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SURFACE WARFARE OFFICER SCHOOL 360-DEGREE ASSESSMENT TOOL: EVALUATION OF THE CURRENT PROGRAM FOR SURFACE WARFARE OFFICERS

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THESIS

SURFACE WARFARE OFFICER SCHOOL 360-DEGREE ASSESSMENT TOOL: EVALUATION OF THE CURRENT PROGRAM FOR SURFACE WARFARE OFFICERS

by

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The Surface Warfare Officer School Command's (SWOSCOM) current 360-degree feedback assessment was constructed using a civilian commercial off-the-shelf product and has not undergone a rigorous review since its creation in 2008. Some of the current assessment's focus areas are not germane to the Surface Warfare Community and have been found to be limited in fully measuring a Naval Surface Warfare Officer's (SWO) leadership through this and previous studies. This thesis examines potential modifications to significantly improve the assessment to better measure and support the SWO community. The research identified the relevance of existing questions to provide feedback on skills and behaviors that affect leadership performance. Using data collected from SWOSCOM consisting of 100 individual redacted feedback reports, an analysis of variance to determine distinctiveness in perspectives of self, bosses, peers, and subordinates regarding early-career SWOs was conducted. Machine learning techniques were applied to identify skills that might be more effective at providing valuable feedback to young officers. This research provides SWOSCOM with specific areas to target and revise in the current assessment by removing or modifying questions that contribute relatively little to the overall assessment and replacing them with questions that are more tailored to the skills and abilities necessary for a SWO and the community to develop a competitive advantage.

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TABLE OF CONTENTS

LIST OF FIGURES

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LIST OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

ADOC	Advanced Division Officer Course
ANOVA	Analysis of Variance
ARI	Adjusted Rand Index
AS	Act Strategically
ATWO	Anti-Terrorism Watch Officer
AUC	Area Under the Curve
BDOC	Basic Division Officer Course
BRP	Build Realistic Plans
BS	Build Support
BST	Billet Specific Training
CICWO	Combat Information Center Watch Officer
CNO	Chief of Naval Operations
CO	Commanding Officer
CQE	Command Qualification Evaluation
DH	Department Head
DIVO	Division Officer
DO	Develop Others
DON	Department of the Navy
EDA	Exploratory Data Analysis
EFA	Exploratory Factor Analysis
ER	Establish Relationships
ET	Establish Trust
FOC	Foster Open Communication
HSD	Honest Significant Difference
JO	Junior Officer
KF	Korn Ferry
ME	Manage Execution
MO	Motivate Others
MSD	Make Sound Decisions
NCBC	Naval Construction Battalion Center

NFLEX	Navy Executive Development Program
NLDF	Navy Leader Development Framework
O	Overall
OB	Other Boss
OOB	Out-of-Bag
OOD	Officer of the Deck
PB	Peers-Boss
PCA	Principal Component Analysis
PCO	Prospective Commanding Officer
PQS	Personal Qualification Standard
PT	Promote Teamwork
PXO	Prospective Executive Officer
PYL	People You Lead
ROC	Receiver Operating Characteristic
SA	Show Adaptability
SDI	Show Drive and Initiative
SWO	Surface Warfare Officer
SWORD	Surface Warfare Officer Requirements Document
SWOS	Surface Warfare Officer School
SWOSCOM	Surface Warfare Officer Command
TC	Think Creatively
USSF	U.S. Fleet Forces
XO	Executive Officer

EXECUTIVE SUMMARY

The Surface Warfare Officer School (SWOS) has been using a 360-degree feedback program since 2008 to mentor Surface Warfare Officers (SWOs) on their performance and leadership abilities. However, the current assessment tool used is based on a commercial off-the-shelf model designed for the corporate world and is not tailored toward the SWO community. Given recent ship collisions, the Navy recognizes that critical decision-making skills and leadership are essential for SWOs and that a tailored 360-degree feedback program could better support the development of their leadership styles. Furthermore, the current assessment does not provide insights toward deficiencies in core competencies required by SWOs to effectively lead and manage, as defined in the Surface Warfare Officer Requirements Document (SWORD). Therefore, the Navy could benefit by improving the way 360-degree feedback is conducted and briefed as part of a larger professional development career path and in 2019, the commander of Naval Surface Forces directed an upgrade to the current 360-degree feedback to fit within the Surface Community better.

360-degree feedback is a method of assessment that gathers information about a person's behavior from multiple sources, such as supervisors, peers, and subordinates. It can provide valuable information to identify and address shortcomings and build upon current strengths from multiple perspectives, which makes it more beneficial than a standard evaluation. Studies have shown that this form of feedback can improve performance, and the U.S. Navy adopted its own version in 2007 for leadership development in officers. Within the Surface Community, this assessment is taken by post-first tour Division Officers (DIVO) and Department Heads (DH) as they progress through their career, with the raters being a mix of senior officers, fellow DIVOs or DHs, and both senior and junior enlisted to gather a full top to bottom look at their leadership skills.

The assessment utilized by the Navy is adopted from Korn Ferry, a global organizational consulting firm, and is solely designed around the concept of leadership development. The assessment contains a total of 68 questions that are broken up into 14

skills and one hybrid skill. These skills are further broken down into four key leadership areas; thought, results, people, and personal leadership.

This research aims to assist the Surface Warfare Officer Command (SWOSCOM) in evaluating and improving their 360-degree feedback program. While the assessment is designed for the corporate world and not for the Surface Community, certain aspects of the assessment may still be useful to retain. The study explored how different raters assess individuals, and identified questions and skills that were effective or ineffective toward the overall assessment that should be considered for retention or modification. By applying both unsupervised and supervised machine learning methods, in the form of K-means clustering and random forests, to 100 randomly selected 360-degree feedback assessments, the purpose of this thesis was to help lay the framework to develop an updated assessment tool with tailored assessment questions for the Surface Community.

The data was broken into five main datasets for each rater: Self, Boss, Peers, People You Lead (PYL) and Other Boss (OB), and an initial exploratory data analysis (EDA) was performed for a first look into the responses. The EDA revealed that, on average, the Self rater assessed themselves more critically than any other rater, the PYL assessed the individual they were rating the highest, and the Boss, OB, and Peers raters all rated the individually similarly. The variance within the responses for each question across all raters was also examined and found that the skills under personal leadership, Establish Trust (ET) and Show Adaptability (SA), had the lowest variance, as did the skill Develop Others (DO) and the hybrid skill Overall (O). Questions to which all raters provide similar responses provide little constructive feedback and should be considered for removal or modification to aid in continuous development.

Following the EDA, the data was prepared for further analysis. A pairwise analysis of variance (ANOVA) was conducted on the datasets to determine if the differences in how the individual being assessed rated themselves, and how the raters rated them, were statistically significant. The test concluded that the ratings from the individual being assessed and the PYL rater were statistically significantly different from all of the other raters, while the differences among the Peers, Boss, and OB raters were not. From this it was decided to combine the Peers, Boss, and OB data sets into one by taking the average

of the three responses for each question. Next, the data was scaled by the skills defined in the Korn Ferry 360-degree Assessment using Cronbach's alpha reliability test. This was performed for three reasons. First, to reduce the dimensionality of the data from 68 variables down to 15, helping to prevent the models from overfitting and improving the interpretability of our results. Second, to allow us to test the internal consistency of the skills and identify questions that lowered this reliability, signify that the question is not strongly related to the others, Finally, with a single score that represented the skill, we were able to better test the effectiveness of that skill in the assessment.

With the data scaled, K-Means clustering was used cluster individuals within each dataset such that similarities between clusters could be identified, as well as to use these cluster assignments as a classification in a random forest analysis. The clustering produced three clusters that correlated to the assessment of an individual. Individuals assessed high were grouped together, those who were assessed low were grouped together, and those who fell in between were the final cluster. Distances between the high-rated and low-rated clusters were compared to gain initial insight on skill effectiveness, with the higher distance, the more effective, and vice versa. Foster Open Communication (FOC), Establish Relationships (ER) and ET were the skills that had the lowest distances between clusters for each of the raters. Conversely, Act Strategically (AS), Show Drive and Initiative (SDI), and Make Sound Decisions (MSD) had the greatest distances.

Random forests were then created for both classification of the cluster the individual was assigned to, and regression to predict the hybrid skill, O. The classification random forest indicated that MSD, FOC, and Manage Execution (ME) were the most influential in identifying whether an individual belonged to the above-average cluster or not. Show Drive and Initiative (SDI), AS, ER, and ET were the least influential. The regression random forest result differed slightly, assessing SDI, and Build Realistic Plans (BRP) as the most influential, and Promote Teamwork (PT), FOC, and ER as the least. It is important to note that the regression model assumed that O is meant to be a comprehensive measurement of performance. This may not be the case and the model could have been affected by biases in the data. When the results of the two random forests

were averaged together the skills ranked the highest were MSD, FOC, and SDI. PT, MO, and AS were the lowest.

The purpose of this thesis was to assist SWOSCOM in reassessing the current 360-degree feedback assessment. This research was not meant to discredit any skill or questions, but to identify portions of the assessment that are effective toward development or that would benefit from modification or truncation. Our findings were that the skills of MSD, SDI, and FOC are effectively used in the assessment; however, the assessment may benefit from modified questions to produce more critical feedback between the individual and the raters. MO was not influential in our models but was the only skill that produced high variance in all questions and could be applied within the Navy. Therefore, the assessment may benefit from keeping these concepts within it but combining the skill with another section. The skills of PT, AS, and ER were deemed ineffective from their performance in the models and lack of variance among raters. Furthermore, the questions that were removed in the scaling process should be considered for modification or removal from the assessment.

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I. INTRODUCTION

A. PURPOSE

Since approximately 2008, the Surface Warfare Officer School (SWOS) has been using a 360-degree feedback program to mentor Surface Warfare Officers (SWOs) on their performance and leadership abilities. The 360-degree feedback professional development tool is provided at two career milestones: upon completion of the Advanced Division Officer Course (ADOC) and again at the Command Qualification Evaluation (CQE), after an officer's first at-sea Department Head (DH) tour (Department of the Navy [DON] 2021). However, the current assessment tool used is based on a commercial off-the-shelf model designed for the corporate world, not tailored toward the SWO community. The 360-degree feedback assessment, currently adopted from Korn Ferry (KF), a global organizational consulting firm, is centered around the competencies of thought, results, people, and personal leadership (Eichinger and Lombardo 2003).

Training SWOs to make critical decisions in complex at-sea scenarios is not something that can be taught in black and white. In light of recent ship collisions, the Navy has seen that terrible consequences can arise while navigating the ship if an officer cannot make these time-sensitive decisions (U.S. Fleet Forces Command [USSF] 2017). Because of this, both the SWO community and the Surface Warfare Officer School Command (SWOSCOM) may find greater value using a 360-degree feedback program tailored to the Surface Navy for officer professional development, providing feedback from subordinates, peers, and senior officers. This feedback early in a division officer's (DIVO) career may better support the development of his or her leadership styles and strengths to help them become more competent SWOs. Being a SWO requires the ability to make a multitude of critical decisions when it comes to competencies such as managing, driving, and fighting the ship. The Navy has already revamped its training programs for SWOs by adding additional training for Junior Officers (JO) and Go/No-Go, or pass-fail, assessments throughout a SWO's career to enhance the quality of officers it retains (LaGrone 2018); however, with a 360-degree feedback tailored for SWOs, it will be able to more effectively

and efficiently identify areas that require more focus as well as improve on systems and trainings already in place.

Despite previous research and theses on the KF 360-degree feedback stating that the program has tremendous potential, it has never undergone a formal review, nor has a governing instruction been established. Additionally, it was found that while the feedback can provide a competitive advantage toward SWOs and their professional leadership development, it may not align with the intent of use for the U.S. Navy (Hanisko and Mulanax 2021). Furthermore, the current assessment does not provide insights toward deficiencies in core competencies required by SWOs to effectively lead and manage as intended by COMNAVSURFORINST 1412.4A, the Surface Warfare Officer Requirements Document (SWORD). Therefore, the Navy could benefit by improving the way 360-degree feedback is conducted and briefed as part of a larger professional development career path.

B. RESEARCH OBJECTIVES

The objective of this research is to support SWOSCOM in reevaluating the current 360-degree feedback program to highlight the skills and questions that are beneficial to retain, and those which offer little to the overall assessment. Once the research questions are addressed, SWOSCOM will be able to modify and improve the assessment to better facilitate an environment of continuous learning and professional development. To that end, we focus on the following questions:

1. How do the different raters using the assessment to assess an individual differ in perspective and what does each consider more important than the others?
2. What questions or skills contribute the most to the overall assessment and should be considered for retention?
3. What questions or skills contribute relatively little to the overall assessment and should be considered for modification or removal?

The exploratory data analysis (EDA) from this research would then be used to help develop tailored assessment questions and create an updated assessment with questions that we found to have high value from the current assessment. Furthermore, from our research, SWOSCOM would be able to compare differences in data from the current and revised future 360-degree assessment tool.

C. SCOPE AND METHODOLOGY

This research will start with examining the distinctiveness between perspectives of the different raters with two goals in mind. The first is to determine how to split and combine the data gathered for analysis, and the second, to determine if there is a difference in what these raters find important when assessing an officer. This research analyzes 100 redacted Korn Ferry Feedback reports provided by SWOSCOM ranging in date from April to September of 2021. The data from these reports were sorted according to the raters' role and analyzed to determine differences between raters.

The methodologies in this study include K-Means clustering to identify groupings of high and low performing officers such that the similarity can be analyzed. With these clusters, random forests were then generated to determine the effectiveness of the skills in relation to predicting the cluster to be inferred as effectiveness in the current assessment. Data scaling involved a pair-wise analysis of variance (ANOVA) along with factor analysis to reduce the dimensionality of the data.

D. THESIS ORGANIZATION

The remainder of this thesis focuses on exploring the data and the techniques we employ to develop statistical models for clustering and identifying the effectiveness of each skill. Chapter II is a review of the SWO community and its leadership, as well as 360-degree feedback programs. Chapter III explains the data for this research and how it was prepared, as well as the Korn Ferry Feedback report. Chapter IV presents the methodology and analysis performed with differences between each set. Lastly, Chapter V summarizes our findings, provides informed conclusions and actionable recommendations, and suggests areas for future research.

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II. BACKGROUND

A. SURFACE WARFARE OFFICERS

Surface Warfare Officers are tasked to become premium warfighters, mariners, and leaders the day they show up to their ship. Upon commissioning, officers selected to become SWOs are given the designator code of 1160 defined as an "Unrestricted Line Officer billet for an officer in training for Surface Warfare qualification" (Department of the Navy [DON] 2022, p. A-6) and beginning training to prepare them to drive ships and manage a division of Sailors. The first training they go through is the Basic Division Officer Course (BDOC), a nine week school where they receive a general understanding of mariner skills, navigation, damage control, leadership, and maritime warfare. Following BDOC, they go through the Officer of the Deck (OOD) Phase I course that offers 6-weeks of simulator-based training for ship-handling and radar operation. Finally, if required, they attend Billet Specialty Training (BST).

With their initial schooling complete, they report to their first warship for their first Division Officer tour. They are assigned a division to lead, as well as all the Personal Qualification Standards (PQS) to complete to meet the requirements for becoming a qualified SWO. These qualifications include required shipboard knowledge, Division Officer Afloat, and important watch stations, including Anti-Terrorism Watch Officer (ATWO), Combat Information Center Watch Officer (CICWO), and most importantly OOD Afloat. After they have completed the required PQS, shown proficiency in all watch stations, and demonstrated effective leadership skills within their division, they must then complete an oral board with all Department Heads and the Executive Officer (XO), chaired by the Commanding Officer (CO). The board has no specific guidelines and is solely dependent on the judgement of the CO but should validate the officer's general professional knowledge of all aspects of Surface Warfare, and comprehensive understanding of their specific ship capabilities, systems, and mission (DON 2021). Following successful completion of the board, the CO designates the officer as a SWO, and he or she receives the designator of 1110 for "an Unrestricted Line Officer who is qualified in Surface Warfare" (DON 21). The notional timeline of early career SWOs from commissioning to

their post-Department Head shore tour, as well as when they take these Go/No Go, and 360-degree Feedback assessments is depicted in Figure 1.

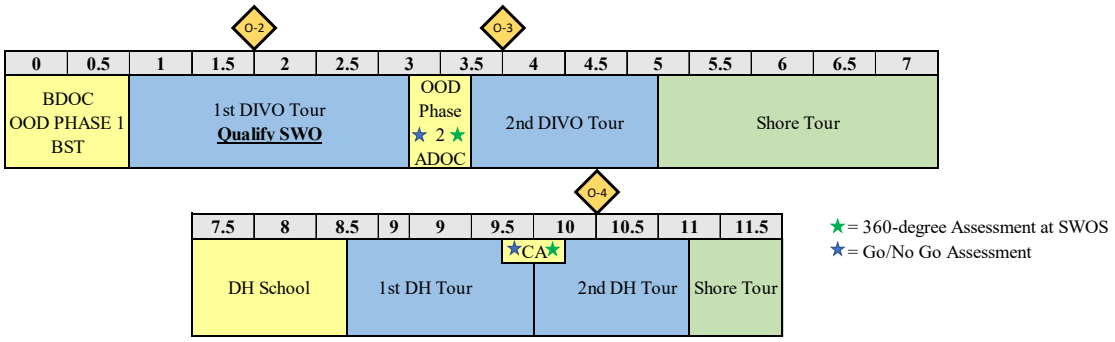

Figure 1. Early Career Notional Timeline for SWOs. Source: MyNavy HR (2022).

B. SWO LEADERSHIP

The characteristics of an exceptional Surface Warfare Officer are not straightforward to describe, with different senior officers often offering varied interpretations that will usually be tied to the Navy's core principles of honor, courage, and commitment. These principles are defined in the DON's Core Values Charter (2022) and are defined as follows to give a better idea of what is expected of the officer. Honor: are they honest and truthful, do they have integrity, and are they forthright? Courage: can they make decisions and act in the best interest of the Navy regardless of the consequences, and can they overcome challenges while still adhering to the highest standard of personal conduct? Commitment: do they foster respect up and down the chain of command, do they show respect to all, and do they exhibit the highest degree of moral character? (DON 2022).

While these are values required of all Naval Officers, they are not exactly all-encompassing and can still leave some ambiguity in some areas. Interviews with senior officers show that there is not a textbook answer of what makes a good leader. SWOs need to be effective at leading a division of sailors as well as running a watch team. Although the two tasks are similar, they require different management styles. Leaders need to have

good management, whether ensuring their division completes all work required, or overseeing their watch team to complete the given mission. They also need to have a balanced professional knowledge including tactical competency and manageable skills to lead their division. Finally, they need to have good character, perhaps the hardest trait to define, and be approachable, show empathy, and have integrity. Along with these, they need to be able to effectively lead while not generating a "wake of human wreckage" (Bryan 2022). Another senior officer said that a good leader needs to have a professional knowledge, good judgement, and trust from his subordinates, peers, and seniors (Kline 2022).

