An Investigation of Optimal Job Characteristics for Recruiting and Retaining Science, Technology, Engineering, and Mathematics (STEM) Professionals

by

Wei Wei

Bachelor of Science, Computer Engineering, 2011
Bachelor of Science, Electrical Engineering, 2011
California State Polytechnic University, Pomona

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Signature redacted

Wei Wei
System Design and Management Program

Signature redacted

Donna H. Rhodes
Thesis Supervisor
Principal Research Scientist, SSRC

Signature redacted

Patrick Hale
Executive Director
System Design and Management Program

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Abstract
Motivated by the aspiration to extrapolate optimal combinations of job characteristics that may minimize employee turnover rate, this research investigates impacts of specific workplace policies in autonomy, performance feedback, skill and task variety, identity, and significance.

A questionnaire is designed to discover what the most effective talent management strategies are to attract, develop and retain top tier talents in STEM fields. In this thesis, the targeted demographics are professionals who hold at least one bachelor's degree in STEM fields or work in STEM fields. By collecting, organizing, and analyzing the survey data set, the research attempts to identify series of workplace autonomy policies and work task characteristics that are appealing to the targeted demographics.

The thesis analyzes the respondent dataset using three approaches. Firstly, chi-squared tests suggest that the dataset exhibits similar job characteristic preference patterns within each demographic dimension (i.e. generation, gender, household composition, education and professional backgrounds). Secondly, conditional probability tests indicate respondents' acquisition and retention rates associated with specific policies. Lastly, the cross-tabulated contingency tables summarize the insights for optimizing performance review frequency and methods.

After investigating questionnaire participants' responses, this thesis enriches the data set with literature review findings. This thesis proposes practical recommendations to improve existing workplace autonomy policies based on the research insights.

Thesis Supervisor: Donna H. Rhodes
Title: Principal Research Scientist, SSRC
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Perhaps the most invaluable treasures I have gained from this life-changing journey is the everlasting bonds that I have formed with my fellow SDMers. To me, they are more than classmates or friends. We are family.

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Chapter 1 – Introduction

“Work is just a part of our Life, not vice versa. So live life full time, work work, part time.”

– Vikrmn, GWG.

1.1 Deciding Where to Work

A typical American adult spends 44 years of one’s life working. The current U.S. life expectancy is 78.8 years [1] with men living to age 76.4 and women living slightly longer until 81.2 on average. This in relation to the average retirement age of 66 years [2] means that out of the average 78.8 human lifespans, workers will spend 55% of their entire expected lifespan working. Labor statistics provided by Lerman and Schmidt provide an overview of economic, social and demographic trends affecting the U.S. labor market. They conclude that the total labor force consisted of 148,847,000 people in 2006. U.S. Bureau of Labor Statistics projections implies that “over the next decade, 40 million people will enter the workforce, about 25 million will leave the workforce, and 109 million will remain [2].”

Because work plays such a huge role in people’s lives, choosing which companies to work for is one of the toughest decisions that people must make. Many organizations have done studies and published lists of “Best Companies to Work For.” These lists have become influential in job hunters’ searches, and for businesses seeking to improve their brand. Frohlich et al. point out that “a company’s workforce is perhaps its most valuable asset, and no one knows more about a workplace than its employees [3].” A rising number of sites such as Fortune.com [4], Glassdoor.com [5], BusinessInsider.com, and PayScale.com [6] regularly publish “Best Companies to Work For” lists based on anonymous company reviews and surveys from employees.

1.1.1 Fortune.com

Fortune partners with Great Place to Work [13] to publish their list of the “100 Best Companies to Work For [4]” by performing the most extensive employee survey in corporate America. They define a great workplace from an employee’s perspective as one where employees:

1. Trust the people they work for
2. Have pride in what they do
3. Enjoy the people they work with

From managements' perspective, Fortune defines a great workplace as one where:

1. Organizational objectives are met
2. Employees give their personal best and work together as a team/family
3. There is an environment of trust [7]

The Trust Index Employee survey determines two-thirds of a company's score. This survey is sent to a random sample of employees at each surveyed company and carries the heaviest evaluative weight [4]. It attempts to capture the level of employee engagement through open-ended questions regarding trust in management, job satisfaction, and the company's collaborative spirit [8]. The remaining third of a company's score is determined by their Culture Audit, which "assess[es] the foundations of company culture on policies, practices, programs and day-to-day management behaviors [8]." It also includes "detailed questions about pay and benefits programs and a series of open-ended questions about hiring practices, methods of internal communication, training, recognition programs, and diversity efforts [4]."

1.1.2 Glassdoor.com

Glassdoor creates its list of "50 Best Places to Work For" [5] by collecting and ranking anonymous employee reviews through their webpage. Their metric includes the best and worst reasons to work for an employer, overall employee satisfaction, employee opinions on the CEO and senior management leadership, career opportunities, compensation & benefits, culture & values, and work-life balance. Employees are also asked to weigh whether they would recommend a friend seek employment at their company, and their employer's business outlook for the next six months [5], [9], [10].

1.1.3 BusinessInsider.com and PayScale.com

Business Insider publishes their "50 Best Company to Work for in America" [6] report based on data collected through PayScale's employee survey. The survey metrics measure job satisfaction, job stress, the ability to telecommute, job meaning, median pay/total cash compensation, and the salary delta with a regional average [11]. The more favorable these values, the better a company is ranked.
1.1.4 Trend in Methodologies – Common “Best Companies to Work for” Indicators

Although the business rating organizations have different approaches and methods to identify and define the best companies to work for, there are a few interesting trends worth noting. When comparing their three different methodologies, certain factors are universally regarded as important:

- The perceived significance and meaningfulness of work
- The level of job satisfaction
- Work-life balance (including telecommuting, work hour flexibility, and so forth)
- Employee trust in the management, leadership, and co-workers
- The available opportunities for career development
- Compensation & Benefits

1.1.5 Trend in Rankings - Technology and Consulting Industry Dominance

Furthermore, the employee-voted “Best Companies to Work For” lists seem to be concentrated in a couple of particular industries. A large amount of the best companies to work for are technology companies (close to 40% - 50%), and the consulting industry is also well represented in the lists. What do those two industries have in common? Both industries are extremely dependent on human capital; hence, they have innovative talent management strategies. While email tools and telecommunications options that enable flexible policies are present in all industries, technology, and consulting-based companies rely most heavily on technologies and computers. They appear to place more value on human capital and the quality of their workforce over workforce size and other factors than other industries.

Technology and consulting companies provide excellent employee compensation. Software engineers and consultants are often paid more than their professional peers in other sectors. Higher compensation may partially explain the higher work satisfaction level reports. This, however, may not be the only factor as described in the following account:

"According to a report from Glassdoor, just 10% of Glassdoor users who reported annual wages higher than $120,000 gave their employers a rating of 1 out of 5 versus 15% of employees earning less than $30,000 annually. However,
controlling for a range of other factors, the report found money does not have a very large impact on satisfaction. An employee’s experience with a company’s culture and values are far more important [3].”

1.2 Challenges in Employee Recruitment and Retention


- A study of trucking companies showed that reducing driver turnover 50% could increase profits by 50%
- A study of brokerage companies showed that increasing broker retention by 10% increased broker value by 155%
- A student of retail stores showed that stores in the top third of employee retention were also in the top third in productivity with 22% higher sales per employee.
- Fast food stores with low turnover had profit margins 50% higher than stores with high turnover [13], [12]

Even top-rated employers are having difficulty hiring and retaining talent. “The U.S. Department of Education estimates that 60 percent of all new jobs in the 21st century will require skills that only 20 percent of current employees possess [14].” Furthermore, the Society for Human Resource Management (SHRM) conducted a study on challenges facing HR over the next ten years and found that HR professionals foresee this as a continuing problem for companies. The result composed of 487 randomly selected HR professionals from SHRM’s membership. It indicates that the three biggest challenges facing HR executives over the next ten years are retaining and rewarding the best employees (59%), developing the next generation of corporate leaders (52%), and creating a corporate culture that attracts the best employees to organizations (36%) [15]. Furthermore, over two-fifths (43%) of HR professionals indicated that obtaining human capital and optimizing human capital investments will be the biggest investment challenge [15].
1.3 Research Question

The important yet unanswered question becomes whether there is a way to extrapolate optimal combinations of job characteristics to attract and retain talents?

Due to the resource limitation, this thesis focuses on professionals who work in Science, Technology, Engineering, and Mathematics (STEM) fields to test and demonstrate the concept. The targeted demographics hold at least one bachelor degree in a STEM field and/or have had STEM as their occupations at some point in their lives.

This thesis attempts to answer this research question by exploring what job characteristics can effectively attract, develop, and retain STEM professionals. The hypothesis is that highly educated STEM professionals do exhibit certain preference patterns in workplace autonomy policies and job essential aspects. This assumption is tested by applying Chi-Squared analysis to obtained technology workforce survey data, which provides segmentations and trends with relatively homogenous knowledge base, skill sets, and education levels. The intensity of these preferences affects STEM respondents' likelihood to leave their jobs and/or accept new offers. By implementing specific autonomy policies and optimizing other aspects of job characteristics, business entities can potentially minimize STEM employee turnover rates.

1.4 Research Approach

The research scope is defined within the STEM functions of High Technology Industries including Computers/Electronics, Software/Internet, and Telecommunications. This thesis contains three parts: a conceptual case study on technology company human resource (HR) policy, a synthesis of literature reviews, and an analysis of data analytics collected from survey data. Based on the findings, this thesis explores their implications and suggests talent management strategies that can potentially improve STEM professional's work satisfactorily, and help employers to attract, develop, and retain high performers. Figure 1 presents the research approach and Chapter 3 describes it further in detail.
1.3.1 Phase 1: Literature Review

The Literature Review phase included a review of prior research, journal articles, other literature, company profiles, and workplace policies. Starting with the influential lists of the “Best Companies to Work For,” this research compares and contrasts the methodologies to identify patterns and common factors that employers contribute to the lists. Then, the study utilizes the job characteristic model as a framework to synthesize and draw a comparison of “the Best Companies to Work For” methodologies to understand what are the dominate autonomy aspects of the job characteristics that are rated as highly important by employees and industries.

1.3.2 Phase 2: Data Collection and Analysis

Based on the literature review, an employee response questionnaire was developed. This questionnaire was used as an instrument in the Data Collection and Analysis phase to gather valuable insights from professional workers through online surveys. The combined dataset was organized, studied, and analyzed to help uncover factors that improve job satisfaction rates and workplace policies. Chi-squared analysis was performed to test whether or not there were any statistical significances in selected key demographics (i.e. age, gender and household composition) and their preference patterns on schedule, location, work methods, and decision-making autonomy policies.

Additionally, the STEM professional’s responses were studied as a whole to measure the gaps between their autonomy policy preference patterns and what they have experienced in their workplace. By applying conditional probability to analyze collective responses in the
likelihood of leaving their current position or accepting new offers based on specific job characteristics, the research attempted to identify autonomy policies that optimized job characteristics towards targeted STEM demographics and that may reduce turnover rates.

1.3.3 Phase 3: Discussion

The third and final phase involved summarizing the study’s implications, conclusions, limitations, and making a recommendation for future research that can lead to more appropriate talent retention strategies and potential job characteristic improvements.
Chapter 2 – Literature Review

This chapter provides background theory required to understand this thesis. It reviews the most important work design theories and related research including the Job Characteristics Model [16], the Extended Work Design Model [17], and the Psychological Ownership-Based Revision of the Job Characteristics Model [18]. Other background research includes a thorough review of past research on job psychological ownership, relevant theories on job design, companies’ rankings in journal articles, trending workplace policies, and other literature that was completed and discussed in the Introduction and the Implications and Discussion Chapters.

2.1 The Job Characteristics Model (JCM)

The Job Characteristics Model (JCM) specifies the conditions under which individuals will become internally motivated to perform effectively on their jobs. Hackman and Oldham developed the Job Diagnostic Survey (JDS) as a measurement tool to diagnose existing jobs to determine if and how they might be redesigned to improve employee motivation and productivity [19]. The JDS is also used to evaluate the effects of job changes on employees. The JCM was tested and validated, both regarding the predicted causal direction and most achieve acceptable levels of statistical significance, using the JDS data obtained from 658 employees working on 62 different jobs in seven organizations [16]. Figure 2 presents the fundamental JCM theory.

The JCM examines five core job dimensions (skill variety, task identity, task significance, autonomy, and feedback) that lead to three critical psychological states of employees that must be present for internally motivated work behavior to develop. It also identifies the attributes of individuals that determine how positively a person will respond to a complex and challenging job resulting four desirable personal and work outcomes [16], [19].
CORE JOB DIMENSIONS

Skill Variety
The degree to which a job requires a variety of different activities in carrying out the work, which involve the use of a number of different skills and talents of the employee.

Task Identity
The degree to which the job requires completion of a "whole" and identifiable piece of work—that is, doing a job from beginning to end with a visible outcome.

Task Significance
The degree to which the job has a substantial impact on the lives or work of other people—whether in the immediate organization or in the external environment.

Autonomy
The degree to which the job provides substantial freedom, independence, and discretion to the employee in scheduling the work and in determining the procedures to be used in carrying it out.

Feedback
The degree to which carrying out the work activities required by the job results in the employee obtaining direct and clear information about the effectiveness of his or her performance.

CRITICAL PSYCHOLOGICAL STATES

Experienced Meaningfulness of the Work
The degree to which the employee experiences the job as one which is generally meaningful, valuable, and worthwhile.

Experienced Responsibility for Work Outcomes
The degree to which the employee feels personally accountable and responsible for the results of the work he or she does.

Knowledge of Results
The degree to which the employee knows and understands, on a continuous basis, how effectively he or she is performing the job.

Personal and Work Outcomes

High Internal Work Motivation

High Quality Work Performance

High Satisfaction with the Work

Low Absenteeism and Turnover

Individual Growth Need Strength (GNS)

Figure 2 Job Characteristics Model (JCM) of Work Motivation [16], [19]

2.1.1 JCM Result

The results suggest a correlation between five "core job dimensions" and three "critical psychological states" with each outcome that are consistent with expectations from the model. Combining skill variety, task identity, and task significance additively determine the psychological meaningfulness of a job. Work autonomy prompts employee feelings of personal responsibility for the work outcomes. Feedback from a job improves individual's knowledge of results and helps one to understand how effectively he or she is performing the role [16], [19].

The three critical psychological states (e.g. experienced meaningfulness of the work, experienced responsibility for outcomes of the work, and knowledge of the actual results of the work activities) are the causal core of the model. The module postulates that "an individual
experiences positive effect to the extent that “he learns (knowledge of results) that he personally (experienced responsibility) has performed well on a task that he cares about (experienced meaningfulness) [16].” Additionally, the regression equations include additional psychological states. The results show that the amount of desirable outcome measure variance controlled (high internal work motivation, high-quality job performance, great satisfaction with the work, low absenteeism and turnover) does increase. When all three psychological states are present, the model’s outcome prediction is maximized [16], [19].

The model also specifies that individual “growth need strength (GNS) [19]” can moderate employees’ reactions to their work at two points. GNS is measured from the “job choice” section of the JDS based on individual’s relative preference for 12 pairs of hypothetical jobs with characteristics relevant to growth need satisfaction. Comparing with individuals with low GNS, individuals with high GNS show stronger relationships between the core job features and their corresponding psychological states, and between the three psychological states and the outcome variables [16].

2.2 The Expanded Work Design Model (EWDM)

Integrating motivational, social and work contextual characteristics into the original Hackman and Oldham model, Humphrey, Nahrgang and Morgeson developed and meta-analytically tested the proposed expanded work design model [17].
The EWDM, on display in Figure 3, divides work design characteristics into three dimensions—motivational, social and work context characteristics. Feedback and autonomy as the core job dimensions in JCM are expanded. Feedback is separated into feedback from the job (motivational characteristics) and feedback from others (social characteristics) [17]. Jackson and colleagues conceptualize autonomy into three components.

1. Work scheduling autonomy (i.e., the freedom to control the scheduling and timing of work)
2. Work methods autonomy (i.e., the freedom to control which methods and procedures are utilized)
3. Decision-making autonomy (i.e., the freedom to make decisions at work) [17]
2.2.1 EWDM Result

Based on the results from a summary of 259 studies and 219,625 participants, the researchers show that 14 work characteristics are explained. Furthermore, on average, 43% of the variance in the 19 worker attitudes and behaviors are examined [17]. The detailed results are summarized in Table 1.

