noted that both the Job Satisfaction and Organization Satisfaction engagement characteristics each consist of only a single observed variable (i.e., question), and therefore, are not technically unobserved variables.

more substantial set of adjustments. In addition to refinements to the model's set of indicators and structural weights, the 2011 model analysis included the introduction of an entirely new driver, and the replacement of a driver with an improved alternate driver.

Model Evolution

Between 2006 and 2011, SEM analysis was typically completed after the main reporting cycle. Therefore, any associated model changes were not incorporated into reporting until the next survey cycle. As the model was remarkably stable over the years, this after-the-fact model confirmation did not present any problems. However, in 2011, significant potential changes to the model were identified but not incorporated into that cycle's main reporting, as the timing of the SEM analysis occurred months after the reporting period. As a result, ahead of the following cycle in 2013, BC Stats improved internal workplace efficiencies in order to conduct the SEM analysis before the next reporting period began. This change made it possible to incorporate the refined model into all 2013 reporting.

Since 2015, BC Stats has conducted the SEM analysis before the reporting period to allow for any potential model changes to be incorporated. The changes discovered in the previous year's engagement model were tested and confirmed and further refinements were made for 2015. In 2018, the model did not undergo any significant changes, as the existing model was determined to remain valid for that cycle. In 2020, additional changes were made to the model, and included in that cycle's reporting.

Off-Cycle Explorations

In the off-cycle period between 2018 and 2020, exploratory analysis was completed on all non-model questions to determine whether additional question items could be pulled into the model. From this analysis, BC Stats identified several potential future updates for the existing model. This exploration also led to the removal of 14 survey questions from the 2020 survey that did not have (or no longer had) any potential benefit to the Engagement model.

BC Stats determined that these potential model updates should be implemented over successive cycles in order to balance model fit, comparability over time, and acceptance of change. New questions with the potential to be used in future model updates were also gradually introduced to the survey in 2020 and again in 2022. Using SEM, BC Stats identified and tested potential

updates to drivers ahead of both the 2020 and 2022 cycles, before confirming these updates and incorporating them into each cycle's engagement model.²

This pre-survey testing was more elaborate and exploratory in nature than the confirmatory testing typically done post-survey. Because of this off-cycle testing, the SEM analysis for 2020 and 2022 was simplified. Instead of testing each proposed change individually from the baseline "default" model, the anticipated/hypothesized changes were added one after the other, starting from the "base" of the model to the top.

This report provides a summary of the 2022 SEM analysis and model updates. As the modelling process in 2022 occurred before any other analysis or reporting, the identified updates to the previous year's engagement model were successfully able to be tested and confirmed. As well, additional refinements were possible. This report includes a discussion of the results from the preliminary analysis, driver analysis, and the structural equation modelling. It should be noted that these analyses were conducted, start to finish and in this order, twice. The first time was with initial survey data (pulled one week into fielding the WES); the second time was with the final WES data. Unless otherwise noted, results presented in this report relate to the final WES data.³

For a fulsome description of model changes from 2006 to the present, see Appendix C: Model Changes Over Time.

Future Updates

To ensure that future updates to the model are supported by available data, BC Stats has adopted an update schedule that requires confirmatory testing on two cycles of results before a change is made. In practice, BC Stats expects to perform the first test in pre-survey testing using the previous cycle's data, and if successful, will test again both with initial and post-survey data to confirm fit. As a result, newly added survey questions must remain outside of the model for at least one cycle before they can be considered for model inclusion.

² BC Stats plans to test the last of the proposed changes identified in the 2020 exploratory analysis for the next cycle scheduled in 2024.

³ The initial data included 14,198 respondents, and the final WES 2022 data contained responses from 24,485 employees (i.e., the final WES 2022 reported respondent count).

Sample Characteristics

In the vast majority of survey-based research, the sample frame plays a critical role in determining the final composition and distribution of the response data. Given the considerable scope of the 2022 target population, it was possible to obtain a large sample with even a moderate completion rate. However, while large samples can improve the accuracy of many statistical analyses, they are still subject to response bias and sampling error. As such, consideration was given to the 2022 sample characteristics prior to advancing the higher-level analyses. Provided below is a description of the relevant summary statistics, completion rates and response rates for 2022.

Sample Size, Completion Rate and Response Rate

The in-scope population for the 2022 consisted of 30,696 employees, from which a total of 24,485 respondents completed the survey. Given the high response rate (80%), as well as the large overall sample size ($n = 24,485$), the resulting margin of error for the overall BC Public Service was, as to be expected, quite small ($\pm 0.3\%$, 19 times out of 20).⁴ For many of the organizations in the BC Public Service, similarly small error terms were observed, with Forests, Lands, Natural Resource Operations and Rural Development providing the smallest organization-level margins of error ($\pm 0.7\%$, 19 times out of 20), and Tourism, Arts, Culture and Sport providing the largest ($\pm 4.3\%$, 19 times out of 20).

Organization survey completion rates varied from a low of 66% to a high of 91%.

While the ratio of sample size to population size (defined here as completion rate) played an important role in determining the margin of error for a given sample, the size of an organization's sample and population had the greater impact on the final margin of error.⁵ As a result, organizations with high completion rates but smaller populations, such as Office of the Premier (90% completion rate), resulted in a higher margin of error than did larger organizations with noticeably smaller response rates, such as Public Safety and Solicitor General (66% completion rate). For this reason, the need for high completion rates is even more critical when considering the representativeness of results for smaller organizations.

⁴ This assumed a proportion of 50% for the estimate of interest, which in turn provided the largest standard error (and therefore largest margin of error) for a given sample and population size. As the error calculations were based on the full sample size, the actual margins of error for each survey question will be somewhat higher due to the incidence of 'Don't Know' and 'Not Applicable' responses.

⁵ This assumes a finite population where the sample size exceeds 10% of the population from which it was taken.

In terms of question specific response trends for the 24,485 respondents who completed the survey, a consistently high response rate was maintained throughout the majority of survey question items. Response rate is defined as the number of respondents who provided a measurable response to a particular survey question (i.e., did not respond with ‘Not Applicable’ or ‘Don’t Know’) divided by the total sample of respondents who completed the survey.

Focusing specifically on the survey’s 74 agreement scale questions, a high response rate of 99.9% was obtained for the question “*I am treated respectfully at work*”, 99.8% for both “*I have positive working relationships with my co-workers*”, and “*Overall, I am satisfied in my work as a BC Public Service employee*”, and 99.7% for eight questions (e.g., “*My workload is manageable*” and “*I am inspired to give my very best*”). Conversely, the question “*I have seen improvements in my current workplace since the last Work Environment Survey*” had the lowest proportion of responders across all of the 74 agreement scale questions, with a response rate of only 69.7%.

Only 69.7% of respondents answered a question about observed workplace improvements since the last WES.

As response rates for the majority of questions was close to 100%, their associated margins of error are similar to that of the overall completion rate. Due to this relationship, low response rate questions can lead to margins of error that are inflated beyond what would be obtained based purely on the sample of respondents who completed the survey. However, it should be noted that in 2022 this discrepancy was only slight, as even the questions with ‘low’ response rates produced nearly census level response rates. Table 1 provides the 10 agreement scale questions with either the highest or lowest response rates, as well as their corresponding 95% margins of error.⁶

TABLE 1: TOP 5 AND BOTTOM 5 RESPONSE RATE QUESTIONS FOR THE BC PUBLIC SERVICE

RESPONSE RATE RANK	QUESTION	RESPONSE RATE	95% MARGIN OF ERROR (±)
Top 5 Response Rates	1 I am treated respectfully at work.	99.9%	0.3%
	2 I have positive working relationships with my co-workers.	99.8%	0.3%
	3 Overall, I am satisfied in my work as a BC Public Service employee.	99.8%	0.3%
	4 The work I do gives me a sense of accomplishment.	99.7%	0.3%

⁶ As margins of error provide an indication of how certain we can be that estimates based on a sample represent the population from which the sample is drawn, the margins of error reported in this table were based on the total population of in-scope employees for 2022 (N = 30,696) rather than the total sample of respondents who completed the survey (n = 24,485). This represents the finite population adjustment factor that was applied to the differing sample totals for each of the 74 agreement scale survey questions.

RESPONSE RATE RANK	QUESTION	RESPONSE RATE	95% MARGIN OF ERROR (±)
5	My job is a good fit with my skills and interests.	99.7%	0.3%
Bottom 5 Response Rates	70 The non-computer based tools (e.g., office or outdoor equipment) I have access to help me excel in my job.	89.2%	0.4%
	71 My work unit takes steps to ensure that critical knowledge is retained when employees leave.	86.9%	0.4%
	72 Executives in my organization follow through with their commitments.	86.4%	0.4%
	73 Executives in my organization act ethically (e.g., demonstrate honesty and integrity in their work).	86.3%	0.4%
	74 I have seen improvements in my current workplace since the last Work Environment Survey.	69.7%	0.5%

Sample Weighting

For many surveys, sampling bias can have a considerable impact on both the analysis and interpretation of survey results. In instances where a sample has not been proportionately drawn from a population, there is a possibility that the disproportionate characteristics of the sample may distort some or all the research findings. Weighting procedures provide a means of correcting for this bias, and in doing so help ensure survey results are representative of the population being investigated. Unfortunately, the incorporation of sample weights can also complicate the interpretation of results, particularly for surveys that are primarily used for benchmarking purposes.

In the case of WES, the increase or decrease of an un-weighted mean score represents an easily understood change in the work environment. Due to the scope of the survey, this change can be tracked across several levels of resolution, including corporate, organizational, divisional, and work unit levels. In all cases, the mean scores are generated by a simple average of the scores for all respondents within a particular group. With the introduction of weights, however, scores for each individual are adjusted to meet the specifications of the weighting scheme. The result is a set of synthetic scores for all respondents, where an employee's contribution to a particular level of analysis may either exceed or fall below their corresponding un-weighted scores.⁷

⁷ This distortion could become particularly pronounced at the work unit level, where a sum of weights within the work unit may in some instances exceed the total population of the work unit. While a work unit level weighting adjustment would address this concern, due to the small size of many work units, the adjustment would become prohibitively complex. It would also run the risk of over stratifying the sample, which in turn could lead to an inflated weighted margin of error for the overall corporate results.

From a respondent's point of view, this weighting adjustment could be difficult to contextualize. Whereas the calculations and longitudinal changes for an un-weighted mean score can be easily understood by many public servants, it is likely that a weighted score would be both poorly understood and widely misinterpreted. This would not only reduce the utility of WES as an educational tool, but also the ownership respondents have for their results.

Fortunately, the high response rate for 2022 helped minimize the impact of sampling bias for groups across the BC Public Service. In cases where an entire organization, division or work unit completed the survey, then sampling bias was eliminated, and a completely representative sample was ensured. As a result of these considerations, sample weights were not incorporated into any level of modelling analysis for 2022. However, if response rates sharply decrease for future iterations of the survey, then the benefits of sample weighting may be revisited.

Preliminary Analysis

For the 2022 reporting year, a preliminary model analysis was conducted in order to determine more clearly which areas of the model would benefit from potential updates, as well as which questions would provide the most suitable measures for employees' perceptions of the work environment.

The primary goal of a SEM preliminary analysis is to identify which survey questions best support the modelling process. While all of the survey questions in the 2022 questionnaire offered excellent insights into a respondent's work environment, sometimes the wording and scale of a question can limit its interaction with other questions in the survey, which in turn reduces its usability during a SEM analysis. To determine which questions would be excluded from further analysis, a systematic examination should be performed across all survey questions.

This question filtering process included the following three steps:

- Review the response scales for each question and determine the need for scale transformations
- Consider the distribution and response characteristics for each question
- Test the assumptions between certain questions through a correlation analysis.

For clarity, it should be noted that throughout the report, questions that were removed from the previous 2020 model will be considered under the status "not in model" and questions that were added to the 2022 model are considered under their specific drivers.

Survey Scale Transformation

As variance-covariance matrices play a central role in SEM analysis, questions with a larger range of values, and therefore greater variance, tend to produce clearer results. Based on this premise, the response data for all 5-point agreement questions in the survey were linearly converted to a 100-point scale prior to the generation of the variance-covariance matrix. This process is known as a percent to maximum conversion (PMT) and is based on the work of

Survey data was transformed from a 5-point scale to a scale from 0 to 100 points.

Miller and Miller.⁸ The result is a set of response data that can be analyzed under SEM, while also providing a range of values that can be easily standardized and interpreted.⁹ By design, all scale questions in the 2022 survey contained 5 points, which allowed for PMT conversion.¹⁰

One final consideration with regards to scale transformation is that it is sometimes necessary to invert the scale for certain questions.¹¹ All of the agreement scale questions in 2022 were oriented in the same direction (Strongly Disagree was the lower end of the scale and Strongly Agree was the higher end); thus, it was not necessary to invert any of the questions.

Data Screening

By generating a comprehensive set of descriptive statistics for each of the 5-point scale questions, it is possible to identify questions that have potential data quality issues. If a question is found to have data quality issues, it can be flagged as presenting a potential modelling challenge and treated with caution throughout the modelling process. Alternately, if the data quality issues are severe enough, the question can be removed entirely from subsequent steps of the analysis.

The statistics of interest when assessing data quality should focus on the distribution of responses for each question and include measures of skewness, kurtosis, and measures of central tendency. Supporting these statistics is the inclusion of response rate and non-response trends, which provide a more complete picture of the distributions for each question.

Data screening typically includes assessing the normality of the data, missing responses, and relationships between questions.

⁸ Miller, T.I. & Miller, M.A. (1991). Citizen surveys: how to do them, how to use them and what they mean. Washington: International City/Country Management Association.

⁹ It should be noted that the converted scores also appear in the standard WES reports. While the use of the converted scores in the reports are intended to reflect the underlying structure of the engagement model, the 100-point scale provides an additional advantage in that it can be easily interpreted and applied for benchmarking purposes.