A recent update of the Chief of Naval Operations' (CNO) Navy Leader Development Framework (NLDF) (2018) defines how the Navy works to create effective leaders who can demonstrate operational excellence, strong character, and resilience through community at every level of seniority. The NLDF describes how as leaders progress throughout their career, they are following three "lanes." The first lane develops both operational and warfighting competence to help officers become experts at their jobs. The second develops character and strengthens the core values of the Navy. The last develops intellectual and personal connections. Additionally, the NLDF explains the methods of how to progress down these lanes through schooling, on-the-job training, and self-guided training (CNO 2018).

With all the tools available to them, it is the responsibility of the junior officers to become the best leaders they can be in becoming a qualified 1110 SWO. While the qualifications, and requirements in becoming a SWO are important, the judgement of the CO is the deciding factor in whether a junior officer becomes a fully qualified SWO. Because of this, the knowledge and ability to stand watch is not everything that goes into their final board. Anybody can recite navigation or engineering knowledge, but the individual needs to be able to be trusted to act on behalf of the CO when the latter is not present (Bryan 2022). This leads to an explanation as to why there is no guidance on how to conduct a SWO board and leads into the topic of agency theory.

Commonly used in the corporate world, agency theory explains the relationship between two parties, the agents and the principal, in which the principal has hired the agents

to represent her and perform a service on her behalf (Kopp 21). With this, a principal delegates decision-making authority and other assets to the agents such that she has minimal involvement in day-to-day occurrences and can focus her time on other things, with the assumption that the agents will always act in her best interests. The agents, however, may not always have the best interests of the principal at heart and act on what benefits themselves, leading to the principal-agent problem. Principal-agent problems commonly occur due to a disparity in objectives or a contrast in risk tolerance (Kopp 21). With the principal delegating her authority to the agent, the agent incurs little to no risk based on the decisions he makes, and adverse outcomes fall on the principal. Therefore, an agent is more likely to take risks than the principal may be comfortable to make. This is known as agency loss and there are several ways the principal may try to reduce it such as giving incentives based on performance.

In terms of the Surface Navy, the principal is the CO, and the agents are junior officers that the CO has qualified as a SWO. Before the Captain qualifies someone, he or she needs to be confident that they will take the right course of action and act on the Captain's behalf. The final SWO board and the CO's Standing Orders are both ways that the CO can reduce the agency loss and be confident that the junior officer will act in a way that benefits him.

C. 360-DEGREE FEEDBACK PROGRAM

360-degree feedback, or multi-rater feedback, is "an assessment method where information is gathered about a person's behaviors from supervisors, peers, and subordinates" (Lepsinger and Lucia 1997). This feedback can be used for a multitude of reasons including leadership development in officers, which is how the Navy uses it. The benefit of this form of feedback as opposed to a standard evaluation is that it provides valuable information which may be used to identify and address shortcomings as well as to recognize and build upon current strengths, all from multiple perspectives and not just from the supervisor's (Hazucha et al. 1993).

With studies showing individuals whose performance was originally rated low, were rated higher when assessed again several months later when using this multi-rater

feedback (Alimo-Metcalfe 1998), the U.S. Navy adopted its own form in 2007 for use with Prospective Commanding and Executive Officers (PCO/PXO), at the Navy Executive Development Program (NFLEX), Naval Construction Battalion Center (NCBC), and SWOS. The assessment used today has not been changed since its employment and in 2019 the Commander of Naval Surface Forces, Vice Admiral (VADM) Kitchener, put out a direction to upgrade the current 360-degree feedback to better fit the Surface Community.

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III. DATA AND THE KORN FERRY FEEDBACK REPORT

This chapter outlines the data and feedback report utilized in the analysis. The Korn Ferry Feedback report employed by SWOSCOM is presented first, followed by a brief overview of the primary data obtained from the reports. The last section details the preparation process for the data to be used in clustering and random forest analysis.

A. KORN FERRY FEEDBACK REPORT

The 360-degree feedback assessment utilized by SWOSCOM is adopted from Korn Ferry, a global organizational consulting firm known for its broad approach to organizational design and talent management (Korn Ferry 2023). Despite its broad application in the corporate sector, this research focuses on the specific use of the assessment within the Surface Navy, leadership development.

The data used in this study was prepared and delivered by Mr. Jim Marion, Deputy Director Fleet Training at SWOSCOM. The data consisted of 100 randomly selected feedback reports assessing early-career SWOs. The reports contained the responses to the 68 questions completed by the individual (Self), bosses, peers, and subordinates (People You Lead). There was one more category of rater named "Other Raters" that was not clearly defined within the assessment and was only used in six percent of the reports received. Due to an unclear definition and little data for this rater, the Other Rater was excluded from any analysis. The translation of the raters to the position of the person on a given ship as shown in Figure 2.

	Division Officer	Department Head
Boss	Commanding Officer	Commanding Officer
Other Boss	Executive Officer	Executive Officer
Peers	Division Officers/Non Commision Officers (E7-E9)	Department Heads
People You Lead	Enlisted (E5-E6)	Enlisted (E5-E6)

Figure 2. Rater Assignment for Surface Warfare Officers

These question responses are grouped together and summarized by skill in the report; however, while taking the assessment, the question order is random. The skills themselves are categorized into four key areas: thought, results, people, and personal leadership. Definitions of each skill, as defined in the Korn Ferry Assessment (2019), follows; questions associated are listed in Appendix A.

- Thought Leadership
  - Make Sound Decisions (MSD): Makes timely decisions based on accurate logic; Looks beyond symptoms to identify causes of problems; Makes decisions in the face of uncertainty; Takes all important issues into account when making decisions.
  - Act Strategically (AS): Balances big-picture concerns with day-to-day activities; Stays informed about industry practices and new developments; Understands the organization's mission and strategies.
  - Think Creatively (TC): Approaches problems with curiosity and open-mindedness; Creatively integrates different ideas and perspectives; Stimulates creative thinking in others; Generates innovative ideas and solutions to problems.
- Results Leadership
  - Build Realistic Plans (BRP): Develops realistic plans, action steps, and timetables for projects and assignments; Identifies specific action steps and accountabilities; Prepares realistic estimates of resources needed to accomplish task.
  - Manage Execution (ME): Conveys clear expectations for assignments; Delegates enough of own work to others; Monitors progress of others and redirects efforts when goals are not being met; Continually looks for ways to improve processes, products, and/or services.
  - Show Drive and Initiative (SDI): Establishes aggressive goals and drives for results; Readily puts in extra time and effort; Tackles problems and works to resolve them without delay; Establishes high standards of performance.
- People Leadership
  - Build Support (BS): Gives compelling reasons for ideas; Anticipates and responds effectively to the positions and reactions of others; Builds support for own ideas through contacts with others; Knows which battles are worth fighting.
  - Motivate Others (MO): Conveys trust in people's competence to do their jobs; Creates a feeling of energy,

excitement, and personal investment; Inspires people to excel; Rewards people for good performance.
    - Develop Others (DO): Attracts high caliber talent; Gives clear, motivating, and constructive feedback; Provides challenging assignments to facilitate individual development; Willingly shares expertise and experience with others.
    - Promote Teamwork (PT): Promotes teamwork among groups; discourages "we vs. they" thinking; Facilitates the discussion and resolution of different views; Involves others in shaping plans and decisions that affect them; Contributes fair share of effort to the team's work.
    - Foster Open Communication (FOC): Keeps people up-to-date with information; Listens attentively and with empathy to concerns expressed by others; Encourages others to express their views, even contrary ones; Speaks clearly and concisely.
    - Establish Relationships: Relates to people in an open, friendly, and accepting manner; Develops relationships with key people in other functions and at other levels; Expresses disagreement tactfully and sensitively; Creates an environment in which people from diverse backgrounds feel comfortable.
- Personal Leadership
    - Establish Trust (ET): Treats people fairly; Shows consistency between words and actions; Accepts responsibility for own mistakes; Encourages discussion of ethical considerations before decisions are made.
    - Show Adaptability (SA): Responds resourcefully to new demands and challenges; Works effectively in ambiguous situations; Adapts behavior in response to feedback and experience; Deals constructively with own failures and mistakes (Korn Ferry 2019).

The report also contains the number of responses received for that assessment, and the importance of a given skill and their competency of that skill in relation to the individual's role as assessed by each rater (self excluded). Finally, there is a summary of the comments made by each person taking the assessment in the free response portion of the assessment at the end, asking the following questions:

- What skills or behaviors make this person most effective?

- What new skills or behaviors would make this person even more effective?
- What else might support this person's insight and development?

B. DATA DESCRIPTION

For this study, data was collected from feedback reports that included information on the number of individuals selected for the assessment, the number of actual responses received, the perceived importance of different skills, and the ratings for each question on a 5-point Likert scale. The reports were initially transformed from PDF to CSV format to enable efficient analysis using the R programming language (R Core Team 2022). Seven datasets in total were derived from the original data, including response data, the perceived importance of specific skills, and the ratings provided by each of the five raters: Self, Boss, Peers, Other Boss (OB), and People You Lead (PYL). The resulting datasets consisted of the responses to 68 questions for 100 individuals, forming a 100x68 data frame. The free response comments from the raters in each report were not used for this thesis; however, they will be analyzed in future research to identify concepts that may be useful to include in a 360-degree assessment designed for SWOs.

In the assessment, participants were given the option to respond with "Don't Know" (0) to certain questions. This response was considered as missing data in the dataset. There are several possible reasons for a participant to choose "Don't Know," including a lack of knowledge to accurately rate an officer, disagreement with the question, or a conscious or unconscious drive to quickly complete the 68-question assessment. However, as the online assessment does not permit users to continue to the next page without answering all questions, the latter possibility is deemed unlikely. The missing data was retained in the dataset and was dealt with during the scaling process, which will be described in the Data Scaling section.

1. Descriptive Statistics

a. General Statistics

After separating and cleaning the data, a preliminary statistical analysis was conducted to gain insight into the feedback provided by each rater in comparison to others. The objective of this initial step was to determine if any of the raters were similar enough to be combined into a single, averaged rater. The general statistics for the average of each rater, including the percentage of responses equal to "5," less than "3," and "Don't Know" answers are shown in Table 1.

Table 1. General Statistics of the KF Datasets

Rater	Average Rating	Average Rating Variance	Range	Percent of responses = 5	Percent of responses < 3	Percent of responses =0
Self	3.73	0.67	[2.78, 4.78]	17%	6%	1%
Boss	4.08	0.67	[2.68, 5.00]	33%	3%	5%
Other Boss	4.04	0.5	[2.57, 4.99]	21%	2%	6%
Peers	4.14	0.35	[2.87, 4.84]	13%	2%	0%
People You Lead	4.38	0.34	[2.60, 5.00]	29%	1%	0%

As can be seen from Table 1, the individual raters provided the lowest overall ratings, but showed the largest variability in comparison to other raters. On the other hand, the "People You Lead" group had the highest average ratings and the smallest variability among raters. The "Boss," "Other Boss," and "Peers" raters showed similar ratings. Additionally, the "Boss" rater was the most likely to provide a rating of five, with 33 percent of responses being the maximum, and was the only group to give all fives for an individual.

b. Variance Comparison

Along with the general statistics, a comparison of both the variance in a question for each dataset individually, as well as in the difference between the Self rating and the average of the other raters, was performed. The purpose of assessing the variance was that

if a question had a unusually low variance, the question may not provide useful feedback. For example, the question from the skill ET "Treats people fairly" had one of the lowest variances in each dataset individually and across all raters. While there may be some exceptions, Naval Officers are expected to treat everyone fairly and the question would not provide useful feedback if they rated themselves as 5 as with the other raters. Conversely, if a question had a high variance, it may offer more critical feedback or may be a question that is not relevant to SWOs. An example of each is the question from DO "Attracts and selects high caliber talent" is not relevant to the community, while the question from BS "Knows which battles are worth fighting" would provide useful feedback.

To perform this comparison, the variance of each question was calculated separately for each of the five raters and. The missing data was ignored in this analysis. A summary of the questions within the top and bottom ten percent of variance by rater is tabulated in Tables 2 and 3.

Table 2. Questions with the Highest Variance

Skill	Question	Self	Boss	PYL	Peers	OB
Act Strategically	Stays informed about industry practices and new developments	X			X	X
Build Support	Knows which battles are worth fighting	X	X	X		X
Develop Others	Attracts and selects high caliber talent	X	X	X	X	
	Provides challenging assignments to facilitate individual development			X		
Establish Relationships	Expresses disagreement tactfully and sensitively		X		X	X
Establish Trust	Encourages discussion of ethical considerations before decisions are made	X				
Foster Open Communication	Makes sure that people have no 'surprises'			X		
Manage Execution	Continually looks for ways to improve processes, products, and/or services	X			X	
	Delegates enough of own work to others			X	X	
	Plans and conducts meetings to make effective use of time			X		
Motivate Others	Creates a feeling of energy, excitement, and personal investment		X		X	X
	Makes decisions in the face of uncertainty			X		

Skill	Question	Self	Boss	PYL	Peers	OB
Make Sound Decisions	Focuses on important information without getting bogged down in unnecessary detail		X		X	
Promote Teamwork	Promotes teamwork among groups; discourages 'we vs. they' thinking		X			
Show Adaptability	Adapts behavior in response to feedback and experience		X			
	Seeks feedback to enhance performance	X				
	Works effectively in ambiguous situations					X
Show Drive and Initiative	Establishes aggressive goals and drives for results					X
	Tackles problems head on and works to resolve them without delay	X				
	Sets high personal standards of performance					X

Table 3. Questions with the Lowest Variance

Skill	Question	Self	Boss	PYL	Peers	OB
Build Realistic Plans	Anticipates and responds effectively to the positions and reactions of others				X	
Develop Others	Willingly shares expertise and experience with others				X	
Establish Relationships	Helps people from diverse cultures/backgrounds/lifestyles succeed in the organization		X	X	X	X
	Creates an environment in which people from diverse backgrounds feel comfortable				X	X
Establish Trust	Accepts responsibilities for own mistakes	X		X		
	Shows consistency between words and actions					X
	Treats people fairly	X	X	X	X	X
Foster Open Communication	Encourages others to express their views, even contrary ones					
	Speaks clearly and concisely			X		X
Manage Execution	Conveys clear expectations for assignments					X
Motivate Others	Rewards people for good performance		X			
Make Sound Decisions	Applies accurate logic in solving problems	X	X			

Skill	Question	Self	Boss	PYL	Peers	OB
	Takes all important issues into account when making decisions	X	X		X	
Overall	Accomplishes a great deal			X		
	Gets the job done			X	X	
	Is an effective manager overall	X				
	Produces high quality work		X	X		
Promote Teamwork	Contributes fair share of effort to the team's work		X			X
Show Adaptability	Responds resourcefully to new demands and challenges	X				
Think Creatively	Generates innovative ideas and solutions to problems	X				

It is important to note that although a question may have a high or low variance, it does not mean that the question is not of some value. A more qualitative study of the questions would be required to make such an inference. However, questions that had low variance across all raters show that they do not contribute much toward leadership development.

The variability in the difference between the Self rating and the average of all other raters was measured by taking the absolute value of the difference between the two for each question. Results of this assessment are presented in Table 4. The color coding is a gradient from green, being the highest amount of variance, to red, being the lowest.

Table 4. Variance in the difference between Self rating and the average of all other raters for each question.

Thought Leadership			Results Leadership			People Leadership			Personal Leadership			Hybrid Skill		
Skill	Q#	Variance	Skill	Q#	Variance	Skill	Q#	Variance	Skill	Q#	Variance	Skill	Q#	Variance
MSD	1	0.167023	BRP	1	0.29411	BS	1	0.268243	ET	1	0.188108	O	1	0.385486
	2	0.241478		2	0.345689		2	0.299761		2	0.466538		2	0.262677
	3	0.367654		3	0.297679		3	0.452005		3	0.361039		3	0.353771
	4	0.293703		4	0.2777		4	0.349158		4	0.105579		4	0.369006
	5	0.157781	ME	1	0.321386	MO	1	0.469089	SA	1	0.361594		5	0.309835
	6	0.351952		2	0.282099		2	0.422559		2	0.340424			
AS	1	0.218441		3	0.386112		3	0.400337		3	0.216859			
	2	0.288718		4	0.404501		4	0.355879		4	0.397775			
	3	0.480498		5	0.466379	DO	1	0.550592		5	0.371701			
	4	0.251025	SDI	1	0.351438		2	0.342992						
TC	1	0.388206		2	0.493968		3	0.47221						
	2	0.392844		3	0.441079		4	0.253467						
	3	0.401063		4	0.295893	PT	1	0.337216						
	4	0.283226		5	0.28281		2	0.325324						
							3	0.285991						
							4	0.251315						
						FOC	1	0.364523						
							2	0.31086						
							3	0.357627						
							4	0.223774						
							5	0.515268						
						ER	1	0.242114						
							2	0.287404						
							3	0.424105						
							4	0.252199						
							5	0.224346						

The skill that stood out in the table was MO, with a larger difference in responses between the individual and other raters for each question. The higher the number in the table indicates that there is a larger disagreement between the Self and raters in this area, and therefore, this area may provide better feedback to foster leadership development. PT also stood out in the table for its smaller difference in each question, meaning that the Self and raters agree, and less critical feedback can be derived from those questions. If any individual thinks they excel in a skill and the other raters are saying they excel in that skill, the individual is only being told what they already knew. However, this analysis is not as simple as a high difference implies a good question and a low difference implies a bad one. As previously stated with the first question of DO, the third question of AS, "Stays informed about industry practices and new developments," does not fit the community well

yet had high variance. Conversely, a question with low variance may just need to be modified to encompass more of the aspects it is trying to cover.

2. Importance

The intent of exploring this data is to have an initial look prior to analysis on whether certain skills should be kept, modified, or condensed. Along with the separate raters assessing the individual through the questions, the Boss rater is able to rate the skill itself as it pertains to the individual's job. This rating of the skill itself is not required by the Boss; therefore, not all the reports had this rating of importance for every skill. The missing data was ignored for this analysis and averages were based on the numbers present. The average importance rating of each skill, as well as the standard deviation and a 95 percent confidence interval of the population mean is shown in Table 5.