<table>
<thead>
<tr>
<th>Motivational characteristics</th>
<th>Social Characteristics (beyond motivational characteristics)</th>
<th>Work Context Characteristics (beyond both motivational and social characteristics)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variance in subjective performance</td>
<td>25%</td>
<td>incremental variances of 9%</td>
</tr>
<tr>
<td>Turnover perceptions</td>
<td>2%</td>
<td>incremental variances of 24%</td>
</tr>
<tr>
<td>Job satisfaction</td>
<td>34%</td>
<td>incremental variances of 17%</td>
</tr>
<tr>
<td>Organizational commitment</td>
<td>24%</td>
<td>incremental variances of 40%</td>
</tr>
<tr>
<td>Role perception outcomes</td>
<td>26%</td>
<td>incremental variances of 18%</td>
</tr>
<tr>
<td>Stress</td>
<td></td>
<td>incremental variances of 16%</td>
</tr>
</tbody>
</table>

2.3 Psychological Ownership within the Job Design Context (POJDC)

Psychological ownership is defined as that “state where an individual feels as though the target of ownership or a piece of that target is theirs [18], [20].” Pierce, Jussila, and Cummings integrated the psychological ownership theories and the Hackman and Oldham Job Characteristics Model in their research. Figure 4 summarizes the connection between job design and the following components -

1. The motives facilitating psychological ownership
2. The routes through which psychological ownership emerges
3. The individual-level outcomes (e.g., emotional, attitudinal, motivational, and behavioral) results from an employee's psychological ownership of his or her role [18]

Figure 4 A Psychological Ownership-Based Revision of the Job Characteristics Model [18]

2.3.1 POJDC Result

The "roots" of psychological ownership explains the motives and help understand why this state exists. Enriched job design is more likely to satisfy the following three motives for psychological ownership than a simplified, standardized, and short-time cycle employment [18].

1. Control and effectance motive reflects the individual's desire to interact effectively with his/her environment [21]
2. Self-identity motive [22]
3. Home (dwelling) motive refers to the person's placement and understanding of him/herself in the time and space [23]

The "routes" to psychological ownership provide insight into how it comes into being [18]. The research identifies the job dimensions enabling three "routes" through which psychological ownership emerges [18].

1. The autonomy job dimension causes the emergence of job-based psychological ownership through control exercised over the job
2. Task identity, autonomy, and feedback job dimensions cause the appearance of job-based psychological ownership through intimate knowledge of the job.

3. Task identity, skill variety, autonomy, and task significance cause the appearance of job-based psychological ownership through the investment of one’s self into the job.

[18]

Improving on the JCM, the research identifies territorial behavioral, positive and negative effects enabled through job design and psychological ownership relation. In sum, the researchers reached the following conclusions:

1. The psychological ownership allows for the prediction of the same JCM outcomes (e.g., internal motivation, job satisfaction, work attendance, and quality job performance).

2. The psychological ownership enables the prediction of other outcomes (e.g., territorial behavior, stress, promotion of change; personal sacrifice; nurturance and development of the target of ownership).

3. The psychological ownership enables the prediction of some dysfunctional (i.e., counterproductive) organizational behaviors (e.g., resistance to change; unwillingness to give up control and share; anger, isolation, preoccupation, shrinkage of the self-accompanying the destruction and/or loss of the target of ownership). [18]
Chapter 3 – Research Methodology

3.1 Objective

The research investigates questionnaire participants' collective responses to extrapolate optimal combinations of job characteristics that may minimize STEM employee turnover rate. The targeted demographics are professionals who hold at least one bachelor's degree in a STEM field or work in a STEM field.

The questionnaire is designed to identify and evaluate what the most effective job characteristics are to attract, develop and retain top tier talents in STEM fields. By collecting, organizing, and analyzing the survey data set, the research attempts to identify series of workplace autonomy policies and work task characteristics that are appealing to the targeted demographics.

This study enriches the existing research and proposes practical improvements to existing workplace autonomy policies combining the findings in literature reviews and the questionnaire participants' responses.

3.2 Questionnaire Structure

The survey questionnaire is designed based on the findings from the literature review, preliminary company policy research, personal experience, and discussion with other professional workers. The questionnaire was divided into three sections shown in Figure 5. (See Appendix 1 for the entire survey questionnaire)

![Figure 5 Questionnaire Structure](image-url)
The first section collects participants’ key demographic information, e.g. age, gender, household composition, educational and professional work background.

The second section attempts to estimate the perceived gaps between the desired autonomy policies and the policies in place, in particular, work schedule, location, process, methodology, and decision-making autonomy policies. Participants are asked to select their preferred workplace autonomy policies, their current workplace autonomy policies, and then consider if all else being equal, what is the likelihood that they would leave their current jobs if the new position offers the optimal work autonomy policies. The autonomy policy options in this section are categorized based on the findings from company policy research, personal experience, and discussion with other professional workers.

The last section is developed to test whether there is evidence to indicate clear preference associated with work task characteristics in certain demographics. The surveyed work task characteristics consist of skill and task variety, task identity and significance, in addition to the job performance feedback.

3.3 Distribution Channel

With MIT COHES[24] exemption approval (see Appendix 3), several distribution channels are deployed to reach out to the targeted demographics.

- Firstly, a website LeadTheWei.org [25] is created as a front end with a brief explanation of thesis objectives and research methodology and a link directly to the questionnaire.
- Secondly, a short cover letter with the survey link is also distributed via e-mails to approximately 200 current graduate students attending the System Design and Management (SDM) [26] program in Massachusetts Institute of Technology. The majority of the SDM cohorts have minimum 3-5 years of professional experiences in STEM fields.
- Thirdly, the research also utilizes social networks including Facebook.com [27] and LinkedIn.com[28] to reach out to a larger professional population in the STEM fields.
- Lastly, a cover letter and a link to the questionnaire are also distributed at the 2015 Grace Hopper Conference for Women in Technology and Computing [29].
3.4 Data Collection

The survey is developed and conducted online via a survey application - Google Survey [30]. All the data is recorded and exported from Google Survey. An implied consent (see Appendix 2) is acknowledged as the beginning of the survey.

A total of 135 people participated in providing data points within the three-week duration. All participants are anonymized and given an ID number as the order the data sets are recorded. The key demographic information (i.e. age, gender, household composition, education level, major, years of experience, and occupation) is collected in the questionnaire. In particular, the researcher collects, studies, and analyzes the collective responses about workplace autonomy policies from in-demand STEM employees. In this thesis, STEM respondents satisfy all three qualifications:

1. At least one bachelor degree in Science, Technology, Engineering and Mathematic (STEM)
2. With minimum of three years of professional experiences in a STEM field
3. Are born between 1965 to 1999, also known as Generation X or Millennial

3.5 Data Analysis

By design, all survey questions are multiple-choice questions with either nominal or ordinal variables. Demographic and professional experience information are considered nominal variables that are categorized into groups without ranks or orders. Employees’ job design preferences are ordinal variables that are ranked based on employees’ attitude towards their likelihood to leave current companies for desired job characteristics.

The data analysis consists of three layers. Firstly, the chi-squared test is primarily focused on respondent autonomy policy preference patterns in a different generation, gender, and household composition. Secondly, conditional probabilities estimate respondents’ retention rate associated with each job dimension. Lastly, the data is cross-tabulated to explore appropriate feedback frequencies and methods from various feedback providers.
3.5.1 The Chi-Squared Test

“A chi-squared test also referred to as \( X^2 \) test (or chi-square test), is any statistical hypothesis test in which the sampling distribution of the test statistic is a chi-square distribution when the null hypothesis is true [31].” The objective of the Chi-Square test is to investigate if there is any significant difference among well-educated professionals' autonomy preference patterns. It is difficult for companies to design policies that meet everyone’s personal taste and needs. Instead, this research identifies preference patterns across the targeted population to guide companies developing a hiring strategy that aligned with a better recruitment and retention outcomes.

The chi-square test is applied to demographic segments including age, gender, and household composition shown in Figure 6. The statistical significance level, alpha, is standardized to 0.05 for all chi-square tests.

After cross-tabulating targeted variables, the chi-square test examines the underlying hypothesis – whether or not respondent groups from different key demographic (i.e. age, gender, and household composition) exhibit significant differences in their autonomy policies preference patterns statistically. If the hypothesis is proven correct, the future analysis precedes interpreting data and extrapolating insights by considering all sample population as a whole. On the other hand, if the hypothesis is proven incorrect, the future analysis identifies the demographic factors and dives deeper in the dataset to understand its implications.

![Figure 6 Chi-Squared Test Approach](image_url)
3.5.2 Conditional Probability

The thesis compares the responses and measures the gap between respondents’ autonomy policy preferences and what they have experienced in the workplace treating the entire sample size as a whole. Subsequently, the study fixes one dimension of the job characteristics as independent variables and predicts respondents’ incremental acquisition or retention rates related to that individual aspect of the characteristic based on perceived significance level.

The employee retention rate is measured by respondents’ likelihood to join or leave a company given each workplace policy. This estimation gauges what aspect of job characteristic has more impact in attracting and retaining STEM respondents.

The conditional probability[32] measures the probability of a policy given that respondents’ would leave their jobs and/or accept new offers. Figure 7 highlights the analysis approach. The result indicates which job characteristics have more significant effects to attract and retain STEM employees. In particular, by how much percentage those specific policies may contribute to acquisition or retention rates.

![Conditional Probability Analysis Approach](image)

3.5.3 Cross-Tabulation

Questionnaire participants are asked to rank their preferred methods and frequencies to receive positive and negative feedback from various feedback providers. The data collected are cross-tabulated [33] in contingency tables to study the most effective feedback methods and frequencies. The contingency tables display the multivariate frequency distribution of the
variables under examinations to provide a main picture of the interrelation between variables [34]. Figure 8 shows the analysis approach.

Cross Tabulation
(To extrapolate effective feedback frequencies and methods from various feedback providers)

<table>
<thead>
<tr>
<th></th>
<th>Positive Feedback</th>
<th>Negative Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clients</td>
<td>Positive Feedback</td>
<td>Negative Feedback</td>
</tr>
<tr>
<td>Peers/Team Members</td>
<td>Positive Feedback</td>
<td>Negative Feedback</td>
</tr>
<tr>
<td>Subordinates</td>
<td>Positive Feedback</td>
<td>Negative Feedback</td>
</tr>
<tr>
<td>Others at Work</td>
<td>Positive Feedback</td>
<td>Negative Feedback</td>
</tr>
</tbody>
</table>

Figure 8 Cross Tabulation Analysis Approach
Chapter 4 – Participant Demographic

The motivation for this thesis is to minimize STEM professional turnover rate by identifying autonomy policies that tune job characteristics towards targeted demographics. The questionnaires are distributed through several channels. Within three-week duration, a total of 135 people participated. All participants are anonymized and given an ID number as the recorded data set orders. The questionnaire collects several key demographic information (i.e. age, gender, household composition, education level, major, years of experience, and occupation).

4.1 Age/Generation and Gender Composition

Table 2 presents participant gender composition and indicates that almost all participants are either Generation X or Millennials. In particular, 52 participants are born between 1965 and 1980, which is Generation X (39%); 79 participants are born between 1981 and 1999, which is Generation Millennials (59%). One age unknown and three baby boomers participants (2%), who born between 1946 and 1964, are excluded from chi-square tests based on age due to insufficient data.

On the other hand, there are 101 male (75%) and 31 female (23%) contributed, and three participants (2%, ID 29, 35, and 65) did not disclose gender information, which are excluded from any further chi-square analysis based on gender.

<table>
<thead>
<tr>
<th>Age/Generation</th>
<th>Gender</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Female</td>
<td>Male</td>
<td>Unknown</td>
<td>Grand Total</td>
</tr>
<tr>
<td>Baby Boomers (Born between 1946 and 1964)</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Generation Xers (Born between 1965 and 1980)</td>
<td>5</td>
<td>46</td>
<td>1</td>
<td>52</td>
</tr>
<tr>
<td>Millennials (Born between 1981 and 1999)</td>
<td>25</td>
<td>53</td>
<td>1</td>
<td>79</td>
</tr>
<tr>
<td>Unknown</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>31</strong></td>
<td><strong>101</strong></td>
<td><strong>3</strong></td>
<td><strong>135</strong></td>
</tr>
</tbody>
</table>
Additional chi-square analysis performed in Chapter 5 tests whether or not there is any statistical significance in job autonomy preference patterns on schedule, location, work methods, and decision-making autonomy policies between different generations and genders.

4.2 Household Composition

Figure 9 presents the four participant household compositions. In particular, dual income with dependents (29), dual income without dependents (30), single income with dependents (30), and individual income without dependents (45). The chi-square test examines whether there is a significant difference in autonomy policy patterns among four household compositions in Chapter 5.

What is your household composition?

Dual income w/ dependents 29 21.6%
Dual income w/out dependents 30 22.4%
Single income w/ dependents 30 22.4%
Single income w/out dependents 45 33.6%

Figure 9 Participant Household Composition

4.3 Highest Education Level and Major

Participants select the highest education level that they have completed, and one or multiple post-high school majors (i.e. STEM, business, health and medicine, public and social services, arts and humanities, multi-/interdisciplinary studies, and other). For the purpose of this research, the post-high school majors are consolidated into two groups - STEM, and other majors. Participants' highest education level and their academic major(s) are shown in Table 3 following the consolidation protocol -

a. The STEM major includes participants who select one or multiple major(s) including
   STEM
b. The other academic major includes participants who do not study in STEM

© Wei Wei 2016
Table 3 Highest Education Level and Major

<table>
<thead>
<tr>
<th>Highest Education Level and Major(s)</th>
<th>Count of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEM (Science, Technology, Engineering and Math)</td>
<td>123</td>
</tr>
<tr>
<td>Bachelor's Degree</td>
<td>51</td>
</tr>
<tr>
<td>Master's Degree</td>
<td>63</td>
</tr>
<tr>
<td>Ph. D or Post Doc</td>
<td>8</td>
</tr>
<tr>
<td>Some college</td>
<td>1</td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>Bachelor's Degree</td>
<td>6</td>
</tr>
<tr>
<td>Master's Degree</td>
<td>3</td>
</tr>
<tr>
<td>Ph. D or Post Doc</td>
<td>2</td>
</tr>
<tr>
<td>Some college</td>
<td>1</td>
</tr>
<tr>
<td>Grand Total</td>
<td>135</td>
</tr>
</tbody>
</table>

Neither highest education level nor associated major is selected as one of the key demographic factors for chi-square analysis because the data indicates that the sample population is predominantly highly educated (98%). That is, 133 out of 135 participants hold at least one Bachelor's degree or higher-level degree. The two participants who had some college (ID 62 and 92) are not a large enough sample size to stand as a comparison group. Similarly, post-high school majors are not selected as one of the key demographic factors for the chi-square analysis because 91% of responses come from STEM major plus the academic major may not be the independent variable. For example, it is likely that people have more than one academic major in university. In fact, many respondents do claim to have degrees or minors in other majors. As a result, highest education and level and associated major are not a part of the chi-square analysis.

However, the respondents are further analyzed as a group in Chapter 6 to study the gaps between preferred job characteristics and the reality of the workplace policies. Additionally, the conditional probability is applied to gauge the implications of the preference and reality gap associated with each job characteristic element in relation to employee retention rate. Excluding data from the two participants without a minimum bachelor's degree, 123 STEM participants are considered as target group (90%).
4.4 Occupation and Years of Experience

Participants indicate years of experience ranges, and one or multiple occupations (i.e. STEM; management; business and financial operations; community and social service; legal; education, training, and library; arts, design, entertainment, sports, and media; health and medicine; and other). For even distribution of the workforce comparison, questionnaire participant work experience and occupation (see Table 4) are categorized into two groups, STEM (70%) and other (30%). For the purpose of this research, the occupation reconsolidation procedure is as following-

a. The STEM field includes participants who select STEM as occupation
b. The other field includes participants who do not select STEM as occupation

<table>
<thead>
<tr>
<th>Table 4 Occupations and Years of Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupation</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>STEM</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>Grand Total</td>
</tr>
</tbody>
</table>

The chi-square analysis does not select occupation and years of experiences as one of the key demographic factors. While years of experience may lead to similar results as chi-square test on age, the chi-square test on occupation may not be accurate because occupation options are not independent variables. For example, it is likely that employees hold several occupations throughout their careers. However, all 95 Respondents are qualified as a target group to predict autonomy policies' influences in STEM professional turnover rate.
Chapter 5 – Autonomy Preference Patterns in Different Demographics

5.1 Overview

The Chi-Square test is performed to assess if there is any significant difference among well-educated professionals’ autonomy preference patterns within the thesis dataset. Autonomy is defined as the degree to which the job provides substantial freedom, independence, and discretion to the employee in scheduling the work and in determining the procedures to be used in carrying it out [16].

The overarching hypothesis in the chi-square test is that there is no significant difference between people’s work schedule, location, methods, and decision-making autonomy policy preference in the key demographic.

Finding 1 Chi-Square Test

<table>
<thead>
<tr>
<th>Demographic Composition</th>
<th>Schedule</th>
<th>Autonomy Preference Patterns</th>
<th>Location</th>
<th>Work Methods</th>
<th>Decision-Making</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age/Generation</td>
<td>Respondents, across different age, gender and household composition, exhibit similar preference patterns regarding schedule, location, methods and decision-making autonomy policy in the workplace.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The statistical significance level, alpha, is standardized to 0.05 for all chi-square tests [31]. After cross-tabulating targeted variables, chi-square tests are performed using the Real Statistics Data Analysis Tool [34] to cross exanimate whether sample population exhibits significant differences in preference patterns from various demographics (i.e. age, gender, and household composition). Finding 1 indicates that the overarching hypothesis is tested and validated by the dataset. Finding 2 to 4 summarized chi-square tests following by detail analysis based on particular demographic factor and specific autonomy policies.

