

Exploring Personality Traits and Network Characteristics through the Big Five Personality Test

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Social Network Analysis

Abstract: This study delves into the exploration of personality traits using the Big Five Personality Test. The survey, conducted through various social media platforms such as Facebook, LinkedIn, WhatsApp and direct messaging, gathered responses online from 109 participants. The data was cleaned and analyzed using Python, and the resulting dataset consist of 64 samples were used to generate visualizations and perform statistical analyses. The paper examines personality traits such as Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness to Experience. Additionally, network characteristics were explored through SocNetV tool, considering attributes mainly personality traits and personal attributes like gender, degree, age group, CGPA, and city.

1. Introduction:

The Big Five Personality Test stands as a cornerstone in psychological assessments, offering a profound understanding of individual differences in personality traits. In this digital era, the survey was strategically disseminated through popular social media platforms, including Facebook, LinkedIn, WhatsApp groups, and direct messaging. The aim was to reach a diverse range of participants and collect responses that would contribute to a robust analysis of personality traits.

1.1. Background:

The background of this study is rooted in the increasing reliance on online platforms for conducting psychological assessments. Leveraging the accessibility and reach of social media, the Big Five Personality Test was administered to a broad demographic. The history of personality testing, particularly the development of the Big Five model over decades by various scientific researchers, underscores the reliability and scientific validation of this assessment tool. As individuals increasingly seek self-awareness and career guidance, personality tests have gained popularity for providing insights into one's strengths and inclinations.

1.2. Objectives:

The primary objectives of this study were twofold. Firstly, to administer the Big Five Personality Test to a diverse group of participants and analyze the resulting data to understand the distribution of personality traits within the sample. Secondly, to explore the network characteristics of the participants through social network analysis tools, shedding light on how personality traits might be interconnected within social groups. The specific aims included assessing the distribution of personality scores, identifying outliers, and visualizing the relationships between personality traits. Additionally, the

study sought to investigate whether certain demographic factors such as gender, age group, education, CGPA, and city correlated with specific personality traits.

1.3. Significance of the Study:

The significance of this study lies in its potential to contribute to both academic and practical domains. From an academic perspective, the research adds to the body of knowledge surrounding personality psychology and the Big Five model. The utilization of online platforms for data collection also addresses the evolving methodologies in psychological research.

On a practical level, the study holds relevance for individuals seeking self-awareness and career guidance. Understanding one's personality traits, as measured by the Big Five Personality Test, can offer valuable insights into career preferences and interpersonal dynamics. The network analysis aspect further explores the social implications of personality traits, contributing to a holistic understanding of individual differences in diverse social settings.

In summary, this research endeavors to bridge the gap between traditional psychological assessments and the contemporary digital landscape, offering a nuanced exploration of personality traits and their social dynamics through a widely recognized and validated model.

2. Methodology:

2.1. Survey Design

The survey design played a crucial role in ensuring a comprehensive exploration of personality traits using the Big Five Personality Test. The questionnaire comprised 50 statements, each corresponding to one of the five personality traits: Openness to Experience (O), Conscientiousness (C), Extraversion (E), Agreeableness (A), and Neuroticism (N). Participants were instructed to respond to each statement on a scale ranging from "Strongly Disagree" to "Strongly Agree," allowing for a nuanced assessment of their personality characteristics.

The survey began by gathering basic demographic information, including gender, favorite color, age group, educational domain, Facebook or LinkedIn link, and CGPA. This initial section provided context to the subsequent personality trait assessment, contributing to a holistic understanding of the participants.

Instructions emphasized the importance of responding honestly and spontaneously, reflecting participants' current self-perception rather than an idealized version of themselves. The survey's accessibility allowed participants to complete it at their own pace, with an estimated time of 4-5 minutes for completion.

2.2. Data Collection:

The survey employed a multi-platform approach for data collection, leveraging the extensive reach of popular social media channels. Participants were invited to participate through Facebook, LinkedIn, WhatsApp groups, and direct messaging on WhatsApp. The distribution of the survey link ensured a diverse participant pool, encompassing individuals from various social and professional backgrounds.