Table 5. Importance Ratings by Raters Excluding Self

Skill	Average	Standard Deviation	95% CI
Make Sound Decisions	2.37	0.71	[2.23, 2.51]
Act Strategically	1.48	0.70	[1.34, 1.62]
Think Creatively	1.43	0.58	[1.32, 1.55]
Build Realistic Plans	2.29	0.74	[2.15, 2.44]
Manage Execution	2.34	0.72	[2.20, 2.48]
Show Drive and Initiative	2.32	0.72	[2.18, 2.47]
Build Support	1.66	0.72	[1.51, 1.80]
Motivate Others	2.16	0.76	[2.00, 2.31]
Develop Others	1.79	0.74	[1.64, 1.93]
Promote Teamwork	2.25	0.72	[2.10, 2.39]
Foster Open Communication	2.20	0.74	[2.05, 2.34]
Establish Relationships	1.77	0.71	[1.63, 1.91]
Establish Trust	2.53	0.64	[2.40, 2.65]
Show Adaptability	2.00	0.75	[1.85, 2.15]

Establish Trust, Make Sound Decisions, and Manage Execution were the highest-rated skills, and Think Creatively, Act Strategically, and Build Support were the lowest. Skills with a high average and low variance were considered important and low average, low variance as less important. Since this data was simply whether a skill was important to an individual's position, this analysis was only used as a quick look and was not used any

further. The purpose of this was solely to get an understanding of what the COs in the Fleet view as important skills for their DIVOs and DHs.

3. Responses

Lastly, the number of people who took a given assessment was explored. While the 360-degree Feedback assessment is used at two points in a SWO's career, the only guidance on how many people need to take it is for DHs at the CA, defined in COMNAVSURFOR INST 1412.7A. The feedback report contains a table of the number of each rater that was asked to conduct the assessment and the actual number of responses they received. The purpose of this exploration was to examine how many people were taking this assessment. Another purpose of this was to assess if any of the reports we received were not meeting the minimum number of participants per rater, however, without a governing instruction for how to properly conduct the assessment, and whether a report was for a JO or DH unavailable, this could not be analyzed. The number of individuals selected to participate in the assessment versus the number of people who took the assessment is identified in Table 6.

Table 6. Number of People Selected to Take Assessment versus Number of Responses Received by Rater

Rater	Selected For Assessment	Response Received	Percent Received
Boss	100	100	100%
Other Boss	190	129	68%
Peers	359	222	62%
People You Lead	361	228	63%

As expected, 100 percent of the boss rater, or CO, took the assessment; however, all other raters were below 70 percent. Directing seniors, peers, and subordinates to provide constructive feedback is one more task on top of shipboard life. Therefore, the response rates might be lower due to ships asking as many people as they can to participate, expecting some to become distracted with other taskings or not have time to complete the assessment.

C. DATA PREPARATION

To make the data more meaningful, a three-step process was employed. The first step involved conducting pairwise ANOVA tests between each rater to determine if any were statistically similar enough to be combined. The second step involved scaling the data using factor analysis, a commonly used technique in assessment data analysis. Finally, the last step involved categorizing the individuals into Above-Average, Below-Average, and Average groups.

1. Scaling by ANOVA

A Tukey's Honest Significant Difference (HSD) test was then performed, which is a multiple comparison test that identifies statistical differences between the means of different groups (Tukey 1949). The results of this test, including the p-values for all skills and the overall hybrid skill, are shown in Table 7.

Table 7. Results of Tukey HSD Test

	Boss-Self	PYL-Self	Peers-Self	OB-Self	PYL-Boss	Peers-Boss	OB-Boss	Peers-PYL	OB-PYL	OB-Peers
MSD	0.0320	0.0001	0.0001	0.2449	0.0002	0.5533	0.9253	0.0397	0.0001	0.1408
AS	0.0001	0.0001	0.0001	0.0021	0.0001	0.2028	0.9125	0.0017	0.0001	0.0250
TC	0.0001	0.0001	0.0001	0.0001	0.0004	0.9259	0.9356	0.0075	0.0001	0.5011
BRP	0.0002	0.0001	0.0001	0.0015	0.0021	0.6608	0.9899	0.1249	0.0004	0.3707
ME	0.0001	0.0001	0.0001	0.0001	0.0003	0.7706	0.9188	0.0177	0.0001	0.2680
SDI	0.0004	0.0001	0.0001	0.0019	0.0196	0.9753	0.9969	0.0993	0.0070	0.8809
BS	0.0006	0.0001	0.0001	0.0024	0.0001	0.8370	0.9977	0.0007	0.0001	0.6596
MO	0.0001	0.0001	0.0001	0.0001	0.0003	0.9690	0.9999	0.0029	0.0002	0.9379
DO	0.0001	0.0001	0.0001	0.0001	0.0008	0.5997	0.9940	0.0859	0.0002	0.3486
PT	0.0003	0.0001	0.0001	0.0115	0.0014	0.9997	0.8966	0.0027	0.0001	0.8150
FOC	0.0001	0.0001	0.0001	0.0001	0.0001	0.9490	0.9993	0.0017	0.0001	0.8730
ER	0.0001	0.0001	0.0001	0.0001	0.0040	0.9993	0.9942	0.0016	0.0010	0.9998
ET	0.0001	0.0001	0.0001	0.0001	0.0063	1.0000	1.0000	0.0083	0.0085	1.0000
SA	0.0001	0.0001	0.0001	0.0001	0.0001	0.9775	1.0000	0.0002	0.0001	0.9706
O	0.0001	0.0001	0.0001	0.0001	0.0004	0.2479	0.9761	0.2287	0.0049	0.6115
NA	0.0001	0.0001	0.0001	0.0001	0.4314	0.4428	0.0997	0.0008	0.0001	0.8432

To address the issue of multiple testing, the P values from the initial test were adjusted using the Bonferroni Correction method to reduce the chances of a false-positive result. This method divides the critical P value of 0.05 by the number of comparisons being made, which was 15 in this case (Napierala 2012). The adjusted P values were then compared to a critical value of 0.003, and cells with values lower than this critical value were highlighted in red. The results showed that the individual being rated had a different perspective compared to the other raters, while the Boss, Peers, and Other Boss raters had a similar perspective. The People You Lead rater, however, had a different perspective. Based on these results, it was decided to merge the Boss, Other Boss, and Peers datasets into one by taking the average of each question for the three, effectively removing most of the missing data. To check the reliability of this new dataset, Cronbach's Alpha reliability test was utilized. Cronbach's Alpha is a statistical measure widely used to evaluate the internal consistency or reliability of a test or questionnaire by assessing the extent to which all items are measuring the same underlying construct or dimension (Cronbach 1951). The resulting alpha had a value greater than 0.90. With this reduction, the three datasets now represented the self-assessment of the individual, the assessments of the people they work with, and the assessments of the people who work for them.

2. Scaling by Factor

To simplify the assessment data and improve performance in classification and regression models, a reduction in the number of predictors, while preserving the information about the response, was necessary (Weng and Young 2017). Initially, Principal Component Analysis (PCA) and Exploratory Factor Analysis (EFA) with an orthogonal rotation were attempted but did not produce desirable results. The extent to which all questions were loaded onto the first component in the Peers-Boss data, indicating that there were no underlying constructs, and every question was assessing the same thing is shown in Figure 3. The same was observed for all other datasets. Additionally, several questions had significant double loadings on other components and did not meet the simple structure goal of factor analysis (Brown 2009).

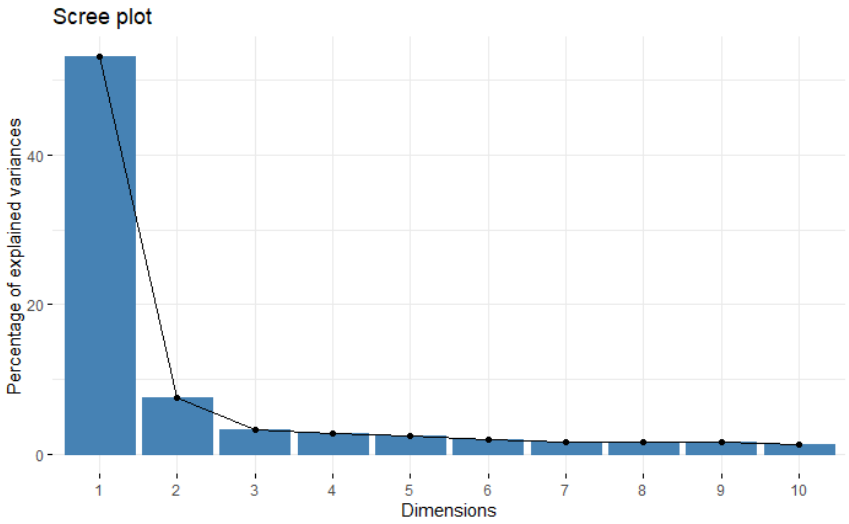

Figure 3. Scree Plot of Peers-Boss Data

High correlation in the data may affect the performance of both PCA and EFA by decreasing the number of components, as seen above, or making the components unstable, where minor changes in the data may significantly alter the components. Thus, further exploration of correlations in each of the three datasets was conducted individually. The correlation matrices are presented in Appendix B: the tables are color-coded to represent correlation strength where green cells indicate a strong correlation greater than 0.7, blue cells indicate a moderate correlation between 0.5 and 0.7, and yellow cells indicate a weak correlation between 0.3 and 0.5.

a. Correlation Exploration

The Self correlation matrix for the Self data in Appendix B, Table 22 was explored first. We initially saw that no two questions were strongly correlated with each other and that there were few that were moderately correlated. Furthermore, only two percent of correlations were considered to be moderate and 28 percent to be weak. Due to the lack of correlation in the Self data, the PCA results of a single large component with most variables loading onto it indicated that there is only one underlying structure in the data and that all questions are measuring the same attribute. However, when the data was rotated orthogonally and an EFA performed, the outcome was 20 distinct factors with minimal

double loadings signifying that the PCA was not able to capture these constructs and may not have been suited for the data.

The Peers-Boss data had more correlations than the Self data, as shown in Appendix B, Table 23, with six percent being strongly correlated, 52 percent moderately, and 33 percent weakly. The skills that stood out to be moderately to strongly correlated with most other skills were TC, BS, MO, PT, and O. Interestingly, the question under the Manage Execution skill, "Delegates enough of own work to others" (Korn Ferry 2019) was correlated with very few other questions. With almost all the questions correlated with each other the single component in the PCA may not be interpreted reliably and the factor analysis had significant double loadings on factors indicating that the model did not fit the data well (Costello and Osborne 2005).

Finally, the People You Lead correlation matrix in Appendix B, Table 24 was evaluated. Of the three datasets, there was the most correlation between questions present with 13 percent being strongly correlated, 71 percent moderately, and 14 percent weakly. Again, the same question from Manage Execution was observed to not be correlated with any other question. As with the Peers-Boss dataset, almost all questions were correlated to each other and both analyses did not fit the data well for the same reasons.

Lastly, the correlation between how each rater assessed an individual was explored. Little correlation between raters for the same questions was observed indicating that there may not be a significant relationship between their responses. However, this may also be a function of the 360-degree feedback model where it is intended to receive responses from the different perspectives of people an individual works with. For example, the question "Treats people fairly" (Korn Ferry 2019) from the Establish Trust skill had one of the lowest variances across all raters; however as shown in Table 8, there was little to no correlation between the raters responding to that question. This finding is counter to our method of combing the Peers, Boss, and Other Boss dataset; however, the pairwise comparison confirmed that those three raters were statistically similar.

Table 8. Correlation matrix for the question "Treats people fairly"

	ET_4_Boss	ET_4_OB	ET_4_Peers	ET_4_PYL	ET_4_Self
ET_4_Boss	1.00				
ET_4_OB	0.06	1.00			
ET_4_Peers	0.11	0.07	1.00		
ET_4_PYL	0.09	0.12	0.02	1.00	
ET_4_Self	0.05	-0.07	0.06	0.10	1.00

b. Scaling by Korn Ferry Skill

To effectively scale the data, the pre-defined skills from the KF assessment were used as the factors, reducing the number of predictors from 68 to 15. The internal consistency of each factor was verified using Cronbach's Alpha. Any questions that negatively impacted the internal consistency were noted and removed from the dataset before scaling. This process was conducted separately on both the Peers-Boss and the People You Lead datasets, and the removed questions are listed in Table 9. This ensured that no information was lost and maintained the reliability of the factors.

Table 9. Questions Removed Prior to Scaling

Act Strategically	Identifies efforts that will have the greatest strategic impact
	Stays informed about industry practices and new developments
	Understands the organization's mission, strategies, strengths, and weaknesses
Build Realistic Plans	Prepares realistic estimates of resources needed to accomplish task
Manage Execution	Delegates enough of own work to others
Show Drive and Initiative	Readily puts in extra time and effort
Build Support	Gives compelling reasons for ideas
Develop Others	Attracts and selects high caliber talent
	Willingly shares expertise and experience with others
Promote Teamwork	Contributes fair share of effort to the team's work
Establish Relationships	Develops relationships with key people in other functions and at other levels
Establish Trust	Treats people fairly

With the questions removed, the average was taken for each skill creating a single score to measure that attribute. Cronbach's reliability was calculated once more for each set, all with a score greater than 0.90.

3. Categorization

Based on discussions with SWOSCOM, it was noted that SWOs taking the assessment are usually divided into three categories: 25 percent above average, 50 percent average, and the remaining 25 percent below average. To reflect this, we divided each dataset into above, below, and average categories using the mean and standard deviation of each dataset separately. The overall average of the individual, as rated by all raters, was not used in this process due to the findings from the ANOVA that indicated the raters judged the individual differently. Instead, the mean of each dataset in question was used to determine which skills were more important to each group of raters. The following equations were used to create the groupings, with $\bar{x}_i$ representing the average of the individual, μ representing the average of all individuals, and $\sigma_{average}$ representing the standard deviation of the average of all individuals, ensuring a 25/50/25 percent split.

$$\text{Above: } \bar{x}_i - \mu > (0.75)\left(\sigma_{average}\right)$$

$$\text{Average: } |\bar{x}_i - \mu| \leq (0.75)\left(\sigma_{average}\right)$$

$$\text{Below: } \mu - \bar{x}_i > (0.75)\left(\sigma_{average}\right)$$

The categorization of each dataset was plotted in principal component space to visualize the grouping of the individuals. Each picture shows all 100 individuals, plotted by the first two principal components in the 15-dimensional space, and colored by their categorization. The results of these plots, with three distinct groupings being observed, are shown in Figure 4. Based on this observation, we continued with the clustering and random forest analysis to determine the effectiveness of each skill.

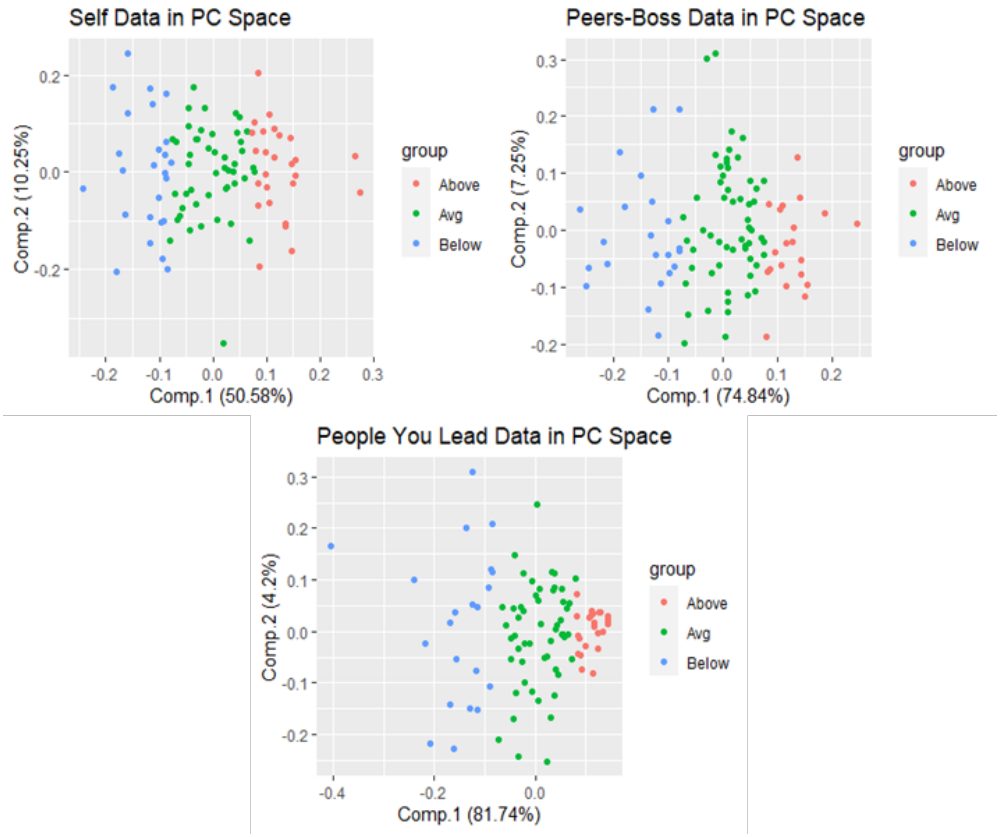

Figure 4. Self, Peers-Boss, and People You Lead in PC Space

IV. ANALYSIS AND RESULTS

This chapter describes the analyses conducted on three data sets. Initially, a K-Means clustering method was employed to investigate the similarities among the individuals grouped together. Next, a classification random forest model was developed to predict the cluster the officers belonged to. Lastly, a regression random forest model was applied to estimate an individual's overall rating. Both random forests were utilized to gain insights into the significance of each skill and whether they provide valuable information to the 360-degree assessment.

A. CLUSTERING OF INDIVIDUALS

1. K-Means Clustering

To begin our analysis, we first applied *K*-means clustering to determine which skills were the most influential in placing an individual in each cluster. *K*-means clustering is a commonly used unsupervised machine learning technique for partitioning a set of *n* observations into *k* clusters, where *k* is a pre-specified number, for this this analysis, three. The algorithm works by iteratively assigning each observation to the nearest centroid of a cluster and then updating the centroid to be the mean of all the points in the cluster. This process continues until the centroids no longer change or a maximum number of iterations is reached (Reddy and Vinazamuri 2014).

The purpose of using this algorithm was to first understand how the data was being grouped and determine similarities within clusters, and second to be used in our classification model created with random forests. Although we already had the desired number of clusters, the optimal *k* value from both the silhouette and within-cluster sum of squares methods were considered. However, both methods suggested the optimal number of clusters to be two. This would have grouped the data into above and below clusters and did not meet the goal of the analysis.