5.2 Findings: Autonomy Preference Patterns by Age/Generation

Finding 2 Autonomy Preference Patterns by Generation

<table>
<thead>
<tr>
<th>Age/Generation</th>
<th>Schedule</th>
<th>Autonomy Preference Patterns</th>
<th>Location</th>
<th>Work Methods</th>
<th>Decision-Making</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation X</td>
<td>H1.1: No significant statistical difference</td>
<td>H1.2: No significant statistical difference</td>
<td>H1.3: No significant statistical difference</td>
<td>H1.4: No significant statistical difference</td>
<td></td>
</tr>
<tr>
<td>Millennials</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Finding 2 summarizes the chi-square test results. The hypothesis is correct; the dataset suggests there is no significant difference statistically between Generation X and Millennials' preference patterns on schedule, location, work methods, and decision-making autonomy policies.

The participant age composition data in Table 2 indicates that there are 52 Generation X participants; 79 Millennial participants. Due to lack of sufficient data, this research excludes further analysis on the rest of generations (i.e. traditionalist, baby boomers). The data from the one age unknown participant (ID 65) and three baby boomer participants (ID 54, 67 and 73; born between 1900 and 1945) are excluded from all chi-square analysis studying the generation difference. The details of chi-square analysis performed are presented and analyzed in the following sections.

5.2.1 Schedule

Hypothesis 1.1 There is no statistically significant difference between Generation X and Millennial respondents' autonomy preference patterns on work schedule policies.

<table>
<thead>
<tr>
<th>Schedule Preference Pattern</th>
<th>9am-5pm, Monday to Friday, unless you need to deviate from the schedule once a while for some reasons.</th>
<th>Alternative fixed schedule such as ten-hour day, four-day workweek or nine hour day, one day off every other week</th>
<th>No fixed hours, as long as you get your work done, you can take as many vacations as possible</th>
<th>Work on a fixed amount of hours (e.g. 40 hours) per week, but it's up to you whether you work at 9am or 5pm; Monday or Sunday</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation Xers</td>
<td>8%</td>
<td>4%</td>
<td>13%</td>
<td>16%</td>
<td>40%</td>
</tr>
<tr>
<td>Millennials</td>
<td>5%</td>
<td>10%</td>
<td>24%</td>
<td>20%</td>
<td>60%</td>
</tr>
<tr>
<td>Grand Total</td>
<td>13%</td>
<td>14%</td>
<td>37%</td>
<td>36%</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Schedule Preference Pattern</th>
<th>Observed Schedule Preference Pattern</th>
<th>Expected Schedule Preference Pattern</th>
<th>CHI-SQUARE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9am-5pm, Monday to Friday, unless you need to deviate from the schedule once a while for some reasons.</td>
<td>Alternative fixed schedule such as ten-hour day, four-day workweek or nine hour day, one day off every other week</td>
<td>No fixed hours, as long as you get your work done, you can take as many vacations as possible</td>
<td>Work on a fixed amount of hours (e.g. 40 hours) per week, but it's up to you whether you work at 9am or 5pm; Monday or Sunday</td>
</tr>
<tr>
<td>Generation Xers</td>
<td>8%</td>
<td>4%</td>
<td>13%</td>
<td>16%</td>
</tr>
<tr>
<td>Millennials</td>
<td>5%</td>
<td>10%</td>
<td>24%</td>
<td>20%</td>
</tr>
<tr>
<td>Grand Total</td>
<td>13%</td>
<td>14%</td>
<td>37%</td>
<td>36%</td>
</tr>
</tbody>
</table>

Chi-Square Test Result - Hypothesis is true
All participants are given the descriptions of four most offered work schedule autonomy policies in the workplace, in addition to a fifth option to provide their preferred policy to the question: "when considering job offers, you would prefer that an employer offers which of the following work schedule autonomy policy?" Three participants (ID 31, 47, 87) indicate that they prefer another type of work schedule policy. Hence, their inputs are excluded in the following analysis because of lack of sufficient 'other' responses.

As the detailed analysis shown in Table 5, the expected schedule preference patterns are calculated based on the observed schedule preference patterns obtained from the questionnaire. The chi-square test [35], [36], leads to a p-value larger than the significance level, 0.05. As a result, the hypothesis 1.1 is validated and proven true based the analysis. There is no statistically significant difference between Generation X and Millennials' autonomy preference pattern on work schedule policies.

5.2.2 Location

Hypothesis 1.2 There is no statistically significant difference between Generation X and Millennials' autonomy preference patterns on work location policies.

Table 6 Chi-Square Test of Location Autonomy Preference Patterns by Generation

<table>
<thead>
<tr>
<th>When considering job offers you would prefer which of the following work location autonomy policy</th>
<th>Working from a main office the majority of the time</th>
<th>company provided main or satellite office as you see fit the majority of the time</th>
<th>Working from home or on the move the majority of the time</th>
<th>Working from the office, home, or anywhere you see fit</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed Location Preference Pattern</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generation Xers</td>
<td>8.5%</td>
<td>10.0%</td>
<td>2.3%</td>
<td>18.5%</td>
<td>39.2%</td>
</tr>
<tr>
<td>Millennials</td>
<td>10.8%</td>
<td>18.5%</td>
<td>2.3%</td>
<td>29.2%</td>
<td>60.8%</td>
</tr>
<tr>
<td>Grand Total</td>
<td>19.2%</td>
<td>28.5%</td>
<td>4.6%</td>
<td>47.7%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Expected Location Preference Pattern</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generation Xers</td>
<td>7.5%</td>
<td>11.2%</td>
<td>1.8%</td>
<td>18.7%</td>
<td>39.2%</td>
</tr>
<tr>
<td>Millennials</td>
<td>11.7%</td>
<td>17.3%</td>
<td>2.8%</td>
<td>29.0%</td>
<td>60.8%</td>
</tr>
<tr>
<td>Grand Total</td>
<td>19.2%</td>
<td>28.5%</td>
<td>4.6%</td>
<td>47.7%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chi-Square</th>
<th>chi-sq</th>
<th>p-value</th>
<th>x-crit</th>
<th>sig</th>
<th>Cramer V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson's</td>
<td>0.006</td>
<td>1.000</td>
<td>7.815</td>
<td>no</td>
<td>0.078</td>
</tr>
<tr>
<td>Max likelihood</td>
<td>0.006</td>
<td>1.000</td>
<td>7.815</td>
<td>no</td>
<td>0.078</td>
</tr>
</tbody>
</table>

Chi-Square Test Result - Hypothesis is true

All participants are given the descriptions of four most offered work location autonomy policies in the workplace, in addition to a fifth option to provide their preferred policy to the question:
"when considering job offers you would prefer which of the following work location autonomy policy?"

As the detailed analysis shown in

Table 6, the expected location preference pattern is calculated based on the observed pattern based on all Generation X or Millennial professionals' feedback on work location policy preferences. Chi-square test concludes the p-value is 1, which is larger than the significance level, 0.05. As a result, the hypothesis 1.2 is proven true based on the analysis. There is no statistically significant difference between Generation X and Millennials’ autonomy preference pattern on work location policies.

5.2.3 Work Method

Hypothesis 1.3 There is no statistically significant difference between Generation X and Millennial respondents’ work methods preference patterns.

Table 7 Chi-Square Test of Work Methods Autonomy Preference Patterns by Generation

<table>
<thead>
<tr>
<th>When considering job offers you would prefer which of the following work methods autonomy policy</th>
<th>Almost no pre-defined work method, process or procedure. Up to your and/or your team to define</th>
<th>Clearly defined work methodology, process and/or procedures</th>
<th>Low level of pre-defined work methodology, process and/or procedures</th>
<th>Somewhat defined work methodology, process and/or procedures</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed Work Methods Preference Pattern</td>
<td>Generation Xers 1%</td>
<td>5%</td>
<td>11%</td>
<td>22%</td>
<td>39%</td>
</tr>
<tr>
<td></td>
<td>Millennials 5%</td>
<td>15%</td>
<td>14%</td>
<td>28%</td>
<td>61%</td>
</tr>
<tr>
<td></td>
<td>Grand Total 5%</td>
<td>20%</td>
<td>25%</td>
<td>50%</td>
<td>100%</td>
</tr>
<tr>
<td>Expected Work Methods Preference Pattern</td>
<td>Generation Xers 2%</td>
<td>8%</td>
<td>10%</td>
<td>20%</td>
<td>39%</td>
</tr>
<tr>
<td></td>
<td>Millennials 3%</td>
<td>12%</td>
<td>15%</td>
<td>30%</td>
<td>61%</td>
</tr>
<tr>
<td></td>
<td>Grand Total 5%</td>
<td>20%</td>
<td>25%</td>
<td>50%</td>
<td>100%</td>
</tr>
</tbody>
</table>

CHI-SQUARE

<table>
<thead>
<tr>
<th>Pearson's chi-sq</th>
<th>p-value</th>
<th>x-crit</th>
<th>sig</th>
<th>Cramer V</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.03</td>
<td>1.00</td>
<td>7.81</td>
<td>no</td>
<td>0.19</td>
</tr>
<tr>
<td>0.04</td>
<td>1.00</td>
<td>7.81</td>
<td>no</td>
<td>0.19</td>
</tr>
</tbody>
</table>

Chi-Square Test Result - Hypothesis is true

All participants were asked to select one of the four work method autonomy levels (i.e. clearly defined, somewhat defined, low level of pre-defined, and almost no pre-defined work method, profess and/or procedures) based on their preferences.

The detailed analysis shown in Table 7 suggests that the observed and expected respondents’ work method preferences exhibit similar patterns. The chi-square test leads to a p-value that is larger than the significance level, 0.05. As a result, the hypothesis 1.3 is validated.
based on the analysis. There is no statistically significant difference between Generation X and Millennial respondents’ work methods preference patterns.

5.2.4 Decision-Making

Hypothesis 1.4 There is no statistically significant difference between Generation X and Millennial respondents’ decision-making autonomy preference patterns.

<table>
<thead>
<tr>
<th>Table 8 Chi-Square Test of Decision-Making Autonomy Preference Patterns by Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>When considering job offers you would prefer which of the following decision-making policy</td>
</tr>
<tr>
<td>Free to make most of decisions at work by yourself</td>
</tr>
<tr>
<td>Observed Decision-Making Preference Pattern</td>
</tr>
<tr>
<td>Generation Xers</td>
</tr>
<tr>
<td>Millennials</td>
</tr>
<tr>
<td>Grand Total</td>
</tr>
<tr>
<td>Expected Decision-Making Preference Pattern</td>
</tr>
<tr>
<td>Generation Xers</td>
</tr>
<tr>
<td>Millennials</td>
</tr>
<tr>
<td>Grand Total</td>
</tr>
<tr>
<td>CHI-SQUARE</td>
</tr>
<tr>
<td>Pearson’s</td>
</tr>
<tr>
<td>Max likelihood</td>
</tr>
<tr>
<td>Chi-Square Test Result - Hypothesis is true</td>
</tr>
</tbody>
</table>

The detailed analysis in Table 8 concludes a p-value larger than the significance level, 0.05. It validates that the hypothesis 1.4 is proven true based on all Generation X or Millennial professionals’ feedback on decision-making policy preferences at the workplace. All participants select one of the four most offered decision-making autonomy policies at workplace based on their preferences (i.e. Strict, formalized decision-making approval processes at work; need approval for higher impact decisions, but free to make other decisions at work by oneself; free to make most of the decisions at work through team consent; or free to make most of decisions at work by oneself). One important finding is that nobody selected strict, formalized decision-making approval processes at work as his or her decision-making autonomy preference.

5.3 Findings: Autonomy Preference Patterns by Gender

Finding 3 Autonomy Preference Patterns by Gender
Autonomy Preference Patterns

Gender Schedule Location Work Methods Decision-Making
Female H2.1 No significant statistical difference H2.2: No significant statistical difference H2.3: No significant statistical difference H2.4: No significant statistical difference
Male statistical difference statistical difference statistical difference statistical difference

Finding 3 summarizes the chi-square test results. The hypothesis is true; there is no statistically significant difference in two genders’ preference patterns on schedule, location, work methods, and decision-making autonomy policies.

The participant gender composition data in Table 2 indicates that there is 101 male, and 31 female professionals contributed to the research. Three participants (ID 29, 35, and 65) did not reveal their gender. The data from the unknown gender participants are excluded from all chi-square tests studying the gender difference. The details of chi-square analysis performed are presented and analyzed in the following sections.

5.3.1 Schedule

Hypothesis 2.1 There is no statistically significant difference between male and female respondents’ preference patterns on work schedule policies.

<table>
<thead>
<tr>
<th>Schedule Preference Pattern</th>
<th>Observed Schedule Preference Pattern</th>
<th>Expected Schedule Preference Pattern</th>
<th>Chi-Square Test Result - Hypothesis is true</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation Xers 2% 4% 9% 9% 23%</td>
<td>Female 13% 10% 26% 27% 77%</td>
<td>Male 15% 14% 36% 36% 100%</td>
<td></td>
</tr>
<tr>
<td>9am-5pm, Monday to Friday, unless you need to deviate from the schedule once a while for some reasons.</td>
<td>Alternative fixed schedule such as ten-hour day, four-day workweek or nine-hour day, one day off every other week</td>
<td>No fixed hours, as long as you get your work done, you can take as many vacations as possible</td>
<td>Work on a fixed amount of hours (e.g. 40 hours) per week, but it’s up to you whether you work at 9am or 9pm; Monday or Sunday</td>
</tr>
<tr>
<td>Grand Total 15% 14% 36% 36% 100%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHI-SQUARE</td>
<td>chi-sq</td>
<td>p-value</td>
<td>x-crit</td>
</tr>
<tr>
<td>Pearson's</td>
<td>0.02</td>
<td>1.00</td>
<td>7.81</td>
</tr>
<tr>
<td>Max likelihood</td>
<td>0.02</td>
<td>1.00</td>
<td>7.81</td>
</tr>
</tbody>
</table>

Excluding the three participants who prefer other work schedule autonomy policies that are not provided in the questionnaire and the three participants who did not specify their genders, all the other participants’ data are applied to the chi-square to tests the hypothesis 2.1.

As the detailed analysis shown in Table 9, the p-value is larger than the significance level, 0.05. As a result, the hypothesis 2.1 is validated and proven true based the analysis.
There is no statistically significant difference between male and female respondents' preference patterns on work schedule policies.

5.3.2 Location

Hypothesis 2.2 There is no statistically significant difference between male and female respondents' preference patterns on work location policies.

<table>
<thead>
<tr>
<th>When considering job offers you would prefer which of the following work location autonomy policy</th>
<th>Working from a main office the majority of the time</th>
<th>Working from any company provided main or satellite office as you see fit the majority of the time</th>
<th>Working from home or on the move the majority of the time</th>
<th>Working from the office, home, or anywhere you see fit</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Female</strong></td>
<td>5%</td>
<td>5%</td>
<td>2%</td>
<td>12%</td>
<td>23%</td>
</tr>
<tr>
<td>Male</td>
<td>16%</td>
<td>23%</td>
<td>3%</td>
<td>36%</td>
<td>77%</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td>20%</td>
<td>28%</td>
<td>6%</td>
<td>47%</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expected Location Preference Pattern</th>
<th>Female</th>
<th>Male</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>7%</td>
<td>1%</td>
<td>11%</td>
</tr>
<tr>
<td>16%</td>
<td>21%</td>
<td>3%</td>
<td>36%</td>
</tr>
<tr>
<td><strong>20%</strong></td>
<td><strong>28%</strong></td>
<td><strong>6%</strong></td>
<td><strong>47%</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHI-SQUARE</th>
<th>pearson's</th>
<th>max likelihood</th>
<th>chi-sq</th>
<th>p-value</th>
<th>x-crit</th>
<th>sig</th>
<th>cramer v</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.007</td>
<td>1.000</td>
<td>7.815</td>
<td>no</td>
<td>0.085</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.007</td>
<td>1.000</td>
<td>7.815</td>
<td>no</td>
<td>0.085</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Chi-Square Test Result - Hypothesis is true

As the detailed analysis shown in Table 10, male and female participants exhibit the similar the expected and observed location preference patterns. The chi-square test leads to a p-value equal to 1, which is larger than the significance level, 0.05. As a result, the hypothesis 2.2 is validated and proven true based the analysis. There is no statistically significant difference between two genders' autonomy preference patterns on work location policies.