¹⁰ A limitation of the conversion is that it should only be performed on scale questions with at least five intervals to allow for a sufficient amount of variance for SEM analysis. In addition to the 74 agreement scale questions, the 2022 questionnaire contained 11 demographic questions, three special topic questions on working from home, and two open ended questions. While it is possible to introduce demographic categorical variables into a SEM analysis, for the purposes of the 2022 model analysis, the measurement model was limited to the agreement scale questions.

¹¹ Scale inversion is required when the positive and negative ends of a scale are in opposition to the majority of other scale questions throughout a survey. An inverted scale may complicate the creation of model drivers and the interpretation of model results. Therefore, aligning any inverted and non-inverted scales facilitated analysis of all survey questions.

Normality of distributions (i.e., skewness and kurtosis)

One of the assumptions implicit to SEM analysis is that the data being modelled is normally distributed, as well as multivariate normally distributed.¹² Violations of these normality assumptions can result in either inflation of the model chi-square statistic, or distortion of other model fit indices. The distortion of these indices in turn can have a significant impact on the interpretation of a model's fit. As a result, identification of non-normal distributions is critical for determining which survey questions should or should not be used in the SEM analysis.

The criteria for flagging problematic response distributions are based on measures of skewness, kurtosis, and mode. If a distribution has an absolute skewness value greater than two, the question's distribution should be noted as problematic. Similarly, absolute kurtosis values greater than two can also be used to identify non-normal distributions. With respect to a distribution's mode, in cases where the mode is at the end point of the response scale (0 or 100 points), the question and its distribution should be flagged as a potential concern.

Assessing the normality of 2022 data

Focusing on the response distributions for the 2022 data, 35 of the 74 agreement scale questions in the survey were found to have potentially problematic distributions for analysis. Of the 35 questions, 34 were found to have a mode of 100, indicating that the majority of respondents strongly agreed with the questions' statement. Conversely, the one other question was found to have a mode of zero, pointing to a trend in which the majority of respondents strongly disagreed with the question's statement.

While all of the 35 questions had modes that pointed to potential non-normal distributions, the actual skewness and kurtosis measures suggested that the distributions were acceptable. Five questions (*"The person I report to supports me and my co-workers in conducting our work in an ethical manner"*, *"Employees in my work unit are clear on the ethical values expected in performing their work."*, *"I am treated respectfully at work."*, *"The person I report to maintains high standards of honesty and integrity."*, and *"I have positive working relationships with my co-workers"*) had either a skewness or kurtosis value which exceeded the recommended threshold (i.e., an absolute value of 2). A review of the response histograms for the questions with kurtosis and/or skewness values of more than |1| indicated that values were generally due to the narrow distribution of responses around these questions' modes.

¹² Normal distributions have a symmetric bell curve and relate to the central limit theorem where mean=median=mode. Multivariate normal distributions are similar but for multiple variables. The mean vector of the variables is normally distributed (e.g., for 2-variable distribution, there would be a 3D bell curve), and any linear combination of those variables would also be normally distributed, and any subset of those variables would be multivariate normally distributed.

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A summary of the distribution measures for the 35 questions with distribution concerns is provided below in Table 2.

TABLE 2: QUESTIONS WITH DISTRIBUTION MODES OF ZERO OR ONE HUNDRED

MODEL STATUS	QUESTION	MODE	SKEWNESS	KURTOSIS
Respectful Environment	A healthy atmosphere (e.g., trust, mutual respect) exists in my work unit.	100	-1.20	0.72
	My work unit values diversity in people and backgrounds.	100	-1.39	1.64
	My work unit values diversity in ideas.	100	-1.06	0.50
	My work unit is free from discrimination, bullying and harassment.	100	-1.36	1.04
Empowerment	I have opportunities to provide input into decisions that affect my work.	100	-0.94	0.08
Staffing Practices	In my work unit, the process of selecting a person for a position is fair.	100	-0.78	-0.47
Pay & Benefits	My pay is competitive with similar jobs in the region.	0	0.24	-1.11
Job Suitability	My work is meaningful.	100	-1.06	0.64
	My job is a good fit with my skills and interests.	100	-1.12	0.88
Stress & Workload	I have support at work to balance my work and personal life.	100	-0.91	-0.01
Teamwork	I have positive working relationships with my co-workers.	100	-1.64	3.08
	When needed, members of my team help me get the job done.	100	-1.45	1.98
	Members of my team communicate effectively with each other.	100	-1.06	0.60
Supervisory-Level Management	The person I report to provides clear expectations regarding my work.	100	-1.12	0.58
	The person I report to consults me on decisions that affect me.	100	-1.15	0.42
	I feel I am able to have a conversation with the person I report to when I need their perspective or advice.	100	-1.60	1.87
	The person I report to leads with an understanding of others' perspectives.	100	-1.28	0.78
BC Public Service Commitment	I would prefer to stay with the BC Public Service, even if offered a similar job elsewhere.	100	-0.68	-0.46
Not in model	My workplace is a place where I can be myself.	100	-1.06	0.44

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MODEL STATUS	QUESTION	MODE	SKEWNESS	KURTOSIS
Not in model	Employees in my work unit are clear on the ethical values expected in performing their work.	100	-1.48	2.06
	If I experience or learn about an ethical issue at work, I know where I can go for help.	100	-1.41	1.44
	Innovation is valued in my work.	100	-0.78	-0.26
	I am inspired to give my very best.	100	-0.79	-0.31
	In my work unit, the selection of a person for a position is based on merit.	100	-0.75	-0.56
	I enjoy the type of work I do.	100	-0.98	0.54
	Where feasible, my work unit supports flexible work arrangements (e.g., adapted work schedules, working from home or an alternate work location, etc.).	100	-1.15	0.30
	The necessary processes and procedures are in place to ensure my safety at work.	100	-1.23	1.17
	The person I report to provides the guidance I need to do my job well.	100	-1.10	0.29
	Performance feedback from the person I report to helps me develop my career.	100	-0.81	-0.36
	I am treated respectfully at work.	100	-1.58	2.25
	The person I report to promotes employee mental health and well-being in the workplace.	100	-1.36	1.10
	The person I report to maintains high standards of honesty and integrity.	100	-1.72	2.51
	The person I report to supports me and my co-workers in conducting our work in an ethical manner.	100	-1.74	2.83
	I am satisfied with the quality of supervision I receive.	100	-1.30	0.78
	Executives in my organization act ethically (e.g., demonstrate honesty and integrity in their work).	100	-1.01	0.33

It should be noted that many of the questions in Table 2 do appear in the 2022 engagement model. While the inclusion of these questions (and the drivers they measure) in the model provide a more comprehensive representation of the work environment, they also introduce several modelling challenges. Taken on their own, questions with non-normal distributions are able to produce reasonable, if not entirely ideal, model results. However, several non-normal questions in combination can have a more drastic impact on model results, and potentially violate one of the underlying assumptions of SEM.

To assess whether the combination of individual non-normal questions leads to multivariate normality challenges across the entire set of model questions, it is necessary to evaluate the questions within the context of the model. As this goes beyond the more basic examination that is performed in the preliminary analysis step, discussion of the specific tests used to assess multivariate normality will be deferred to the Structural Equation Modelling Analysis section.

Missing responses

The response rate for survey questions are frequently impacted by their wording and response options. If the wording of a question is confusing or only applies to a limited subset of the survey sample, many respondents may be inclined to answer the question with ‘Don’t Know’ or ‘Not Applicable’. Depending on the proportion of respondents who answer in this way, the missing responses can have a significant effect on the resulting response distributions. If the rate of missing responses is large enough for certain questions, it then becomes necessary to examine whether the ‘missingness’ of data is entirely random or depends on the characteristics of the respondents. In the event that the data is not missing completely at random (MCAR), then concerns of representativeness and response bias become an important consideration.

Using a missing response rate criterion of 10%, the percentage of missing data should be reviewed for all survey questions. Questions that have a cumulative missing response rate (i.e., including both ‘Don’t Know’ and ‘Not Applicable’ responses) of 10% or higher can then be flagged as having potential bias concerns.

In the case of the 2022 responses, six agreement scale questions were found to have a missing response rate that exceeded 10%. The question with the highest missing response rate (30.3%) was: *“I have seen improvements in my current workplace since the last Work Environment Survey.”*. Due to the high rate of ‘Don’t Know’ and ‘Not Applicable’ responses for this question, it was excluded from further analysis. This led to a total of 73 agreement scale questions used in further analysis.

A summary of the missing rates for the six questions is provided below in Table 3.

TABLE 3: QUESTIONS WITH MISSING RESPONSE RATES THAT EXCEED TEN PERCENT

MODEL STATUS	QUESTION	MISSING RATE
Tools & Workspace	The non-computer based tools (e.g., office or outdoor equipment) I have access to help me excel in my job.	10.8%
Staffing Practices	My work unit takes steps to ensure that critical knowledge is retained when employees leave.	13.2%
Executive-Level Management	Executives in my organization follow through with their commitments.	13.6%

MODEL STATUS	QUESTION	MISSING RATE
Not in model	In my work unit, the selection of a person for a position is based on merit.	10.1%
	Executives in my organization act ethically (e.g., demonstrate honesty and integrity in their work).	13.7%
	I have seen improvements in my current workplace since the last Work Environment Survey.	30.3%

Pearson R correlations between questions

Up to this point in the preliminary analysis, each question was analyzed on its own in order to filter out any questions that could be deemed incompatible with SEM analysis. However, the primary focus of SEM analysis is the relationships between questions. As such, a preliminary analysis of the relationships between questions can be useful to begin developing the framework of the engagement model.

To this end, a comprehensive correlation matrix was generated to examine the relationships between all the questions that are being explored. As SEM requires questions to have at least a moderate connection with each other, correlation coefficients provide a clear indication as to whether a linear relationship exists between two questions. Due to this requirement, questions with either extremely low or non-existent correlations with all other questions should be flagged as potentially incompatible with SEM analysis.

While the correlations amongst questions should be sufficiently strong in order to identify clear relationships between driver and indicators, correlations that are too strong pose a separate challenge. The main difficulties with having overly strong correlations tend to emerge in the driver analysis stage. If correlations are too high, then it becomes unclear whether questions that have been found to group well together into a driver (i.e., latent variable) do so because they measure distinct, but related concepts of a shared construct, or if they are actually measuring the same concept. Unfortunately, this redundancy between questions, known as multicollinearity, does not provide a meaningful advantage to SEM analysis and in some instances can compromise the ability to interpret model estimates and indices. As a result, questions with extremely high correlations should be flagged as potentially problematic for both the driver analysis and SEM stages.

Identifying relationships among the 2022 questions

Turning to the 2022 results, a correlation matrix was generated by correlating each of the remaining 73 agreement scale questions with one another. The result was a large table containing 5,329 correlation coefficients (R) and a total of 2,628 unique question combinations. Due in large part to the considerable sample size obtained in 2022, all of the coefficients in the

matrix were found to be positive and significant at the 0.01 level.¹³ A review of the size of the coefficients revealed no R values less than 0.174, suggesting that every question in the survey had at least a small, yet measurable relationship with all other questions in the survey.

For context, perfectly correlated questions produce a value of 1.000, which we always see on the diagonal of the correlation matrix because these are the same questions. Off-diagonal questions that show results close to 1 would indicate that we are measuring the same construct within the survey.

In terms of very high correlation coefficients, numerous question combinations were found to have strong relationships, with 39 question combinations producing coefficients greater than or equal to 0.800, one of which resulted in coefficients greater than 0.900.

From the perspective of the engagement model, eight of the 39 question combinations reflect relationships that exist within the model. In every case, the eight highly correlated model relationships occur between questions that are grouped together in the model's drivers rather than the structural relationship that exist between drivers. The implication is that the drivers with highly correlated indicators may be subject to multicollinearity issues and as a result, complicate the interpretation of the model's estimates and measures of model fit.

Eight of 39 question combinations with very high correlation coefficients ($R > 0.800$) are found within the engagement model.

These correlation coefficients can be reviewed when exploring potential changes to a driver. When a driver is considered for expansion, these coefficients can be used to help identify which non-model questions might be suitable to add to the driver (i.e., questions with correlation coefficients that are neither too high nor too low with existing questions within the driver). Should a non-model question with high correlation coefficients to existing questions be targeted for addition, a best practice would be to either remove the highly correlated question(s) first, or to anticipate potential multicollinearity issues.

For the sake of clarity, portions of the completed correlation matrix have been isolated and reproduced in this report to better illustrate which question combinations produced the highest correlation coefficients. These have been summarised in a series of sub-matrices presented in Appendix A: High Correlations & Model Variations.

¹³ Correlations were performed using a bivariate Pearson's R, with a two-tailed significance test at the $p > 0.01$. It should be noted that, even with the relatively strict significance level, some correlations may have exceeded the maximum probability-value of 0.01.

Driver Analysis

While the preliminary analysis helps identify which questions are potentially problematic for SEM, further testing is necessary in order to gauge the compatibility of the model. In order to ensure that underlying questions within drivers are the best fit, reliability analysis is conducted to confirm that related questions are measuring the same concept, while multicollinearity analysis is conducted to confirm that the questions are not redundant.¹⁴

In 2022, reliability and multicollinearity were checked selectively, that is, only for the drivers that were considered for refinement. This included the Executive-Level Management, Staffing Practices, and Job Suitability drivers.

SEM literature recommends that latent variables be comprised of at least two indicator variables, but ideally three or more.¹⁵ However, it is important to consider limits on how many more are acceptable. Although SEM provides a powerful tool for explaining the predictive relationships of questions, the usefulness of SEM is compromised when models become unnecessarily complicated. This means that it can be useful to limit the number of questions for reasons of parsimony.¹⁶ Therefore, when evaluating the Engagement model, BC Stats gives preference to constructing latent variables comprised of between three to five observed variables. BC Stats takes this into consideration when proposing reductions or additions to existing drivers, or when exploring potentially new drivers.