The outcomes of the K-Means algorithm are shown in Figure 5. These pictures show that individuals categorized as above-average, average, and below-average really do

tend to cluster. To check the validity of the clusters, we computed the rate of class-cluster agreement. The results of this check are tabulated in Table 10.

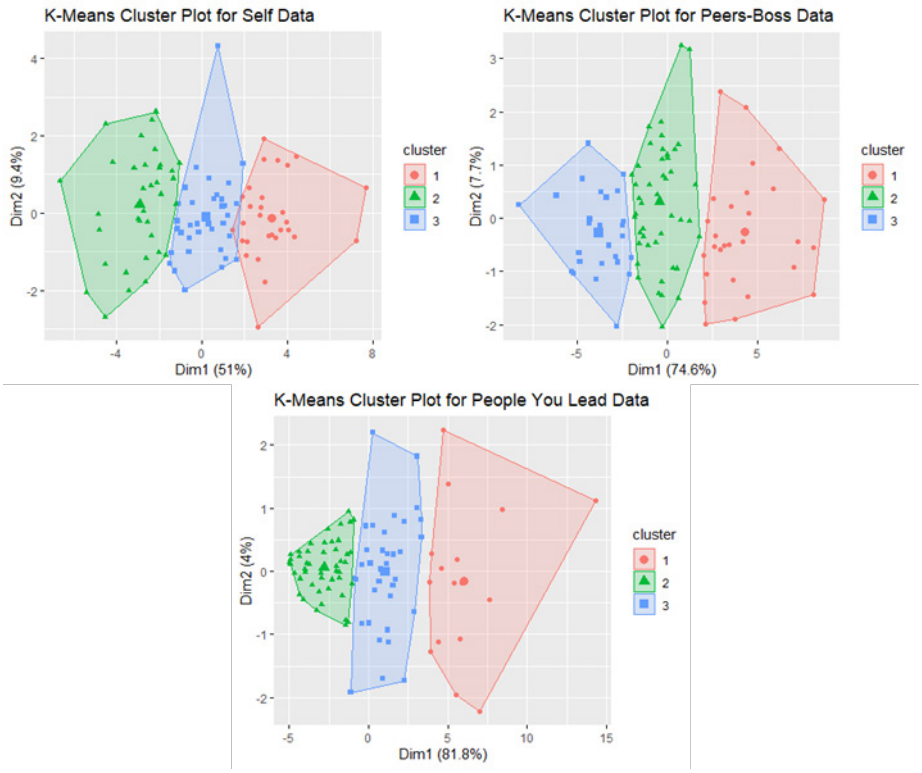

Figure 5. K-Means Cluster on Self, Peers-Boss, and People You Lead Data Sets.

Table 10. Validation of K-Means Clustering.

Data Set	Accuracy
Self	87%
Peers-Boss	88%
People You Lead	71%

Accuracies for the three datasets were considered acceptable to classify the three clusters into above, below, and average groups. People You Lead had the lowest accuracy of the three due to the algorithm having trouble distinguishing between above and average individuals in our categorization.

2. Clustering Results

Next, the distances between the skills within the above-average cluster and the below-average cluster were calculated to determine the skills that were effective and ineffective in distinguishing between this above-average and below-average cluster. Greater distances between centers may be interpreted as effective and smaller distances as less. The results of this comparison are presented in Table 11.

Table 11. Distances Between Above and Below Average Clusters.

Data Set	MSD	AS	TC	BRP	ME	SDI	BS	MO	DO	PT	FOC	ER	ET	SA	O
Self	0.84	1.13	0.81	0.82	1.03	1.15	0.81	1.05	0.99	0.83	0.69	0.64	0.77	0.90	0.90
Peers-Boss	0.87	0.94	0.83	0.80	0.84	0.91	0.95	0.79	0.81	0.82	0.72	0.61	0.75	0.80	0.93
People You Lead	1.25	1.29	1.10	1.18	1.19	1.02	1.32	1.08	1.25	1.11	1.00	0.89	0.96	1.14	0.98

The color scale in the table indicates the effectiveness of each skill in distinguishing between clusters. The greatest distances are shown in green and the smallest distances in red. FOC, ER, and ET had the smallest distances in all three datasets, indicating that while they are important for an officer to excel in, they offer limited feedback on an individual's development. Additionally, these skills had some of the highest means and lowest variability, which shows that raters consistently assess individuals high in these areas. On the other hand, the skills AS, SDI, and MSD all had greater distances, indicating that they may offer more valuable feedback on an individual's performance.

B. RANDOM FOREST TO INFER EFFECTIVENESS OF SKILLS

After performing the clustering, we employed random forests for both classification and regression analysis. The objective was to predict membership in the above-average cluster and an individual's overall rating, as well as the difference between raters. Random forest is a supervised machine learning technique that combines multiple decision trees by averaging their predictions, thereby reducing variance and increasing prediction accuracy. It is suitable for both classification and regression and retains measures of variable

importance (Biau and Scornet 2016). By utilizing the variable importance from each model, we aimed to identify which skills were of lesser importance in the assessment and which were more critical. Furthermore, skills of higher importance could be used to infer what the different raters believed was more important when assessing an officer. An important distinction is that variable importance in the model need not equate to actual skill importance in the assessment. This analysis is not meant to immediately discard skills of little importance, but to gain insight on whether a skill adds to the assessment or not. Furthermore, if the results of the PCA are true and each skill is in fact assessing the same area, the results of the random forest will be biased to the skills that loaded together on a single component.

Before building the forests, each data set was divided into training and test sets. The process involved randomly selecting 70 percent of the original data to train the forest, with the remaining 30 percent to evaluate the forest. A random seed was set for each model prior to separating to ensure there were at least ten observations of each class in both sets. All random forests were generated utilizing the random Forest package in R (Liaw and Wiener 2022).

1. Classification Random Forest

The first use of random forest was to build a classification model to predict whether an individual belonged to the above-average cluster or not. The fit of the model was evaluated using the area under curve (AUC). The AUC is a measure of the area underneath the receiver operating characteristic (ROC) curve, specifically the relationship between the false positive rate, one minus the specificity, and the true positive rate, or sensitivity. An AUC of 1 indicates a perfect classifier, while an AUC of 0.5 indicates a model that does not have any predictive power (Narkhede 2018). The misclassification rate and balanced accuracy were also used to evaluate the fit of the model. Misclassification rate was measured by subtracting the model accuracy from one, and the balanced accuracy by taking the average of the specificity and sensitivity, resulting in the average accuracy obtained on either class (Brodersen et al. 2010).

The variable importance was measured using the mean decrease in Gini for these models. The Gini impurity is a measure of the probability that a random sample of a data set will be misclassified, and the decrease in Gini impurity refers to the reduction of this probability that results from a feature being used in a decision tree. By averaging the decrease in Gini impurity across all decision trees in a random forest, the mean decrease in Gini provides a measure of the importance of a feature in the classification or regression task (Yuan et al. 2021).

The random forests for the three data sets were all built in the same manner. The clustering of each individual was transformed into a one-hot encoding format, with the highest performing officer cluster labeled as "Above" and the others labeled as "Not." The "Above" label served as the target variable, while the skills were used as predictors. The model was constructed using 75 trees to help prevent overfitting, and the number of variables sampled at each split was determined by rounding down the square root of the number of predictors, three, to minimize the out-of-bag error (OOB).

Each forest generated fitted the training sets with accuracy greater than 90 percent with the AUC for each being 0.93 or higher. Therefore, overfitting was of concern. However, the accuracy on the test sets, while consistently lower than that of the respective training sets, ranged between 80 and 90 percent. This suggests that overfitting may not be an issue. Moreover, given that the clustering heavily relied on the individual's performance, high model performance was expected.

The analysis began with an evaluation of the Self data set. The model had a balanced accuracy of 86 percent, as displayed in Table 12, and AUC of 0.9522, depicted in Figure 6.

Table 12. Confusion matrix of predicted versus test data for Self data.

Self		Actual	
		Above	Not
Predicted	Above	9	2
	Not	2	17

Sensitivity	0.8182
Specificity	0.8947
Misclass Rate	0.1333
Balanced Accuracy	0.8565

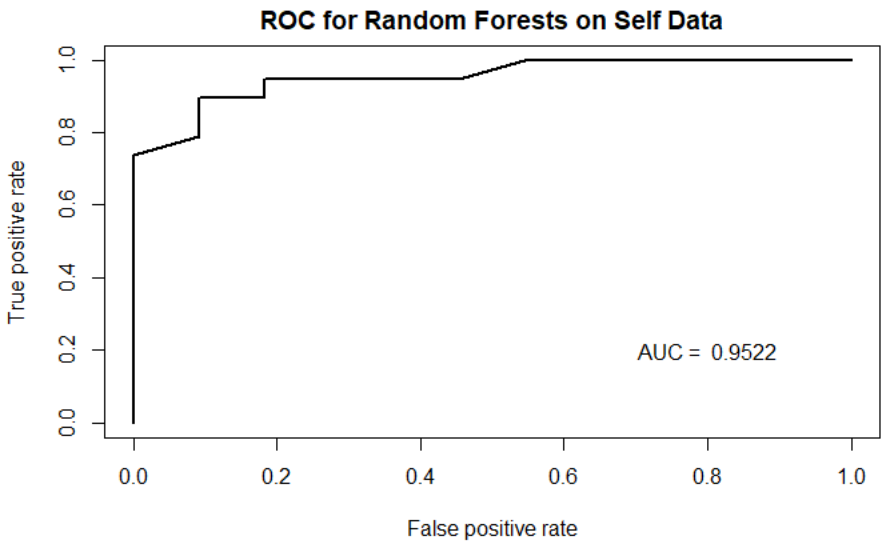

Figure 6. ROC curve for Self data.

Evaluating the mean decrease in Gini, we found that FOC, MSD, and ME were the most influential in predicting whether and individual was in the "Above" cluster, while ER, DO, and ET were the least influential. The variable importance for each skill is shown in Figure 7. The large drop between FOC and MSD was further explored by recreating the model without FOC. When performed there was no significant change in AUC or balanced accuracy, indicating that the variable importance may be affected by the high correlation between skills in the data.

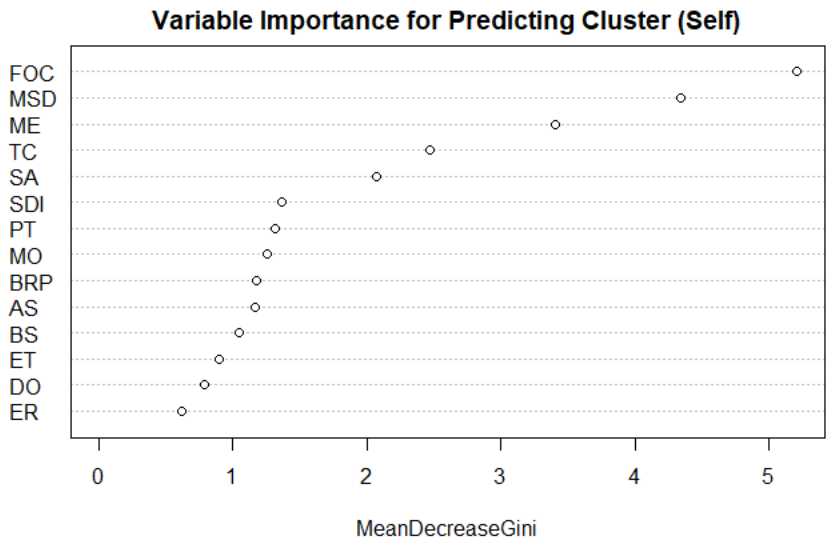

Figure 7. Variable importance for predicting "Above" cluster on Self data.

Next, the Peers-Boss data set was evaluated. The model had a balanced accuracy of 85 percent, as shown in Table 13, and AUC of 1, as depicted in Figure 8.

Table 13. Confusion matrix of predicted versus test data for Peers-Boss data.

Peers-Boss		Actual	
		Above	Not
Predicted	Above	7	0
	Not	3	20

Sensitivity	0.7000
Specificity	1.0000
Misclass Rate	0.1000
Balanced Accuracy	0.8500

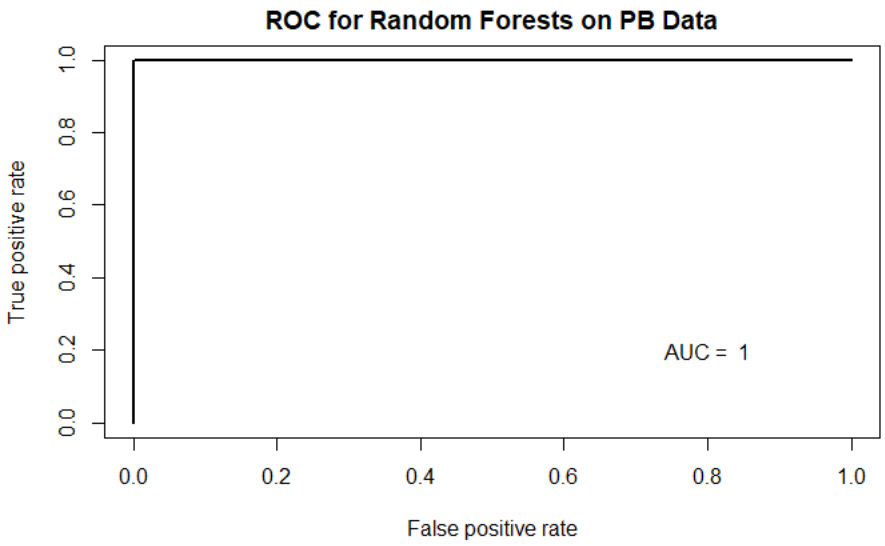

Figure 8. ROC curve for Peers-Boss data.

FOC was the most important variable by a large margin followed by ER and MSD. The skills with little importance were DO, BRP, and SA. The variable importance for each skill is shown in Figure 9. To further investigate the large drop in importance, FOC was removed from the forest to compare results. No significant difference was observed when it was removed, and it was not until the top seven variables were removed that there was a change in AUC and balanced accuracy. Because of this, the forest was noted to be affected by the high levels of correlation in the data.

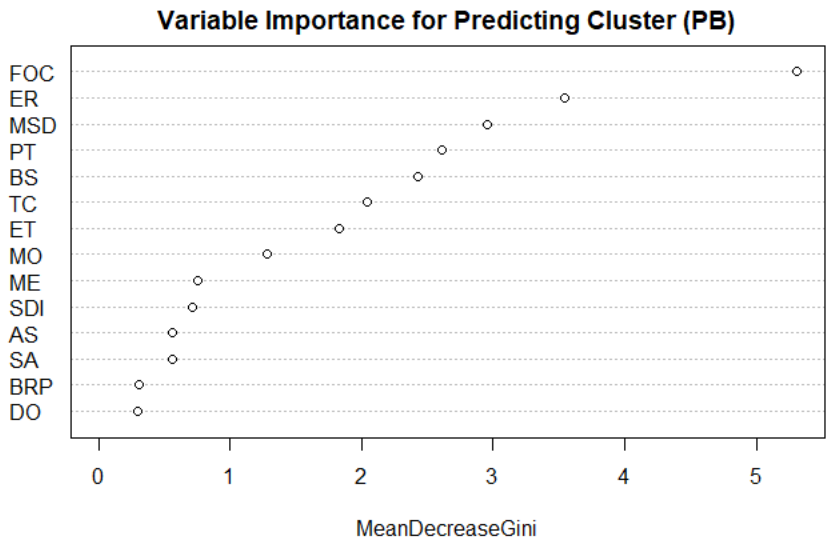

Figure 9. Variable importance for predicting "Above" cluster on Peers-Boss data.

Finally, the People You Lead data set was evaluated. The model had a balanced accuracy of 88 percent, as shown in Table 14, and AUC of 0.9774, as depicted in Figure 10.

Table 14. Confusion Matrix of predicted versus test data for People You Lead data.

People You Lead		Actual	
		Above	Not
Predicted	Above	8	1
	Not	2	19

Sensitivity	0.8000
Specificity	0.9500
Misclass Rate	0.1000
Balanced Accuracy	0.8750

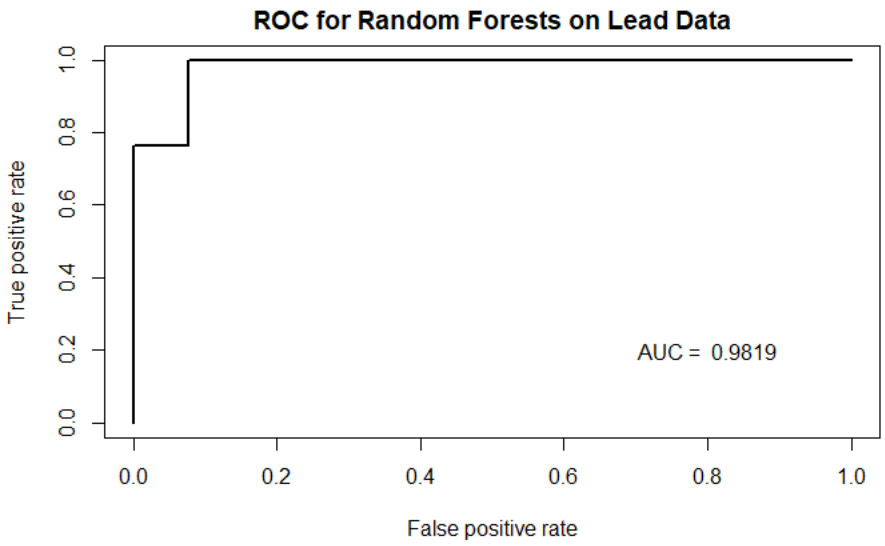

Figure 10. ROC curve for People You Lead data.

Assessing the mean decrease in Gini, MSD, BS, and ME were the most important when predicting "Above" cluster placement. SDI, ET, and MO were the least important. Unlike the other models, when the most important variable was removed from the model an immediate effect occurred. The balanced accuracy dropped from 96 percent to 85 percent, suggesting that multiple correlations were not as present as they were in the other data sets. The variable importance for each skill is shown in Figure 11.