5.3.3 Work Method

Hypothesis 2.3 There is no statistically significant difference between male and female respondents' work methods preference patterns.
Table 11 Chi-Square Test of Work Methods Autonomy Preference Patterns by Gender

<table>
<thead>
<tr>
<th>Work Methods Preference Pattern</th>
<th>Observed</th>
<th>Expected</th>
<th>CHI-SQUARE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Female</td>
<td>Male</td>
<td>Pearson's</td>
</tr>
<tr>
<td>Almost no pre-defined work method, process or procedure up to your and/or your team to define</td>
<td>1%</td>
<td>5%</td>
<td>0.04</td>
</tr>
<tr>
<td>Clearly defined work methodology, process and/or procedures</td>
<td>8%</td>
<td>11%</td>
<td>1.00</td>
</tr>
<tr>
<td>Low level of pre-defined work methodology, process and/or procedures</td>
<td>5%</td>
<td>19%</td>
<td>7.81</td>
</tr>
<tr>
<td>Somewhat defined work methodology, process and/or procedures</td>
<td>10%</td>
<td>20%</td>
<td>no</td>
</tr>
<tr>
<td>Grand Total</td>
<td>23%</td>
<td>77%</td>
<td></td>
</tr>
</tbody>
</table>

Table 12 Chi-Square Test of Decision-Making Autonomy Preference Patterns by Gender

<table>
<thead>
<tr>
<th>Decision-Making Preference Pattern</th>
<th>Observed</th>
<th>Expected</th>
<th>CHI-SQUARE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Female</td>
<td>Male</td>
<td>Pearson's</td>
</tr>
<tr>
<td>Free to make most of decisions at work by yourself</td>
<td>1%</td>
<td>9%</td>
<td>0.02</td>
</tr>
<tr>
<td>Free to make most of decisions at work through team consent</td>
<td>8%</td>
<td>29%</td>
<td>0.99</td>
</tr>
<tr>
<td>Approval of higher impact decisions, but free to make other decisions at work by yourself</td>
<td>14%</td>
<td>39%</td>
<td>5.99</td>
</tr>
<tr>
<td>Strict, formalized decision making approval processes at work</td>
<td>0%</td>
<td>0%</td>
<td>no</td>
</tr>
<tr>
<td>Grand Total</td>
<td>23%</td>
<td>77%</td>
<td></td>
</tr>
</tbody>
</table>

Per the detailed analysis shown in Table 11, male and female participants exhibit the similar the expected and observed work methods preference patterns. The chi-square test leads to a p-value equal to 1, which is larger than the significance level, 0.05. As a result, the hypothesis 2.3 is validated and proven true based the analysis. There is no statistically significant difference between two genders' autonomy preference patterns on work methods policies.

5.3.4 Decision-Making

Hypothesis 2.4 there is no statistically significant difference between male and female respondents' preference patterns in decision-making autonomy at the workplace.
Table 12 shows the detailed analysis. Male and female participants exhibit the similar expected and observed decision-making autonomy preference patterns. The chi-square test leads to a p-value larger than the significance level, 0.05. As a result, the hypothesis 2.4 is validated and proven true based on the analysis. There is no statistically significant difference between two genders' autonomy preference patterns on work decision-making policies.

5.4 Findings: Autonomy Preference Patterns by Household Composition

<table>
<thead>
<tr>
<th>Household Composition</th>
<th>Autonomy Preference Patterns</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Schedule</td>
</tr>
<tr>
<td>Dual income w/ dependents</td>
<td>H3.1 No significant statistical difference</td>
</tr>
<tr>
<td>Dual income w/o dependents</td>
<td>H3.2: No significant statistical difference</td>
</tr>
<tr>
<td>Single income w/ dependents</td>
<td>H3.3: No significant statistical difference</td>
</tr>
<tr>
<td>Single income w/o dependents</td>
<td>H3.4: No significant statistical difference</td>
</tr>
</tbody>
</table>

Finding 4 summarizes the chi-square test results. The hypothesis is true; participants from four different household compositions do not show the statistically significant difference in the preference patterns of schedule, location, work methods, and decision-making autonomy policies.

The participants are categorized into four household composition groups in Figure 9. Dual income with dependents (30); dual income without dependents (30); single income with dependents (30); individual income without dependents (45). The details of chi-square analysis performed are presented and analyzed in the following sections.

5.4.1 Schedule

**Hypothesis 3.1** Respondents from different household composition groups do not exhibit a statistically significant difference in work schedule preference patterns.
Table 13 Chi-Square Test of Schedule Autonomy Preference Patterns by Household Composition

<table>
<thead>
<tr>
<th>Observed Schedule Preference Pattern</th>
<th>9am-5pm, Monday to Friday, unless you need to deviate from the schedule once a while for some reasons.</th>
<th>Alternative fixed schedule such as ten-hour day, four-day workweek or nine-hour day, one day off every other week</th>
<th>No fixed hours, as long as you get your work done, you can take as many vacations as possible</th>
<th>Work on a fixed amount of hours (e.g. 40 hours) per week, but it's up to you whether you work at 9am or 9pm; Monday or Sunday</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dual income w/ dependents</td>
<td>2%</td>
<td>2%</td>
<td>10%</td>
<td>8%</td>
<td>22%</td>
</tr>
<tr>
<td>Dual income w/o dependents</td>
<td>4%</td>
<td>4%</td>
<td>5%</td>
<td>10%</td>
<td>23%</td>
</tr>
<tr>
<td>Single income w/ dependents</td>
<td>5%</td>
<td>3%</td>
<td>8%</td>
<td>8%</td>
<td>23%</td>
</tr>
<tr>
<td>Single income w/o dependents</td>
<td>4%</td>
<td>5%</td>
<td>13%</td>
<td>10%</td>
<td>32%</td>
</tr>
<tr>
<td>Grand Total</td>
<td>15%</td>
<td>14%</td>
<td>36%</td>
<td>36%</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expected Schedule Preference Pattern</th>
<th>9am-5pm, Monday to Friday, unless you need to deviate from the schedule once a while for some reasons.</th>
<th>Alternative fixed schedule such as ten-hour day, four-day workweek or nine-hour day, one day off every other week</th>
<th>No fixed hours, as long as you get your work done, you can take as many vacations as possible</th>
<th>Work on a fixed amount of hours (e.g. 40 hours) per week, but it's up to you whether you work at 9am or 9pm; Monday or Sunday</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dual income w/ dependents</td>
<td>3%</td>
<td>3%</td>
<td>8%</td>
<td>8%</td>
<td>22%</td>
</tr>
<tr>
<td>Dual income w/o dependents</td>
<td>3%</td>
<td>3%</td>
<td>8%</td>
<td>8%</td>
<td>23%</td>
</tr>
<tr>
<td>Single income w/ dependents</td>
<td>3%</td>
<td>3%</td>
<td>8%</td>
<td>8%</td>
<td>23%</td>
</tr>
<tr>
<td>Single income w/o dependents</td>
<td>5%</td>
<td>4%</td>
<td>12%</td>
<td>12%</td>
<td>32%</td>
</tr>
<tr>
<td>Total</td>
<td>15%</td>
<td>14%</td>
<td>36%</td>
<td>36%</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHI-SQUARE</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson's</td>
<td>0.04</td>
<td>1.00</td>
<td>16.92</td>
<td>no</td>
<td>0.12</td>
</tr>
<tr>
<td>Max likelihood</td>
<td>0.05</td>
<td>1.00</td>
<td>16.92</td>
<td>no</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Chi-Square Test Result - Hypothesis is true

Table 13 suggests participants from all four household compositions exhibit similar preference patterns on expected and observed work schedule autonomy. The chi-square test leads to a p-value larger than the significance level, 0.05. As a result, the hypothesis 3.1 is validated and proven true based the analysis. Regardless of participants' household compositions, they show similar preference patterns on the work schedule autonomy policy.

5.4.2 Location

Hypothesis 3.2 Respondents from different household composition groups do not exhibit a statistically significant difference in work location preference patterns.
Table 14 Chi-Square Test of Location Autonomy Preference Patterns by Household Composition

<table>
<thead>
<tr>
<th>Working from a main office the majority of the time</th>
<th>Working from any company provided main or satellite office as you see fit the majority of the time</th>
<th>Working from home or on the move the majority of the time</th>
<th>Working from the office, home, or anywhere you see fit</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dual income w/ dependents 3%</td>
<td>4%</td>
<td>1%</td>
<td>13%</td>
<td>22%</td>
</tr>
<tr>
<td>Dual income w/o dependents 6%</td>
<td>7%</td>
<td>1%</td>
<td>9%</td>
<td>22%</td>
</tr>
<tr>
<td>Single income w/ dependents 6%</td>
<td>5%</td>
<td>1%</td>
<td>10%</td>
<td>22%</td>
</tr>
<tr>
<td>Single income w/o dependents 5%</td>
<td>10%</td>
<td>1%</td>
<td>18%</td>
<td>34%</td>
</tr>
<tr>
<td>Grand Total 20%</td>
<td>27%</td>
<td>4%</td>
<td>49%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 14 indicates all four household composition groups exhibit similar preference patterns on expected and observed work schedule autonomy. The chi-square test leads to a p-value larger than the significance level, 0.05. As a result, the hypothesis 3.2 is validated and proven true based the analysis. Regardless of participants' household compositions, they show similar preference patterns on the work location autonomy policy.

5.4.3 Work Method

Hypothesis 3.3 Respondents from different household composition groups do not exhibit a statistically significant difference in work methods preference patterns.

Table 15 Chi-Square Test of Work Methods Autonomy Preference Patterns by Household Composition

<table>
<thead>
<tr>
<th>Almost no pre-defined work method, process or procedure. Up to you and/or your team to define.</th>
<th>Clearly defined work methodology, process and/or procedures</th>
<th>Low level of pre-defined work methodology, process and/or procedures</th>
<th>Somewhat defined work methodology, process and/or procedures</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dual income w/ dependents 1%</td>
<td>2%</td>
<td>4%</td>
<td>13%</td>
<td>22%</td>
</tr>
<tr>
<td>Dual income w/o dependents 4%</td>
<td>8%</td>
<td>2%</td>
<td>11%</td>
<td>22%</td>
</tr>
<tr>
<td>Single income w/ dependents 0%</td>
<td>3%</td>
<td>7%</td>
<td>13%</td>
<td>22%</td>
</tr>
<tr>
<td>Single income w/o dependents 1%</td>
<td>9%</td>
<td>11%</td>
<td>12%</td>
<td>34%</td>
</tr>
<tr>
<td>Grand Total 7%</td>
<td>19%</td>
<td>25%</td>
<td>49%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 14 Chi-Square Test of Location Autonomy Preference Patterns by Household Composition

<table>
<thead>
<tr>
<th>Observed Work Methods Preference Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dual income w/ dependents 3%</td>
</tr>
<tr>
<td>Dual income w/o dependents 6%</td>
</tr>
<tr>
<td>Single income w/ dependents 6%</td>
</tr>
<tr>
<td>Single income w/o dependents 5%</td>
</tr>
<tr>
<td>Grand Total 20%</td>
</tr>
</tbody>
</table>

Table 15 Chi-Square Test of Work Methods Autonomy Preference Patterns by Household Composition

CHI-SQUARE

<table>
<thead>
<tr>
<th>chi-sq</th>
<th>p-value</th>
<th>x-crit</th>
<th>sig</th>
<th>Cramer V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson's 0.131</td>
<td>1.000</td>
<td>16.919</td>
<td>no</td>
<td>0.209</td>
</tr>
</tbody>
</table>
From the detailed analysis shown in Table 15, all four household composition groups show similar preference patterns on expected and observed work schedule autonomy. The chi-square test leads to a p-value larger than the significance level, 0.05. As a result, the hypothesis 3.3 is validated and proven true based the analysis. Regardless of participants’ household composition, they show similar preference patterns on the work methods autonomy policy.

5.4.4 Decision-Making

Hypothesis 3.4 Respondents from different household composition groups do not exhibit a statistically significant difference in decision-making autonomy preference patterns.

Table 16 Chi-Square Test of Decision-Making Autonomy Preference Patterns by Household Composition

<table>
<thead>
<tr>
<th></th>
<th>Dual income w/ dependents</th>
<th>Dual income w/out dependents</th>
<th>Single income w/ dependents</th>
<th>Single income w/out dependents</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed Decision-Making Preference Pattern</td>
<td>2%</td>
<td>1%</td>
<td>2%</td>
<td>5%</td>
<td>11%</td>
</tr>
<tr>
<td>Free to make most decisions at work by yourself</td>
<td>8%</td>
<td>7%</td>
<td>7%</td>
<td>14%</td>
<td>37%</td>
</tr>
<tr>
<td>Free to make most of decisions at work through team consent</td>
<td>11%</td>
<td>13%</td>
<td>13%</td>
<td>14%</td>
<td>51%</td>
</tr>
<tr>
<td>Need approval for higher impact decisions, but free to make other decisions at work by yourself</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Strict, formalized decision making approval processes at work</td>
<td>22%</td>
<td>22%</td>
<td>22%</td>
<td>22%</td>
<td>100%</td>
</tr>
<tr>
<td>Expected Decision-Making Preference Pattern</td>
<td>2%</td>
<td>3%</td>
<td>3%</td>
<td>4%</td>
<td>11%</td>
</tr>
<tr>
<td>Free to make most decisions at work by yourself</td>
<td>8%</td>
<td>8%</td>
<td>8%</td>
<td>13%</td>
<td>37%</td>
</tr>
<tr>
<td>Free to make most of decisions at work through team consent</td>
<td>11%</td>
<td>12%</td>
<td>12%</td>
<td>13%</td>
<td>51%</td>
</tr>
<tr>
<td>Need approval for higher impact decisions, but free to make other decisions at work by yourself</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Strict, formalized decision making approval processes at work</td>
<td>22%</td>
<td>22%</td>
<td>22%</td>
<td>34%</td>
<td>100%</td>
</tr>
<tr>
<td>Total</td>
<td>11%</td>
<td>37%</td>
<td>51%</td>
<td>34%</td>
<td>100%</td>
</tr>
</tbody>
</table>

CHI-SQUARE

<table>
<thead>
<tr>
<th></th>
<th>chi-sq</th>
<th>p-value</th>
<th>x-cnt</th>
<th>sig</th>
<th>Cramer V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson's</td>
<td>0.02</td>
<td>1.00</td>
<td>12.59</td>
<td>no</td>
<td>0.11</td>
</tr>
<tr>
<td>Max likelihood</td>
<td>0.02</td>
<td>1.00</td>
<td>12.59</td>
<td>no</td>
<td>0.11</td>
</tr>
</tbody>
</table>

Chi-Square Test Result - Hypothesis is true

From the detailed analysis shown in Table 16, all four household composition groups show similar preference patterns on expected and observed decision-making autonomy. The chi-square test leads to a p-value larger than the significance level, 0.05. As a result, the hypothesis 3.4 is validated and proven true based the analysis. Regardless of participants’ household composition, they show similar preference patterns on decision-making autonomy policy.
5.5 Implication and Discussion

This chapter applies cross-tabulation and chi-square tests to study three key demographic factors’ (i.e. age/generation, gender, and household composition) inter-relationships with work schedule, location, methods, and decision-making autonomy policy preference. The study suggests that none of the demographic factors indicates a significant difference in preference patterns based on the dataset. In other words, regardless of sample population’s age, gender, or household composition, respondents exhibit similar preference patterns regarding schedule, location, methods, and decision-making policies in the workplace.

These findings suggest that we can simplify the analysis by considering the STEM respondents as one homogenous group with similar job characteristics preference patterns. The next chapter further studies sample population’s preference pattern as a whole to understand the potential implications of the preference profiles.
Chapter 6 – Perceived Incremental Acquisition/Retention Rate

6.1 Overview

This chapter further studies the well-educated sample population as a whole to assess the STEM participants’ acquisition and retention rate on each dimension building on previous chapter’s findings. In particular, the dataset consists of 125 participants who have completed at least one bachelor degree and/or claims STEM as their occupations are considered as STEM participants.


The research isolates each job characteristic variable to compare and identify the gaps between STEM respondents’ preference patterns and what they experience in the workplace. Firstly, each section estimates the gaps between respondents’ autonomy policy preferences and the common workplace practice. Secondly, this research further analyzes specific policies in each aspect of job characteristic (i.e. autonomy, skill and task variety, identity and significance) to assess the effects in attracting and retaining respondents measured by the likelihood to join or leave a company given each job characteristics dimension.

6.1.2 Measurement: Incremental Acquisition/Retention Rate

By design, all survey questions are multiple-choice questions with either nominal or ordinal variables. Demographic and professional experience information are nominal variables that are categorized into groups without ranks or orders. Employees’ job design preferences are ordinal variables that are ranked based on employees’ attitude towards their likelihood to leave current companies for desired job characteristics. The research performs conditional probability analysis to determine which job characteristics seem to have more significant effects to attract and retain STEM employees. In particular, by how much percentage those specific policies may contribute to attracting and retaining employees.
All else being equal, the research measures incremental respondent acquisition /retention rate associated with specific policies, which are ranked by the popularity among the sample population. The probability measures the incremental retention rate that respondents likely or very likely to accept new job offers or leave their current jobs under the condition that all else being equal except the controlled specific policy.

6.1.3 Limitations of the Measurements

However, there are limitations associated with estimating perceived gaps between workforce preference and workplace policy, and incremental acquisition/retention rates. Both estimations are extremely subjective. The intensity of the “likelihood” could vary to each questionnaire participant. For example, the difference between “likely” and “very likely” to change jobs is completely up to respondents’ interpretations. As a result, this study only attempts to differentiate affirmative and negative responses, rather than focusing on the exact frequency distributions based on the dataset.