Conducting the Reliability Analysis

The internal consistency of each latent variable can be examined through the application of a Cronbach alpha analysis. The Cronbach alpha is an indicator of how well a group of questions measure a single construct. Typically, alpha values of 0.7 or greater represent a unidimensional construct, whereas values of less than 0.7 suggest that a group of questions is measuring a multidimensional construct. In the event that the questions in a latent variable produce an alpha value of less than 0.7, the latent variable should be flagged prior to beginning SEM analysis. The

¹⁴ In previous years, additional testing was explored, namely exploratory factor analysis through principal components analysis (PCA). In 2022, PCA was not conducted. For more information, see Exploratory Factor Analysis (Appendix B: Historical Testing Methods).

¹⁵ Garson, G. D. (2012). *Structural Equation Modeling*. Asheboro, NC: Statistical Associates Publishers.

¹⁶ Within the context of SEM, parsimony refers to the relative complexity of a model. When comparing similar models, simpler models (i.e., more parsimonious) are preferred over more complex models. As a model's complexity is typically defined by its degrees of freedom (df), models with fewer parameters and/or questions are considered to be more parsimonious.

flagged latent variable can then be subjected to a higher degree of scrutiny during the modelling phase, to help minimize the impact of internally inconsistent questions on the final model.

The reliability analysis also provides an Inter-Item Correlation Matrix, which gives a sense of the relationship among questions as to whether they are measuring the same construct. Ideally, the values in this matrix should exceed 0.4.

Finally, the Cronbach Alpha if Item Deleted values are observed. If the Cronbach alpha would increase when a given question was removed from the latent variable, this indicates that the removal of the question may be beneficial to the model, and that this possibility should be considered before moving to SEM.

Conducting the Multicollinearity Analysis

Multicollinearity provides an indication of how closely two or more predictor variables are correlated. While models with high multicollinearity values don't necessarily lose overall predictive power, individual relationships between questions and latent variables can be compromised due to question redundancy or overlap. The decision rules for multicollinearity checks are based on two criteria: tolerance ≥ 0.20 and variance inflation factors (VIF) ≤ 4.0 .

Within the context of WES, multicollinearity can be tested at a broad level, such that the analysis takes into account the engagement model, as well as a more specific level that only takes into account the relationships between particular drivers. When testing for multicollinearity across the engagement model, or drivers with a less studied relationship, three options are available. The first option involves regressing proposed model questions against Job Satisfaction as an outcome variable. The second multicollinearity check regresses proposed model questions against Organization Satisfaction. The third multicollinearity check regresses proposed model questions against BC Public Service Commitment as the outcome. If any of these checks produce a problematic tolerance and/or VIF value for a particular question(s), then further consideration is given to the potentially redundant questions. If the redundancy is substantial, then the removal of the question is considered prior to beginning SEM.

When a clear relationship is known to exist between certain drivers, a more fine-grained multicollinearity check should be performed. In this case, the dependent variable for the regression is the particular driver with the given relationship. As with the high-level check, the independent variables are the questions being tested for multicollinearity. However, for this check, the set of questions being tested for redundancy should not include all proposed model questions, but instead, a small subset of questions (i.e., proposed driver questions). The primary requirement in this instance is that a clearly established, unidirectional relationship should exist between the sub-set of questions being tested for multicollinearity and the outcome driver.

Results of the Driver Analysis

In 2022, there was interest in enhancing the model by improving existing drivers in three specific areas:

1. **Executive-Level Management** – This driver was comprised of two question items prior to conducting the analysis. It was hypothesized to add one question about commitment follow-through to enhance and expand the existing Executive-Level Management driver.
2. **Staffing Practices** – This driver was comprised of two question items prior to conducting the analysis. It was hypothesized to remove one highly correlated question and replace it by adding two more specific questions. These questions were theorized to provide a new dimension to the existing Staffing Practices driver.
3. **Job Suitability** – This driver was comprised of two question items prior to conducting the analysis. It was hypothesized to add one question about accomplishment to enhance and expand the existing Job Suitability driver.

The following section offers a detailed overview of how the above three proposed changes were tested through the Driver Analysis.

Expanding the Executive-Level Management driver

Since inception, the Executive-Level Management driver has typically been comprised of two questions relating to direction and communication by Executive. An expansion of the existing driver questions was explored by adding one question about commitment follow-through (Table 4).

TABLE 4: EXECUTIVE-LEVEL MANAGEMENT – PROPOSED DRIVER REVISIONS

EXISTING DRIVER QUESTIONS	PROPOSED DRIVER QUESTIONS
Executives in my organization provide clear direction for the future.	Executives in my organization provide clear direction for the future.
Executives in my organization communicate decisions in a timely manner.	Executives in my organization communicate decisions in a timely manner.
	Executives in my organization follow through with their commitments.

An exploration of the 2022 data was performed to assess whether the existing Executive-Level Management driver could be expanded by one question. A reliability analysis of the newly proposed four-question driver had a high Cronbach alpha of 0.951. The Cronbach's Alpha if Item Deleted values ranged from 0.921 to 0.933, indicating that removing any other questions would

not be an improvement. The three proposed questions were put into an Inter-Item Correlation Matrix and were strongly correlated with each other (ranging from 0.853 to 0.875).

Due to the presence of these strong correlations, a multicollinearity check was performed to confirm whether redundancy existed between the remaining questions in the proposed Executive-Level Management driver. Within the context of the engagement model, Executive-Level Management has the strongest impact on the Vision, Mission & Goals driver. For this reason, both the existing driver composition and the proposed driver composition were regressed separately against the Vision, Mission & Goals driver in order to assess multicollinearity issues. As shown in Table 5 below, the result of the multicollinearity check confirmed that one or more overlaps existed among questions in both the existing and proposed driver configurations.¹⁷

TABLE 5: COLLINEARITY MEASURES FOR EXISTING AND PROPOSED EXECUTIVE-LEVEL MANAGEMENT DRIVER

QUESTION	TOLERANCE (EXISTING)	TOLERANCE (PROPOSED)	VIF (EXISTING)	VIF (PROPOSED)
Executives in my organization provide clear direction for the future.	0.242	0.198	4.126	5.060
Executives in my organization communicate decisions in a timely manner.	0.242	0.177	4.126	5.661
Executives in my organization follow through with their commitments.	N/A	0.205	N/A	4.867

The existing Executive-Level Management Driver displayed VIF issues. When the commitment follow-through question was added in the proposed driver composition, tolerance dropped slightly below the threshold and VIF issues remained. Despite the possibly negative impact observed from the proposed expansion of the driver, BC Stats deemed the overall value of expanding the driver to three question items to outweigh the potential drawbacks, and it was recommended to test this driver update in SEM.

Modifying the Staffing Practices driver

Historically, the Staffing Practices driver was comprised of two questions about the process and selection of employees being fair and merit-based within work units. A modification of the existing driver questions was explored. This included the removal of one question and the addition of two others (Table 6).

¹⁷ In this section, all collinearity tests used acceptable threshold criteria for tolerance values ≥ 0.20 , and for VIF values ≤ 4.0 . Questions are sorted in each table from lowest to highest by existing VIF values.

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TABLE 6: STAFFING PRACTICES – PROPOSED DRIVER REVISIONS

EXISTING DRIVER QUESTIONS	PROPOSED DRIVER QUESTIONS
In my work unit, the process of selecting a person for a position is fair.	In my work unit, the process of selecting a person for a position is fair.
In my work unit, the selection of a person for a position is based on merit.	
	In my work unit, the best person with the right skills is hired for the job.
	My work unit takes steps to ensure that critical knowledge is retained when employees leave.

An exploration of the 2022 data was performed to assess whether the existing Staffing Practices driver could be modified with the proposed changes. A reliability analysis of the newly proposed three-question driver had a high Cronbach alpha of 0.888. The Cronbach's Alpha if Item Deleted values ranged from 0.773 to 0.937. The increase in alpha would occur when the retention question was removed. It was not desired to revert to a two-question driver again, so this question remained in the analysis.

The three proposed questions were put into an Inter-Item Correlation Matrix and were strongly correlated with each other (ranging from 0.630 to 0.882). These were all deemed acceptable as they surpass the 0.40 threshold.

Due to the presence of a higher correlation, a multicollinearity check was performed to confirm whether redundancy existed between the questions in the proposed Staffing Practices driver. Within the context of the engagement model, Staffing Practices has the strongest impact on the Respectful Environment driver. For this reason, both the existing driver composition and the proposed driver composition were regressed separately against the Respectful Environment driver in order to assess multicollinearity issues. As shown in Table 7 below, the result of the multicollinearity check confirmed less overlap existed between questions with the new driver makeup.

TABLE 7: COLLINEARITY MEASURES FOR EXISTING AND PROPOSED STAFFING PRACTICES DRIVER

QUESTION	TOLERANCE (EXISTING)	TOLERANCE (PROPOSED)	VIF (EXISTING)	VIF (PROPOSED)
In my work unit, the process of selecting a person for a position is fair.	0.190	0.220	5.259	4.554
In my work unit, the selection of a person for a position is based on merit.	0.190	N/A	5.259	N/A
In my work unit, the best person with the right skills is hired for the job.	N/A	0.202	N/A	4.939
My work unit takes steps to ensure that critical knowledge is retained when employees leave.	N/A	0.549	N/A	1.823

The existing Staffing Practices had issues with both the tolerance and VIF. The updated driver reduced the tolerance issues, and had one acceptable VIF, and the others moved closer to an acceptable threshold. Given that the two questions in the existing driver composition about fair process and merit-based selection were found to be highly correlated, removing the merit-based question appeared to have the most positive impact. Expanding the driver to be comprised of more than two questions was also deemed preferential based on internal research and ongoing program direction. As a result, the new questions in the proposed driver composition will provide new dimensions to the driver. The proposed modification of the driver met the criteria and removed a correlation issue; therefore, it was recommended to run SEM with the proposed driver composition.

Expanding the Job Suitability driver

Historically, the Job Suitability driver was comprised of two questions about employee’s perceptions of meaningful work that is a good fit with skills and interests. An expansion of the existing driver questions was explored by adding one question about feeling a sense of accomplishment in their work (Table 8).

TABLE 8: JOB SUITABILITY – PROPOSED DRIVER REVISIONS

EXISTING DRIVER QUESTIONS	PROPOSED DRIVER QUESTIONS
My work is meaningful.	My work is meaningful.
My job is a good fit with my skills and interests.	My job is a good fit with my skills and interests.
	The work I do gives me a sense of accomplishment.

An exploration of the 2022 data was performed to assess whether the existing Job Suitability driver could be expanded with the proposed changes. A reliability analysis of the newly proposed three-question driver had a high Cronbach alpha of 0.903. The Cronbach’s Alpha if Item Deleted values ranged from 0.832 to 0.886, indicating that removing the proposed question would not be an improvement.

The three proposed questions were put into an Inter-Item Correlation Matrix and were strongly correlated with each other (ranging from 0.713 to 0.796). These were all considered acceptable as they surpass the 0.40 threshold.

Although the correlations were not overly high, a multicollinearity check was performed to confirm whether redundancy existed between the questions in the proposed Job Suitability driver. Within the context of the engagement model, the Job Suitability driver has the strongest impact on the Job Satisfaction driver in the roof. For this reason, both the existing driver

composition and the proposed driver composition were regressed separately against the Job Satisfaction driver in order to assess multicollinearity issues. As shown in Table 9 below, the result of the multicollinearity check confirmed that no overlap existed between questions with either driver makeup.

TABLE 9: COLLINEARITY MEASURES FOR EXISTING JOB SUITABILITY DRIVER

QUESTION	TOLERANCE (EXISTING)	TOLERANCE (PROPOSED)	VIF (EXISTING)	VIF (PROPOSED)
My work is meaningful.	0.491	0.339	2.036	2.949
My job is a good fit with my skills and interests.	0.491	0.387	2.036	2.584
The work I do gives me a sense of accomplishment.	N/A	0.289	N/A	3.466

Both the existing and proposed questions for Job Suitability had acceptable tolerance and VIF. Similar to the Staffing Practices rationale, the new question could provide a new dimension to round out the scope of the driver and did not have a negative impact in testing. Expanding the driver to be more than two questions was also deemed preferential.

The proposed expansion of the driver met the required criteria. Therefore, it was recommended to run SEM with the proposed driver composition.

Overall Conclusions of Driver Analysis

The final recommendations regarding the three potential driver changes to the Employee Engagement Model were to consider:

- Expanding the Executive-Level Management driver by adding the question: *“Executives in my organization follow through with their commitments”*;
- Modifying the Staffing Practices driver by removing the question: *“In my work unit, the selection of a person for a position is based on merit”* and by adding two other questions: *“In my work unit, the best person with the right skills is hired for the job”* and *“My work unit takes steps to ensure that critical knowledge is retained when employees leave”*; and,
- Expanding the Job Suitability driver with the addition of the question: *“The work I do gives me a sense of accomplishment”*.

Structural Equation Modelling Analysis

SEM represents an analysis that is more confirmatory in scope. SEM provides a means of measuring causal relationships that have already been defined by theory. Therefore, prior to performing SEM analysis, the relationship between latent variables must be clearly described by pre-existing theory and empirically confirmed findings.

For 2022, confirmation of the engagement house model was achieved by incorporating 2022 data into the pre-existing 2020 SEM model. As the structure of the 2022 model was based on both empirically and theoretically established findings, the existing model offered a strong framework against which the 2022 data could be tested.¹⁸

Structural equation modelling is used to confirm pre-defined theoretical causal relationships and exploratory analysis.

Variance-Covariance Matrices

The first step in performing the SEM analysis involved the generation of a SEM-ready dataset. Typically, this takes the form of a variance-covariance matrix that contains all of the questions within the model being tested together. The rationale for using a variance-covariance matrix is that it provides a structure for all the joint probability distributions contained within the dataset. While AMOS allows for the loading of both matrices and complete datasets, only matrices were used in the 2022 analysis in an effort to minimize the processing load on the workstations due to the large size of the dataset.