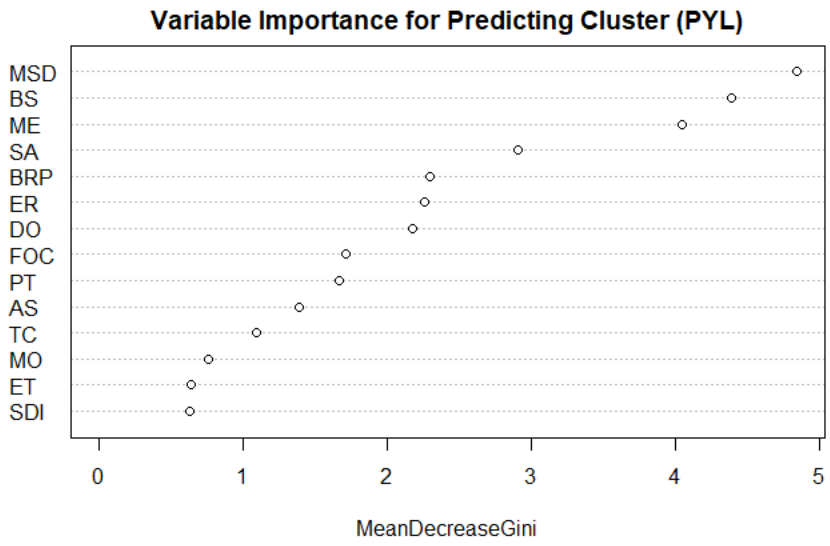

Figure 11. Variable importance for predicting "Above" cluster on People You Lead data.

The three models were further analyzed by comparing their mean decrease in Gini. The main objective of this analysis was to identify the skills that had the least impact on the models and therefore, potentially have minor impact toward the overall assessment. To accomplish this, the variable importance was standardized to a range of zero to one by using the highest and lowest values of the variable importance, and then averaged. The results of this comparison are shown in Table 15.

Table 15. Self, Peers-Boss, and People You Lead mean decrease in Gini (standardized).

Cluster Classification	MSD	AS	TC	BRP	ME	SDI	BS	MO	DO	PT	FOC	ER	ET	SA
Self	0.81	0.12	0.40	0.12	0.61	0.16	0.09	0.14	0.04	0.15	1.00	0.00	0.06	0.32
PB	0.53	0.05	0.35	0.00	0.09	0.09	0.43	0.20	0.00	0.46	1.00	0.65	0.30	0.05
PYL	1.00	0.18	0.11	0.39	0.81	0.00	0.89	0.03	0.37	0.25	0.26	0.39	0.00	0.54
Average	0.78	0.12	0.29	0.17	0.50	0.08	0.47	0.12	0.13	0.29	0.75	0.34	0.12	0.30

The skills that had the highest averages were FOC, MSD, and ME, suggesting that these skills have some significance to the 360-degree assessment. Conversely, the skills with the lowest importance were SDI, AS, and MO.

To assess the variation in raters' perspectives, the importance score for each skill was averaged within their corresponding key leadership areas, and then compared. The results of this comparison are presented in Table 16.

Table 16. Leadership area assessment from classification random forests.

Classification	Self	PB	PYL	Average
Thought	0.44	0.31	0.43	0.40
Results	0.30	0.06	0.40	0.25
People	0.24	0.46	0.36	0.35
Personal	0.19	0.18	0.27	0.21

Both Self and People You Lead rated thought leadership as the most important skill for predicting high performing officers, whereas Peers-Boss rated people leadership as the most important. Similarly, both Self and People You Lead viewed personal leadership as the least important area, while Peers-Boss considered results leadership to be the least important. When the ratings of all raters were averaged, thought leadership emerged as the most important skill, while personal leadership was rated as the least important.

2. Regression Random Forest

The second use of random forest was to build a regression model to predict the overall rating for each individual for each dataset. The fit of the models was evaluated using the R-squared (R^2) and the root mean square error (RMSE). R^2 is a statistical measure that represents the proportion of variance in the response variable that can be explained by the predictors (James et al. 2013). The RMSE is the square root of the mean square error (MSE), a measure of accuracy that accounts for the squared difference between the actual observation and the predicted. (James et al. 2013). As stated with classification random forest, this analysis is not meant to make immediate decisions on the current assessment.

The variable importance was evaluated using the percent increase in MSE for these models. The percent increase in mean squared error is a way to measure how important a specific predictor variable is in a random forest regression model. It does this by comparing

the change in MSE when a variable is randomly shuffled with the original MSE. A larger increase in MSE means that the variable is more important in predicting the outcome variable.

The random forest models for the three datasets were built using a similar approach. The hybrid skill O rating was used as the response variable, while the skills were used as predictors. A key assumption of the overall regression was that the measurement Overall was intended by Korn Ferry to be a comprehensive measurement of an individual's performance. This was also supported by comparing the average of all skills to the overall rating. In all three datasets the average of the skills was within +/-0.5 of the overall rating for greater than 70 percent of the data. To minimize overfitting and maximize the percentage of variance explained, 75 trees were used, and four variables were randomly sampled at each split. The same training and test sets from the classification random forests were used to create the regression random forests.

The fit of each model is displayed in Table 17. The Peers-Boss regression model performed the best on the test set out of the three with an R^2 of 0.91 and a RMSE of 0.18. This was expected as the initial EDA showed that the variability of responses for these raters was lower than that of the others. The lesser performance of both the Self and People You Lead tests can be attributed to a higher variance in responses, as well as the presence of more outliers than in the Peers-Boss dataset.

Table 17. Random Forest Regression Model Fit.

Random Forest Regression	Self	PB	PYL
R^2	0.6552	0.9081	0.6291
RMSE	0.41	0.1826	0.2813

The Self dataset was evaluated first. Figure 12 illustrates the comparison between the predicted overall rating and the actual overall rating in the test set.

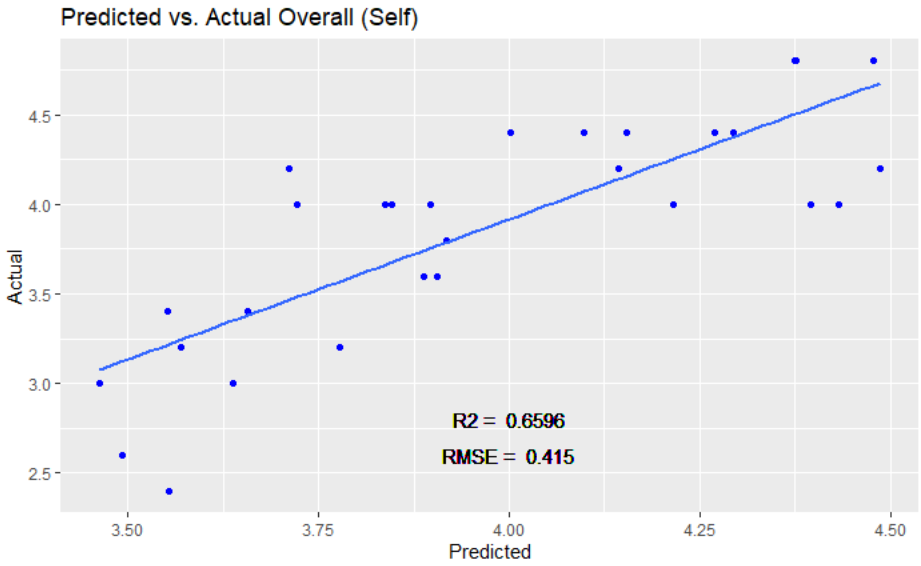

Figure 12. Predicted versus Actual overall rating for Self test set.

The variable with the highest importance in assessing the percent increase in MSE was SDI, followed by FOC, MSD, and SA after a significant drop. In contrast to the classification forests, the regression forest demonstrated that the removal of SDI from the model had a notable impact on R^2 and RMSE, indicating that multiple correlations were not as influential in this type of forest. The variables with the least importance were BS, ME, and DO. Furthermore, BS and ME had a negative importance suggesting that if removed, the model would perform better. When removed, the model performed marginally better. Figure 13 displays the importance of each variable in the forest.

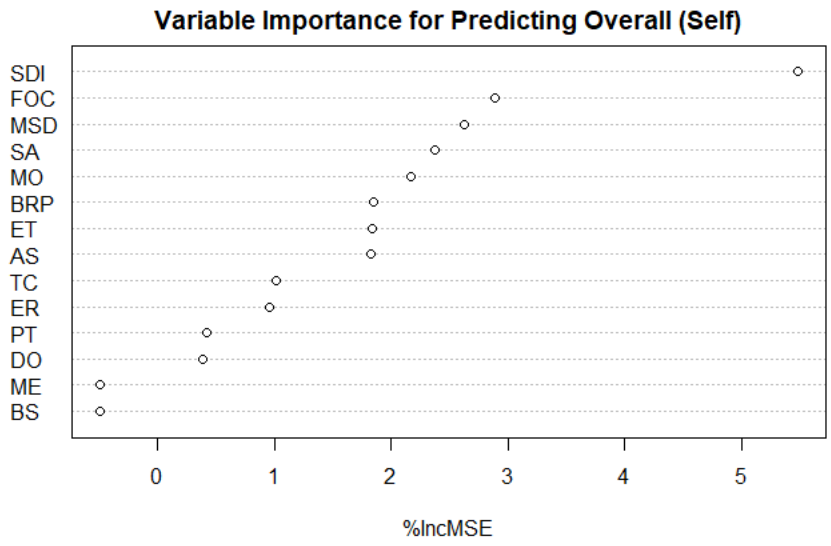

Figure 13. Variable importance for predicting Overall rating for Self data.

The overall rating for the Peers-Boss data was evaluated next. This model had the highest R^2 and lowest RMSE of the three forests created. The predicted overall rating against the actual overall rating in the test set is shown in Figure 14.

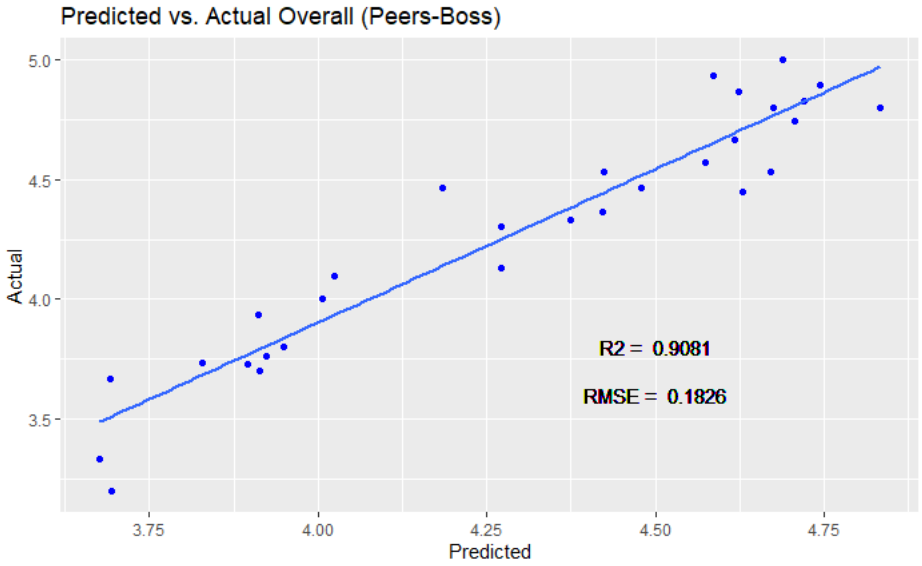

Figure 14. Predicted versus Actual overall rating for Peers-Boss test set.

SDI had the highest importance in the model, however, when removed, the R^2 and RMSE were not noticeably affected indicating heavy correlation between the variables. Only after removing the top four variables did a significant change in R^2 and RMSE occur. FOC and PT were the least important in this model. Variable importance is depicted in Figure 15.

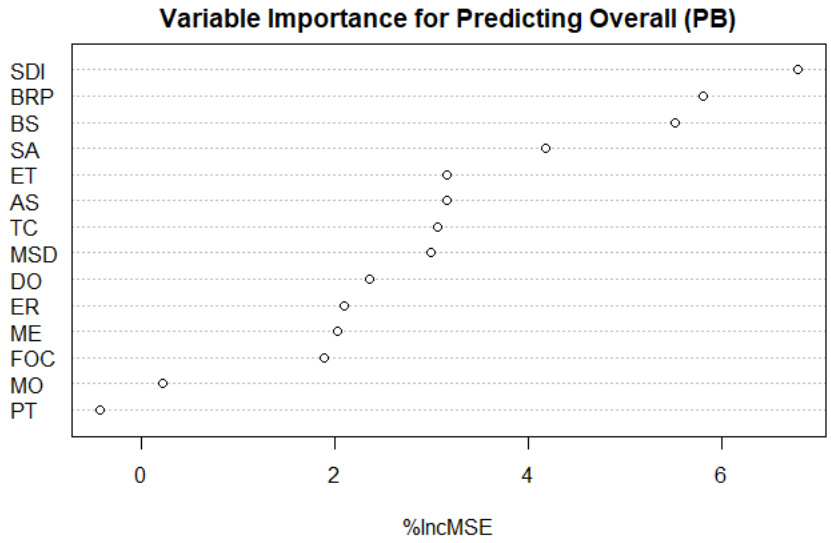

Figure 15. Variable importance for predicting Overall rating for Peers-Boss data.

Finally, the overall rating was assessed in the People You Lead data. The fit of the model was similar to the Self data in R^2 but had a lower RMSE. The predicted rating versus the actual is depicted in Figure 16.

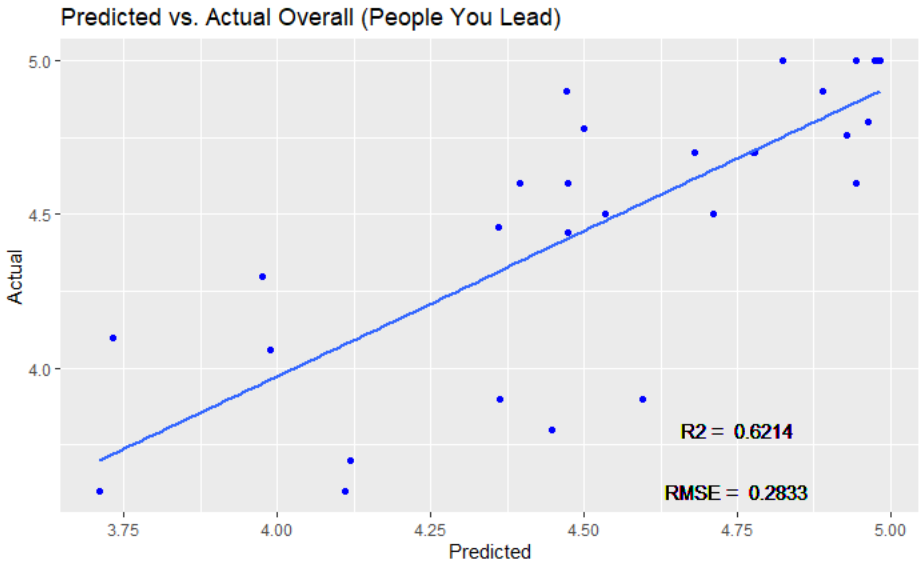

Figure 16. Predicted versus Actual overall rating for People You Lead test set.

The skills with the highest importance in the model were ET, ME, and DO, while FOC, PT, and ER were deemed less significant. Furthermore, FOC and PT demonstrated a decrease in MSE, suggesting that removing them from the model could result in improved performance. After excluding FOC and PT, the model's R^2 increased and the RMSE decreased slightly. The variable importance for each skill, noticeably, the drop in importance between the first and second variables was not as drastic as in other models. Figure 17 displays the importance of each variable in the forest.

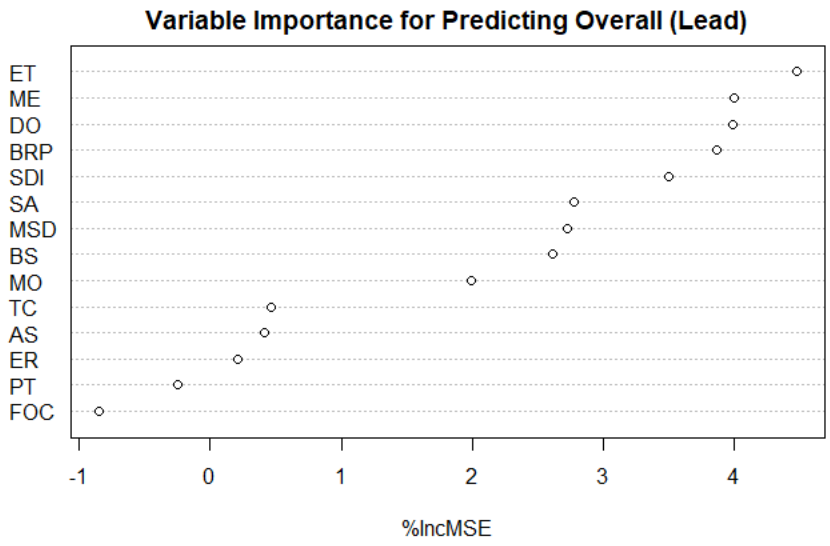

Figure 17. Variable importance for predicting Overall rating for People You Lead data.

For the same purpose as the classification forests, the percent increase in MSE when each variable was dropped was standardized and compared for each data set. The results contained in Table 18 revealed that SDI and BRP were the most important skills overall for the regression model, in contrast to their lower ranking in the classification model. Conversely, PT, ER, and FOC had the least overall importance for the regressions, with FOC's placement differing from its ranking as one of the most important skills in the classification model.

Table 18. Self, Peers-Boss, and People You Lead percent increase in MSE (standardized).

Overall Regression	MSD	AS	TC	BRP	ME	SDI	BS	MO	DO	PT	FOC	ER	ET	SA
Self	0.52	0.39	0.25	0.39	0.00	1.00	0.00	0.44	0.15	0.15	0.57	0.24	0.39	0.48
PB	0.47	0.50	0.48	0.86	0.34	1.00	0.82	0.09	0.39	0.00	0.32	0.35	0.50	0.64
PYL	0.67	0.24	0.25	0.89	0.91	0.82	0.65	0.53	0.91	0.11	0.00	0.20	1.00	0.68
Average	0.56	0.37	0.33	0.71	0.42	0.94	0.49	0.36	0.48	0.09	0.30	0.26	0.63	0.60

The leadership areas evaluated by raters were then analyzed using the regression model the same way as the classification model, and the results are presented in Table 19. The findings revealed that unanimously all raters viewed results leadership as the most important leadership area when assessing overall performance. The area of least importance was people leadership for both Self and Peers-Boss and Thought for People You Lead. However, it is worth noting that people leadership was ranked only slightly above thought for People You Lead.

Table 19. Leadership area assessment from regression random forests

Regression	Self	PB	PYL	Average
Thought	0.39	0.48	0.39	0.42
Results	0.46	0.73	0.87	0.69
People	0.26	0.33	0.40	0.33
Personal	0.44	0.57	0.84	0.61

C. MODEL COMPARISON

With both random forest models created for the three data sets, we performed a comparison of the two to gain insights in the different perspective of raters' perspectives and an encompassing measurement of variable importance.