6.2 Schedule Autonomy

Work schedule autonomy means the freedom to control the scheduling and timing of work [16], [17]. The questionnaire asks participants to answer the question “when considering job offers; which of the following work schedule autonomy policy would you prefer.” Participants are given the descriptions of four most offered work schedule autonomy policies in the workplace, in addition to a fifth option to provide their preferred policy. Three participants (ID 31, 47, 87) indicate that they prefer other types of work schedule policy shown below. All three participants’ inputs are excluded in this analysis because the lack of sufficient data points

- Participant (ID 31) prefers fixed working hours as 7am-4pm on weekdays;
- Participant (ID 47) prefers semi-fixed schedule with mandatory peak times (e.g. 10 am – 3 pm on weekdays);
- Participant (ID 87) prefers to work from 9 am to 5 pm, but no fixed hours and free to leave early, as long as the work is completed.
On the other hand, participants provided several answers when asked, "what kind of work schedule autonomy policy have you experienced." For the research purpose, some of the responses are consolidated as following:

- Four participants (ID 47, 54, 104, 121) experience policies that require a set of mandatory hours on weekdays, plus some flexible hours at nights and/or weekend. They are put into the alternative fixed hour category.
- Two participants (ID 31, 97) report that their companies require working hours from 7 be to 4 pm, and 6 am to 2:30 pm on weekdays, which are very similar to the traditional work schedule plan. As a result, those two data sets are categorized in the "9am-5pm, Monday to Friday, unless you need to deviate from the schedule once a while for some reasons" policy.
- Participant (ID 20) is categorized in the "No fixed hours, as long as you get your work done, you can take as many vacations as possible" group because his workplace has "a constantly changing schedule with unpredictable, increasing hours".
- Two STEM participants (ID 24, 30) are excluded from this analysis because they claim to have experienced all work schedule policies.

6.2.1 Finding: Perceived WP-WP Gap

Figure 10 demonstrates the gaps between respondents' preference in each work schedule policy and what they have experienced in the workplace. It is not surprising that the most stringent policy (9 am – 5 pm, fixed hours and schedule policy) is also the one with the highest discrepancy. Thirteen percent of the respondents prefer this policy while 54% report that they experience it. On the other end of the spectrum, 38% of the respondents prefer to work without any fixed hours or schedule, as long as they get their work done. However, only 10% of them experience such level of flexibility at work. The most commonly acceptable and offered schedule policy seems to be somewhere in between the two extremes. Thirty-seven percent of respondents prefer a fixed amount of hours (most likely 40 hours per week), but no fixed schedule. In other words, 37% of the STEM employees want to have the maximum amount of autonomy to set up their schedule as long as they fulfill the agreeable hours. However, only 18% of them experience such autonomy policy. Respondents report that 38% of them prefer, and 10% of them experience a semi-fixed schedule policy. A typical semi-fixed schedule policy
could be "core hours" that employees are required to work, but free to work at nights or weekends to "make up" the rest of pre-defined hours.

![Graph: Preferred Work Schedule Policy vs. Actual Work Schedule Policy Experienced](image)

**Figure 10 Gaps between Workforce Preference and Work Schedule Autonomy Policy**

### 6.2.2 Finding: Incremental Acquisition/Retention Rate

All participants are asked to rank the likelihood that they would leave the current job (or accept a new offer) if the new positions offer their optimal work schedule autonomy policy, all else being equal. This question attempts to gauge respondents' perceived significance of their preferred work schedule autonomy policy independently. Twenty-two participants, who indicate that their employer offers what they want already or do not answer, are excluded from the further analysis in Table 17 and 18. Table 17 summarizes the respondents' perceived significance per work schedule policy. The incremental respondent retention rate for specific work schedule policy shown in Table 18 refers to the percentage of respondents that likely or very likely to move to another employer who offers preferred working schedule policy, all else being equal.

***Table 17 Perceived Significance per Work Schedule Autonomy Policy***

<table>
<thead>
<tr>
<th>Rank 1 Work a fixed amount of hours, but no fixed schedule</th>
<th>Rank 2 No fixed hours, or schedule as long as you get your work done</th>
<th>Rank 3 Alternative fixed schedule</th>
<th>Rank 3 9am-5pm, fixed hours and schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>43%</td>
<td>28%</td>
<td>15%</td>
<td>13%</td>
</tr>
<tr>
<td>33%</td>
<td>33%</td>
<td>28%</td>
<td>33%</td>
</tr>
<tr>
<td>13%</td>
<td>17%</td>
<td>28%</td>
<td>17%</td>
</tr>
<tr>
<td>13%</td>
<td>17%</td>
<td>28%</td>
<td>17%</td>
</tr>
<tr>
<td>Grand Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Table 18 Incremental Respondent Attraction/Retention Rate per Work Schedule Autonomy Policy

<table>
<thead>
<tr>
<th>Rank 1 Schedule Autonomy Policy: (38% of sample population)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work on a fixed amount of hours (e.g. 40 hours) per week, but it is up to you whether you work at 9 am or 9 pm; Monday or Sunday</td>
</tr>
<tr>
<td>Thirty-eight percent of respondents prefer to work a fixed amount of hours per week, but have maximum autonomy on their work schedule. Of which, 43% and 13% of that population are likely and very likely, respectively, to leave their current job (or accept a job offer) if the new position allows them to work a fixed amount of hours (e.g. 40 hours) per week, but it's up to them whether they work at 9 am or 9 pm; Monday or Sunday. Therefore, if all else being equal, having such schedule autonomy policy in place is likely to attract or retain additional 21% of respondents as shown in Table 18.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rank 2 Schedule Autonomy Policy: (35% of sample population)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No fixed hours, as long as you get your work done, you can take as many vacations as possible</td>
</tr>
<tr>
<td>Thirty-five percent of the respondents prefer not to have any fixed amount of working hours or schedule at all, as long as they get their work done. Of which, 42% and 28% of that population are likely and very likely, respectively, to leave their current job (or accept a job offer) if the employer offers policy that doesn't have any fixed amount of working hours per week, as long as they get their work done (Table 17). Therefore, if all else being equal, having such schedule autonomy policy in place is likely to attract or retain additional 24% of respondents shown in Table 18.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rank 3 Schedule Autonomy Policy: (14% of sample population)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative fixed schedule such as ten-hour day, four-day workweek or nine-hour day, one day off every other week</td>
</tr>
</tbody>
</table>

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Fourteen percent of the respondents prefer an alternative fixed schedule such as “core hours” on workdays, and then flexible hours beyond that; ten-hour day, four-day workweek; or nine-hour day, one day off every other week. Of which, 40% and 7% of that population are likely or very likely, respectively, to leave their current job (or accept a job offer) if the employer offers an alternative fixed schedule policy. Therefore, if all else being equal, having such schedule autonomy policy in place is likely to attract or retain additional 7% of respondents.

_Rank 4 Schedule Autonomy Policy: (13% of sample population)_

9am-5pm, Monday to Friday, unless you need to deviate from the schedule once a while for some reasons

Thirteen percent of respondents prefer the traditional 9-5 schedule policy. Of which, 15% and 0% of that population are likely and very likely, respectively, to leave their current job (or accept a job offer) if the employer offers traditional or relatively structured work schedule (9am-5pm, Monday to Friday), unless they need to deviate from the schedule once a while for some reasons. On the contrary, 95% of participants are either unlikely or very unlikely to be attracted by offering this scheduling policy alone. Therefore, if all else being equal, having such schedule autonomy policy in place is likely to attract or retain additional 2% of respondents.

### 6.3 Location Autonomy

Work location autonomy is defined as the freedom to control the location of work. For example work from home, from a selection of offices, and the degree of work-related travel.

#### 6.3.1 Finding: Perceived WP-WP Gap

Figure 11 demonstrates the gaps between respondents’ preference in each work location policy and what they have experienced in the workplace. Unlike some of the common misconception, the vast majority of the respondents do not prefer to work from home or on the move the majority of the time. In fact, only 5% of them prefer such a policy. Similar to the finding of work schedule, the most stringent policy (working from one main office most of the time) is also the one with the highest discrepancy. Twenty percent of the respondents prefer this policy while 78% report that they experience it. Almost half of the sample population desires to have the flexibility to work from the office, home or anywhere as they see fit; however, only 7% of them experience such policy. Twenty-seven percent of respondents state that they would like to work...
from any company provided main or satellite offices as they see fit though only 12% experience it at the workplace.

![Bar chart showing preferred and actual work location policies.]

**Figure 11 Gaps between Workforce Preference and Work Location Autonomy Policy**

Participants are asked to rank the likelihood that they would leave the current job (or accept a new offer) if the new positions offer their optimal work location autonomy policy while all else being equal. This question attempts to gauge respondents’ perceived significance of their preferred work location autonomy policy independently shown in Table 19. There are 21 respondents, who indicate that their employer offers what they want already or do not answer, are excluded from this analysis. The incremental respondents’ retention rate for specific work schedule policy (in Table 20) refers to the percentage of respondents that likely or very likely to move to another employer who offers preferred working location policy, all else being equal.

**Table 19 Perceived Significance per Work Location Autonomy Policy**

<table>
<thead>
<tr>
<th>2.2.1. When considering job offers you would prefer which work location autonomy policy</th>
<th>Rank 1</th>
<th>Rank 2</th>
<th>Rank 3</th>
<th>Rank 4</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working from the office, home, or anywhere you see fit</td>
<td>Working from any company provided main or satellite office as you see fit</td>
<td>Working from a main office the majority of the time</td>
<td>Working from home or on the move</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likely</td>
<td>43%</td>
<td>18%</td>
<td>16%</td>
<td>80%</td>
<td>32%</td>
</tr>
<tr>
<td>Unlikely</td>
<td>26%</td>
<td>57%</td>
<td>53%</td>
<td>0%</td>
<td>37%</td>
</tr>
<tr>
<td>Very likely</td>
<td>24%</td>
<td>11%</td>
<td>5%</td>
<td>20%</td>
<td>19%</td>
</tr>
<tr>
<td>Very unlikely</td>
<td>7%</td>
<td>14%</td>
<td>26%</td>
<td>0%</td>
<td>11%</td>
</tr>
<tr>
<td>Grand Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Table 20 Incremental Respondent Attraction/Retention Rate per Work Location Autonomy Policy

<table>
<thead>
<tr>
<th>Rank 1 Location Autonomy Policy</th>
<th>Rank 2 Location Autonomy Policy</th>
<th>Rank 3 Location Autonomy Policy</th>
<th>Rank 4 Location Autonomy Policy</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working from the office, home, or anywhere you see fit</td>
<td>Working from any company provided main or satellite office as you see fit the majority of the time</td>
<td>Working from a main office the majority of the time</td>
<td>Working from home or on the move the majority of the time</td>
<td>Grand Total</td>
</tr>
<tr>
<td>Likely</td>
<td>22%</td>
<td>5%</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>Unlikely</td>
<td>13%</td>
<td>16%</td>
<td>9%</td>
<td>0%</td>
</tr>
<tr>
<td>Very likely</td>
<td>12%</td>
<td>3%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Very unlikely</td>
<td>4%</td>
<td>4%</td>
<td>5%</td>
<td>0%</td>
</tr>
<tr>
<td>Grand Total</td>
<td>51%</td>
<td>26%</td>
<td>18%</td>
<td>5%</td>
</tr>
</tbody>
</table>

6.3.2 Finding: Incremental Acquisition/Retention Rate

Rank 1 Location Autonomy Policy: (51% of sample STEM population)
Working from the office, home, or anywhere you see fit

Over half of the respondents prefer to have the maximum autonomy to choose work location. Depends on circumstances, they can decide if they would work from the office, home or anywhere as they see fit. Of which, 43% and 24% of that population are likely and very likely, respectively, to leave their current job (or accept a job offer) if the new position allows them to work from anywhere they see fit. As the finding suggests in Table 20, by giving employee absolute freedom to choose work location, conditional probably predicts that employer could see 34% increases in respondents' acquisition/retention rate.

Rank 2 Location Autonomy Policy: (26% of sample population)
Working from any company provided main or satellite office as you see fit the majority of the time

Over a quarter of the respondents choose to work from any company provided main or satellite offices as they see fit the majority of the time. Of which, 18% and 11% of them are likely and very likely, respectively, to leave their current job (or accept a job offer) if the employer offers such location autonomy policy. Conditional probability result in Table 20 suggests that implementing such location policy alone would only increase the retention rate by 8%. Unless business entities already have satellite offices in place, this location autonomy policy may not be an idea for many companies. Giving the fact that it may cost considerable capital investment to establish and maintain satellite offices, the 8% potential increase in the respondents' retention rate alone may not justify the investment.
Rank 3 Location Autonomy Policy: (18% of sample population)

*Working from the main office the majority of the time*

Eighteen percent of respondents prefer the traditional approach, work from the main office the majority of the time. Of which, only 16% and 5% are likely and very likely, respectively, to leave their current job (or accept a job offer) if the employer offers such location policy. It is not surprising that majority of this STEM group do not consider work location as a major differentiator. The conditional probabilities only show 4% potential increase in retaining rate.

Rank 4 Location Autonomy Policy: (5% of sample population)

*Working from home or on the move the majority of the time*

Contrary to some common beliefs, only 5% of the sample respondents prefer to work from home or on the move the majority of the time. The vast majority of the Respondent want to have the autonomy to choose where they work, but very few actually would choose to work from home or on the move the majority of the time. However, the location autonomy seems to be critical for those who prefer to work from home. In fact, 80% and 20% of them are likely and very likely, respectively, to leave their current job (or accept a job offer) if the employer offers such location autonomy policy. As a result, allowing employees work from home or on the move may have the potential to acquire or retain all 5% of those respondents.

6.4 Work Methods Autonomy

Work methods autonomy is defined as the freedom to control which methods and procedures are utilized. [17]

6.4.1 Finding: Perceived WP-WP Gap

Among all aspects of workplace autonomy, work method policies seem to be the most aligned with respondents’ preference patterns. Although the level of work methodology, process and procedure flexibility is extremely subjective, comparing with other autonomy aspects. Depending on which industries the respondents come from, work methods could mean product development process, design standards, and best practices, or research and engineering procedures. Overall, the respondents do not show large gaps between their preference pattern and what they have experienced in the workplace (Figure 12).
Participants are asked to rank the likelihood that they would leave the current job (or accept a new offer) if the new positions offer their optimal work methods autonomy policy while all else being equal. This question attempts to gauge respondents' perceived significance of their preferred work methods autonomy policy independently shown in Table 21. There are 19 participants, who indicate that their employer offers what they want already or do not answer, are excluded from the further analysis. Table 22 presents the incremental respondents retention rate for specific work methods policy refers to the percentage of respondents that likely or very likely to move to another employer who offers preferred working methods policy, all else being equal.

Table 21 Perceived Significance per Work Methods Autonomy Policy

<table>
<thead>
<tr>
<th>Rank 1</th>
<th>Rank 2</th>
<th>Rank 3</th>
<th>Rank 4</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Likely</td>
<td>37%</td>
<td>41%</td>
<td>37%</td>
<td>33%</td>
</tr>
<tr>
<td>Unlikely</td>
<td>47%</td>
<td>47%</td>
<td>26%</td>
<td>33%</td>
</tr>
<tr>
<td>Very likely</td>
<td>7%</td>
<td>3%</td>
<td>22%</td>
<td>33%</td>
</tr>
<tr>
<td>Very unlikely</td>
<td>9%</td>
<td>9%</td>
<td>15%</td>
<td>0%</td>
</tr>
<tr>
<td>Grand Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Table 22 Incremental Respondent Attraction/Retention Rate per Work Methods Policy

<table>
<thead>
<tr>
<th>2.3.1. When considering job offers, what’s your preference on work methods?</th>
<th>Rank 1</th>
<th>Rank 2</th>
<th>Rank 3</th>
<th>Rank 4</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somewhat defined work methodology, process and/or procedures</td>
<td>15%</td>
<td>12%</td>
<td>10%</td>
<td>1%</td>
<td>38%</td>
</tr>
<tr>
<td>Clearly defined work methodology, process and/or procedures</td>
<td>19%</td>
<td>14%</td>
<td>7%</td>
<td>1%</td>
<td>41%</td>
</tr>
<tr>
<td>Low level of pre-defined work methodology, process and/or procedures</td>
<td>3%</td>
<td>1%</td>
<td>6%</td>
<td>1%</td>
<td>10%</td>
</tr>
<tr>
<td>Almost no pre-defined work method, process or procedure. Up to you and/or your team to define.</td>
<td>4%</td>
<td>3%</td>
<td>4%</td>
<td>0%</td>
<td>10%</td>
</tr>
<tr>
<td>Likely</td>
<td>41%</td>
<td>30%</td>
<td>26%</td>
<td>3%</td>
<td>100%</td>
</tr>
</tbody>
</table>

6.4.2 Finding: Incremental Acquisition/Retention Rate

**Rank 1 Work Methods Autonomy Policy:** (41% of sample STEM population)

*Somewhat defined work methodology, process and/or procedures*

The data shows that 41% of the respondents prefer somewhat defined work methodology, process and/or procedures. Of which, 37% and 7% of that population are likely and very likely, respectively, to leave their current job (or accept a job offer) if the new workplace offers such somewhat standardized methodology, process and/or procedures. Therefore, if all else being equal, having such work methods autonomy policy in place is likely to attract or retain additional 18% of respondents.