The survey link was shared individually with friends through direct messages, allowing for a personal touch in the invitation. This approach aimed to encourage participation and ensure a mix of responses from acquaintances and individuals within the participants' social networks.

A total of 109 responses were collected, forming the initial dataset. This dataset was then subjected to further analysis after the data cleaning process.

2.3. Data Cleaning:

To ensure the integrity and reliability of the dataset, a rigorous data cleaning process was employed. This involved several steps, including the removal of missing data and null values, duplicate values, addressing outliers, and performing necessary transformations.

Outliers, identified through boxplots and other statistical methods, were carefully examined. A total of eight outliers were detected in the dataset. Two extreme outlier was removed, and the remaining six outliers were adjusted by taking the mean score.

The final dataset consisted of 64 samples, each representing a participant who had completed the survey. This cleaned dataset formed the basis for subsequent analyses and visualizations.

Data cleaning primarily revolved around the time spent by individual surveyors while completing the questionnaire. Figure a displays the outcomes of the time spent analysis after eliminating duplicate values, resulting in a total of 104 remaining rows. Figures b-j depict the stages involved in the removal of outliers.

```
DataFrame with time_spent column:  
   S_time   E_time  time_spent  
0  11:28:00  11:34:22    6.366667  
1  12:33:00  12:37:37    4.616667  
2  01:33:00  01:36:34    3.566667  
3  02:09:00  02:12:50    3.833333  
4  03:58:00  04:16:31   18.516667  
..  ...  
181 10:13:00  10:17:24    4.400000  
182 12:03:00  12:14:07   11.116667  
183 11:53:00  12:04:19   11.316667  
184 11:01:00  11:07:16    6.266667  
187 07:48:00  07:57:41   9.683333  
[104 rows x 3 columns]
```

Figure a

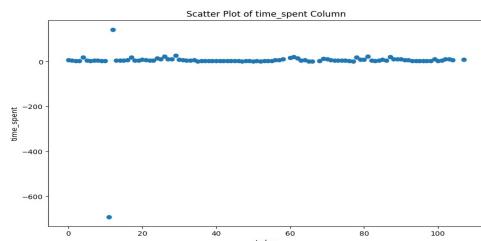
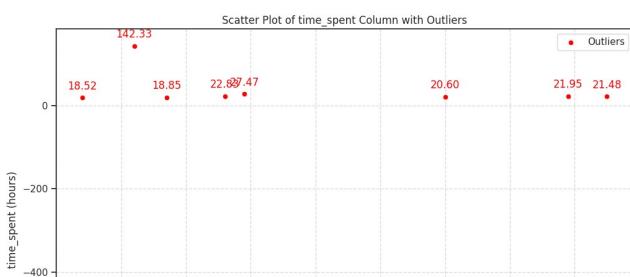


Figure b



3

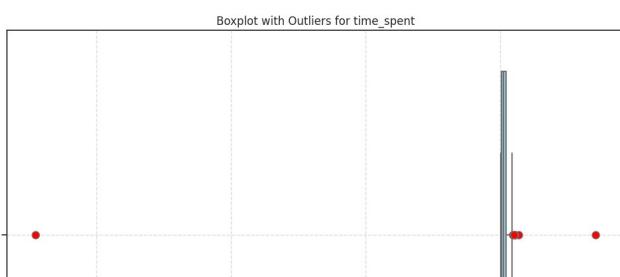


Figure I

Figure j (*outliers removed*)

2.4. Data Analysis Tools:

Python programming language was employed as the primary tool for data analysis. Python's versatile libraries, such as pandas, Num Py, and Matplotlib, facilitated efficient data manipulation, cleaning, and visualization. The use of boxplots, histograms, and scatter plots allowed for a comprehensive exploration of the dataset, visualizing the distribution of responses and identifying patterns. Following figures shows different distribution recorded in the dataset and the time taken detail.