1. Raters' Perspective

The results of the leadership assessment comparison are shown in Table 20. The analysis shows that Self viewed thought leadership as the most important aspect of leadership and people as the least important. On the other hand, Peers-Boss considered both thought and results leadership to be the most crucial and personal leadership to be the least important. Finally, People You lead placed the highest value on results leadership and viewed people leadership as the least important. As with the models, these results are affected by the correlations in the initial data and the lack of variance in the skills that fell under the people leadership area. The fact that people leadership is one of the least important areas should not be interpreted to mean that raters do not place value on those

that they work with, but that the questions in that area may not be contributing useful information toward leadership development. As previously stated, if an individual assesses themselves highly in this area, and all other raters assess that individual highly in that area as well, there is no constructive feedback to be provided.

Table 20. Leadership assessment from both random forest analyses averaged together.

Combined	Self	PB	PYL	Average
Thought	0.42	0.40	0.41	0.41
Results	0.38	0.40	0.64	0.47
People	0.25	0.39	0.38	0.34
Personal	0.31	0.37	0.56	0.41

2. Variable Importance

Along with the raters' perspectives, the importance of each skill was looked at using both models. The relative importance of skill from both models is presented in Figure 18. Skills at the top of each column, shaded in green, were of the most importance and least at the bottom, shaded in red. MSD, FOC, and SDI were the most important skills, while PT, MO, and AS were the least. These skills, except for MO, also had several questions with little variance between raters and were previously identified by SWOSCOM for modification or removal.

Cluster Classification	Both Averaged	Overall Regression
Make Sound Decisions	Make Sound Decisions	Show Drive and Initiative
Foster Open Communication	Foster Open Communication	Build Realistic Plans
Manage Execution	Show Drive and Initiative	Establish Trust
Build Support	Build Support	Show Adaptability
Establish Relationships	Manage Execution	Make Sound Decisions
Show Adaptability	Show Adaptability	Build Support
Think Creatively	Build Realistic Plans	Develop Others
Promote Teamwork	Establish Trust	Manage Execution
Build Realistic Plans	Think Creatively	Act Strategically
Develop Others	Develop Others	Motivate Others

Cluster Classification	Both Averaged	Overall Regression
Establish Trust	Establish Relationships	Think Creatively
Motivate Others	Act Strategically	Foster Open Communication
Act Strategically	Motivate Others	Establish Relationships
Show Drive and Initiative	Promote Teamwork	Promote Teamwork

Figure 18. Skill importance derived from random forest analysis.

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V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A. SUMMARY

The overarching objective of this thesis was to assist SWOSCOM in reassessing the current 360-degree feedback assessment used for leadership development. This research was not meant to discredit any skill or questions, but to identify portions of the assessment that are effective toward development or that would benefit from modification or truncation. Specifically, it has been ten years since this 360-degree assessment was last evaluated and its aim is to facilitate an environment of continuous learning and professional development required reassessment and changes, as necessary.

Using 100 randomly selected Korn Ferry feedback reports, an initial EDA of the rater responses, and the importance of the skills, in relation to an individual's job was performed. The purpose of the analysis was to gain insights into how each rater assessed an individual as well as create an initial metric of skill importance from the view of senior officers in the fleet. The analysis on rater's responses revealed that the Boss, Other Boss, and Peers raters all rated individuals statistically similarly, and the three datasets were combined into one for further analysis. The initial importance analysis found that the skills MSD, ME, and ET were the three most important, while AS, TC, and BS were the least. It should be noted that this assessment was rated on a scale between one and three, and skills that averaged above two should also be considered important to some extent.

After conducting the EDA, both PCA and EFA were carried out on the data to attempt to determine factor structure and further scale the data. However, neither analysis fit the data well and both were inconclusive. The PCA and EFA resulted in a single component explaining most of the variance and a single factor offering little to interpret. The analysis may benefit from using a different rotation method; however, an alternative method was utilized for this research. The data was thus scaled using the predefined skills in the assessment for further analysis.

With the three datasets scaled, both unsupervised and supervised machine learning methods were applied in the form of *K*-Means clustering and random forest. Both methods

were used to assess the effectiveness of the skills and questions within the current assessment. The cluster sought to group individuals together based on performance and identify similarities within the clusters. The random forests were used for both classification of the identified clusters and regression to predict the hybrid skill Overall, which was assumed to be the overall comprehensive assessment in the assessment. Both models aimed to further evaluate the effectiveness of the skills.

B. CONCLUSIONS AND RECOMMENDATIONS

(1) How do the different raters using the assessment to assess an individual differ in perspective and what does each consider more important than the others?

a. Conclusion

The initial EDA found that the individual, on average, rated themselves lower than any other rater in all skills of the assessment with the largest variance, while the People You Lead rated had the highest average rating per skill with the lowest variance. It is easy to conclude that an officer would be more critical of themselves on a leadership assessment; however, the high ratings of the people who work for them raises more questions. Specifically, do these raters truly believe that the officer they work for should be rated so highly, or is there a fear of retaliation if they rate an officer poorly? Another conclusion from the EDA was that the Boss, CO, Other Boss, XO, and Peers, fellow DIVOs, all rated the officer they were assessing statistically similarly; however, these raters had the smallest range of responses. Whether the ratings these raters responded with were an actual representation of the individual they were assessing would need to be further studied.

The clustering and random forests further identified differences in which leadership areas were favored in the models over others. Both the Self and Peers-Boss favored thought leadership, while the People You Lead favored results leadership. People leadership was unanimously one of the lowest rated areas; however, the skills within this area had the lowest variance and therefore offered little predictive power in the models, lowering their effectiveness. Due to this it should not be concluded that raters do not view this skill as important as this was not the purpose of the comparison.

b. Recommendation

Due to the degree of divergence noted in the data, we suggest that SWOSCOM should emphasize that this assessment is strictly for the enhancement of leadership skills and has no other purpose. It is inconclusive that the feedback provided accurately reflects the truth, and raters should feel at ease in their responses. To ensure that the assessment serves its intended purpose, it is preferable for an officer who believes they are performing well to receive an honest, low rating to encourage growth.

(1) What questions or skills contribute the most to the overall assessment and should be considered for retention?

a. Conclusion

In total three different analyses were performed to measure if a skill was effective within the current assessment. The first was a variance comparison in the difference between the Self and other raters for each question. The analysis found that ME, SDI, and MO all contained questions with high variance and were therefore effectively producing helpful feedback for an individual.

The second was the cluster analysis to determine groupings and measure the distances between these groupings. AS had the greatest distance between the above average cluster and the below average cluster indicating a good separator. Note that three of the four questions within AS were removed during the scaling process and the one that remained had high variance. SDI, BS, and MSD all had a large distance between clusters as well.

Lastly, random forests models were created to measure the variable importance of each skill. In the classification model, MSD, FOC, and ME were the variables of the most importance, inferring that these skills were the most influential in determining if an individual was placed in the above average cluster or not. The regression model had slightly different results with SDI and BRP having the most importance. Since the two random forests were predicting different responses, slightly different results are not surprising. When the two models were combined by averaging the scaled variable importance for each, the skills that had the most importance were MSD, FOC, and SDI.

b. Recommendation

The skills MSD, FOC, BRP, and SDI have demonstrated some level of effectiveness within the current assessment and should be considered for retention. However, not all the questions within those skills should be considered effective. Several questions were removed throughout the scaling process due to lowering the internal consistency of the skill and should be considered for modification or removal. Furthermore, while the random forests deemed MSD and FOC effective, the questions within those skills should be considered for change to produce better feedback from raters. This research showed that these skills are effectively used and the questions that Korn Ferry designed to fit within them may still hold some value if they are properly modified for the community.

(1) What questions or skills contribute relatively little to the overall assessment and should be considered for modification or removal?

a. Conclusion

While skills were being identified as effective, we also identified the ones that were not. The variance comparison showed that most questions within BRP, PT, and ER had low variance. Questions with low variance should not be considered as not important concepts, but then are not effective within the assessment. The purpose of the assessment is for leadership development: if an individual rates themselves highly as with the other raters there is no critical feedback. The first and third questions of DO had two of the highest variances, however, these questions do not fit within the Surface Community and the high variance may have been due to raters simply putting a response for the question that likely meant little and thus had little value.

From our machine learning methods, clustering identified FOC, ER, and ET as ineffective with smaller distance between clusters: however, as stated before, FOC is effective but may benefit from modified questions. The random forests deemed AS, ET and MO as not influential in the classification model, and PT, FOC. and ER in the regression model. Combined, PT, MO, and AS were the skills with the least importance in the models.

b. Recommendation

The skills ER, DO, ET, AS, and PT should be considered least effective within the instrument. This is not to say that the concepts of these skills are not important to assess officers, but that modification, truncation, or even removal of the questions in these skills may aid in providing critical feedback to facilitate leadership development. MO was also identified in the models to be ineffective; however, the questions within the skill generated large variances between the raters and therefore provided an individual with good feedback. Therefore, the assessment may benefit from keeping these ideas within it but combining the skill with another section. Additionally, the questions that were removed during the scaling process should be looked at and considered for revision or removal from the assessment. Maintaining these skills within the assessment and rewording the question so that it is tailored to the Surface Community may have beneficial results.

2. Other Findings

Part of the initial EDA was analyzing the importance of each skill as it pertained to the individual's position. The assessment was given by the Boss, or CO, rater and provided us with a glimpse of what senior officers in the fleet believe are important leadership qualities in their junior officers. MSD, ME, and ET were the highest rated skills. Conversely, AS, TC, and BS were the lowest rated. Additionally, the scale of this rating was between one and three, therefore, any skill that had an average rating above two should be considered important.

Based on our analysis, some of the skills identified as important by senior officers were deemed ineffective. Therefore, we recommend that if these skills are chosen to be modified or removed, the core concept behind them should still be retained. The skills that were rated with little importance should be considered removal or to be combined together to create a more comprehensive skill that still encapsulates the same notions that they had individually.

C. FURTHER RESEARCH

This analysis was performed only after the data from the assessments were scaled in order to determine skill effectiveness. Future research efforts might include a more in-depth look at the effectiveness of each question. A similar analysis could be performed toward this effort, however, ideally involving a larger sample size than the one used in this research.

One of the initial intentions for this research was to perform a factor analysis on the data to determine underlying structures and compare the resulting factors to those within the current assessment. However, the analysis proved to not fit the data well and was of no use toward this goal. There are multiple rotation methods that can be used when performing factor analysis. Future research could involve an extensive look into each rotation and determine which, if any, best fits the data. This would allow decision makers to identify constructs in the assessment that better define a given skill and potentially help reduce the number of questions.

Finally, the overarching goal of this project is to design an updated 360-degree feedback assessment that is tailored to the SWO community. This project is already in the working and is using Surface Warfare Officer Requirements Document (SWORD) as the guiding document. Findings from this research may be applied to aid in identifying skills that are not effective in the current assessment and in creating new questions that better suits SWOs.

APPENDIX A. KORN FERRY 360-DEGREE ASSESSMENT SKILLS AND QUESTIONS

Table 21. Korn Ferry 360-Degree Assessment Skills. Source: Korn Ferry (2019).

Skill	Questions
Make Sound Decisions	Applies accurate logic in solving problems
	Looks beyond symptoms to identify causes of problems
	Makes decisions in the face of uncertainty
	Makes timely decisions
	Takes all important issues into account when making decisions
	Focuses on important information without getting bogged down in unnecessary detail
Act Strategically	Balances big picture concerns with day-to-day activities
	Identifies efforts that will have the greatest strategic impact
	Stays informed about industry practices and new developments
	Understands the organization's mission, strategies, strengths, and weaknesses
Think Creatively	Approaches problems with curiosity and open-mindedness
	Creatively integrates different ideas and perspectives
	Stimulates creative thinking in others
	Generates innovative ideas and solutions to problems
Build Realistic Plans	Anticipates problems and develops contingency plans
	Develops realistic plans, action steps, and timetables for projects and assignments
	Identifies specific action steps and accountabilities
	Prepares realistic estimates of resources needed to accomplish task

Skill	Questions
Manage Execution	Continually looks for ways to improve processes, products, and/or services
	Conveys clear expectations for assignments
	Delegates enough of own work to others
	Monitors progress of others and redirects efforts when goals are not being met
	Plans and conducts meetings to make effective use of time
Show Drive and Initiative	Establishes aggressive goals and drives for results
	Readily puts in extra time and effort
	Tackles problems head on and works to resolve them without delay
	Establishes high standards of performance for employees
	Sets high personal standards of performance
Build Support	Anticipates and responds effectively to the positions and reactions of others
	Gives compelling reasons for ideas
	Knows which battles are worth fighting
	Builds support for own ideas through contacts with others
Motivate Others	Creates a feeling of energy, excitement, and personal investment
	Inspires people to excel
	Rewards people for good performance
	Conveys trust in people's competence to do their jobs
Develop Others	Attracts and selects high caliber talent
	Gives clear, motivating, and constructive feedback
	Provides challenging assignments to facilitate individual development
	Willingly shares expertise and experience with others
Promote Teamwork	Contributes fair share of effort to the team's work
	Promotes teamwork among groups; discourages 'we vs. they' thinking
	Facilitates the discussion and resolution of different views

Skill	Questions Involves others in shaping plans and decisions that affect them
Foster Open Communication	Encourages others to express their views, even contrary ones
	Keeps people up-to-date with information
	Listens attentively and with empathy to concerns expressed by others
	Makes sure that people have no 'surprises'
	Speaks clearly and concisely
Establish Relationships	Compromises to build give and take relationships with others
	Develops relationships with key people in other functions and at other levels
	Expresses disagreement tactfully and sensitively
	Helps people from diverse cultures/backgrounds/lifestyles succeed in the organization
	Creates an environment in which people from diverse backgrounds feel comfortable
Establish Trust	Accepts responsibilities for own mistakes
	Encourages discussion of ethical considerations before decisions are made
	Shows consistency between words and actions
	Treats people fairly
Show Adaptability	Adapts behavior in response to feedback and experience
	Deals constructively with own failures and mistakes
	Responds resourcefully to new demands and challenges
	Seeks feedback to enhance performance
	Works effectively in ambiguous situations
Overall	Accomplishes a great deal
	Gets the job done
	Gets work done on time
	Is an effective manager overall
	Produces high quality work

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APPENDIX B. CORRELATION TABLES

The following tables show the correlation between questions in the Self, Peers-Boss, and People You Lead datasets.