**Rank 2 Work Methods Autonomy Policy:** (30% of sample population)

*Clearly defined work methodology, process and/or procedures*

Thirty percent of respondents prefer ranked 2 schedule autonomy policy. Of which, 41% and 3% of that population are likely and very likely, respectively, to leave their current job (or accept a job offer) if the employer offers clearly defined work methodology, process and/or procedures. Therefore, if all else being equal, having such policy in place is likely to attract or retain additional 13% of respondents.

**Rank 3 Work Methods Autonomy Policy:** (26% of sample population)

*Low level of pre-defined work methodology, processes and/or procedures*

Twenty-six percent of the population prefer a low level of pre-defined work methodology, process and/or procedures. Of which, 37% and 22% of that population are likely and very likely, respectively, to leave their current job (or accept a job offer) if the employer offers such
autonomy in work methods. In reality, low level of pre-defined work methodology, process and/or procedures enables employees to think outside of the box, be more creative, may even encourage more innovation as a result. Therefore, if all else being equal, having such schedule autonomy policy in place is likely to attract or retain additional 16% of respondents.

**Rank 4 Work Methods Autonomy Policy: (3% of sample population)**

*Almost no pre-defined work method, process or procedure. Up to you and/or your team to define them*

Only 3% of respondents prefer to work at a company where there is almost no pre-defined work method, process or procedure. Overall, having no pre-defined work methods, process or procedure at all, is perceived as disorganized and too ambiguous for anybody to succeed in such workplace.

### 6.5 Decision-Making Autonomy

Decision-making autonomy is defined as the freedom to make decisions at work. [16], [17].

#### 6.5.1 Finding: Perceived WP-WP Gap

The most commonly offered decision-making policy at workplace seems to be the most desirable one by employees as well shown in Figure 13. Almost half of the sample respondents prefer to make low-level impact decisions at work by themselves while needing approval for higher impact decisions. Although only 15% of the employers allow employees freedom to make most of the decisions at work through team consent, almost 40% of the respondents prefer to make work related decision through team consensus rather than hierarchical approvals. Respondents do not seem to desire absolute autonomy in decision making; only 12% of them claim to prefer having the freedom to make most of the decisions at work all by themselves. On the other hand, nobody enjoys a work environment with strict, formalized decision-making approval processes, even though it is the second most commonly offered policy in the workplace.
Participants are asked to rank the likelihood that they would leave the current job (or accept a new offer) if the new positions offer their optimal decision-making autonomy policy while all else being equal. The result is shown in Table 23. There are 21 respondents, who indicate that their employer offers what they want already or do not answer, are excluded from this analysis. Table 24 summarizes the incremental respondents retention rate for specific work decision-making policy that refers to the percentage of respondents that likely or very likely to move to another employer who offers preferred decision-making policy while all else being equal.

Table 23 Perceived Significance per Work Decision-Making Autonomy Policy

<table>
<thead>
<tr>
<th>Rank</th>
<th>Need approval for higher impact decisions, but free to make other decisions at work by yourself</th>
<th>Free to make most of decisions at work through team consent</th>
<th>Free to make most of decisions at work by yourself</th>
<th>Strict, formalized decision making approval processes at work</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Likely</td>
<td>47%</td>
<td>39%</td>
<td>33%</td>
<td>0%</td>
<td>42%</td>
</tr>
<tr>
<td>Unlikely</td>
<td>35%</td>
<td>39%</td>
<td>25%</td>
<td>0%</td>
<td>35%</td>
</tr>
<tr>
<td>Very likely</td>
<td>6%</td>
<td>16%</td>
<td>42%</td>
<td>0%</td>
<td>14%</td>
</tr>
<tr>
<td>Very unlikely</td>
<td>12%</td>
<td>7%</td>
<td>0%</td>
<td>0%</td>
<td>9%</td>
</tr>
<tr>
<td>Grand Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Table 24 Incremental Respondent Attraction/Retention Rate per Decision-Making Autonomy Policy

<table>
<thead>
<tr>
<th>When considering job offers, what's your preference on decision-making autonomy?</th>
<th>Rank 1</th>
<th>Rank 2</th>
<th>Rank 3</th>
<th>Rank 4</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Likely</td>
<td>22%</td>
<td>16%</td>
<td>4%</td>
<td>0%</td>
<td>42%</td>
</tr>
<tr>
<td>Unlikely</td>
<td>16%</td>
<td>16%</td>
<td>3%</td>
<td>0%</td>
<td>35%</td>
</tr>
<tr>
<td>Very likely</td>
<td>3%</td>
<td>7%</td>
<td>5%</td>
<td>0%</td>
<td>14%</td>
</tr>
<tr>
<td>Very unlikely</td>
<td>6%</td>
<td>3%</td>
<td>0%</td>
<td>0%</td>
<td>9%</td>
</tr>
<tr>
<td>Grand Total</td>
<td>47%</td>
<td>42%</td>
<td>11%</td>
<td>0%</td>
<td>100%</td>
</tr>
</tbody>
</table>

6.5.2 Finding: Incremental Acquisition/Retention Rate

**Rank 1 Decision-Making Autonomy Policy: (47% of Respondents)**

*Need approval for higher impact decisions, but free to make other decisions at work by yourself*

Forty-seven percent of respondent decisions prefer to make lower impact decisions by themselves while needing approval for higher impact decisions at work. Of which, 47% and 6% of them are likely and very likely, respectively, to leave their current job (or accept a job offer) if the new position offers such decision-making autonomy. Therefore, if all else being equal, having such decision-making autonomy policy in place is likely to attract or retain additional 25% of respondents.

**Rank 2 Decision-Making Autonomy Policy: (42% of Respondents)**

*Free to make most of the decisions at work through team consent*

Forty-two percent of the respondents prefer to make most of the decisions at work through team consent. Of which, 39% and 16% of that population are likely and very likely, respectively, to leave their current job (or accept a job offer) if the employer offers such policy. Therefore, if all else being equal, allowing work relate decisions made by team consensus is likely to attract or retain additional 23% of respondents.

**Rank 3 decision-making Autonomy Policy: (11% of Respondents)**

*Free to make most of the decisions at work by yourself*

Only 11% of the respondents prefer to work at a place where they are free to make most of the decisions all by themselves. Of which, 33% and 42% of them are likely and very likely, respectively, to leave their current job (or accept a job offer) if the employer offers such ultimate
freedom in the workplace. Therefore, if all else being equal, having such decision-making autonomy policy in place is likely to attract or retain additional 9% of respondents.

**Rank 4 decision-making Autonomy Policy: (0% of sample population)**

*Strict, formalized decision-making approval processes at work*

Even though over a quarter of workplace reinforces strict, formalized, decision-making approval process, none of the respondents appears to enjoy it. Hence, if all else being equal, there are much higher employee turnover rate if other employers offer more favorable decision-making policies.

### 6.7 Skill and Task Variety

Skill variety is defined as when an employee must use some different skills and talents. Task variety is defined as when an employee must perform various tasks at work. [17], [19], [16]

#### 6.7.1 Finding: Incremental Acquisition/Retention Rate

Respondents are asked to rank the level of skill and task varieties they have experienced at their workplace and the likelihood that they would leave the current job (or accept a new offer) if the new positions offer a higher level of skill and task variety while all else being equal. The result is shown in Table 25. This analysis excludes 19 participants, who indicate that their employer offers what they want already or do not answer. The conditional probability is applied to measure the incremental respondents’ retention rate for specific skill and task variety shown in Table 26.

#### Table 25 Perceived Significance per Skill and Task Variety Level

| 3.1.2. All else being equal, what is the likelihood that you would leave your current job (or accept a job offer) if the new position | 3.1.1. What degree of skill and task variety have you experienced at work? |
|---|---|---|---|---|---|
| &nbsp; | Very high degree of skill and task variety | High degree of skill and task variety | Low degree of skill and task variety | Very low degree of skill and task variety | Grand Total |
| Likely | 46% | 44% | 47% | 0% | 44% |
| Unlikely | 0% | 31% | 12% | 0% | 19% |
| Very likely | 43% | 19% | 35% | 100% | 33% |
| Very unlikely | 11% | 6% | 6% | 0% | 7% |
| Grand Total | 100% | 100% | 100% | 100% | 100% |
Table 26 Incremental Respondent Attraction/ Retention Rate per Skill and Task Variety Level

<table>
<thead>
<tr>
<th>Job (or accept a job offer) if the new position offers a higher degree of skill and task variety</th>
<th>3.1.1. What degree of skill and task variety have you experienced at work?</th>
<th>3.1.2. All else being equal, what is the likelihood that you would leave your current job (or accept a job offer) if the new position offers a higher degree of skill and task variety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high degree of skill and task variety</td>
<td>High degree of skill and task variety</td>
<td>Low degree of skill and task variety</td>
</tr>
<tr>
<td>Likely</td>
<td>12%</td>
<td>25%</td>
</tr>
<tr>
<td>Unlikely</td>
<td>0%</td>
<td>18%</td>
</tr>
<tr>
<td>Very likely</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>Very unlikely</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>Grand Total</td>
<td>26%</td>
<td>57%</td>
</tr>
</tbody>
</table>

The respondents appear to have a relatively high desire for skill and task varieties at the workplace.

1) The data shows that 57% and 26% of respondents have already experienced a high and very high degree of skill and task variety. However, 89% of those who have experienced a very high degree of skill and task variety are likely or very likely to leave for a new position that offers an even higher degree of skill and task varieties.

2) Likewise, 63% of those who experienced a high level of skill and task variety are likely or very likely to leave for a higher degree of skill and task varieties.

3) Additionally, 82% of those who experienced a low level of skill and task variety are likely or very like to leave.

The conditional probabilities in Table 26 suggest that there may be potential increases in the respondents retention rates if the employer provides a higher degree of skill and task varieties than they currently offer. In particular, data suggests 23%, 36%, and 13% increases for those companies offer very high, high and low degree of skill and task varieties currently.

6.8 Task Identity

Task identity is defined as when an employee's job has a visible outcome after they have worked on it from the beginning to the end. [19], [16]

6.8.1 Finding: Incremental Acquisition/Retention Rate

Respondents are asked to rank the level of task identity they have experienced at their workplace and the likelihood that they would leave the current job (or accept a new offer) if the new positions offer a higher degree of task identity while all else being equal. This analysis in Table 27 excludes 14 participants, who indicate that their employer offers what they want
already or do not answer. The conditional probability is applied to measure the incremental respondent retention rate for specific perceived task identity level shown in Table 28.

Table 27 Perceived Significance per Task Identity Level

| 3.2.2. All else being equal, what is the likelihood you would leave your current job (or accept a job offer) if the new position offers a higher degree of task identity? | 3.2.1. What degree of task identity have you experienced at work? |
|---|---|---|---|---|---|---|
| Very high degree of task identity | High degree of task identity | Low degree of task identity | Very low degree of task identity | Grand Total |
| Likely | 17% | 47% | 57% | 33% | 48% |
| Unlikely | 33% | 31% | 11% | 33% | 25% |
| Very likely | 33% | 18% | 26% | 17% | 21% |
| Very unlikely | 17% | 5% | 6% | 17% | 6% |
| Grand Total | 100% | 100% | 100% | 100% | 100% |

Table 28 Incremental Respondent Attraction/ Retention Rate per Task Identity Level

| 3.2.2. All else being equal, what is the likelihood you would leave your current job (or accept a job offer) if the new position offers a higher degree of task identity? | 3.2.1. What degree of task identity have you experienced at work? |
|---|---|---|---|---|---|---|
| Very high degree of task identity | High degree of task identity | Low degree of task identity | Very low degree of task identity | Grand Total |
| Likely | 1% | 27% | 16% | 2% | 48% |
| Unlikely | 2% | 17% | 4% | 2% | 25% |
| Very likely | 2% | 10% | 8% | 1% | 21% |
| Very unlikely | 1% | 3% | 2% | 1% | 6% |
| Grand Total | 6% | 57% | 32% | 6% | 100% |

The respondents appear to have a relatively high desire for task identity at the workplace, even when they have already experienced high or very high level of task identity.

1) The data shows 57% and 6% of respondents have already experienced a high and very high degree of skill and task variety. Moreover, 50% of those who have experienced a very high degree of skill and task variety are likely or very likely to leave for a new position that offers an even higher degree of task identity.

2) Likewise, 65% of those who experienced a high level of skill and task variety are likely or very likely to leave for a higher degree of task identity.

3) Additionally, 83% of those who experienced a low degree of task identity are likely or very likely to quit.

4) A half of the respondents who experienced very low level of task identity is likely or very likely to leave for a higher degree of task identity jobs.
The conditional probabilities in Table 28 suggest that there may be potential increases in the respondent retention rates if the employer provides a higher degree of skill and task varieties than they currently offer. In particular, data suggests 3%, 37%, 26%, and 3% increases for those companies offer very high, high, low, and very low degree of skill and task varieties, respectively.

6.9 Task Significance

Task significance is defined as when the job has a substantial impact on the lives or work of other people – either in the present organization or the external environment. [19], [16]

6.9.1 Finding: Incremental Acquisition/Retention Rate

Respondents are asked to rank the level of task significance they have experienced at their workplace. All participants are also requested to rank the likelihood that they would leave the current job (or accept a new offer) if the new positions offer a higher degree of task significance while all else being equal. This analysis in Table 29 excludes the data sets from 14 participants, who indicate that their employer offers what they want already or do not answer. The conditional probability is applied to measure the incremental respondents’ retention rate for specific perceived task significance level shown in Table 30.

### Table 29 Perceived Importance per Task Significance Level

| 3.3.2. All else being equal, what is the likelihood you would leave your current job (or accept a new job) if the new position offers a higher degree of task significance? | 3.3.1. What degree of task significance have you experienced at work? |
|---|---|---|---|---|---|
| Likely | Very high degree of task significance | 29% | 34% | 39% | 0% | 34% |
| | High degree of task significance | 18% | 20% | 9% | 50% | 17% |
| | Very high degree of task significance | 41% | 36% | 48% | 50% | 41% |
| Very unlikely | Low degree of task significance | 12% | 11% | 3% | 0% | 8% |
| Grand Total | Very low degree of task significance | 100% | 100% | 100% | 100% |

### Table 30 Incremental Respondent Attraction/Retention Rate per Task Significance Level

| 3.3.2. All else being equal, what is the likelihood you would leave your current job (or accept a new job) if the new position offers a higher degree of task significance? | 3.3.1. What degree of task significance have you experienced at work? |
|---|---|---|---|---|---|
| Likely | Very high degree of task significance | 5% | 18% | 12% | 0% | 34% |
| | High degree of task significance | 3% | 10% | 3% | 1% | 17% |
| | Very high degree of task significance | 6% | 19% | 15% | 1% | 41% |
| Very unlikely | Low degree of task significance | 2% | 6% | 1% | 0% | 8% |
| Grand Total | Very low degree of task significance | 16% | 52% | 31% | 2% | 100% |

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The respondents appear to have a relatively high desire for task significance at the workplace, even when they have already experienced high or very high level of task significance.

1) It suggests 52% and 16% of respondents have already experienced a high and very high degree of task significance. Moreover, 71% of those who have experienced a very high degree of task significance are likely or very likely to leave for a new position that offers an even higher degree of task significance.

2) Likewise, 70% of those who experienced a high level of task significance are likely or very likely to leave for a higher degree of task significance.

3) More importantly, 88% of those who experienced a low degree of task significance are likely or very likely to quit.

4) A half of the respondents who experienced very low level of task significance is very likely to go for a higher degree of task significance jobs.

The conditional probabilities in Table 30 suggest that there may be potential increases in the respondents' retention rates if the employer provides a higher degree of task significance than they currently offer. In particular, data suggests 11%, 37%, 27%, and 1% increases for those companies offer very high, high, low, and very low degree of task significance, respectively.
Chapter 7 – Performance Review and Feedback

7.1 Overview

Feedback is defined as the degree to which carrying out the work activities required by the job results in the employee obtaining direct and clear information about the effectiveness of his or her performance. [19]

Questionnaire participants are asked to rank their preferred methods and frequencies to receive positive and negative feedback from various feedback providers. The data collected are cross-tabulated to extrapolate the most effective feedback methods and frequencies. Figure 14, 15, 16, and 17 present the data analysis results.