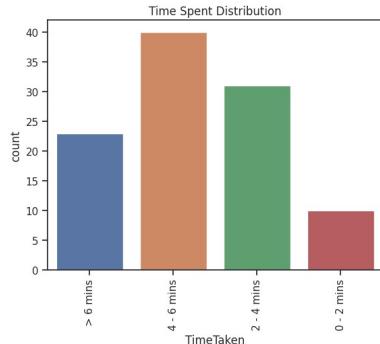


Figure k

TimeTaken	Value
0	> 6 mins
1	4 - 6 mins
2	2 - 4 mins
3	2 - 4 mins
4	4 - 6 mins
...	
99	4 - 6 mins
100	4 - 6 mins
101	4 - 6 mins
102	4 - 6 mins
103	> 6 mins

Figure l

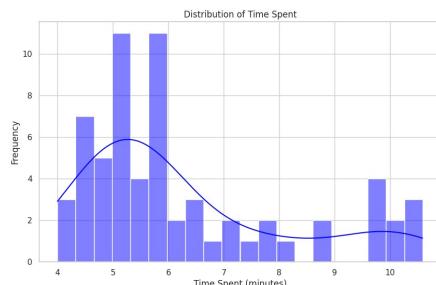


Figure m1

Following table shows the result of time taken after removing rows less than 4 minutes:

TimeTaken	Value
0	> 6 mins
1	4 - 6 mins
4	4 - 6 mins
5	4 - 6 mins
...	

Figure m2 (time taken greater than 4 min)

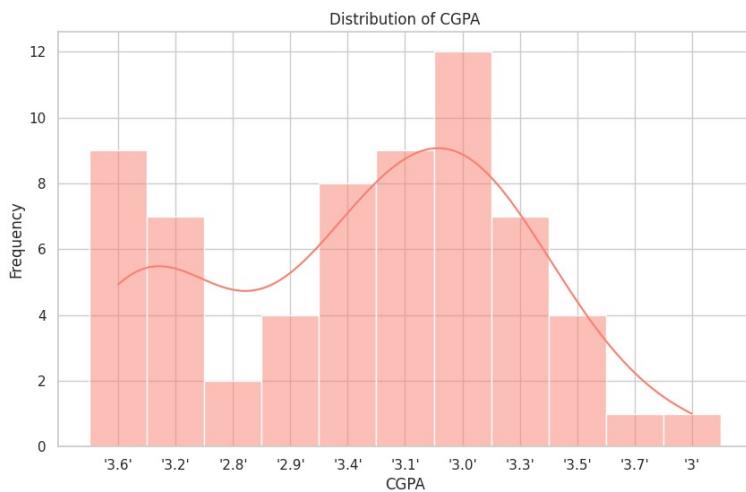


Figure n

For network analysis, SocNetV tool were utilized. This tool enabled the creation of network graphs based on personality traits and demographic attributes. Various centrality measures, such as degree centrality and betweenness centrality, were examined to understand the network characteristics of the participants.

The combination of these data analysis tools provided a robust framework for exploring both the individual personality traits and the social network dynamics within the participant group.

3. The Big Five Personality Test:

3.1. Overview:

The Big Five Personality Test, also known as the Five-Factor Model, stands as a prominent and extensively researched psychological model for assessing and categorizing personality traits. Developed over several decades by independent scientific researchers, this test has become a widely recognized and validated tool in the field of psychology. The overarching framework of the Big Five Personality Test categorizes individuals based on five fundamental personality dimensions, providing a nuanced understanding of their psychological makeup.

The survey conducted in this study utilized the Big Five Personality Test to evaluate participants' personality traits. The assessment involved 50 statements, each linked to one of the five key dimensions, offering a comprehensive overview of individual differences and tendencies.

3.2. Traits Measured:

The Big Five Personality Test evaluates individuals across five primary personality traits, commonly referred to as the "Big Five." These traits encompass a broad range of characteristics, providing a holistic perspective on an individual's personality:

Openness to Experience (O): This trait gauges a person's receptiveness to novel ideas, experiences, and diverse ways of thinking. Individuals high in openness tend to exhibit creativity, curiosity, and an open-minded approach to the world.

Conscientiousness (C): Conscientiousness is associated with traits such as organization, reliability, and self-discipline. Those high in conscientiousness are typically organized, responsible, and goal-oriented.