Using a set of 48 five-point scale questions, three variance-covariance matrices were generated for the purposes of SEM analysis.¹⁹

1. Initial Listwise Deleted Matrix – 48 questions: The first matrix was based on an initial dataset pulled from survey data collected from the survey opening date of January 27 through to February 2 (i.e., approximately one week into fielding). This matrix employed a listwise deletion of records, reducing the sample to only those respondents who provided a scale-based response (i.e., not a 'Don't Know' or 'Not Applicable' response) to the 48 scale

¹⁸ The process is possible through AMOS, SPSS's structural equation modelling solution.

¹⁹ Only the questions in the previous 2020 model and the new proposed questions for the 2022 model were included in the listwise deleted matrices for the 2022 analysis.

questions. The listwise deletion produced a reduced model N, consisting of responses from 7,578 employees, as it was based on the initial dataset of 14,198 respondents. This matrix was used to preliminarily test drivers targeted for potential revision.

2. Full Listwise Deleted Matrix – 48 questions: The second matrix also employed a listwise deletion of records after the survey closed on February 21, reducing the sample to only those respondents who provided a scale-based response to the 48 scale questions. Compared to the initial listwise deleted matrix, the full listwise deleted matrix produced a substantially larger model N, consisting of responses from 13,116 employees, as it was based on the full dataset of 24,485 respondents. This matrix was used to confirm drivers that were revised on the initial matrix.
3. Final Listwise Deleted Matrix – 47 questions: The third matrix also employed a listwise deletion, but instead of using 48 scale questions for the deletion, the matrix was based on a reduced set of 47 model questions (i.e., one proposed question removal from a driver was confirmed and accepted in the final model). This new listwise deleted matrix produced a very slightly larger model N, consisting of responses from 13,244 employees. This matrix represents the final set of questions used in the 2022 analysis, and as a result, was obtained only after the complete SEM analysis had been conducted. For this reason, this dataset was only used as confirmation of the relationships in the final model variation and not for the preceding model refinements.

The following section presents model results based on one or more of the three listwise deleted datasets listed above.

Establishing Model Fit Criteria and SEM Requirements

BC Stats established a set of criteria to determine how well proposed models would fit the data. These criteria represent the minimum acceptable thresholds commonly used in SEM.

The fit indices of interest consisted of: relative chi square statistic (CMIN/df), significance for the chi square statistic (p), Standardized Root Mean Squared Residual (SRMR), Comparative Fit Index (CFI), Normed Fit Index (NFI), Tucker-Lewis Index (TLI), Parsimony-Adjusted Measures (PCFI), and Root Mean Square Error Approximation (RMSEA). We also monitored the drivers' standardized regression estimates (R) and squared multiple correlations (R^2) for the model's three engagement characteristics, as they collectively provided an outcome measure for the overall model. Table 10 provides the decision criteria used for all key indices and tests.

TABLE 10: CRITERIA FOR STRUCTURAL EQUATION MODELLING ANALYSIS

TYPE OF INDEX/ESTIMATE	NAME OF INDEX/ESTIMATE	CRITERIA
Absolute Fit Indices	CMIN/df	Lower the better
	p	> 0.05*
	SRMR	≤ 0.05
Baseline Comparisons	CFI	> 0.95
	NFI	> 0.95
	TLI	> 0.95
Parsimony Adjusted Measures	PCFI	Higher the better
	RMSEA	≤ 0.05
R for Drivers	Regression Weight	$p \leq 0.05$
R ² for Outcomes	Square Multiple Correlation	Higher the better

* Represents a test of non-significance

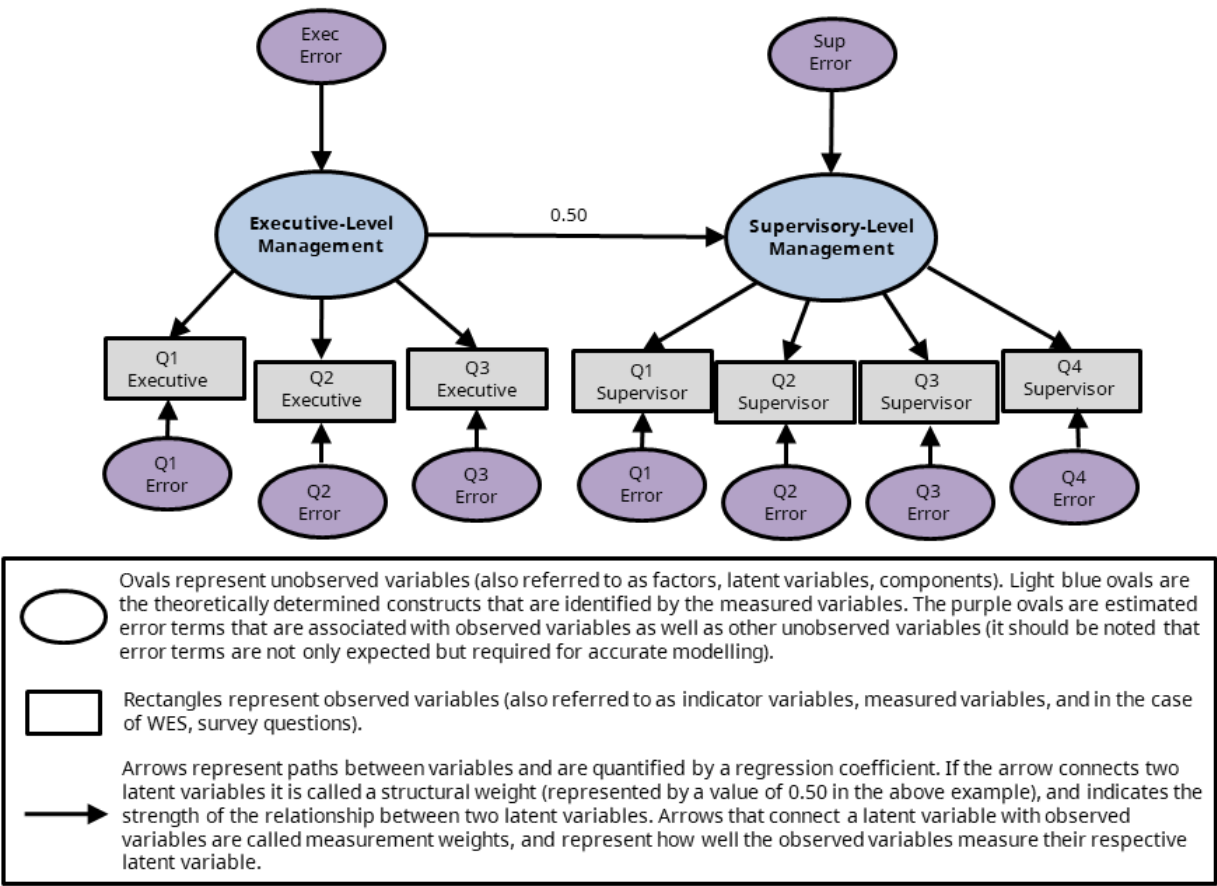
As well as the model fit criteria, the estimation method type to be used during the analysis had to be decided prior to beginning SEM analysis. Depending on the unique characteristics of a dataset (e.g., sample size, normality, etc.), a particular estimation method may be better suited than others when generating parameter estimates and/or performing fit analysis. For the 2022 data, the well-tested Maximum Likelihood (ML) estimator was determined to offer the most reliable and robust results. As the ML method has been used to analyse the model since its initial development, changes over time to the model's estimates are not a by-product of changes in the estimation method.²⁰

Understanding Structural Path Diagrams

To better understand the relationships between the engagement model's latent variables and their underlying survey questions, an example of a structural diagram is presented in Figure 1. The example diagram provides a simplified depiction of the structural relationship that exists between the Executive-Level Management and Supervisory-Level Management drivers.

²⁰ While holding the estimation method constant over time provides some confidence that the model estimates obtained each survey cycle are comparable, this assumption only holds true if the data being tested is multivariate normal, and has been multivariate normal across all cycles. Based on a high-level analysis of the data, the assumption that the 2022 data is multivariate normal may not be entirely justified. A more detailed discussion of this analysis, and its implications on the engagement model, is provided in the limitations section.

FIGURE 1: EXAMPLE DIAGRAM OF THE RELATIONSHIP BETWEEN THE TWO MANAGEMENT DRIVERS



As structural models allow for the estimation of complex causal relationships between questions, diagrams can be useful in understanding both the direction and nature of the relationships. For WES, all measurement and structural paths were assumed to be linearly related, and as such, the coefficients presented are associated with each path’s resulting linear regression equation. For a more detailed structural diagram, refer to Figure 2.

Establishing the Default 2022 Model

Based on a literature review of employee engagement research conducted in 2009, BC Stats determined that the contemporary research supported a model that is multipartite and hierarchical in structure. For the BC Public Service, the foundation of this structure is comprised of management drivers, which support workplace function drivers, which in turn impact the characteristics of engagement. While the workplace functions can have a significant impact on engagement, engagement is primarily influenced by the structure’s foundation. Acting as the house model’s building blocks, the workplace functions help support and mediate the foundation’s impact on the engagement outcomes. This in turn provides a broad and nuanced

depiction of the work environment, while also helping to explain much of the variance in the engagement outcomes.²¹

Work began on the confirmation of model fit during the 2020-2022 off-cycle period, using the 2020 data and the full 2020 house model. This work was continued in 2022 using the initial 2022 data, and the final 2022 data, both on the full 2020 house model. Since all the existing 2020 driver questions were found in the 2022 survey, the 2020 model was easily fit to the 2022 data to establish the 2022 ‘default’ model. The default model, in effect, would provide a baseline against which proposed revisions to the model for 2022 could begin to be compared.

A default model provides a baseline so that model changes can be evaluated.

Incorporation of 2022 data into the 2020 model confirmed that the three engagement characteristics and 13 foundational and building block drivers did provide reasonable measures of employee perceptions.

Once the 2022 default model was established, it became possible to test the model with a stronger focus on its parameter estimates, modification indices, and fit indices. A comparison was made between the 2022 default model and the engagement models from previous survey years. The results suggested that the 2022 default model provided a representation of the work environment that was comparable to previous iterations of the model. This conclusion was supported not only by the fit indices, but also by the amount of variance in the engagement characteristics the model was able to explain. The 2022 default model provided the highest squared multiple correlations for both Organization Satisfaction and BC Public Service Commitment. The cycle-over-cycle comparison is summarised below in Table 11.

²¹ The ‘house-model’ refers to the full BCPS employee engagement model. The term ‘house’ is used as a metaphor, to help readers more easily interpret and apply the hierarchical and interconnected relationships that are contained within the model. Historically, a basic engagement model comprised of only the two management drivers and the three engagement characteristics is tested in most years in order to check whether the model’s foundational relationships continued to hold, before a more thorough analysis of the full house model. The basic model was confirmed in 2022.

TABLE 11: CYCLE-OVER-CYCLE COMPARISON OF MODEL FIT INDICES

WES CYCLE	MATRIX	MODEL N	CFI	SRMR	RMSEA	R ² – SQUARED MULTIPLE CORRELATION		
						Job Satisfaction	Organization Satisfaction	BC Public Service Commitment
2006*	Pairwise	14,392	0.993	0.023	0.034	62%	69%	65%
2007	Pairwise	17,469	0.993	0.021	0.033	50%	68%	73%
2008	Pairwise	21,103	0.981	0.024	0.034	54%	66%	69%
2009	Pairwise	23,250	0.982	0.023	0.033	55%	66%	70%
2010	Pairwise	20,941	0.980	0.026	0.035	50%	70%	66%
2011	Pairwise	20,006	0.981	0.025	0.035	55%	67%	68%
	Listwise	12,181	0.983	0.025	0.034	59%	70%	70%
2013	Listwise	10,949	0.977	0.025	0.036	70%	69%	74%
2015	Listwise	10,511	0.977	0.032	0.036	71%	71%	77%
2018	Listwise	14,581	0.976	0.027	0.036	72%	71%	79%
2020	Listwise	14,836	0.976	0.028	0.037	72%	73%	79%
2022	Listwise	13,116	0.959	0.041	0.044	72%	76%	82%

* The in-scope population for 2006 did not include the Ministry of Transportation. As such, 2006 model results should not be directly compared to the results for subsequent years.

As indicated in the Variance-Covariance Matrices section of this report, the 2022 default model was tested on a listwise dataset. Specifically, the dataset consisted of the full listwise covariance matrix (listwise deleted across 48 agreement scale questions).²² The fit indices for the 2022 default model indicated that the model provided a good representation of the data and would provide a solid base upon which model variations could be developed. Furthermore, in the event that the subsequent model variations did not produce measurable improvements, the 2022 default model's fit was sufficient to meet the immediate analytic needs of the WES program.

Testing the Engagement Model Variations

Three drivers provided the focus for model adjustments in 2022. These three drivers consisted of an expanded Executive-Level Management driver, an expanded Job Suitability driver, and a modified Staffing Practices driver. As the engagement model rests solidly on the management

²² For information on the pairwise deletion method used historically in WES, see Pairwise Deleted Matrices (Appendix B: Historical Testing Methods).

foundation, the testing of the Executive-Level Management driver was given priority. Consequently, the Executive-Level Management driver tests were performed first prior to adjustments elsewhere in the model. Note that the remainder of the tests were also done in order of building blocks that connect closest to the foundation. Each of the model tests were conducted using the previous model, rather than each test compared back to the default model.

Expanding the Executive-Level Management (ELM) driver

As recommended in the preliminary driver analysis, SEM analysis was conducted to determine whether adding the executive related question “*Executives in my organization follow through with their commitments*” from the model would improve model fit. Specifically, the question was added to the existing Executive-Level Management driver, and then the expanded driver’s parameter estimates and the driver’s overall impact on the model were re-examined.