Table 22. Self correlation matrix

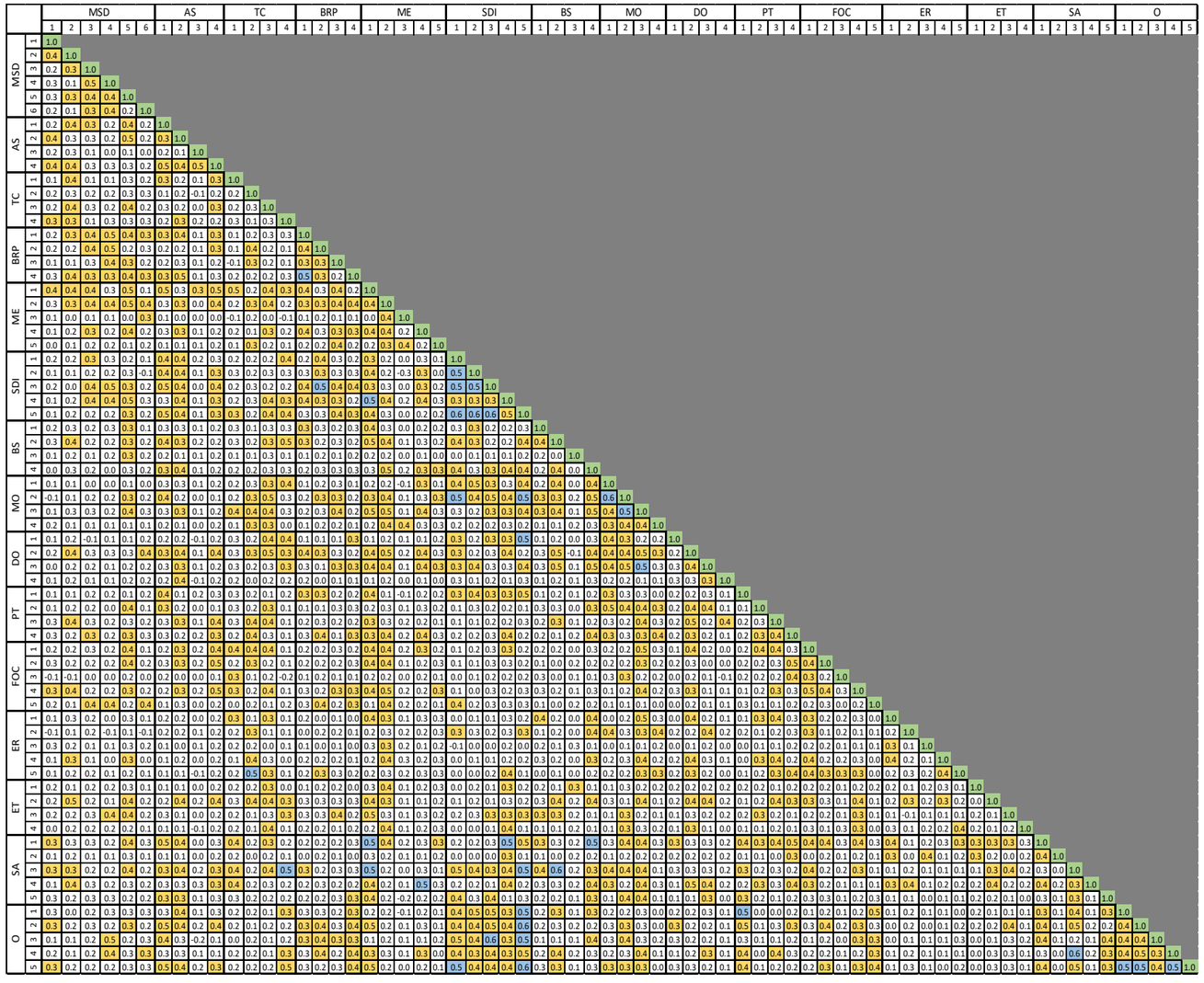

Table 23. Peers-Boss correlation matrix

		MSD						AS				TC				BRP				ME					SDI					BS				MO				DO				PT				FOC					ER					ET				SA					O				
		1	2	3	4	5	6	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	3	4	5	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	3	4	5	1	2	3	4	1	2	3	4	5	1	2	3	4	5
MSD	1	1.0																																																																		
	2	0.8	1.0																																																																	
	3	0.7	0.7	1.0																																																																
	4	0.7	0.7	0.8	1.0																																																															
	5	0.7	0.6	0.7	0.6	1.0																																																														
	6	0.7	0.6	0.6	0.6	0.6	1.0																																																													
AS	1	0.7	0.7	0.6	0.6	0.7	0.6	1.0																																																												
	2	0.7	0.7	0.6	0.7	0.8	0.6	0.7	1.0																																																											
	3	0.5	0.5	0.6	0.6	0.4	0.4	0.4	0.5	1.0																																																										
	4	0.7	0.7	0.7	0.7	0.6	0.6	0.7	0.7	0.5	1.0																																																									
TC	1	0.6	0.6	0.5	0.5	0.6	0.5	0.7	0.5	0.4	0.5	1.0																																																								
	2	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.5	0.5	0.6	0.7	1.0																																																							
	3	0.7	0.7	0.6	0.7	0.6	0.6	0.6	0.7	0.4	0.6	0.6	0.6	1.0																																																						
	4	0.8	0.8	0.7	0.8	0.6	0.6	0.7	0.7	0.4	0.7	0.6	0.6	0.7	1.0																																																					
BRP	1	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.5	0.7	0.6	0.6	0.6	0.7	1.0																																																				
	2	0.7	0.7	0.6	0.6	0.6	0.6	0.7	0.7	0.3	0.6	0.5	0.5	0.5	0.6	0.6	1.0																																																			
	3	0.7	0.6	0.7	0.7	0.6	0.6	0.6	0.7	0.5	0.6	0.5	0.6	0.6	0.7	0.7	0.7	1.0																																																		
	4	0.8	0.8	0.7	0.8	0.7	0.6	0.7	0.7	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	1.0																																																	
ME	1	0.6	0.6	0.7	0.6	0.6	0.5	0.7	0.6	0.5	0.5	0.6	0.5	0.6	0.6	0.7	0.5	0.7	0.6	1.0																																																
	2	0.7	0.7	0.7	0.8	0.7	0.6	0.6	0.7	0.5	0.7	0.6	0.6	0.7	0.7	0.7	0.6	0.7	0.7	0.7	1.0																																															
	3	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.3	0.1	0.4	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.3	1.0																																														
	4	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.4	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.7	0.4	1.0																																													
	5	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.4	0.5	0.5	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.6	0.6	0.4	0.5	1.0																																												
SDI	1	0.6	0.7	0.6	0.7	0.5	0.6	0.6	0.7	0.4	0.5	0.5	0.5	0.6	0.7	0.6	0.7	0.8	0.7	0.6	0.7	0.2	0.7	0.5	1.0																																											
	2	0.5	0.5	0.5	0.6	0.4	0.4	0.5	0.4	0.3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.1	0.5	0.3	0.7	1.0																																										
	3	0.7	0.6	0.7	0.7	0.6	0.6	0.7	0.7	0.5	0.6	0.6	0.5	0.6	0.7	0.7	0.7	0.7	0.6	0.6	0.7	0.3	0.7	0.5	0.8	0.7	1.0																																									
	4	0.6	0.7	0.6	0.6	0.6	0.5	0.7	0.6	0.4	0.6	0.6	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.2	0.7	0.5	0.7	0.6	0.7	1.0																																								
	5	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.4	0.6	0.6	0.5	0.5	0.6	0.6	0.5	0.7	0.6	0.6	0.7	0.1	0.6	0.5	0.7	0.7	0.7	0.7	1.0																																							
BS	1	0.6	0.6	0.5	0.5	0.6	0.6	0.6	0.6	0.3	0.6	0.7	0.7	0.6	0.6	0.6	0.6	0.5	0.6	0.5	0.6	0.3	0.5	0.6	0.5	0.4	0.6	0.5	0.5	1.0																																						
	2	0.7	0.7	0.8	0.7	0.7	0.6	0.6	0.7	0.5	0.6	0.5	0.6	0.6	0.8	0.7	0.6	0.7	0.7	0.7	0.7	0.1	0.7	0.5	0.7	0.5	0.7	0.6	0.7	0.6	1.0																																					
	3	0.6	0.5	0.4	0.4	0.6	0.6	0.6	0.5	0.3	0.6	0.6	0.7	0.5	0.4	0.5	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.5	0.4	0.4	0.5	0.5	0.4	0.7	0.4	1.0																																				
	4	0.6	0.5	0.5	0.6	0.7	0.6	0.6	0.6	0.4	0.6	0.7	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.5	0.6	0.2	0.6	0.6	0.6	0.5	0.6	0.6	0.6	0.7	0.6	0.6	1.0																																			
MO	1	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.3	0.5	0.6	0.6	0.6	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.2	0.6	0.5	0.6	0.6	0.7	0.6	0.5	0.6	0.6	0.6	0.6	1.0																																		
	2	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.4	0.6	0.6	0.6	0.7	0.6	0.5	0.6	0.6	0.6	0.5	0.7	0.3	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.7	0.8	1.0																																	
	3	0.4	0.4	0.3	0.4	0.5	0.4	0.4	0.5	0.3	0.4	0.5	0.5	0.5	0.3	0.3	0.4	0.3	0.4	0.4	0.5	0.1	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.5	0.5	0.5	0.6	1.0																																
	4	0.4	0.4	0.3	0.4	0.4	0.5	0.4	0.4	0.3	0.4	0.5	0.5	0.5	0.4	0.3	0.4	0.3	0.4	0.2	0.5	0.2	0.4	0.4	0.3	0.4	0.4	0.4	0.4	0.5	0.3	0.5	0.5	0.6	0.6	0.6	1.0																															
DO	1	0.5	0.5	0.5	0.5	0.7	0.6	0.6	0.6	0.3	0.5	0.6	0.6	0.6	0.6	0.5	0.6	0.5	0.5	0.5	0.7	0.4	0.7	0.7	0.6	0.5	0.6	0.6	0.6	0.6	0.5	0.6	0.7	0.6	0.7	0.6	0.6	1.0																														
	2	0.6	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.4	0.6	0.7	0.7	0.7	0.6	0.6	0.5	0.6	0.6	0.5	0.7	0.4	0.6	0.7	0.5	0.4	0.5	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.7	0.5	0.5	0.7	1.0																													
	3	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.4	0.5	0.4	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.4	0.7	0.4	0.7	0.6	0.6	0.5	0.6	0.6	0.5	0.5	0.6	0.5	0.5	0.6	0.6	0.4	0.4	0.7	0.6	1.0																												
	4	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.5	0.4	0.4	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.1	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.4	0.6	0.5	0.5	0.3	0.3	0.4	0.5	0.4	1.0																											
PT	1	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.5	0.4	0.5	0.4	0.5	0.5	0.5	0.4	0.5	0.6	0.5	0.4	0.6	0.2	0.5	0.4	0.6	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.6	0.6	0.7	0.5	0.4	0.6	0.5	0.4	0.5	1.0																										
	2	0.4	0.4	0.4	0.3	0.5	0.5	0.5	0.4	0.2	0.4	0.6	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.2	0.4	0.6	0.4	0.4	0.5	0.5	0.4	0.7	0.4	0.5	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.5	0.4	0.5	1.0																									
	3	0.5	0.5	0.5	0.4	0.6	0.5	0.6	0.5	0.3	0.5	0.7	0.7	0.5	0.5	0.5	0.4	0.5	0.4	0.5	0.5	0.2	0.5	0.6	0.4	0.4	0.5	0.4	0.4	0.6	0.5	0.6	0.6	0.6	0.5	0.5	0.4	0.5	0.6	0.4	0.5	0.4	0.6	1.0																								
	4	0.6	0.6	0.5	0.6	0.7	0.6	0.6	0.6	0.4	0.5	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.7	0.5	0.6	0.2	0.6	0.6	0.5	0.5	0.6	0.6	0.5	0.6	0.6	0.6	0.7	0.6	0.6	0.5	0.6	0.6	0.7	0.6	0.5	0.5	0.6	0.6	1.0																							
FOC	1	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.1	0.3	0.5	0.5	0.4	0.3	0.2	0.2	0.3	0.3	0.2	0.4	0.2	0.3	0.5	0.3	0.3	0.3	0.2	0.3	0.6	0.3	0.3	0.5	0.4	0.4	0.5	0.4	0.3	0.4	0.2	0.4	0.4	0.5	0.6	0.5	1.0																						
	2	0.6	0.6	0.6	0.7	0.6	0.5	0.6	0.6	0.4	0.6	0.6	0.5	0.6	0.7	0.6	0.5	0.6	0.7	0.5	0.7	0.2	0.5	0.5	0.6	0.5	0.5	0.5	0.6	0.5	0.7	0.4	0.6	0.5	0.6	0.4	0.4	0.6	0.6	0.4	0.5	0.5	0.4	0.5	0.6	0.4	1.0																					
	3	0.2	0.3	0.1	0.1	0.3	0.2	0.3	0.2	0.0	0.2	0.5	0.4	0.4	0.2	0.2	0.1	0.2	0.2	0.2	0.3	0.0	0.2	0.3	0.2	0.3	0.2	0.2	0.2	0.5	0.2	0.4	0.4	0.4	0.3	0.5	0.5	0.3	0.4	0.1	0.2	0.4	0.6	0.5	0.5	0.6	0.2	1.0																				
	4	0.7	0.7	0.6	0.7	0.6	0.6	0.6	0.6	0.4	0.5	0.5	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.2	0.6	0.5	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.5	0.6	0.5	0.6	0.4	0.4	0.6	0.6	0.5	0.5	0.6	0.5	0.5	0.6	0.3	0.6	0.4	1.0																			
	5	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.6	0.5	0.5	0.6	0.3	0.5	0.5	0.5	0.4	0.5	0.5	0.5	0.4	0.6	0.4	0.4	0.5	0.6	0.5	0.3	0.5	0.5	0.5	0.4	0.4	0.3	0.5	0.6	0.3	0.5	0.2	0.6	1.0																		
ER	1	0.4	0.3	0.3	0.3	0.4	0.6	0.4	0.3	0.2	0.4	0.5	0.6	0.5	0.3	0.3	0.4	0.3	0.3	0.3	0.4	0.2	0.3	0.4	0.3	0.3	0.3	0.3	0.2	0.6	0.3	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.7	0.6	0.6	0.5	0.3	0.5	0.4	0.3	1.0																	
	2	0.5	0.5	0.6	0.6	0.5	0.7	0.6	0.5	0.4	0.6	0.5	0.6	0.5	0.6	0.6	0.5	0.5	0.6	0.5	0.6	0.3	0.6	0.5	0.6	0.6	0.7	0.6	0.6	0.7	0.6	0.6	0.7	0.7	0.7	0.4	0.5	0.6	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.3	0.5	0.3	0.6	0.5	0.5	1.0																
	3	0.2	0.2	0.1	0.1	0.3	0.4	0.3	0.2	0.1	0.3	0.6	0.5	0.3	0.1	0.2	0.1	0.2	0.1	0.2	0.2	0.2	0.3	0.3	0.1	0.3	0.2	0.2	0.2	0.6	0.1	0.6	0.5	0.4	0.3	0.3	0.4	0.3	0.4	0.2	0.3	0.4	0.6	0.6	0.4	0.6	0.3	0.6	0.3	0.2	0.6	0.4	1.0															
	4	0.4	0.4	0.3	0.3	0.4	0.4	0.4	0.3	0.1	0.4	0.4	0.5	0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.5	0.1	0.3	0.4	0.3	0.4	0.4	0.4	0.4	0.5	0.3	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.3	0.4	0.5	0.5	0.5	0.4	0.5	0.4	0.4	0.4	0.4	0.5	0.4	0.4	1.0														
	5	0.4	0.4	0.2	0.3	0.4	0.3	0.4	0.3	0.2	0.4	0.5	0.6	0.4	0.3	0.3	0.4	0.3	0.3	0.3	0.4	0.0	0.4	0.3	0.4	0.4	0.4	0.5	0.4	0.5	0.4	0.4	0.4	0.5	0.5	0.4	0.5	0.5	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.3	0.5	0.4	0.2	0.4	0.4	0.4	0.7	1.0													
ET	1	0.4	0.4	0.4	0.3	0.4	0.5	0.5	0.4	0.2	0.5	0.6	0.5	0.4	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.1	0.4	0.3	0.5	0.5	0.5	0.5	0.5	0.6	0.3	0.6	0.6	0.6	0.5	0.4	0.4	0.5	0.5	0.4	0.4	0.5	0.6	0.6	0.5	0.3	0.4	0.4	0.5	0.2	0.5	0.5	0.6	0.5	0.5	1.0												
	2	0.4	0.5	0.5	0.5	0.5	0.3	0.4	0.5	0.4	0.4	0.4	0.5	0.5	0.5	0.4	0.4	0.5	0.6	0.5	0.6	0.3	0.6	0.5	0.5	0.4	0.5	0.5	0.5	0.5	0.6	0.3	0.5	0.5	0.5	0.4	0.3	0.5	0.4	0.4	0.4	0.5	0.4	0.4	0.5	0.5	0.5	0.3	0.5	0.5	0.3	0.5	0.2	0.4	0.4	0.3	1.0											
	3	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.5	0.4	0.6	0.6	0.5	0.6	0.6	0.6	0.5	0.6	0.5	0.5	0.6	0.2	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.5	0.6	0.5	0.6	0.6	0.7	0.5	0.4	0.6	0.6	0.6	0.5	0.7	0.5	0.5	0.5	0.4	0.5	0.4	0.6	0.6	0.4	0.6	0.3	0.5	0.4	0.6	0.5	1.0										
	4	0.2	0.2	0.1	0.1	0.3	0.2	0.3	0.2	0.0	0.2	0.4	0.3	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.3	0.0	0.2	0.3	0.2	0.4	0.2	0.2	0.4	0.5	0.2	0.4	0.3	0.3	0.4	0.4	0.4	0.4	0.3	0.2	0.2	0.5	0.5	0.3	0.4	0.6	0.3	0.7	0.3	0.2	0.4	0.4	0.5	0.6	0.6	0.4	0.3	0.5	1.0									
SA	1	0.6	0.5	0.5	0.5	0.7	0.7	0.5	0.5	0.4	0.5	0.6	0.6	0.6	0.5	0.6	0.5	0.4	0.5	0.5	0.6	0.2	0.5	0.6	0.5	0.4	0.6	0.6	0.6	0.7	0.6	0.6	0.7	0.6	0.7	0.5	0.5	0.7	0.6	0.5	0.5	0.5	0.7	0.6	0.7	0.4	0.5	0.4	0.6	0.5	0.7	0.7	0.5	0.6	0.5	0.6	0.4	0.6	0.4	1.0								
	2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.2	0.3	0.3	0.4	0.4	0.3	0.2	0.3	0.2	0.3	0.3	0.4	0.3	0.1	0.4	0.3	0.3	0.5	0.4	0.5	0.5	0.5	0.3	0.5	0.4	0.4	0.4	0.3	0.4	0.3	0.3	0.3	0.3	0.4	0.5	0.4	0.3	0.3	0.3	0.4	0.3	0.3	0.4	0.5	0.5	0.3	0.3	0.6	0.3	0.5	0.4	0.6	1.0							
	3	0.7	0.6	0.7	0.7	0.6	0.6	0.6	0.6	0.5	0.7	0.6	0.6	0.5	0.7	0.6	0.7	0.6	0.7	0.6	0.7	0.3	0.6	0.6	0.6	0.5	0.7	0.6	0.7	0.6	0.7	0.5	0.6	0.6	0.7	0.4	0.5	0.6	0.6	0.5	0.5	0.6	0.5	0.5	0.6	0.3	0.6	0.2	0.6	0.5	0.4	0.7	0.2	0.4	0.4	0.4	0.5	0.6	0.2	0.6	0.5	1.0						
	4	0.3	0.5	0.4	0.5	0.5	0.4	0.5	0.5	0.3	0.4	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.5	0.6	0.5	0.2	0.4	0.4	0.5	0.5	0.4	0.5	0.4	0.5	0.5	0.4	0.4	0.6	0.5	0.4	0.4	0.4	0.5	0.4	0.5	0.5	0.5	0.5	0.6	0.5	0.4	0.5	0.5	0.4	0.5	0.5	0.4	0.4	0.4	0.5	0.5	0.4	0.4	0.5	0.4	0.5	1.0					
	5	0.7	0.7	0.8	0.7	0.6	0.7	0.6	0.7	0.5	0.7	0.5	0.5	0.6	0.7	0.7	0.6	0.6	0.7	0.5	0.7	0.3	0.6	0.5	0.6	0.5	0.7	0.6	0.6	0.5	0.6	0.5	0.5	0.5	0.6	0.3	0.3	0.6	0.6	0.5	0.5	0.5	0.3	0.4	0.5	0.2	0.6	0.1	0.6	0.6	0.3	0.6	0.2	0.3	0.3	0.4	0.4	0.6	0.2	0.5	0.3	0.7	0.2	1.0				
O	1	0.7	0.6	0.7	0.8	0.6	0.6	0.7	0.7	0.5	0.6	0.6	0.5	0.6	0.8	0.7	0.7	0.7	0.7	0.6	0.7	0.2	0.7	0.5	0.8	0.8	0.8	0.7	0.8	0.6	0.8	0.5	0.6	0.6	0.7	0.4	0.4	0.6	0.5	0.6	0.5	0.7	0.4	0.5	0.6	0.3	0.6	0.2	0.7	0.6	0.4	0.7	0.2	0.4	0.4	0.5	0.5	0.7	0.3	0.6	0.5	0.7	0.5	0.7	1.0			
	2	0.7	0.7	0.7	0.7	0.6	0.6	0.7	0.6	0.4	0.7	0.7	0.6	0.6	0.7	0.6	0.7	0.7	0.7	0.6	0.7	0.2	0.6	0.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.6	0.6	0.4	0.4	0.6	0.6	0.5	0.5	0.6	0.5	0.5	0.5	0.3	0.6	0.2	0.6	0.6	0.5	0.7	0.3	0.4	0.4	0.6	0.4	0.6	0.3	0.6	0.5	0.7	0.4	0.6	0.8	1.0		
	3	0.6	0.6	0.6	0.7	0.6	0.6	0.7	0.6	0.4	0.7	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.6	0.7	0.3	0.6	0.5	0.7	0.6	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.5	0.6	0.3	0.4	0.6	0.6	0.5	0.5	0.6	0.4	0.5	0.5	0.3	0.7	0.2	0.6	0.5	0.3	0.6	0.3	0.4	0.3	0.5	0.5	0.6	0.3	0.6	0.4	0.6	0.4	0.7	0.8	0.8	1.0	
	4	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.4	0.7	0.6	0.6	0.7	0.7	0.7	0.6	0.7	0.6	0.6	0.8	0.3	0.7	0.6	0.7	0.6	0.8	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.7	0.4	0.5	0.7	0.7	0.6	0.5	0.6	0.5	0.6	0.6	0.3	0.6	0.2	0.6	0.6	0.5	0.8	0.3	0.5	0.4	0.5	0.4	0.7	0.3	0.6	0.4	0.7	0.4	0.8	0.8	0.8	0.7	1.0	
	5	0.7	0.6	0.7	0.7	0.6	0.7	0.7	0.7	0.4	0.7	0.6	0.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.2	0.6	0.5	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.5	0.6	0.6	0.6	0.4	0.4	0.6	0.6	0.5	0.5	0.6	0.5	0.5	0.6	0.3	0.6	0.3	0.6	0.6	0.5	0.7	0.3	0.5	0.4	0.6	0.4	0.6	0.3	0.6	0.4	0.7	0.5	0.7	0.8	0.8	0.7	0.8	1.0

Table 24. People You Lead correlation matrix.