Extraversion (E): Extraversion measures the extent to which a person is outgoing, sociable, and enjoys social interactions. Individuals with high extraversion are often assertive, energetic, and socially engaged.

Agreeableness (A): This trait reflects a person's interpersonal style and how they relate to others. Individuals high in agreeableness tend to be warm, empathetic, and cooperative.

Neuroticism (N): Neuroticism is associated with emotional stability and how individuals cope with stress. Those high in neuroticism may experience higher levels of anxiety, mood swings, and stress.

Each participant's response to the 50 statements in the survey contributes to a profile that indicates their standing on each of these personality dimensions. The combination of scores provides a nuanced and individualized understanding of their personality.

3.3. Importance in Psychology and Research:

The Big Five Personality Test holds significant importance in psychology and research due to its robust theoretical foundation and practical applications. Researchers and psychologists widely use this model to explore and understand individual differences in personality and behavior. The comprehensive nature of the Big Five allows for a more nuanced and accurate representation of an individual's psychological makeup compared to other personality assessments.

The test's reliability and scientific validation contribute to its widespread acceptance and use. Alongside other well-known personality tests such as the Jung test (MBTI style) and the DISC assessment, the Big Five Personality Test is considered one of the most reliable and globally recognized tools.

Its applications extend beyond academic research, often being employed in clinical settings, career counseling, and organizational psychology. The insights derived from the Big Five Personality Test aid in personal development, career planning, and the understanding of interpersonal dynamics in various social contexts. In essence, the test serves as a valuable instrument for comprehending the intricacies of human personality and behavior.

Following are the mean score of personality traits through Radar Chart:

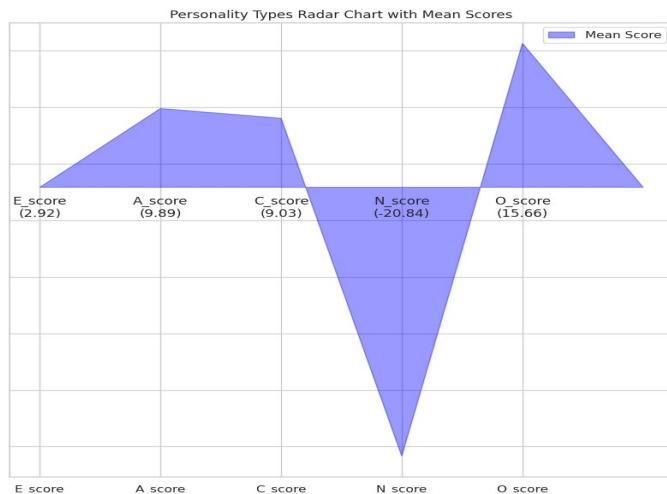


Figure o

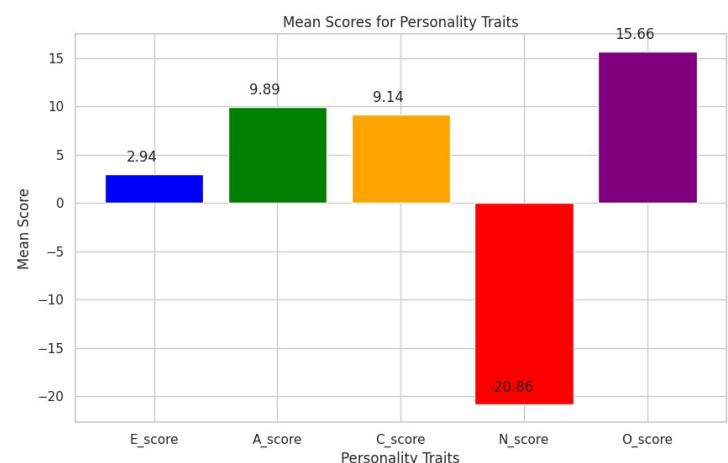


Figure p

Density is the degree of compactness of a substance, measured by the quantity of mass per unit volume of a substance 1.