7.2 Finding: Preferred Positive Feedback Frequency

Aggregated responses from 124 respondents (Figure 14) indicate several trends across all categories of positive feedback providers (i.e. managers, clients, peers/team members, subordinates, and others at work).

a) Overall, the majority of the respondents prefer to have a higher frequency (i.e. on a weekly basis, on a daily basis, and as often as possible) for receiving positive feedback from all providers. In particular, positive feedbacks from the manager (65%), clients (65%), peers/team member (63%), subordinates (57%), others at work (51%).

b) The most desirable positive feedback frequency is on a weekly basis across all provider categories. On average, 37% of respondents would prefer to receive positive feedback on a weekly basis. Although many respondents only receive feedbacks from their managers on monthly, bi-monthly, or even yearly basis, 44% and 46% of respondents prefer to receive positive feedbacks from their managers and clients on a weekly basis.
7.3 Finding: Preferred Negative Feedback Frequency

Regarding receiving negative feedback, the respondents appear to split into two evenly distributed groups (Figure 15).

a) Close to a half of the respondents prefers higher negative feedback frequency (i.e. as often as possible, on a daily basis, and on a weekly basis). In specific, from managers (45%), clients (52%), peers/team member (59%), subordinates (50%), others at work (35%).

b) Close to a half of the respondents prefer lower negative feedback frequency (i.e. on monthly and yearly basis). In specific, from managers (52%), clients (44%), peers/team member (40%), subordinates (44%), others at work (48%).

c) On average, the most desirable negative feedback frequency appears to be on a monthly basis across all providers (34%), while the most desirable positive feedback frequency seems to be on a weekly basis (37%).
7.4 Finding: Preferred Feedback Methods

Figure 16 and 17 illustrate several trends in the preferred positive and negative feedback communications methods.

a) There is no major discrepancy between preferred positive and negative feedback methods. The only notable inconsistency is that fewer people want to receive negative review or comments in group meetings (4%) comparing to receiving positive feedback (10%).

b) It appears that feedback, positive or negative, are more efficient when it is given in a controlled private setting. The top two preferred methods on average are the one-on-one basis (i.e. discussions in person or over the phone, and over email).

c) Respondents prefer to receive feedbacks in one-on-one settings predominately. The data indicates 61% respondents prefer it for receiving positive feedback, and 74% for negative feedback.

d) As one of the most commonly implemented methods in the workplace, performance review that is recorded in writing and discussed in person, only have less than 10% supporters on average.
Figure 16 Preferred Methods for Receiving Positive Feedback

<table>
<thead>
<tr>
<th>Method</th>
<th>Managers</th>
<th>Clients</th>
<th>Peers/Team members</th>
<th>Subordinates</th>
<th>Others at work</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-on-one discussion (in person or over the phone)</td>
<td>64%</td>
<td>54%</td>
<td>63%</td>
<td>68%</td>
<td>53%</td>
<td>61%</td>
</tr>
<tr>
<td>One-on-one over email</td>
<td>4%</td>
<td>12%</td>
<td>9%</td>
<td>11%</td>
<td>16%</td>
<td>11%</td>
</tr>
<tr>
<td>Group meetings (in person or over the phone)</td>
<td>5%</td>
<td>10%</td>
<td>18%</td>
<td>9%</td>
<td>11%</td>
<td>10%</td>
</tr>
<tr>
<td>Performance review (recorded in writing and discussed in person)</td>
<td>2%</td>
<td>10%</td>
<td>5%</td>
<td>7%</td>
<td>8%</td>
<td>10%</td>
</tr>
<tr>
<td>Emails to your group</td>
<td>2%</td>
<td>11%</td>
<td>2%</td>
<td>2%</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>Other</td>
<td>1%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>7%</td>
<td>3%</td>
</tr>
</tbody>
</table>

Figure 17 Preferred Methods for Receiving Negative Feedback

<table>
<thead>
<tr>
<th>Method</th>
<th>Managers</th>
<th>Clients</th>
<th>Peers/Team members</th>
<th>Subordinates</th>
<th>Others at work</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-on-one discussion (in person or over the phone)</td>
<td>80%</td>
<td>70%</td>
<td>77%</td>
<td>75%</td>
<td>66%</td>
<td>74%</td>
</tr>
<tr>
<td>One-on-one over email</td>
<td>5%</td>
<td>11%</td>
<td>9%</td>
<td>13%</td>
<td>16%</td>
<td>11%</td>
</tr>
<tr>
<td>Performance review (recorded in writing and discussed in person)</td>
<td>14%</td>
<td>8%</td>
<td>5%</td>
<td>7%</td>
<td>7%</td>
<td>8%</td>
</tr>
<tr>
<td>Group meetings (in person or over the phone)</td>
<td>0%</td>
<td>5%</td>
<td>8%</td>
<td>3%</td>
<td>6%</td>
<td>4%</td>
</tr>
<tr>
<td>Other</td>
<td>0%</td>
<td>2%</td>
<td>1%</td>
<td>2%</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Emails to your group</td>
<td>1%</td>
<td>4%</td>
<td>0%</td>
<td>0%</td>
<td>2%</td>
<td>1%</td>
</tr>
</tbody>
</table>
Chapter 8 – Implication and Discussion

8.1 Creating more Long-Term STEM Employees through Continues Policy Improvement

This thesis identifies questionnaire respondents’ preferences in workplace autonomy policies and job specific aspects. By implementing certain autonomy policies and optimizing other aspects of job characteristics, business entities can potentially minimize STEM employee turnover rates and maintain more long-term employees.

Long-term employees create value for business entities in four aspects. Firstly, they generate more net benefit over time with an investment in training and development. Secondly, they are more efficient because they require less training and supervision to get their work done. Thirdly, long-term employees often provide employee referrals and generate the best flow of high-caliber job applicants. Lastly, they often are a significant source of customer referrals because they are better at identifying, serving and retaining the best customers [12].

The research suggests many workplace policies need adjustment and improvement to create more long-term STEM employees. There are significant discrepancies between respondents’ job preferences and what they experience in workplace contribute to relatively high turnover rates. It is important to understand employees’ preference patterns before deciding which autonomy policies to implement. This thesis provides preliminary analysis and insights into respondent’s preference patterns in the core job characteristics.

8.2 Need for Work-Life Balance

This thesis’s finding indicates that the work-life balance has significant influence in attracting and retaining STEM talents in the workplace based on the dataset. It is common that work demands interference with employees' personal lives. With technology advancement, employees reply to work emails and continue working even when they are officially off work. Similarly, sometimes they make personal calls or run errands during work hours when needed. There are many incentives for companies to institute policies enabling work-life balance. It is not only externally garnering good publicity and attracting a more potential workforce, but also build stronger loyalty and employee commitment internally. [12]
Overall, many companies have successfully implemented various formal flexible work arrangements. For instance, telecommuting from a satellite location; flextime, “core hours” do not apply; flextime with “core hours; compressed workweek; break arrangements; phased retirement; part-time/reduced hours schedules; transition period part-time; job-sharing; telecommuting from other locations; shift flexibility [37]. The Families and Work Institute’s 2014 National Study of Employers (NSE) includes samples across 1,051 employers with 50 or more employees. The study finds that the most common forms of flexibility at the workplace are controlled over taking breaks, time off for important family and personal needs, and flexible time. Comparing with the findings from 2008, flexibility for full-time employees over where and when they work is rising. In particular, occasional flex place (from 50% to 67%); time off during the workday when important needs arise (from 73% to 82%) [38].

8.3 Trending Schedule and Location Autonomy Policy

This thesis collects participants’ responses to the most commonly established job characteristics. Respondents indicate overwhelming desire to have a higher degree of autonomy in the workplace and receive frequent feedback from people they interact. In fact, many companies initiate innovative workplace policies attempting to gain a competitive edge and capture top tier talents.

Technology-based companies are pioneers in providing flexibilities to accommodate employee needs and to increase productivity. For example, Netflix reinvents human resource policy by allowing unlimited vacation days as long as work gets done. "We should focus on what people get done, not how many hours or days worked[39]." "We do not have a 9-5 day policy; we do not need a vacation policy [39]." Mozilla Corporation is another example of providing work location autonomy. An large amount of the engineering team is geographically distributed. It argues having a hundred percent local employee based policy is likely to produce a “sloppy organization”; having a mostly local employee based policy is likely to make remote workers suffer from the “sloppy organization”. However, when there are mostly non-local employees, it is liable to produce a better organization that is clear, crisp, well documented [40].
8.4 The Traditional Hierarchical Structure May Not Be a Good Fit for STEM Professionals

The traditional corporate ladder structure (a top-down hierarchy with upward linear career progression) no longer suits the changing world of work due to driving forces. Because of the rise in nontraditional families; converging expectations of men and women; flattened hierarchies; shortage of critical talent; evolving needs of generations' virtual, connected workplace; and multicultural workforce [41]. Instead, current companies tried to recruit and retain driven, independent and competent employees by flattening organization structure.

According to the research data, respondents tend to be dissatisfied with working in an environment with significant restrictions on work process, procedure, and methodologies, or rigorous decision-making approval process. It appears they enjoy some degree of freedom to determine what to work on, and how to get the work done. Autonomy has broad definition than simplify providing flexible work hours and place, even though work schedule and location flexibility policies are more commonly implemented comparing with work methods or decision-making autonomy policies. Research shows that comparing with work scheduling autonomy; work methods and decision-making autonomy have much stronger relationships with job satisfaction [17].

Many research institutes and business entities attempt to extrapolate scalable, agile frameworks that adapt to today’s changing world of work. For example, Deloitte Development LLC introduces the Mass Career Customization (MCC) model that is a framework that identifies the core, customizable dimensions of a career. Depending on employee’s needs and preferences, the MCC introduces the ways, individuals, in collaboration with their employers, dial their careers up and down over time across the four career dimensions.

1) Page, options relating to the rate of career growth
2) Workload choices, choices relating to the quantity of work output
3) Location/schedule, options for where and when work is performed
4) Role, options in position and responsibilities. [14]

Furthermore, many companies established policies to encourage creativity and to foster larger innovation in the workplace recognizing the significance of autonomy.
• Netflix, Inc. is an on-demand Internet streaming media provider founded in 1997 [42]. It reinvents the traditional HR policies and creates a culture that supports rapid innovation and excellent execution by focusing on recruiting and retaining high performers and giving the freedom and autonomy over work. "Avoid Chaos as you grow with even more high-performance people - not with rules [39]." Netflix highlights the power of non-monetary rewards. It suggests non-monetary rewards can be especially powerful when they are congruent with employee values. Being clear about the organization’s values can help attract (and reject) people who ‘fit’ [12].

• Amazon.com, Inc. is an electronic commerce and cloud computing company founded in 1994 [43]. It reinforces leadership principles that values individual work methods and decision-making autonomy. Amazon values bias for action that encourages employees to take calculated risks because "many decisions and actions are reversible and do not need extensive study [44]." It also states employees are "obligated to challenge respectfully decisions when they disagree, even when doing so is uncomfortable or exhausting. Leaders have conviction and are tenacious. They do not compromise for the sake of social cohesion [44]."

• Valve Corporation is an American video game development and digital distribution company [45]. Valve is also a great example of empowering individuals and providing maximum work methods and decision-making autonomy. There are few restrictions on work process, procedures or methodologies. "We do not have any management and nobody 'reports to' anybody else. One hundred percent of employees' time is self-directed projects. Additionally, employees have a large amount of decision-making autonomy. "This company is yours to steer- toward opportunities and away from risks." Anyone can decide what the right thing to do is, and have the freedom to recruit other people to work on it with them [9].

Additionally, this thesis suggests respondent’s desire for career development through higher degrees of skill and task variety, and real-time performance feedback. From corporate’s perspective, the most efficient way to expand operations capacity is to cross train employees. From employee’s perspective, increasing skill and task variety keeps their skill relevant, promotes their job security, and expands their career options. The literature review suggests that the corporate lattice model is proposed to "better align with the changing needs, norms and
The corporate lattice model consists of three parts. Firstly, lattice ways to build careers by “including lateral and diagonal directions and planned descents along which people can grow.” Secondly, it enables a dynamic, increasingly virtual workplace that changes when and where work is done by leveraging advanced technology. Lastly, it proposes lattice organizations to share information transparently, to create communities and providing more collaborative, inclusive and meaning options for employees to contribute regardless of their level on the organizational chart.

8.5 Effective Performance Feedback System has to be Confidential, Real Time, and Multi-Dimensional

Performance feedback is essential in the workplace. Business entities use it as a justification for promotions, and a measurement for adjusting employee compensations. Through formal and informal performance feedbacks, employees increase the “job-based psychological ownership by operating through intimate knowing of the job.” Based on the feedbacks, employees can identify training, and skill development opportunities.

As one of the most commonly implemented methods in the workplace, performance review that is recorded in writing and discussed in person, only have less than 10% supporters on average. Performance appraisal is a commonly offered workplace practice that provides a formal, way to communicate strategy and expectations, to evaluate current job performance, to identify areas of improvement, and to develop skills for potential future jobs. Collected evidence from literature review, respondent questionnaire interviews, and personal experience, annual performance rating also consists of many problems.

Firstly, the formal annual performance review is not only limited by the ability to write, but also constrained by memory’s serial position effect that a person tent to recall the first and last items in a series best, and the middle items worst. People have cognitive bias leads to primacy effect (the tendency of remembering first information presented better than information presented later on), and recency effect (the tendency to recall what happens recently better). Additionally, real-time feedback makes the employee feel recognized supported and appreciated. The best-selling book, One Minute Manager, achieves an extremely effective management style by introducing three key concepts. One minute goal setting advocates recording the expected objectives and performance standards on one page of paper from the
beginning, so it only takes one minute to read the goals. One minute praising encourages managers to spend one minute to praise employees immediately after they did something good, so employees are more motivated to do more of the same. One minute reprimands advocate manager to provide direct and immediate constructive criticisms to employees who do something wrong [49]. Those feedbacks are more efficient than longer term periodic reviews because it is much easier to relate to the root causes of issues and correct mistakes if it is recent. As a result, a more constant feedback system is needed to provide a closer to real-time performance feedback loop.

Secondly, the formal annual performance review is likely to be perceived as unfair or ineffective because it tends to overweight negative information [12], or provide only generic superficial feedback that doesn't bring impactful values. Direct managers conduct a general review, but even the “optimal” manager to employee ratio (one to seven or 10) [50] leads to the tendency of lacking sufficient observation to provide insightful or even fair performance reviews for every employee.

Respondent’s responses from the questionnaire indicate that they do indeed care about feedbacks from broader spectrums of personnel that they interact with in the workplace. In fact, there are a few ways to measuring employee performance via multiple dimensions to mitigate cognitive biases. Valve Corporation is another example of relying heavily on two formalized team based performance reviews. “Peer reviews are done to give each other useful feedback on how to best grow as individual contributors. Stack ranking is done to gain insight into who’s providing the most value to the company and to adjust thereby each person’s compensation to be commensurate with his or her actual value [46]”. Providing a performance feedback from multiple sources does not only increase the review validity and accuracy but also help to gain better acceptance by people rated.

Lastly, to achieve greater consistency, fairness and accuracy of the feedback, business entities shall develop explicit performance criteria and absolute confidentiality of the process. One-on-one performance feedbacks can foster a psychologically safe environment and protect the confidential nature of performance feedback. It takes strong trust to have constructive criticisms without hurting professional relationships. In a long-term employment environment, the boundary of work tends to be more blurry. Working alongside with good coworkers and for a good manager builds strong trust and close friendships. However, without a transparent and trusting culture, direct feedbacks, especially negative ones, may hurt working relationships.
Instead of embarrassing colleagues in public, anonymous feedbacks may enable a more candid and honest peer reviews. For example, an anonymous 360-degree appraisal may be appropriate for the team-based system and empowered culture [12].

In sum, this thesis shows strong evidence that respondents desire for real-time confidential feedback from not only managers but all other colleagues they interact in the workplace. The vast majority of respondents prefer to have frequent reviews and feedback from managers, clients, peers, subordinates, and others from work. However, among all forms of communications, the vast majority of them prefer to have those discussions, positive and negative, in one-on-one settings. Therefore, enabling a collaborative and trusting environment for frequent, insightful feedbacks can not only fasten STEM professional’s career development but also strengthen working relationships.
Chapter 9 Conclusion, Limitation and Future Work

9.1 Conclusion

The motivation of this thesis is to explore what job characteristics most effectively attract, develop, and retain STEM (Science, Technology, Engineering, and Mathematics) professionals. The research provided a preliminary validation of the hypothesis that highly educated professional employees with STEM backgrounds do exhibit certain preferences in the core job dimensions. By implementing certain autonomy policies and optimizing other aspects of job characteristics, business entities can minimize STEM employee turnover or attrition due to extra-monetary job-characteristics.

9.1.1 Major Findings in Autonomy

Autonomy plays a huge role in achieving desirable personal and work outcomes. In fact, autonomy is the only core job dimension that causes the emergence of job-based psychological ownership by operating through all three “routes” to psychological ownership (i.e. control exercised over the job, intimate knowing of the job, and investment of the self into the job [18]).

The chi-squared test represents overwhelming general desires in higher degrees of autonomy. Respondents share similar autonomy policy preference patterns in the schedule, location, methods and decision-making at workplace across various ages, genders, and household composition according to the survey data.

Schedule

Seventy-five percent of respondents prefer to have autonomy over their work schedule. It indicates 21% incremental retention rate with a flexible work schedule policy with fixed amount of hours per week, and 24% incremental retention rate when there are no fixed hours at all, as long as the work gets done. However, over half of the respondents experience the regular fixed hours and schedule in the workplace.

Location

Although close to 80% of respondents working from the main office, 80% of all questionnaire respondents prefer to have more autonomy in their work locations. Almost half of respondents
prefer to have the freedom to choose to work from the office, home or anywhere they see fit. Such policy suggests an increase of 34% in respondent acquisition/retention rate.