From the Driver Analysis, some multicollinearity issues remained in the driver. Although this highlighted a potential issue, it was next necessary to see how the expanded driver impacted the model overall. The model’s fit was retested after the driver was expanded. The driver remained as an integral piece of the model: all of its paths remained significant. Further, changes in the fit indices were slightly improved compared to the 2022 default model. A comparison of the 2022 default model’s fit statistics, with the original two-question Executive-Level Management driver compared to the expanded three-question driver, is provided below in Table 12.

TABLE 12: COMPARISON OF 2022 DEFAULT MODEL AND MODEL WITH EXPANDED ELM DRIVER

MODEL*	CMIN/ DF	CFI	NFI	TLI	PCFI	SRMR	RMSEA	R ² - SQUARED MULTIPLE CORRELATION		
								Job Satisfaction	Organization Satisfaction	BC Public Service Commitment
2022 Default	24.344	0.964	0.963	0.960	0.858	0.0347	0.042	72%	76%	82%
Default + ELM Revision	23.655	0.965	0.964	0.961	0.863	0.0343	0.042	72%	76%	82%

* Both models were based on the same full listwise matrix with a model n of 13,116.

As shown in Table 12 above, the squared multiple correlations did not change for the model’s three outcome characteristics. However, the Executive-Level Management driver is a foundational block in the model; thus, change in the driver directly impacts building blocks. In fact, the driver has a very strong effect on the Vision, Mission & Goals, Supervisory-Level Management, Staffing Practices, and Professional Development drivers.²³ By expanding the driver by one question, the

²³ While the Executive-Level Management driver has a very strong effect on Staffing Practices, other drivers more strongly impact them. However, Executive-Level Management has the strongest connection within the model to Vision, Mission & Goals, Supervisory-Level Management, and Professional Development drivers. The Executive-Level Management driver also has effects on seven other building blocks, and one roof driver.

direct impact of the Executive-Level Management driver on the four drivers to which it connects most strongly resulted in an increase in strength for each of the drivers (see Table 13).

TABLE 13: CHANGE IN PATH STRENGTH OF DRIVERS MOST STRONGLY IMPACTED BY ELM DRIVER

MODEL	VISION, MISSION & GOALS	SUPERVISORY-LEVEL MANAGEMENT	STAFFING PRACTICES	PROFESSIONAL DEVELOPMENT
2022 Default	62.9%	49.2%	34.1%	36.6%
Default + ELM Revision	64.9%	50.5%	35.7%	37.7%
Change	+2.0%	+1.3%	+1.6%	+1.1%

As the expansion of the Executive-Level Management driver improved its effects on several building block drivers without compromising the model's overall fit, it was determined that the proposed expansion of the driver offered an advantage over the 2022 default model, and was accepted.

The Executive-Level Management driver was expanded by one question after testing.

Modifying the Staffing Practices (SP) driver

SEM was used to determine the feasibility of modifying the Staffing Practices driver by adding two questions: *“In my work unit, the best person with the right skills is hired for the job”*, and *“My work unit takes steps to ensure that critical knowledge is retained when employees leave”*, as well as by removing one question: *“In my work unit, the selection of a person for a position is based on merit”*. As with the expansion of the Executive-Level Management driver, the questions of interest were added to, or removed from, the existing Staffing Practices driver, and then the modified driver's parameter estimates and the driver's overall impact on the previous model were examined.

It was necessary to see how the modified driver impacted the model overall. The model's fit was retested after the driver was modified. The driver remained an integral piece of the model, as all of its paths remained significant.

Further, changes in the fit indices were negligible, or slightly worse, compared to the previous model (2022 default model with expanded Executive-Level Management). A comparison of the previous model's fit statistics, with the original two-question Staffing Practices driver, and then with the modified three question driver, is provided below in Table 14.

TABLE 14: COMPARISON OF PREVIOUS MODEL TO MODEL WITH MODIFIED SP DRIVER

MODEL*	CMIN/ DF	CFI	NFI	TLI	PCFI	SRMR	RMSEA	R ² - SQUARED MULTIPLE CORRELATION		
								Job Satisfaction	Organization Satisfaction	BC Public Service Commitment
Default + ELM Revision	23.655	0.965	0.964	0.961	0.863	0.034	0.042	72%	76%	82%
Default + ELM + SP Revisions	27.321	0.958	0.957	0.954	0.860	0.042	0.045	72%	76%	82%

* Both models were based on the same full listwise matrix with a model n of 13,116.

Although the modification of the Staffing Practices driver didn't necessarily improve the model's overall fit, all of the SEM criteria were still met. Since model fit change was negligible, the deciding factors were the removal of one highly correlated question and adding new dimensions to broaden the driver scope. Therefore, the proposed modification of the driver offered an advantage over the existing driver composition and was accepted.

The Staffing Practices was modified after testing.

Expanding the Job Suitability (Job Suit) driver

Next, SEM was used to test potential changes to the Job Suitability driver. The question *"The work I do gives me a sense of accomplishment"* was added to the existing Job Suitability driver, and then the expanded drivers' parameter estimates and the drivers' overall impact on the previous model were examined more closely.

The addition of this question had minimal impact on the driver, and the driver remained an integral piece of the model where all of its paths remained significant. Changes in the fit indices were negligible, or slightly better, compared to the previous model tested. A comparison of the previous model's fit statistics, with the original two-question Job Suitability driver, and then with the expanded three-question driver, is provided below in Table 15.

TABLE 15: COMPARISON OF PREVIOUS MODEL AND MODEL WITH EXPANDED JOB SUIT DRIVER

MODEL*	CMIN/ DF	CFI	NFI	TLI	PCFI	SRMR	RMSEA	R ² - SQUARED MULTIPLE CORRELATION		
								Job Satisfaction	Organization Satisfaction	BC Public Service Commitment
Default + ELM + SP Revisions	27.321	0.958	0.957	0.954	0.860	0.042	0.045	72%	76%	82%
Default + ELM + SP + Job Suit Revisions	26.469	0.959	0.958	0.955	0.864	0.042	0.044	72%	76%	82%

* Both models were based on the same full listwise matrix with a model n of 13,116.

Although the model fit difference was negligible, all important criteria were still met. It was therefore decided to accept the proposed revision and add the additional question to better round out the Job Suitability driver with a new dimension.

After testing, the Job Suitability driver was expanded.

Identifying the Final 2022 Engagement Model

Following a review of the model variations tested in 2022, all three proposed changes were accepted: expansions of the Executive-Level Management, and Job Suitability drivers, and modification of the Staffing Practices driver.

At this point, all three changes were integrated into the 2022 default model as the '2022 Enhanced Model'.²⁴ Table 16 provides the fit indices of the 2022 Default model, compared with the 2022 Enhanced model (with all approved changes incorporated).

TABLE 16: COMPARISON OF 2020 DEFAULT MODEL AND ENHANCED MODEL

MODEL*	CMIN/ DF	CFI	NFI	TLI	PCFI	SRMR	RMSEA	R ² - SQUARED MULTIPLE CORRELATION		
								Job Satisfaction	Organization Satisfaction	BC Public Service Commitment
2022 Default	24.344	0.964	0.963	0.960	0.858	0.035	0.042	72%	76%	82%
2022 Enhanced	26.255	0.959	0.958	0.955	0.864	0.041	0.044	72%	76%	82%

* All models were based on the full listwise matrix with a model n of 13,116.

²⁴ When all driver changes were incorporated, one structural path was added from the Professional Development driver to Teamwork driver, based on a review of the modification indices in the SEM output and BC Stats determining this relationship was theoretically reasonable. In addition, there was the removal of a no longer significant connection between the Pay & Benefits driver and Recognition driver.

The 2022 Enhanced Model offered a comparable model fit to the 2022 default model. The incorporated changes added new dimensions to the Job Suitability and Executive-Level Management drivers that broadened the scope of these two drivers, and reduced the presence of redundancy in the Staffing Practices driver.

To help clarify the differences between the 2022 Enhanced Model and the other model variations described in this report, a table summarising the questions in each variation has been included in Appendix A (see Table 28 in Model Variations).

As the 2022 Enhanced Model represented the final model variation for the 2022 SEM analysis, it was possible to construct a more focused listwise deleted covariance matrix based only upon the 47 questions that appeared in the final 2022 model. As previously mentioned, this final matrix only includes the necessary questions, and therefore can produce a larger N for analysis. Using this updated matrix confirms that the fit is still comparable. The results for this model's specific final covariance matrix, as well as the results for the full listwise matrix based upon the set of 48 questions, are provided in Table 17 and Table 18.

TABLE 17: COMPARISON OF THE 2022 ENHANCED MODEL'S ESTIMATES FOR THE DIFFERENT MATRICES

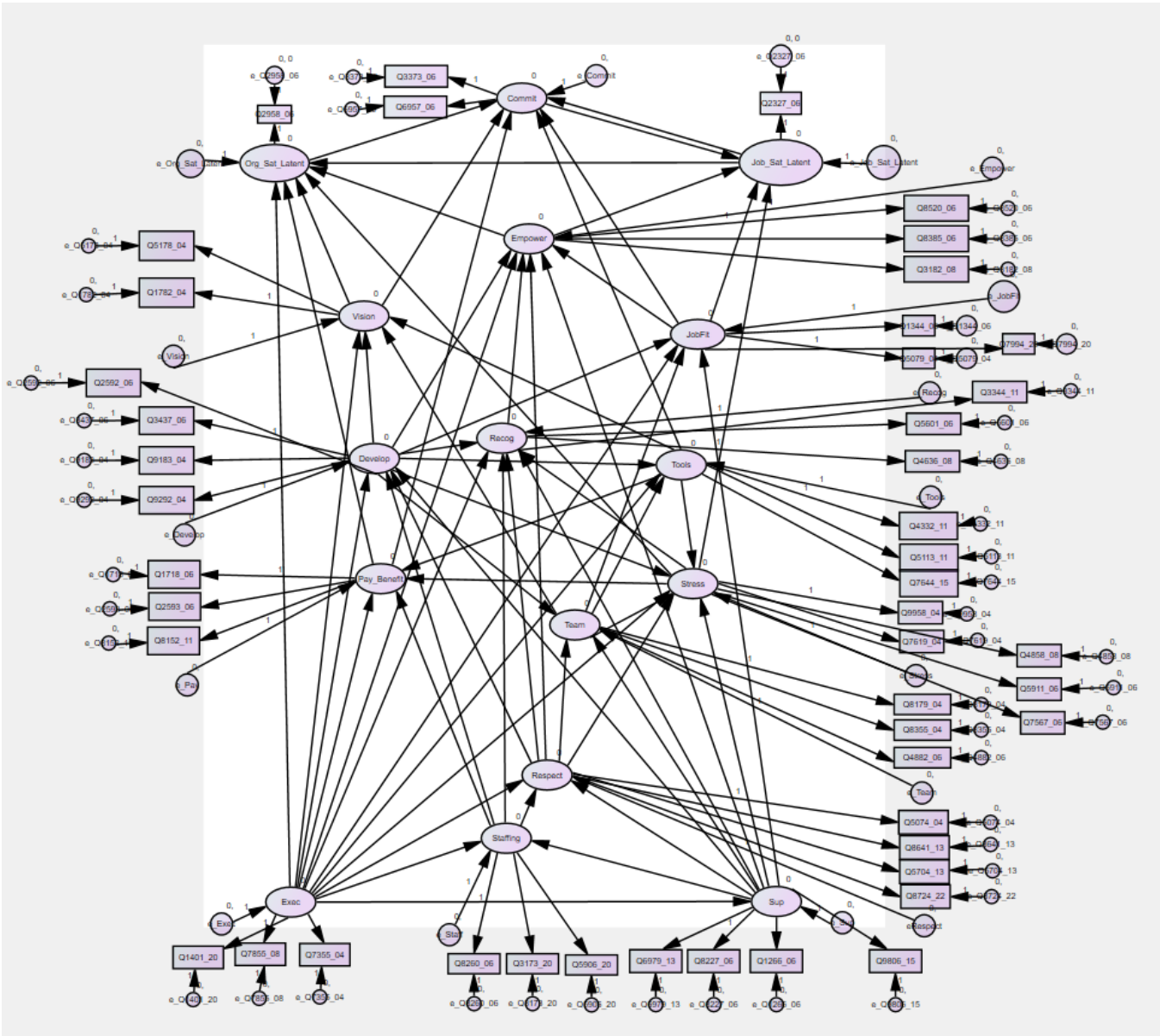
MATRIX	COUNT OF QUESTIONS	MODEL N	CMIN/ DF	CFI	NFI	TLI	PCFI	SRMR	RMSEA
Full Listwise Deleted Matrix	48	13,116	26.255	0.959	0.958	0.955	0.864	0.041	0.044
Final Listwise Deleted Matrix	47	13,244	26.504	0.959	0.958	0.955	0.864	0.041	0.044

TABLE 18: COMPARISON OF THE 2022 ENHANCED MODEL'S ESTIMATES FOR THE DIFFERENT MATRICES CONTINUED

MATRIX	R ² - SQUARED MULTIPLE CORRELATION		
	Job Satisfaction	Organization Satisfaction	BC Public Service Commitment
Full Listwise Deleted Matrix	72%	76%	82%
Final Listwise Deleted Matrix	73%	76%	82%

A diagram of the final 2022 Enhanced Model is included below in Figure 2. Due to the complexity of the model, it was necessary to suppress the majority of regression coefficients in order to enforce some degree of readability for the structural diagram shown below. The numbers that are present, all of which are equal to one or zero, represent either reference indicators or specific parameter constraints that were needed to correctly perform the SEM analysis.