		MSD						AS				TC				BRP				ME					SDI					BS				MO				DO				PT				FOC					ER					ET				SA					O				
		1	2	3	4	5	6	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	3	4	5	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	3	4	5	1	2	3	4	1	2	3	4	5	1	2	3	4	5
MSD	1	1.0
	2	0.7	1.0
	3	0.7	0.7	1.0
	4	0.8	0.7	0.8	1.0
	5	0.8	0.7	0.8	0.8	1.0
	6	0.6	0.7	0.7	0.7	0.6	1.0
AS	1	0.7	0.7	0.7	0.7	0.7	0.7	1.0
	2	0.7	0.7	0.7	0.8	0.7	0.7	0.7	1.0
	3	0.6	0.6	0.7	0.7	0.6	0.6	0.6	0.7	1.0
	4	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.6	1.0
TC	1	0.6	0.5	0.5	0.5	0.6	0.5	0.6	0.5	0.4	0.6	1.0
	2	0.8	0.7	0.7	0.8	0.8	0.6	0.7	0.7	0.6	0.7	0.6	1.0
	3	0.7	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.5	0.6	0.7	0.7	1.0
	4	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.6	0.7	0.7	1.0
BRP	1	0.8	0.7	0.7	0.8	0.7	0.7	0.8	0.7	0.6	0.7	0.6	0.7	0.6	0.8	1.0
	2	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.7	0.6	0.7	0.8	1.0
	3	0.6	0.7	0.7	0.8	0.7	0.7	0.6	0.7	0.6	0.6	0.5	0.7	0.6	0.7	0.7	0.7	1.0
	4	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.6	0.7	0.6	0.7	0.7	0.8	0.8	0.8	0.7	1.0
ME	1	0.7	0.7	0.7	0.6	0.7	0.6	0.7	0.7	0.6	0.7	0.6	0.7	0.6	0.7	0.7	0.6	0.6	0.6	1.0
	2	0.7	0.7	0.7	0.7	0.7	0.5	0.6	0.7	0.6	0.7	0.6	0.8	0.6	0.7	0.6	0.6	0.6	0.7	0.7	1.0
	3	0.2	0.4	0.3	0.3	0.2	0.3	0.3	0.3	0.2	0.3	0.1	0.4	0.2	0.3	0.2	0.2	0.1	0.3	0.2	0.3	1.0
	4	0.7	0.7	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.2	1.0
	5	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.5	0.5	0.7	0.7	0.6	0.6	0.7	0.6	0.6	0.5	0.6	0.2	0.6	1.0
SDI	1	0.6	0.6	0.6	0.7	0.6	0.5	0.6	0.6	0.6	0.6	0.4	0.7	0.6	0.6	0.7	0.6	0.7	0.6	0.6	0.6	0.4	0.6	0.6	1.0
	2	0.5	0.4	0.4	0.5	0.6	0.3	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.3	0.5	0.5	0.4	0.5	0.4	0.4	0.0	0.5	0.5	0.4	1.0
	3	0.6	0.6	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.5	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.2	0.7	0.5	0.5	0.4	1.0
	4	0.7	0.6	0.7	0.8	0.7	0.6	0.6	0.7	0.6	0.7	0.5	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.4	0.7	0.5	0.7	0.5	0.6	1.0
	5	0.7	0.6	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.5	0.6	0.7	0.7	0.6	0.6	0.7	0.6	0.2	0.7	0.5	0.6	0.6	0.7	0.6	1.0
BS	1	0.7	0.7	0.7	0.8	0.7	0.7	0.8	0.7	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.2	0.8	0.6	0.6	0.4	0.7	0.7	0.6	1.0
	2	0.7	0.7	0.7	0.7	0.6	0.6	0.7	0.7	0.6	0.7	0.6	0.7	0.7	0.7	0.7	0.6	0.6	0.8	0.7	0.7	0.2	0.7	0.6	0.6	0.3	0.6	0.7	0.6	0.7	1.0
	3	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.6	0.6	0.7	0.5	0.6	0.5	0.7	0.7	0.7	0.6	0.7	0.6	0.6	0.3	0.6	0.5	0.6	0.3	0.6	0.6	0.5	0.7	0.7	1.0
	4	0.8	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.6	0.7	0.6	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.2	0.7	0.6	0.6	0.3	0.6	0.6	0.6	0.8	0.7	0.6	1.0
MO	1	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.5	0.6	0.6	0.5	0.6	0.6	0.5	0.6	0.5	0.5	0.5	0.5	0.2	0.6	0.5	0.4	0.5	0.6	0.6	0.6	0.6	0.5	0.5	0.5	1.0
	2	0.7	0.6	0.7	0.7	0.7	0.6	0.7	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.6	0.7	0.6	0.6	0.2	0.7	0.6	0.5	0.5	0.7	0.6	0.7	0.7	0.6	0.6	0.7	0.7	1.0
	3	0.6	0.5	0.6	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.5	0.6	0.5	0.5	0.6	0.6	0.5	0.3	0.6	0.5	0.5	0.5	0.5	0.6	0.6	0.5	0.6	0.5	0.6	0.5	0.6	1.0
	4	0.6	0.6	0.7	0.6	0.6	0.6	0.7	0.6	0.5	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.7	0.2	0.6	0.5	0.5	0.4	0.6	0.7	0.5	0.7	0.7	0.6	0.5	0.5	0.6	0.5	1.0
DO	1	0.6	0.6	0.7	0.7	0.6	0.5	0.7	0.7	0.6	0.7	0.6	0.6	0.7	0.7	0.6	0.6	0.6	0.7	0.6	0.7	0.4	0.7	0.6	0.6	0.3	0.6	0.7	0.6	0.7	0.7	0.6	0.7	0.6	0.7	0.6	0.7	1.0
	2	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.6	0.7	0.6	0.8	0.6	0.7	0.7	0.7	0.6	0.7	0.6	0.6	0.3	0.7	0.6	0.6	0.6	0.7	0.6	0.7	0.7	0.6	0.6	0.7	0.7	0.7	0.6	0.6	0.7	1.0
	3	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.6	0.7	0.5	0.7	0.6	0.7	0.7	0.6	0.7	0.6	0.6	0.7	0.4	0.7	0.7	0.7	0.3	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.6	0.6	0.5	0.5	0.6	0.7	1.0
	4	0.6	0.6	0.6	0.6	0.7	0.5	0.6	0.6	0.5	0.7	0.6	0.6	0.5	0.6	0.6	0.5	0.5	0.7	0.6	0.7	0.2	0.6	0.4	0.5	0.4	0.6	0.7	0.6	0.6	0.7	0.6	0.6	0.5	0.5	0.6	0.6	0.5	0.6	0.6	1.0
PT	1	0.6	0.6	0.6	0.5	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.1	0.6	0.5	0.5	0.5	0.6	0.4	0.6	0.6	0.5	0.5	0.6	0.5	0.6	0.6	0.5	0.5	0.6	0.5	0.4	1.0
	2	0.6	0.5	0.6	0.6	0.6	0.5	0.5	0.5	0.4	0.5	0.7	0.5	0.6	0.6	0.6	0.6	0.5	0.6	0.5	0.6	0.2	0.6	0.5	0.5	0.5	0.5	0.8	0.6	0.6	0.7	0.5	0.5	0.6	0.7	0.6	0.7	0.6	0.6	0.5	0.6	0.4	1.0
	3	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.6	0.7	0.6	0.7	0.3	0.7	0.7	0.6	0.5	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.7	1.0
	4	0.6	0.6	0.7	0.6	0.7	0.5	0.6	0.6	0.5	0.7	0.6	0.6	0.7	0.7	0.6	0.6	0.5	0.7	0.6	0.7	0.3	0.6	0.5	0.7	0.4	0.6	0.7	0.6	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.7	0.7	0.6	0.7	0.7	1.0
FOC	1	0.7	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.5	0.6	0.7	0.7	0.7	0.6	0.6	0.6	0.5	0.6	0.6	0.7	0.2	0.6	0.6	0.4	0.4	0.7	0.6	0.6	0.7	0.7	0.5	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.5	0.7	0.8	0.7	1.0
	2	0.6	0.7	0.6	0.7	0.7	0.6	0.6	0.7	0.5	0.8	0.6	0.6	0.5	0.7	0.6	0.6	0.6	0.7	0.6	0.8	0.3	0.7	0.5	0.6	0.4	0.6	0.7	0.6	0.7	0.8	0.6	0.6	0.5	0.6	0.5	0.7	0.6	0.6	0.6	0.7	0.5	0.6	0.6	0.7	0.6	1.0
	3	0.6	0.5	0.5	0.6	0.6	0.5	0.5	0.6	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.6	0.2	0.6	0.5	0.5	0.4	0.5	0.6	0.6	0.6	0.5	0.5	0.5	0.6	0.7	0.5	0.7	0.6	0.6	0.4	0.5	0.5	0.6	0.7	0.6	0.7	0.5	1.0
	4	0.6	0.6	0.6	0.6	0.7	0.6	0.7	0.6	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.6	0.6	0.7	0.7	0.7	0.3	0.6	0.6	0.5	0.2	0.6	0.6	0.5	0.6	0.7	0.7	0.7	0.5	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.7	0.6	0.7	0.4	1.0
	5	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.6	0.6	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.2	0.6	0.6	0.5	0.5	0.6	0.5	0.6	0.7	0.5	0.5	0.6	0.7	0.7	0.5	0.6	0.6	0.7	0.5	0.4	0.5	0.5	0.7	0.5	0.7	0.5	0.6	0.4	1.0
ER	1	0.7	0.5	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.5	0.6	0.6	0.6	0.6	0.6	0.7	0.5	0.5	0.2	0.6	0.5	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.7	0.6	0.6	0.5	0.5	0.6	0.6	1.0
	2	0.6	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.7	0.6	0.6	0.6	0.7	0.7	0.6	0.7	0.6	0.6	0.6	0.2	0.7	0.5	0.5	0.3	0.7	0.6	0.7	0.7	0.6	0.6	0.7	0.6	0.7	0.5	0.6	0.6	0.7	0.6	0.5	0.5	0.5	0.7	0.6	0.7	0.6	0.6	0.6	0.6	0.6	1.0
	3	0.5	0.5	0.5	0.6	0.5	0.6	0.6	0.6	0.5	0.4	0.4	0.5	0.6	0.6	0.5	0.6	0.6	0.5	0.4	0.6	0.3	0.6	0.6	0.6	0.3	0.4	0.6	0.4	0.7	0.6	0.5	0.6	0.5	0.5	0.4	0.5	0.6	0.5	0.5	0.4	0.4	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0
	4	0.5	0.5	0.5	0.6	0.6	0.5	0.5	0.6	0.4	0.6	0.7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.6	0.2	0.5	0.4	0.4	0.4	0.6	0.6	0.5	0.6	0.6	0.5	0.5	0.6	0.7	0.4	0.6	0.6	0.6	0.4	0.5	0.4	0.7	0.6	0.6	0.6	0.6	0.7	0.6	0.5	0.5	0.6	0.5	1.0
	5	0.6	0.5	0.5	0.6	0.7	0.5	0.6	0.6	0.5	0.6	0.7	0.5	0.6	0.6	0.5	0.6	0.5	0.5	0.6	0.7	0.1	0.6	0.4	0.4	0.5	0.6	0.7	0.7	0.6	0.6	0.5	0.6	0.6	0.6	0.5	0.7	0.6	0.6	0.4	0.6	0.5	0.7	0.7	0.7	0.7	0.6	0.7	0.6	0.6	0.6	0.6	0.5	0.8	1.0
ET	1	0.5	0.4	0.4	0.5	0.5	0.3	0.4	0.6	0.3	0.5	0.5	0.5	0.4	0.4	0.4	0.5	0.5	0.4	0.5	0.6	0.0	0.5	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.4	0.5	0.5	0.5	0.5	0.4	0.3	0.5	0.6	0.6	0.5	0.4	0.5	0.5	0.6	0.5	0.5	0.5	0.4	0.5	0.6	0.6	1.0
	2	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.5	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.7	0.7	0.7	0.3	0.6	0.5	0.6	0.4	0.6	0.6	0.6	0.7	0.8	0.6	0.7	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.7	0.7	0.8	0.7	0.6	0.7	0.5	0.6	0.6	0.5	0.6	0.7	0.5	1.0
	3	0.7	0.5	0.6	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.1	0.7	0.6	0.5	0.7	0.6	0.6	0.6	0.7	0.5	0.5	0.6	0.5	0.6	0.6	0.6	0.5	0.6	0.5	0.5	0.6	0.6	0.7	0.5	0.6	0.6	0.6	0.4	0.7	0.6	0.6	0.6	0.5	0.6	0.6	0.5	1.0
	4	0.5	0.4	0.4	0.5	0.6	0.4	0.4	0.5	0.3	0.5	0.7	0.5	0.5	0.5	0.4	0.5	0.4	0.5	0.5	0.6	0.1	0.5	0.4	0.4	0.5	0.5	0.5	0.6	0.5	0.5	0.4	0.5	0.6	0.6	0.4	0.6	0.5	0.5	0.4	0.6	0.5	0.7	0.5	0.5	0.6	0.6	0.7	0.4	0.4	0.5	0.5	0.5	0.8	0.7	0.6	0.6	0.5	1.0
SA	1	0.7	0.7	0.7	0.6	0.7	0.7	0.7	0.6	0.6	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.6	0.2	0.7	0.6	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.6	0.7	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.8	0.6	0.7	0.7	0.6	0.7	0.6	0.7	0.7	0.5	0.6	0.6	0.4	0.7	0.6	0.5	1.0
	2	0.6	0.6	0.7	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.6	0.6	0.6	0.5	0.6	0.6	0.6	0.3	0.6	0.5	0.4	0.4	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.5	0.6	1.0
	3	0.7	0.7	0.8	0.7	0.7	0.6	0.8	0.7	0.6	0.8	0.6	0.7	0.6	0.7	0.7	0.8	0.6	0.7	0.7	0.6	0.3	0.7	0.5	0.6	0.5	0.7	0.7	0.8	0.7	0.6	0.7	0.7	0.6	0.7	0.5	0.7	0.7	0.8	0.6	0.6	0.6	0.6	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.4	0.5	0.6	0.4	0.6	0.6	0.5	0.7	0.6	1.0
	4	0.7	0.5	0.6	0.6	0.6	0.5	0.6	0.6	0.5	0.7	0.6	0.6	0.6	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.2	0.6	0.5	0.5	0.4	0.6	0.7	0.7	0.7	0.6	0.5	0.6	0.6	0.7	0.5	0.7	0.6	0.6	0.6	0.6	0.4	0.7	0.7	0.6	0.7	0.7	0.7	0.5	0.6	0.6	0.5	0.5	0.7	0.7	0.5	0.6	0.6	0.7	0.6	0.6	0.6	1.0
	5	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.6	0.7	0.6	0.7	0.7	0.6	0.6	0.7	0.7	0.7	0.2	0.7	0.6	0.6	0.4	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.6	0.6	0.6	0.7	0.7	0.6	0.7	0.5	0.8	0.7	0.6	0.6	0.5	0.6	0.6	0.7	0.7	0.5	0.6	0.6	0.5	0.6	0.7	0.5	0.7	0.7	0.7	0.6	1.0
O	1	0.7	0.6	0.7	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.7	0.6	0.6	0.7	0.7	0.7	0.6	0.6	0.6	0.1	0.7	0.7	0.6	0.7	0.7	0.5	0.7	0.7	0.6	0.5	0.7	0.6	0.7	0.5	0.5	0.6	0.7	0.6	0.5	0.7	0.6	0.7	0.5	0.6	0.5	0.5	0.5	0.7	0.6	0.6	0.6	0.5	0.6	0.5	0.5	0.8	0.5	0.6	0.6	0.6	0.5	0.7	1.0
	2	0.7	0.6	0.7	0.6	0.6	0.5	0.6	0.7	0.5	0.6	0.4	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.1	0.6	0.6	0.5	0.5	0.7	0.5	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.7	0.5	0.5	0.7	0.5	0.6	0.5	0.6	0.4	0.5	0.4	0.7	0.5	0.6	0.5	0.5	0.5	0.6	0.5	0.6	0.5	0.5	0.6	0.6	0.5	0.7	0.8	1.0
	3	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.6	0.6	0.6	0.6	0.5	0.5	0.2	0.6	0.6	0.5	0.5	0.7	0.4	0.6	0.6	0.5	0.5	0.6	0.5	0.6	0.5	0.4	0.6	0.6	0.5	0.4	0.7	0.4	0.5	0.4	0.5	0.5	0.5	0.4	0.6	0.4	0.5	0.5	0.5	0.4	0.5	0.4	0.7	0.4	0.5	0.7	0.5	0.4	0.7	0.8	0.7	1.0
	4	0.7	0.6	0.7	0.7	0.6	0.6	0.7	0.6	0.6	0.5	0.6	0.7	0.6	0.6	0.7	0.7	0.5	0.7	0.6	0.6	0.2	0.7	0.7	0.6	0.6	0.6	0.5	0.6	0.7	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.7	0.7	0.5	0.6	0.5	0.7	0.7	0.7	0.6	0.6	0.5	0.7	0.6	0.6	0.6	0.4	0.5	0.4	0.6	0.7	0.5	0.6	0.6	0.6	0.5	0.7	0.7	0.7	0.7	1.0
	5	0.7	0.6	0.7	0.6	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.5	0.0	0.6	0.6	0.5	0.6	0.7	0.4	0.6	0.6	0.5	0.6	0.6	0.6	0.7	0.4	0.5	0.5	0.6	0.6	0.4	0.7	0.5	0.6	0.5	0.6	0.4	0.5	0.5	0.7	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.7	0.5	0.6	0.6	0.6	0.5	0.7	0.9	0.8	0.8	0.7	1.0

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