Methods

Among all aspects of workplace autonomy, work method policies seem to be the most aligned with respondents' preference pattern. Forty-one and thirty percent of respondents prefer to have somewhat defined and clearly defined work methodology, process, and procedures. Only 3% appear to have almost no pre-defined work methods, process or procedure, but the maximum freedom to control which methods and procedures are utilized for work. This finding seems to differ from Humphrey et al.'s finding that work methods autonomy has a strong and positive relationship with job satisfaction [17].

Decision-making

Having some decision-making autonomy, but need approval for higher impact decisions appears to be the most commonly offered and accepted policy in the workplace (25% incremental retention rate). However, there are a couple of discrepancies. Firstly, no respondent indicates any preference in having strict, formalized decision-making approval processes at work. However, 26% of respondent still experience it. Additionally, with 23% of the incremental retention rate, close to 40% of respondent prefer to make most of the decisions at work through team consent instead of the traditional hierarchical approach.

9.1.2 Major Findings in Skill and Task Variety, Identity, and Significance

The majority of respondent indicate that when all else being equal, they would be likely or very likely to leave their current jobs (or accept job offers) if the new position offers a higher degrees of skill and task variety (73%), task identity (69%), and task significance (75%).

9.1.3 Major Findings in Feedback

Aggregated responses from 124 respondents indicate several trends across all categories of feedback providers (i.e. managers, clients, peers/team members, subordinates, and others at work).
Overall, the majority of the surveyed STEM professionals prefer to have higher frequency (i.e. on weekly basis, on daily basis, and as often as possible) for receiving positive feedback from all providers (i.e. managers, clients, peers/team members, subordinates, and others at work). In particular, positive feedback from the manager (65%), clients (65%), peers/team member (63%), subordinates (57%), others at work (51%). While it is clear the most desirable positive feedback frequency is on a weekly basis, respondents appear to split into two evenly distributed groups (i.e. on a monthly basis and as often as possible) in the desirable negative feedback frequency.

There is no major discrepancy between preferred positive and negative feedback methods. It appears that feedback, positive or negative, are more efficient when it is given in one-on-one settings.

9.2 Limitation and Future Work

9.2.1 Limitation of Sample Population

The research sample is not representative of actual population mix; rather, it consists of participants with homogenous STEM background. Given the scope of the thesis, with limited time and resources, leads to a relatively small sample size (135 responses).

The STEM field workplace practices may differ from one industry to another. However this thesis has a relatively small sample size that may not further examine the variance in a different industry. The sample size and composition also limits the feasibility to compare the difference between STEM and non-STEM respondents' preferences.

Hence, a more comprehensive research with a larger sample size may reach out to many industries and potentially identify and differentiate STEM professional preference patterns by industries.

9.2.2 Limitation of Questionnaire Methodology

There may be several potential issues in questionnaire methodology. Also, to the sample size mentioned earlier, the data collection and data analysis process may introduce unexpected errors.
There are two potential errors in the data collection process. Firstly, the questionnaire respondents may possess certain biases in the research topic comparing with the population who choose not to respond. Secondly, respondents may misinterpret the questions or simply make mistakes when providing feedback.

Data analysis process has its limitations as well. In addition to the human errors associated with data processing, perhaps, the most significant limitation is that the survey dataset is a collection of respondents’ subjective responses.

For instance, the perceived gaps are measured by the difference between respondents’ preference patterns and what they experience in the workplace. On the other hand, the incremental retention rate is measured by the probability that respondents’ likelihood to accept new job offers or leave their current jobs under the condition that all else being equal expect the controlled specific policy. However, there are limitations associated with estimating perceived gaps between workforce preference and workplace policy, and acquisition/retention rates. Both estimations are extremely subjective.

Questionnaire participants may interpret the intensity of the “likelihood” differently. For example, the difference between “likely” and “very likely” to change jobs is completely up to respondents’ interpretations. This study attempts to differentiate affirmative and negative responses, rather than focusing on the exact frequency distributions based on the dataset.

9.2.3 Risk for Adjusting Job Characteristics

This thesis underscores the STEM participant’s general desire for having more work autonomy, task variety, identity, significance, and receiving performance feedbacks more frequently in a private setting. These insights are extrapolated by isolating participants’ responses in the individual job dimensions. However, due to the limitation of the master thesis scope, this thesis does not investigate the effects and the interrelationships of various job factors combinations. As a result, additional research is recommended to determine which policy to implement and how to reduce the workforce preference and workplace policy gaps.

- Firstly, a more comprehensive research is needed to explore the interrelationships of different job characteristics sets.
- Secondly, further research is needed to examine dynamic job characteristics in various companies based on their profiles (e.g., sizes, organization structure, private, or public owned company).
• Thirdly, depending on the nature of work, additional research is needed to understand the potential impacts on project deliverables, and tradeoffs with people in other departments if STEM professionals are given higher degrees of autonomy and task variety.
• Fourthly, further research is needed to understand why there is still some resistance in both workforce and workplace to improve autonomy policies. For example, many respondents fear taking advance of the schedule autonomy policy may affect their career advancements negatively. “It may reflect poorly on me if I leave early.”
• Lastly, it is crucial to identify and mitigate risks associated with adjusting job characteristics. For example, established entities in medium or large organizations may have higher risks for culture changes.

9.2.4 Potential Workplace Policies in Future

Many researchers and organizations are interested in gaining a better understanding of optimal job characteristics. This thesis indicates there are significant gaps between workforce preference and workplace policy, and suggests many potential improvements may be made in workplace policy. Many companies, especially start-ups, and technology-based entities have maximized autonomy policies, implemented innovative work methods, and flatten organization structures. With the help of technology advancement, there are excellent research opportunities in the redesign of job characteristics through innovating business models, or by other means.
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I. Survey Participant Demographic Information

1.1. When were you born?

1.2. What is your gender?

1.3. What is your household composition?

- Dual income w/ dependents
- Dual income w/out dependents
- Single income w/ dependents
- Single income w/out dependents

1.4. What is the highest level of education you have completed?

1.5. What is your post-high school major(s)?

(Select all that apply)

- STEM (Science, Technology, Engineering and Math)
- Business
- Health and Medicine
- Public and Social Services
- Arts and Humanities
- Multi-/Interdisciplinary Studies
- N/A
- Other: 

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1.6. How many years of work experience do you have?
- 0-2
- 3-5
- 6-10
- 11-15
- 15-20
- 21-25
- 26-30
- 30+

1.7. What is your occupation?
Select all that applies
- STEM (Science, Technology, Engineering and Math)
- Management
- Business and Financial Operations
- Life, Physical, and Social Science
- Community and Social Service
- Legal
- Education, Training, and Library
- Arts, Design, Entertainment, Sports, and Media
- Healthcare and medicine
- Other: ____________________________
II. Perceived Gaps between Desired Workplace Autonomy and Policies

2.1. Work Schedule Autonomy

Work Schedule Autonomy is defined as the freedom to control the scheduling and timing of work.

2.1.1 When considering job offers, you would prefer that an employer offers the following work schedule autonomy policy:

- 9am-5pm, Monday to Friday, unless you need to deviate from the schedule once a while for some reasons.
- Alternative fixed schedule such as ten-hour day, four-day workweek or nine-hour day, one day off every other week.
- Work on a fixed amount of hours (e.g. 40 hours) per week, but it's up to you whether you work at 9am or 9pm; Monday or Sunday.
- No fixed hours, as long as you get your work done, you can take as many vacations as possible.
- Other: __________________________

2.1.2 What kind of work schedule autonomy policy have you experienced?

Select the most recent one please:

- 9am-5pm, Monday to Friday, unless you need to deviate from the schedule once a while for some reasons.
- Alternative fixed schedule such as ten-hour day, four-day workweek or nine-hour day, one day off every other week.
- Work a fixed amount of hours (e.g. 40 hours) per week, but it's up to you whether you work at 9am or 9pm; Monday or Sunday.
- No fixed hours, as long as you get your work done, you can take as many vacations as possible.
- Other: __________________________

2.1.3 All else being equal, what is the likelihood you would leave your current job (or accept a job offer) if the new position offers your ideal work schedule autonomy policy?

- Very likely
- Likely
- Unlikely
- Very unlikely
- Your employer offers what you want already
- Other: __________________________
2.2. Work Location Autonomy

Work Location Autonomy is defined as the freedom to control the location of work. For example: work from home, from a selection of offices, and the degree of work-related travel

2.2.1. When considering job offers you would prefer the following work location autonomy policy

- Working from a main office the majority of the time
- Working from any company provided main or satellite office as you see fit the majority of the time
- Working from home or on the move the majority of the time
- Working from the office, home, or anywhere you see fit
- Other: __________________________

2.2.2. What kind of work location autonomy policy have you experienced?
Select the most recent one please.

- Working from a main office the majority of the time
- Working from any company provided main or satellite office as you see fit the majority of the time
- Working from home or on the move the majority of the time
- Working from the office, home, or anywhere you see fit
- Other: __________________________

2.2.3. All else being equal, what’s the likelihood you would leave your current job (or accept a job offer) if the new position offers your ideal work location autonomy policy?

- Very likely
- Likely
- Unlikely
- Very unlikely
- Your employer offers what you want already
- Other: __________________________
2.3. Work Methods Autonomy

Work Methods Autonomy is defined as the freedom to control which methods and procedures are utilized.

2.3.1. When considering job offers, you would prefer that an employer offers the following work methods autonomy policy

- Clearly defined work methodology, process and/or procedures
- Somewhat defined work methodology, process and/or procedures
- Low level of pre-defined work methodology, process and/or procedures
- Almost no pre-defined work method, process or procedure. Up to your and/or your team to define.

2.3.2. What kind of work methods autonomy policy have you experienced?
Select the most recent one please.

- Clearly defined work methodology, process and/or procedures
- Somewhat defined work methodology, process and/or procedures
- Low level of pre-defined work methodology, process and/or procedures
- Almost no pre-defined work method, process or procedure. Up to you and/or your team to define.

2.3.3. All else being equal, what's the likelihood you would leave your current job (or accept a job offer) if the new position offers your ideal work methods autonomy policy?

- Very likely
- Likely
- Unlikely
- Very unlikely
- Your employer offers what you want already
- Other: ____________________________
2.4. Decision-Making Autonomy

Decision-Making Autonomy is defined as the freedom to make decisions at work.

2.4.1. When considering job offers, you would prefer an employer who uses the following work decision-making autonomy policy:
- Strict, formalized decision making approval processes at work
- Need approval for higher impact decisions, but free to make other decisions at work by yourself
- Free to make most of decisions at work through team consent
- Free to make most of decisions at work by yourself
- Other: [ ]

2.4.2. What kind of work decision-making autonomy policy have you experienced?
Select the most recent one please.
- Strict, formalized decision making approval processes at work
- Need approval for higher impact decisions, but free to make other decisions at work by yourself
- Free to make most of decisions at work through team consent
- Free to make most of decisions at work by yourself.
- Other: [ ]

2.4.3. All else being equal, what is the likelihood you would leave your current job (or accept a job offer) if the new position offers your ideal work decision-making autonomy policy?
- Very likely
- Likely
- Unlikely
- Very unlikely
- Your employer offers what you want already
- Other: [ ]
III. Preferred Work Task Characteristics
Page 3 of 3

3.1. Skill and Task Variety
Skill Variety is defined as when an employee must use a number of different skills and talents
Task Variety is defined as when an employee must perform different tasks at work

3.1.1. What degree of skill and task variety have you experienced at work?
Select the most recent one please.
- Very high degree of skill and task variety
- High degree of skill and task variety
- Low degree of skill and task variety
- Very low degree of skill and task variety

3.1.2. All else being equal, what is the likelihood that you would leave your current job (or accept a job offer) if the new position offers a higher degree of skill and task variety?
- Very likely
- Likely
- Unlikely
- Very unlikely
- Your employer offers what you want already
3.2. Task Identity

Task Identity is defined as when an employee’s job has a visible outcome after they have worked on it from the beginning to the end.

3.2.1. What degree of task identity have you experienced at work?
Select the most recent one please.

- Very high degree of task identity with a visible outcome
- High degree of task identity with a visible outcome
- Low degree of task identity with a visible outcome
- Very low degree of task identity with a visible outcome

3.2.2. All else being equal, what is the likelihood you would leave your current job (or accept a job offer) if the new position offers a higher degree of task identity with a visible outcome?

- Very likely
- Likely
- Unlikely
- Very unlikely
- Your employer offers what you want already

3.3. Task Significance

Task Significance is defined as when the job has a substantial impact on the lives or work of other people – either in the immediate organization or in the external environment.

3.3.1. What degree of task significance have you experienced at work?
Select the most recent one please.

- Very high degree of task significance and impact on the lives or work of others
- High degree of task significance and impact on the lives or work of others
- Low degree of task significance and impact on the lives or work of others
- Very low degree of task significance and impact on the lives or work of others

3.3.2. All else being equal, what is the likelihood you would leave your current job (or accept a job offer) if the new position offers a higher degree of task significance and impact on the lives or work of others?

- Very likely
- Likely
- Unlikely
- Very unlikely
- Your employer offers what you want already
3.4. Work Performance Feedback

3.4.1. On average, how often do you want to receive POSITIVE feedback?

<table>
<thead>
<tr>
<th>Feedback Provider</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>You don't care much about feedback</td>
</tr>
<tr>
<td>Managers</td>
<td>0</td>
</tr>
<tr>
<td>Clients</td>
<td>0</td>
</tr>
<tr>
<td>Peers/Team Members</td>
<td>0</td>
</tr>
<tr>
<td>Subordinates</td>
<td>0</td>
</tr>
<tr>
<td>Others at work</td>
<td>0</td>
</tr>
</tbody>
</table>

3.4.2. On average, how often do you want to receive constructive NEGATIVE feedback?

<table>
<thead>
<tr>
<th>Feedback Provider</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>You don't care much about feedback</td>
</tr>
<tr>
<td>Managers</td>
<td>0</td>
</tr>
<tr>
<td>Clients</td>
<td>0</td>
</tr>
<tr>
<td>Peers/Team Members</td>
<td>0</td>
</tr>
<tr>
<td>Subordinates</td>
<td>0</td>
</tr>
<tr>
<td>Others at work</td>
<td>0</td>
</tr>
</tbody>
</table>
3.4.3. In general, how do you want to receive POSITIVE feedback?

Positive Feedback Provider vs. Methods of Communication

<table>
<thead>
<tr>
<th>Performance review (recorded in writing and discussed in person)</th>
<th>One-on-one discussion (in person or over the phone)</th>
<th>One-on-one over email</th>
<th>Group meetings (in person or over the phone)</th>
<th>Emails to your group</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clients</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peers/Team Members</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subordinates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others at work</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.4.4. In general, how do you want to receive constructive NEGATIVE feedback?

Negative Feedback Provider vs. Methods of Communication

<table>
<thead>
<tr>
<th>Performance review (recorded in writing and discussed in person)</th>
<th>One-on-one discussion (in person or over the phone)</th>
<th>One-on-one over email</th>
<th>Group meetings (in person or over the phone)</th>
<th>Emails to your group</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clients</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Peers/Team Members</td>
<td></td>
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<tr>
<td>Subordinates</td>
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<tr>
<td>Others at work</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
CONSENT TO PARTICIPATE IN SURVEY

A Study of Talent Management Strategy

You are invited to participate in a research study conducted by Wei Wei from the System Design and Management program at the Massachusetts Institute of Technology (M.I.T.).

The purpose of the study is to understand employee perspectives of talent management strategy regarding workplace autonomy policies and their significance. Your input will provide valuable insight and help uncover factors to improve job satisfaction rates and workplace policies. The results of this study will be included in Wei Wei’s master’s thesis.

Please read the information below and ask questions about anything you do not understand before participating.

• Your participation is strictly voluntary, and you may stop the study at any time for any reason. The questionnaire should take about 15 minutes.

• Your answers will remain confidential. Data collected for this study will be organized, studied, and reported only in aggregated form.

Thank you for your time and support!

Please contact Wei Wei at (909) 833-0807 or Wei_Wei@mit.edu with any questions or concerns.

-------------------------------------------------------------------------------------------------

I understand the procedures described above. Completion of the questionnaire implies consent.

-------------------------------------------------------------------------------------------------
Appendix 3 COUHES Exemption Approval

MIT Committee On the Use of Humans as Experimental Subjects

To: Wei Wei
From: Leigh Firm, Chair COUHES
Date: 10/22/2015
Committee Action: Exemption Granted
Committee Action Date: 10/22/2015
COUHES Protocol #: 1510272079
Study Title: A Study of Flexible Workforce Strategy in Software Development Companies

The above-referenced protocol is considered exempt after review by the Committee on the Use of Humans as Experimental Subjects pursuant to Federal regulations, 45 CFR Part 46.101(b)(2).

This part of the federal regulations requires that the information be recorded by investigators in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. It is necessary that the information obtained not be such that if disclosed outside the research, it could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

If the research involves collaboration with another institution then the research cannot commence until COUHES receives written notification of approval from the collaborating institution's IRB.

Any changes to the protocol that impact human subjects, including changes in experimental design, equipment, personnel or funding, must be approved by COUHES before they can be initiated. You should retain a copy of this letter for your records.
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