FIGURE 2: STRUCTURAL DIAGRAM OF THE FINAL 2022 ENHANCED MODEL



Assessment of Organizational Differences

The final BCPS Engagement Model was tested and confirmed on corporate-level data. Many of the organizations in the BCPS are too small to individually support the number of drivers that comprise the overall corporate model, whereas testing on larger organizations could be expected to observe variations in both structure and composition from the corporate model. Even larger variations could be expected in modelling on smaller sub-groups, such as divisions or work units. Organization-specific model tests have not been planned or performed on the 2022 data due to the amount of time and effort involved to test each organization separately, and in order to view all analysis through a common lens for better cross-comparability. Thus, while the BCPS Engagement Model may be considered an imperfect fit for some organizations, it nevertheless serves as a suitable and comparable measure of engagement factors in workplaces across the public service.

The corporate pathway analysis report can be found on the BC Stats website:

<https://www2.gov.bc.ca/gov/content/data/statistics/government/employee-research/wes/wes-resources/model-pathways-methodology>

Limitations and Recommendations

The first steps taken before the SEM analysis included examining descriptive statistics, correlations, and driver analysis results, which were then incorporated into the final assessment of the model's fit.

In the past, one of the greatest limitations experienced during the modelling process was that the SEM analysis was conducted in a post-survey time frame, which required that testing be completed with previously established sets of drivers. In 2022, BC Stats conducted exploratory analysis prior to launching the survey in order to remove this limitation and confirm model fit.

Additionally, BC Stats recognizes that process limitations can exist when model testing identifies potential issues with a latent variable (e.g., that two questions are highly correlated), but a suitable alternative cannot be immediately identified in the available question bank. BC Stats occasionally recommends adding new topics to the survey to potentially address such issues; however, such additions must wait to be tested and confirmed in a future year before they can be successfully integrated into the model. Therefore, some model improvements undergo a time lag limitation before they can be rectified. This is likely to continue in future years due to the nature of the limitation.

Finally, the effectiveness of the modelling process in past years and in 2022 has been limited by large sample sizes and non-normal data. The following section provides a description of how these limitations may have impacted the 2022 model results. Where possible, solutions have also been presented describing how these challenges can best be resolved through future adjustments to the modelling process.

Determining the Best Dataset for Modelling

Since 2013, only listwise matrices have been used in the modelling process, and BC Stats recommends that only listwise matrices continue to be used in future modelling.²⁵

Imputation and its connection with covariance matrices

As the creation of a covariance matrix is directly impacted by the presence of missing data, the handling of missing data becomes a topic of particular interest. Pairwise and listwise deletion can both be considered simplistic forms of imputation. In the event that the patterns of missingness throughout a dataset are randomly distributed (i.e., missing completely at random or MCAR),

²⁵ In previous years, BC Stats used a pairwise deletion matrix for the modelling process. For more information, see Pairwise Deleted Matrices (Appendix B: Historical Testing Methods).

then the use of pairwise or listwise deletion is acceptable from a statistical perspective. However, if the data is not MCAR, but is missing at different rates for certain groups of respondents, then it is considered missing at random (MAR). In the event that data is MAR, then both pairwise and listwise deletion can introduce significant response bias into the resulting dataset.

In 2012, BC Stats performed a missing values analysis on the 2011 WES data. The missing data was found to be both MAR and MNAR (missing not at random). Given the broad scope of the public service, and the resulting variation in work units and job types, it makes sense that particular groups of employees responded at different rates to certain questions in the survey. Therefore, any imputation technique is inadvisable, as the reasons for why data is missing is directly linked to the purpose of the study (i.e., engaged/disengaged employees have differing patterns of missing data).

Modelling with a sub-sample

The chi-square statistic is one of the primary means of assessing model fit and is indirectly implicated in many of the fit indices generated by AMOS. Unfortunately, the chi-square is susceptible to substantial distortion when working with large samples sizes, which can make a meaningful determination of model fit unclear. A related issue with large samples is that many of the model's parameter estimates tend to be significant, even if the relationships they represent are relatively weak.

To help address this issue in 2022 and for future iterations, BC Stats performed the SEM analysis on a sub-sample of respondents.²⁶ However, the sub-sample used in 2022 may still have been too large to avoid substantial chi-square distortion, and did not address the potential issue of bias of early responders (assumed to have generally more positive responses). In future, BC Stats recommends using a smaller representative sample of approximately 1,000 respondents, which could be utilized to minimize distortions to the chi-square statistics and the associated model fit indices. By establishing a standardised sample size, it would also become easier to contrast models across years and/or between organizations, as sample size discrepancies would no longer be a confounding factor in the comparisons.

Future SEM should consider using a smaller standardised sample size of respondents.

Depending on the sampling technique that is used, a standardised sample could also help correct for potential response bias that may be present in a full dataset. As sample weights are not currently used, it would be advantageous to develop a sampling plan that better approximates

²⁶ BC Stats began initial analysis to establish the 2022 default model and then examined potential model changes with a subset of respondents, by using data pulled from just the first week of data collection. Once listwise deleted, this matrix was based on a much smaller sample than usual of 7,578 respondents.

the population's proportions across various demographic groups. This could help to self-weight the sample, which would in turn reduce the impact that the absence of sample weights has on the modelling process.²⁷

In order to assess the representativeness of the sub-sample, the model results produced by the sub-sample could be compared against the model results obtained from the overall sample. In the event that the results differ, a closer examination of the sub-sample's characteristics could be performed to determine in what ways the sub-sample differs from the full sample. If the models' results are comparable, then it becomes possible to infer two pieces of information. First, equivalent model results between the sub-sample and full sample would suggest that the sub-sample is in fact representative of the overall sample, and can be safely used to model WES data. Second, comparability between the sub-sample and full sample would provide insight as to what impact the large size of the full sample has on the model's fit indices and parameter estimates.

Assessing and Handling Non-Normal Data

Since the first fielding of WES, the focus of work units across government has been on improving their unit's cycle-over-cycle scores. Whereas this is a perfectly reasonable strategy from the perspective of employees, it does pose a particular challenge when it comes to modelling the results. The long-term impact of 'managing a distribution' of work units' scores is that the response distributions across all levels of government gradually become more and more non-normal (i.e., skewed). As multivariate normal data is one of the underlying assumptions of SEM, it becomes necessary to address the data's normality prior to the start of the modelling process.

Testing for non-normality

For the 2022 analysis, as with previous years, the data was assumed to be normal, or at the very least, the model questions in combination were assumed to be multivariate normal. Based on this assumption, the Maximum Likelihood (ML) estimation method was used when performing the SEM analysis. Despite the ML estimator's overall robustness to moderate violations of normality, it has been found to produce distorted model fit indices in situations where the data has departed substantially from a normal distribution. Once the modelling process for 2022 was completed, the data's normality was examined to provide a clearer indication as to whether or not the usage of the ML estimator was justified.

²⁷ Currently, no sample weights have been used in the modelling process. This is due in large part to the inability to easily incorporate sample weights into AMOS. As AMOS does not have a built-in function that handles sample weights, methods to weight the covariance matrices that are used in AMOS have been explored. While the weighting of a covariance matrix is possible, the process is cumbersome and not well supported by currently available software. As a result, an effective method of introducing sample weights to the modelling process has yet to be found.

To determine whether or not the data was normally distributed, a listwise deleted dataset was loaded into AMOS.²⁸ The normality of the data was then tested using Mardia's statistic. Typically, a Mardia's statistic value of more than two or three indicates the presence of non-normal distributions. In the case of the 2022 data, the resulting Mardia's statistic exceeded the maximum threshold, suggesting that the data was not multivariate normal, and therefore, may have produced distorted model fit indices through the ML estimator. However, this is to be expected with a large sample size.

To better understand where the non-normality was occurring within the dataset, a review of the Mahalanobis distances was also performed. The Mahalanobis distance values provided an indication of which individual records within the dataset were furthest from the centroid. In effect, this highlighted the records in the dataset that were outliers relative to the overall distribution of scores. Once identified, these outlying records can be removed from the dataset, and the normality reassessed with Mardia's statistic. Unfortunately, the number of outliers identified through Mahalanobis distance values exceeded the maximum number that could be identified in AMOS's output tables.²⁹ While this indicated that a large number of records were potentially contributing to the non-normality of the data, the number of records identified in the Mahalanobis distance table was also likely a function of the large overall sample size of the dataset. Therefore, outliers have not been removed due to both the complexity involved, and the program's objectives of assessing engagement of all employees.

Assessing the impact of non-normal data on the modelling process

With the combined findings of the Mardia's statistic and Mahalanobis distance values, a substantial normality issue was found to exist within the 2022 data. Given the challenges in interpreting ML generated fit indices for non-normal data, it became necessary to assess the potential impact the non-normal data had on the 2022 model's outputs. This assessment was performed in two steps:

1. The first step focused on the model's parameter estimates. In order to determine whether the non-normal data had produced biased parameter estimates, a bootstrapped comparison was performed. This was achieved by comparing the model's original ML generated parameter estimates to an equivalent set of bootstrapped estimates.

²⁸ In order to use AMOS's normality tests, it was first necessary to load raw data into the software, rather than using a covariance matrix as done for the main analysis.

²⁹ The Mahalanobis output table in AMOS is limited to 100 records. The values in the table are presented in a sorted format, such that those records furthest from the centroid appear at the top of the table, and those nearer to the centroid are found at the bottom of the table. Judging by the size of the distance values for the records near the bottom of the table, it seemed likely that a substantial number of additional records would also diverge from the centroid, even if the original 100 records were removed from the dataset.

2. The second step focused on the model's fit indices. While ML provides the most robust SEM estimation method, alternate estimators, such as Asymptotically Distribution Free (ADF), are not as negatively impacted by extreme violations of normality. As a result, a set of ML and ADF model fit indices were generated and compared to one another.³⁰

The results from the bootstrapped comparison indicated that both the ML and bootstrapped parameters estimates were largely equivalent. This suggests that, even despite the non-normal distributions in the data, the parameter estimates generated by the ML method were not biased in any particular direction. In other words, both the strength and significance level of the structural weights and measurements weights that were generated by ML were very similar to the weights generated through the bootstrapped method. The implication of this finding is that the relationships in the 2022 model do in fact exist and are not simply an artifact of the data's skew issues.

The comparison of the ADF and ML fit indices suggested that the impact of the non-normal data was much less clear cut. When the 2022 model was tested with the ADF estimator, the resulting fit indices indicated that the model's representation of the data was problematic. Focusing on the chi-square statistic (specifically CMIN/df), the ADF estimator produced a markedly lower value than compared to the ML method. The interpretation of this finding is that the ML method may have overestimated the degree to which the model fit the data. However, other aspects of the model (such as the data's large sample size, the model's complexity, and its composition of drivers) likely had their own impact on the chi-square result. As some aspects of the model are known to inflate chi-square values (i.e., sample size), it was difficult to determine how much influence the non-normality of the data had on the model's fit indices.

The findings from both steps of the assessment show that the non-normal data did have an impact on the modelling process. However, the extent of that impact remains uncertain. It is unlikely that the strength of the relationships within the 2022 model would change substantially if the data was more normally distributed. With that said, both the number and composition of drivers in the model could look different if the model was developed and tested using ADF. For instance, indicators in the Job Suitability, Teamwork, Staffing Practices, Stress & Workload, Respectful Environment, Empowerment, Supervisory-Level Management and BC Public Service Commitment drivers have modes of 100 (i.e., Strongly Agree) and Pay & Benefits has an indicator with mode of 0 (i.e., Strongly Disagree). While the skew and kurtosis measures for these drivers were mostly acceptable, their modes suggest their response distributions are non-normal, which

³⁰ It should be noted that due to AMOS's data requirements for ADF and bootstrapping, a listwise deleted raw dataset, rather than a matrix, would need to be generated. As the creation of a listwise deleted dataset is required before its resulting covariance matrix can be generated, this change to the modelling process would have no impact on the SEM analysis. Furthermore, as AMOS is unable to perform ADF or bootstrapping on a dataset with missing values, the dataset would need to be listwise deleted in order to correct for the data's non-normal distributions.

in turn may be contributing to the lack of multivariate normality in the model. The extent to which certain drivers may need to be adjusted, or removed entirely from the model, remains unclear at this time.

Implications for Future Modelling Efforts

Going forward, the 2022 engagement model should provide an acceptable representation of the public service's work environment, until such a time that a more extensive modelling process can be performed that addresses these limitations. It is recommended that future modelling processes focus first on resolving limitations related to the large sample sizes; once this has been explored, the multivariate normality of the data can next be reviewed. BC Stats is aware that the WES data is non-normal and therefore a combination of several modelling and analytics techniques may be needed to adequately address the impact of the skewed data. These techniques may include the use of bootstrapped parameter estimates, bootstrapped fit indices (i.e., Bollen-Stine), ADF estimation methods, sub-sampling of the overall dataset, and in extreme cases, log transformations of the data.³¹ However, any significant changes made to the modelling methodology would limit the comparability of results with those of previous years using the old methodology; therefore, BC Stats recommends an incremental approach that weighs the costs and benefits of deploying new modelling techniques.

Future analysis may consider exploring ADF estimation methods on smaller sample sizes.

The model's underlying framework is well substantiated, both in theory and through extensive empirical data, but improvements and adjustments will always be considered. To better determine the scope of future cycle-over-cycle changes, the differences between the final 2020 model and the 2022 model may provide a useful metric. Specifically, the adjustments made to the final 2022 model were limited to the addition of a small number of structural paths and the expansion, or modification, of three drivers. In combination, these changes represented a refinement of the model's representation of the work environment, rather than a complete re-imagining of the model.

³¹ Transformations of the data represents a solution of last resort. As the ease with which results can be interpreted is one of the key advantages offered by the survey, any adjustment to the response data could confuse users and reduce the value of the findings. If log transformations are to be used, it is recommended that the transformation only be used on the modelled data, and not the data that is summarised in the standard WES reporting. While this reduces the direct comparability of the modelled relationships with the mean scores that are presented in reports, the underlying model connections and trends would remain constant between the model and the reports.