In below figure, it displays density plots for five personality traits: Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness. Each plot shows the distribution of individual scores and the mean score for each trait. The x-axis represents the score ranging from -30 to 30, while the y-axis represents density values ranging from 0 to a maximum value that varies

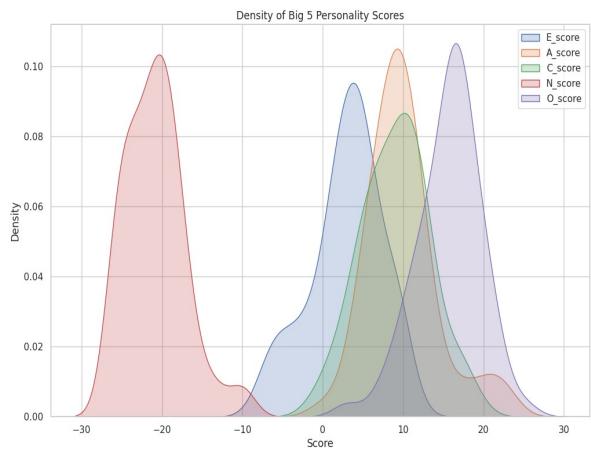


Figure r (Density)

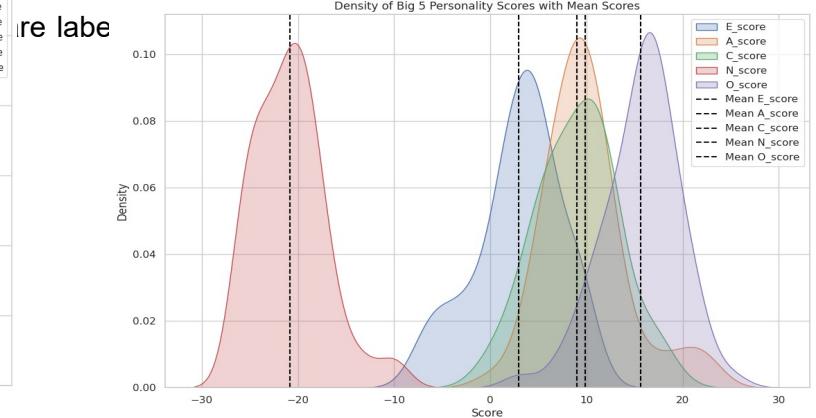


Figure s

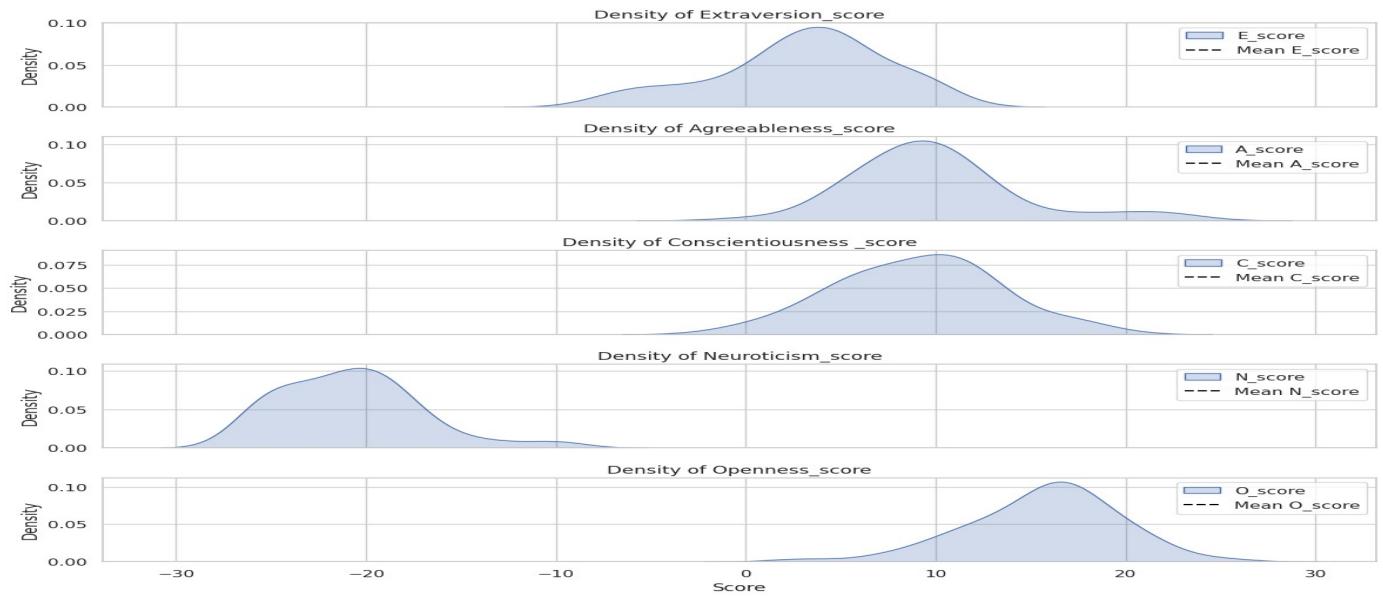


Figure t

different variables. The diagonal plots are histograms representing the distribution of scores for each variable individually.

- The image is a pairplot of personality traits including Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness. Each trait is plotted against each other to visualize correlations between them.
- There seems to be no strong correlation between most pairs of traits as the points are dispersed without forming a clear trend.
- A slight negative correlation might be inferred between Neuroticism and Agreeableness; as one increases, the other tends to decrease slightly. Same results shows below as Heat map.