It should be emphasized that while the 2022 model is an improvement over the final 2020 model, it does not necessarily represent an end point. As the BC Public Service is a dynamic and continuously shifting work environment, a modelled representation of this work environment should exhibit a similar capacity for change. As a result, further improvements, and changes to the 2022 model will not only be worthwhile, but likely a necessity as time goes on. For this reason, it is recommended that future modelling of WES results should continue the shift from an after-the-fact strictly confirmatory approach to the more thorough yet strategic examination of each cycle's data before reporting results or producing deliverables. The result, while posing a complication for benchmarking purposes, will ensure that the model developed each survey cycle will provide the best possible representation of the BC Public Service's work environment at that time. When time allows, and if changes have been proposed in advance, these can be tested during the off-cycle with the previous cycle's data in order to inform the direction for updating the model, as was the case in 2022.

Future analysis should continue to occur before reporting to ensure the best possible representation of the BC Public Service is portrayed.

Appendix A: High Correlations & Model Variations

High Correlations

As mentioned in the Correlations sub-section within the Preliminary Analysis, a correlation matrix was generated by correlating 73 agreement scale questions with one another. A review of the size of the coefficients revealed no R values less than 0.174, suggesting that every question in the survey had at least a small, yet measurable relationship with all other questions in the survey.

However, 39 question combinations were found to have strong relationships with coefficients greater than or equal to 0.800, one of which resulted in coefficients greater than 0.900. All 39 highly correlated question combinations are provided in the tables below, where red highlighted cells indicate correlation coefficients greater than or equal to 0.900, while yellow highlighted cells indicate correlation coefficients greater than or equal to 0.800 and less than 0.900. There are some instances where other question pair correlations have been included for completeness. In these select tables, green has been used to highlight correlations below 0.800.

TABLE 19: HIGH CORRELATION BETWEEN INNOVATION FOCUSED QUESTIONS

MODEL STATUS	QUESTION	Innovation is valued in my work.	I have the opportunities I need to implement new ideas.
Not in model	Innovation is valued in my work.	1.000	0.854
Empowerment	I have the opportunities I need to implement new ideas.	0.854	1.000

THE TECHNICAL REPORT: MODELLING THE SURVEY RESULTS

TABLE 20: HIGH CORRELATION BETWEEN STAFFING PRACTICES FOCUSED QUESTIONS

MODEL STATUS	QUESTION	In my work unit, the selection of a person for a position is based on merit.	In my work unit, the process of selecting a person for a position is fair.	In my work unit, the best person with the right skills is hired for the job.
Not in model	In my work unit, the selection of a person for a position is based on merit.	1.000	0.900	0.870
Staffing Practices	In my work unit, the process of selecting a person for a position is fair.	0.900	1.000	0.878
Staffing Practices	In my work unit, the best person with the right skills is hired for the job.	0.870	0.878	1.000

TABLE 21: HIGH CORRELATION BETWEEN RECOGNITION FOCUSED QUESTIONS

MODEL STATUS	QUESTION	I receive meaningful recognition for work well done.	In my work unit, recognition is based on performance.
Recognition	I receive meaningful recognition for work well done.	1.000	0.819
Recognition	In my work unit, recognition is based on performance.	0.819	1.000

TABLE 22: HIGH CORRELATION BETWEEN PAY FOCUSED QUESTIONS

MODEL STATUS	QUESTION	I am fairly paid for the work I do.	My pay is competitive with similar jobs in the region.
Pay & Benefits	I am fairly paid for the work I do.	1.000	0.822
Pay & Benefits	My pay is competitive with similar jobs in the region.	0.822	1.000

THE TECHNICAL REPORT: MODELLING THE SURVEY RESULTS

TABLE 23: HIGH CORRELATION BETWEEN ENJOYMENT FOCUSED QUESTIONS

MODEL STATUS	QUESTION	The work I do gives me a sense of accomplishment	I enjoy the type of work I do.
Job Suitability	The work I do gives me a sense of accomplishment.	1.000	0.834
Not in model	I enjoy the type of work I do.	0.834	1.000

TABLE 24: HIGH CORRELATIONS AMONG EXECUTIVE FOCUSED QUESTIONS

MODEL STATUS	QUESTION	A	B	C	D	E	F
Executive-Level Management	A. Executives in my organization communicate decisions in a timely manner.	1.000	0.868	0.853	0.860	0.748	0.815
Executive-Level Management	B. Executives in my organization provide clear direction for the future.	0.868	1.000	0.868	0.857	0.740	0.831
Executive-Level Management	C. Executives in my organization follow through with their commitments.	0.853	0.868	1.000	0.853	0.806	0.867
Not in model	D. Essential information flows effectively from executives to staff.	0.860	0.857	0.853	1.000	0.743	0.824
Not in model	E. Executives in my organization act ethically (e.g., demonstrate honesty and integrity in their work).	0.748	0.740	0.806	0.743	1.000	0.861
Not in model	F. I have confidence in the executives of my organization.	0.815	0.831	0.867	0.824	0.861	1.000

THE TECHNICAL REPORT: MODELLING THE SURVEY RESULTS

TABLE 25: HIGH CORRELATIONS AMONG SUPERVISOR FOCUSED QUESTIONS

MODEL STATUS	QUESTION	A	B	C	D	E	F	G	H	I	J
Not in model	A. The person I report to provides the guidance I need to do my job well.	1.000	0.862	0.820	0.774	0.784	0.799	0.737	0.745	0.736	0.842
Not in model	B. Performance feedback from the person I report to helps me develop my career.	0.862	1.000	0.772	0.745	0.718	0.752	0.704	0.688	0.681	0.783
Supervisory-Level Management	C. The person I report to provides clear expectations regarding my work.	0.820	0.772	1.000	0.790	0.761	0.783	0.718	0.729	0.731	0.822
Supervisory-Level Management	D. The person I report to consults me on decisions that affect me.	0.774	0.745	0.790	1.000	0.798	0.818	0.766	0.753	0.745	0.807
Supervisory-Level Management	E. I feel I am able to have a conversation with the person I report to when I need their perspective or advice.	0.784	0.718	0.761	0.798	1.000	0.848	0.787	0.802	0.795	0.838
Supervisory-Level Management	F. The person I report to leads with an understanding of others' perspectives.	0.799	0.752	0.783	0.818	0.848	1.000	0.830	0.816	0.800	0.852
Not in model	G. The person I report to promotes employee mental health and well-being in the workplace.	0.737	0.704	0.718	0.766	0.787	0.830	1.000	0.799	0.799	0.798
Not in model	H. The person I report to maintains high standards of honesty and integrity.	0.745	0.688	0.729	0.753	0.802	0.816	0.799	1.000	0.899	0.813
Not in model	I. The person I report to supports me and my co-workers in conducting our work in an ethical manner.	0.736	0.681	0.731	0.745	0.795	0.800	0.799	0.899	1.000	0.805
Not in model	J. I am satisfied with the quality of supervision I receive.	0.842	0.783	0.822	0.807	0.838	0.852	0.798	0.813	0.805	1.000

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TABLE 26: HIGH CORRELATION BETWEEN VISION FOCUSED QUESTIONS

MODEL STATUS	QUESTION	My organization is taking steps to ensure the long-term success of its vision, mission and goals.	The vision, mission and goals of my organization are communicated well.	I feel connected to my organization's vision, mission and goals.	I am motivated by my organization to help achieve its objectives.
Vision, Mission & Goals	My organization is taking steps to ensure the long-term success of its vision, mission and goals.	1.000	0.832	0.783	0.782
Vision, Mission & Goals	The vision, mission and goals of my organization are communicated well.	0.832	1.000	0.822	0.773
Not in model	I feel connected to my organization's vision, mission and goals.	0.783	0.822	1.000	0.873
Not in model	I am motivated by my organization to help achieve its objectives.	0.782	0.773	0.873	1.000

TABLE 27: HIGH CORRELATION BETWEEN PUBLIC SERVICE FOCUSED QUESTIONS

MODEL STATUS	QUESTION	I am proud to tell people I work for the BC Public Service.	I would recommend the BC Public Service as a great place to work.
Not in model	I am proud to tell people I work for the BC Public Service.	1.000	0.814
Not in model	I would recommend the BC Public Service as a great place to work.	0.814	1.000

Model Variations

Table 28 summarises the questions in all model variations described in this report to clarify the differences. As a reminder, each variation builds off the previous model from left to right (instead of each change reverting to the default model). Since Job Suit changes were accepted, DEFAULT + ELM + SP + Job Suit REVISIONS is equivalent to ENHANCED (FINAL).

TABLE 28: COMPARISON OF QUESTIONS INCLUDED IN MODEL VARIATIONS³²

QUESTION	2022 DEFAULT MODEL	DEFAULT + ELM REVISIONS	DEFAULT + ELM + SP REVISIONS	DEFAULT + ELM + SP + JOB SUIT REVISIONS	ENHANCED (FINAL)
A healthy atmosphere (e.g., trust, mutual respect) exists in my work unit.	RE	RE	RE	RE	RE
My work unit values diversity in people and backgrounds.	RE	RE	RE	RE	RE
My work unit values diversity in ideas.	RE	RE	RE	RE	RE
My work unit is free from discrimination, bullying and harassment.	RE	RE	RE	RE	RE
The person I report to provides clear expectations regarding my work.	SLM	SLM	SLM	SLM	SLM
The person I report to consults me on decisions that affect me.	SLM	SLM	SLM	SLM	SLM
I feel I am able to have a conversation with the person I report to when I need their perspective or advice.	SLM	SLM	SLM	SLM	SLM
The person I report to leads with an understanding of others' perspectives.	SLM	SLM	SLM	SLM	SLM
My organization supports my work related learning and development.	ProD	ProD	ProD	ProD	ProD
The quality of training and development I have received is satisfactory.	ProD	ProD	ProD	ProD	ProD
I have adequate opportunities to develop my skills.	ProD	ProD	ProD	ProD	ProD

³² The following abbreviations have been used to simplify the table: Respectful Environment (RE); Supervisory-Level Management (SLM); Professional Development (ProD); Tools & Workspace (T&W); Empowerment (Emp); Staffing Practices (SP); Recognition (Rec); Pay & Benefits (P&B); Job Suitability (Job Suit); Stress & Workload (S&W); Teamwork (Team); Vision, Mission & Goals (VMG); Executive-Level Management (ELM); Job Satisfaction (Job Sat); Organization Satisfaction (Org Sat); and BC Public Service Commitment (BCPS Commit).

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QUESTION	2022 DEFAULT MODEL	DEFAULT + ELM REVISIONS	DEFAULT + ELM + SP REVISIONS	DEFAULT + ELM + SP + JOB SUIT REVISIONS	ENHANCED (FINAL)
I have opportunities for career growth within the BC Public Service.	ProD	ProD	ProD	ProD	ProD
My physical work environment (e.g., sound level, lighting, heat, ergonomics, etc.) enables me to work well.	T&W	T&W	T&W	T&W	T&W
The computer based tools (e.g., hardware, software) I have access to help me excel in my job.	T&W	T&W	T&W	T&W	T&W
The non-computer based tools (e.g., office or outdoor equipment) I have access to help me excel in my job.	T&W	T&W	T&W	T&W	T&W
I have opportunities to provide input into decisions that affect my work.	Emp	Emp	Emp	Emp	Emp
I have the freedom to make the decisions necessary to do my job well.	Emp	Emp	Emp	Emp	Emp
I have the opportunities I need to implement new ideas.	Emp	Emp	Emp	Emp	Emp
In my work unit, the selection of a person for a position is based on merit.	SP	SP			
In my work unit, the process of selecting a person for a position is fair.	SP	SP	SP	SP	SP
In my work unit, the best person with the right skills is hired for the job.			SP	SP	SP
My work unit takes steps to ensure that critical knowledge is retained when employees leave.			SP	SP	SP
Employees are held accountable in my work unit.	Rec	Rec	Rec	Rec	Rec
I receive meaningful recognition for work well done.	Rec	Rec	Rec	Rec	Rec
In my work unit, recognition is based on performance.	Rec	Rec	Rec	Rec	Rec
I am fairly paid for the work I do.	P&B	P&B	P&B	P&B	P&B
My benefits meet my (and my family's) needs well.	P&B	P&B	P&B	P&B	P&B
My pay is competitive with similar jobs in the region.	P&B	P&B	P&B	P&B	P&B
My work is meaningful.	Job Suit	Job Suit	Job Suit	Job Suit	Job Suit

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QUESTION	2022 DEFAULT MODEL	DEFAULT + ELM REVISIONS	DEFAULT + ELM + SP REVISIONS	DEFAULT + ELM + SP + JOB SUIT REVISIONS	ENHANCED (FINAL)
My job is a good fit with my skills and interests.	Job Suit	Job Suit	Job Suit	Job Suit	Job Suit
The work I do gives me a sense of accomplishment.				Job Suit	Job Suit
Work is distributed fairly in my work unit.	S&W	S&W	S&W	S&W	S&W
My work unit is well supported during times of change.	S&W	S&W	S&W	S&W	S&W
My workload is manageable.	S&W	S&W	S&W	S&W	S&W
I have support at work to provide a high level of service.	S&W	S&W	S&W	S&W	S&W
I have support at work to balance my work and personal life.	S&W	S&W	S&W	S&W	S&W
When needed, members of my team help me get the job done.	Team	Team	Team	Team	Team
Members of my team communicate effectively with each other.	Team	Team	Team	Team	Team
I have positive working relationships with my co-workers.	Team	Team	Team	Team	Team
My organization is taking steps to ensure the long-term success of its vision, mission and goals.	VMG	VMG	VMG	VMG	VMG
The vision, mission and goals of my organization are communicated well.	VMG	VMG	VMG	VMG	VMG
Executives in my organization communicate decisions in a timely manner.	ELM	ELM	ELM	ELM	ELM
Executives in my organization provide clear direction for the future.	ELM	ELM	ELM	ELM	ELM
Executives in my organization follow through with their commitments.		ELM	ELM	ELM	ELM
I am satisfied with my job.	Job Sat	Job Sat	Job Sat	Job Sat	Job Sat
I am satisfied with my organization.	Org Sat	Org Sat	Org Sat	Org Sat	Org Sat
Overall, I am satisfied in my work as a BC Public Service employee.	BCPS Commit	BCPS Commit	BCPS Commit	BCPS Commit	BCPS Commit
I would prefer to stay with the BC Public Service, even if offered a similar job elsewhere.	BCPS Commit	BCPS Commit	BCPS Commit	BCPS Commit	BCPS Commit

Appendix B: Historical Testing Methods

Exploratory Factor Analysis

Up until 2015, BC Stats conducted exploratory factor analysis as a mid-step prior to SEM. Factor analysis can be applied to questions in order to reduce the question count as well as to help to better understand the structure of relationships between questions (e.g., identify new latent variables). Exploratory analysis can provide a means of discerning how well the questions within each proposed latent variable represent a statistically sound grouping of questions. Through exploratory analysis, the latent variables were historically refined in an a posteriori fashion, until the factor analysis criteria were satisfied. Exploratory factor analysis was performed in previous cycles through principal components analysis (PCA). PCA worked by identifying a linear grouping of questions and extracting the maximum amount of variance from the group. This process was continued iteratively, group after group, extracting the maximum remaining variance as each group was identified. This resulted in a set of independent latent variables that were each comprised of a closely related group of questions.

In 2020, it was no longer deemed a requirement to run through the PCA. Given that the BCPS Engagement Model was well established and that revisions typically focus on the components within drivers rather than the drivers themselves, exploratory factor analysis was deemed an unnecessary step to complete every cycle. The combination of the preliminary tests, driver analysis, and SEM analysis are considered sufficient in determining whether changes to the existing latent variables are acceptable. BC Stats may again perform PCA factor analysis in a future cycle if a new latent variable is ever proposed to be added to the model, if an existing latent variable is ever proposed to be removed from the model, or if modelling was to begin from scratch.

Pairwise Deleted Matrices

There are several options for handling missing responses in SEM analysis. From 2011 onwards, the listwise deleted dataset method has been used. From 2006 until 2011, a different method, the pairwise deleted dataset, was used. A pairwise deleted dataset produces the largest possible overall sample size. The most immediate impact of using a pairwise matrix (as opposed to listwise) is that the sample sizes used to calculate the covariance estimates vary for each combination of questions. Mainly, the group of respondents used to calculate the covariance

statistic between two questions will not necessarily be the exact same as the group used to calculate the covariance statistic for a separate pair of questions. As a result, pairwise matrices are comprised of several differing sub-groups of respondents.

As noted above, in 2011, the model's underlying variance-covariance matrix used listwise deletion for the first time, as well as the historical pairwise deletion method. The listwise and pairwise datasets used in 2011 produced similar model fit indices and squared multiple correlations. The comparability of the two matrices suggested that any potential bias that could have been introduced by a pairwise deleted matrix may be only slight, and possibly minimised by the large overall sample size. It was speculated that if narrowed to the organization level, the minor differences between pairwise and listwise model results would increase as the sample size being modelled decreased. While the models that were developed and tested using pairwise datasets likely provided valid and reliable model results, the usage of pairwise data did introduce certain conceptual concerns and response bias. In order to bypass the issues present in a pairwise matrix, the models since 2013 have been based on listwise deleted covariance matrices only. The implications and future discussions around missing responses and dataset choices have been described in greater detail in the Limitations and Recommendations section.

Appendix C: Model Changes Over Time

This report focuses on the most recent changes to the Engagement model from the previous cycle in 2020 to the most recent cycle in 2022. The tables that follow provide a historical timeline for each of the engagement characteristics and drivers in the model. The current composition for 2022 is presented in the “Current Questions” column, with the date that the given question first appeared in the driver. If applicable, any questions that were found in the driver in previous cycles are presented in the “Questions Used Previously” column. Two more date columns display the lifespan of the previously used question(s).

TABLE 29: BC PUBLIC SERVICE COMMITMENT ENGAGEMENT CHARACTERISTIC

CURRENT QUESTIONS	ADDED IN	QUESTIONS USED PREVIOUSLY	LAST USED	FIRST USED
Overall, I am satisfied in my work as a BC Public Service employee.	2006			
I would prefer to stay with the BC Public Service, even if offered a similar job elsewhere.	2006			

TABLE 30: ORGANIZATION SATISFACTION ENGAGEMENT CHARACTERISTIC

CURRENT QUESTIONS	ADDED IN	QUESTIONS USED PREVIOUSLY	LAST USED	FIRST USED
I am satisfied with my organization.	2006			

TABLE 31: JOB SATISFACTION ENGAGEMENT CHARACTERISTIC

CURRENT QUESTIONS	ADDED IN	QUESTIONS USED PREVIOUSLY	LAST USED	FIRST USED
I am satisfied with my job.	2006			

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TABLE 32: EMPOWERMENT DRIVER

CURRENT QUESTIONS	ADDED IN	QUESTIONS USED PREVIOUSLY	LAST USED	FIRST USED
I have the freedom to make the decisions necessary to do my job well.	2006	I am encouraged to be innovative in my work.	2009	2006
I have opportunities to provide input into decisions that affect my work.	2006			
I have the opportunities I need to implement new ideas.	2010			

TABLE 33: STRESS & WORKLOAD DRIVER

CURRENT QUESTIONS	ADDED IN	QUESTIONS USED PREVIOUSLY	LAST USED	FIRST USED
My workload is manageable.	2006	My work-related stress is manageable.	2018	2006
Work is distributed fairly in my work unit.	2020			
My work unit is well supported during times of change.	2020			
I have support at work to provide a high level of service.	2020			
I have support at work to balance my work and personal life.	2020			

TABLE 34: JOB SUITABILITY DRIVER

CURRENT QUESTIONS	ADDED IN	QUESTIONS USED PREVIOUSLY	LAST USED	FIRST USED
My work is meaningful.	2013			
My job is a good fit with my skills and interests.	2013			
The work I do gives me a sense of accomplishment.	2022			

TABLE 35: VISION, MISSION & GOALS DRIVER

CURRENT QUESTIONS	ADDED IN	QUESTIONS USED PREVIOUSLY	LAST USED	FIRST USED
My organization is taking steps to ensure the long-term success of its vision, mission and goals.	2006			
The vision, mission and goals of my organization are communicated well.	2006			

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TABLE 36: TEAMWORK DRIVER

CURRENT QUESTIONS	ADDED IN	QUESTIONS USED PREVIOUSLY	LAST USED	FIRST USED
When needed, members of my team help me get the job done.	2006			
Members of my team communicate effectively with each other.	2006			
I have positive working relationships with my co-workers.	2006			

TABLE 37: TOOLS & WORKSPACE DRIVER³³

CURRENT QUESTIONS	ADDED IN	QUESTIONS USED PREVIOUSLY	LAST USED	FIRST USED
The computer based tools (e.g., hardware, software) I have access to help me excel in my job.	2013	I have the tools (i.e., technology, equipment, etc.) I need to do my job well.	2010	2006
The non-computer based tools (e.g., office or outdoor equipment) I have access to help me excel in my job.	2013	My physical work environment is satisfactory.	2011	2006
My physical work environment (e.g., sound level, lighting, heat, ergonomics, etc.) enables me to work well.	2015	I have the tools I need to do my job well.	2011	2011

TABLE 38: RECOGNITION DRIVER

CURRENT QUESTIONS	ADDED IN	QUESTIONS USED PREVIOUSLY	LAST USED	FIRST USED
I receive meaningful recognition for work well done.	2006	Recognition is based on merit in my work unit.	2007	2006
In my work unit, recognition is based on performance.	2008			
Employees are held accountable in my work unit.	2020			

³³ The Tools & Workspace driver was formerly known as the “Physical Environment & Tools” driver from 2006 to 2011 and “Workplace Tools” in 2013.

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TABLE 39: PROFESSIONAL DEVELOPMENT DRIVER

CURRENT QUESTIONS	ADDED IN	QUESTIONS USED PREVIOUSLY	LAST USED	FIRST USED
My organization supports my work related learning and development.	2006			
The quality of training and development I have received is satisfactory.	2006			
I have adequate opportunities to develop my skills.	2006			
I have opportunities for career growth within the BC Public Service.	2020			

TABLE 40: PAY & BENEFITS DRIVER

CURRENT QUESTIONS	ADDED IN	QUESTIONS USED PREVIOUSLY	LAST USED	FIRST USED
I am fairly paid for the work I do.	2006			
My benefits meet my (and my family's) needs well.	2006			
My pay is competitive with similar jobs in the region.	2013			

TABLE 41: STAFFING PRACTICES DRIVER

CURRENT QUESTIONS	ADDED IN	QUESTIONS USED PREVIOUSLY	LAST USED	FIRST USED
In my work unit, the process of selecting a person for a position is fair.	2006	In my work unit, the process of selecting a person for a position is based on merit.	2007	2006
In my work unit, the best person with the right skills is hired for the job.	2022	In my work unit, the selection of a person for a position is based on merit.	2020	2008
My work unit takes steps to ensure that critical knowledge is retained when employees leave.	2022			

TABLE 42: RESPECTFUL ENVIRONMENT DRIVER

CURRENT QUESTIONS	ADDED IN	QUESTIONS USED PREVIOUSLY	LAST USED	FIRST USED
A healthy atmosphere (e.g., trust, mutual respect) exists in my work unit.	2006	My work unit values diversity.	2011	2006
My work unit is free from discrimination and harassment.	2006			
My work unit values diversity in ideas.	2013			

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CURRENT QUESTIONS	ADDED IN	QUESTIONS USED PREVIOUSLY	LAST USED	FIRST USED
My work unit values diversity in people and backgrounds.	2013			

TABLE 43: SUPERVISORY-LEVEL MANAGEMENT DRIVER

CURRENT QUESTIONS	ADDED IN	QUESTIONS USED PREVIOUSLY	LAST USED	FIRST USED
The person I report to consults me on decisions that affect me.	2006	The person I report to keeps me informed of things I need to know.	2018	2006
The person I report to provides clear expectations regarding my work.	2011			
The person I report to leads with an understanding of others' perspectives.	2013			
I feel I am able to have a conversation with the person I report to when I need their perspective or advice.	2015			

TABLE 44: EXECUTIVE-LEVEL MANAGEMENT DRIVER

CURRENT QUESTIONS	ADDED IN	QUESTIONS USED PREVIOUSLY	LAST USED	FIRST USED
Executives in my organization provide clear direction for the future.	2006	Executives in my organization make effective and timely decisions.	2007	2006
Executives in my organization communicate decisions in a timely manner.	2008	Executives in my organization clearly communicate strategic changes and/or changes in priorities.	2009	2008
Executives in my organization follow through with their commitments.	2022			

Appendix D: Background

High Level

Study	2022 Work Environment Survey (WES)
Project Sponsor	BC Public Service Agency

Operations

Data Collection Method	Online survey
Fielding Window / Dates	January 27 - February 18, 2022
Project History	Annual survey 2006-2011, Biennial survey 2013, 2015, 2018, 2020, 2022

Population / Sample

Scope	Individuals who were deemed as active BC Public Service employees in the Corporate Human Resource Information and Payroll System (CHIPS) as of January 11, 2022 (and remained active through to survey launch date of January 27, 2022) and had valid contact information.
Population	30,696
Obtained Sample	24,485
Response Rate	80%
Sampling Strategy	Census

Key Measure(s)

Key Construct	Engagement score: 67 points (out of 100)
Type of Measure	Five-point frequency scale
Methods of Analysis	Descriptive statistics and structural equation modeling

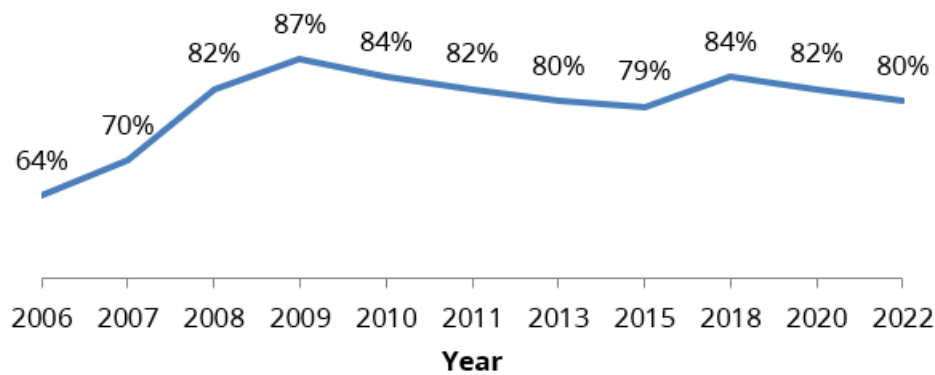
Confidentiality

During survey administration, employees received personalized invitations and reminders. All survey responses were encrypted during submission and stored on a secure server accessed only by select members of the BC Stats Work Environment Survey Team. BC Stats employees are sworn under the [Statistics Act](#), and all information collected in the survey is protected by the Statistics Act. Only aggregate results are provided in the reports. Individual responses or information that could identify an individual cannot be disclosed.

Response Rates

In the BC Public Service this cycle, 80% of employees completed the survey, a two percentage point (ppt) decrease since 2020. Figure 3 shows the response rates trend since the inception of the WES program.

FIGURE 3: RESPONSE RATES OVER TIME



BC Stats wishes to thank all employees who participated and contributed to achieving such a high response rate. High survey response rates ensure high quality, reliable data.

BC Stats is the provincial government's leader in statistical and economic research, information and analysis essential for evidence-based decision-making. BC Stats, the central statistics agency of government, is excited to be taking a lead role in the strategic understanding of data sources and analysis across government. The goal is to increase overall business intelligence—information decision makers can use. For more information, please contact Kathleen Assaf.



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