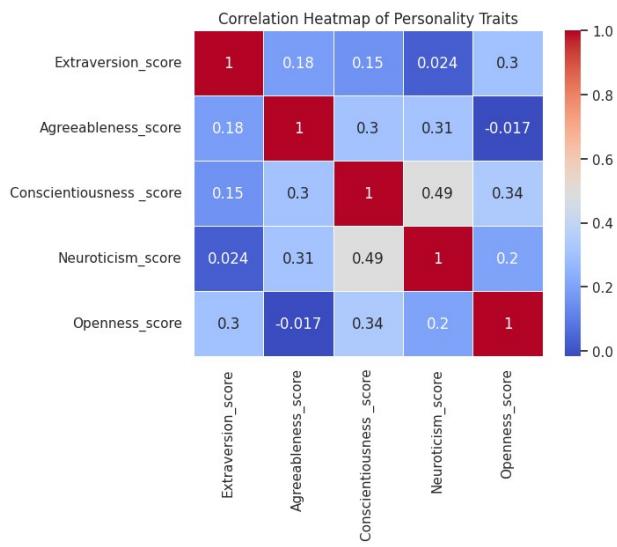


Figure w

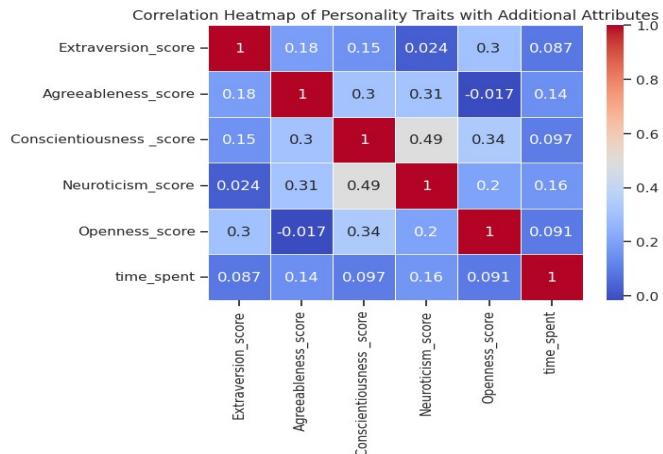
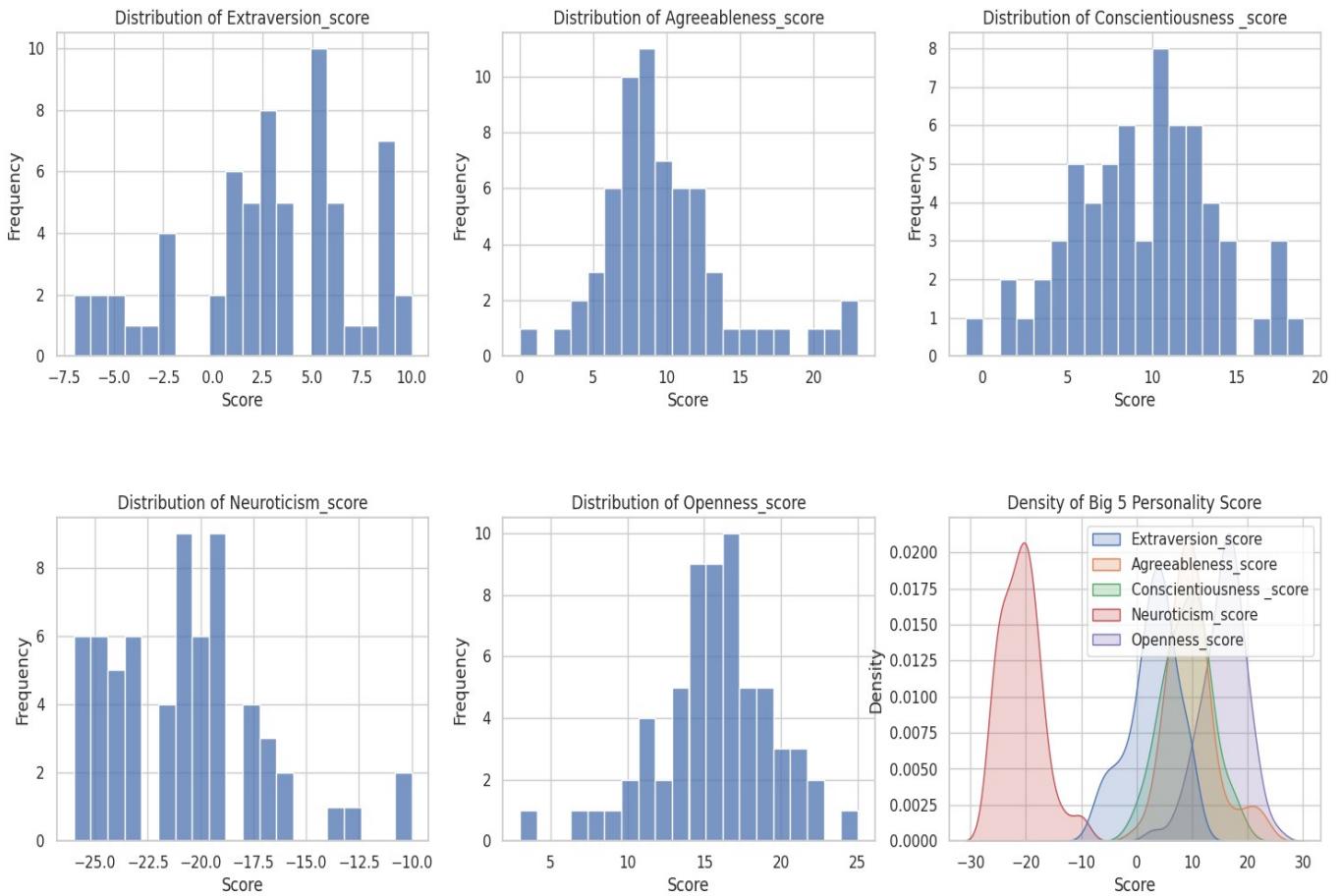


Figure x

4. Survey Results & Discussions:

4.1. Personality Scores:

- **4.1.1. Extroversion (E):** The analysis of Extroversion scores reveals a varied distribution with most participants scoring around 0 to 5. Participants scoring higher in Extroversion tend to be more outgoing and social, while those with lower scores may exhibit reserved and introverted behaviors.
- **4.1.2 Agreeableness (A):** In the realm of Agreeableness, participants demonstrated a concentration around scores of 10 to 15. Those with elevated Agreeableness scores tend to be more cooperative and compassionate, whereas lower scores may suggest critical and competitive tendencies.
- **4.1.3 Conscientiousness:** The examination of Conscientiousness scores showcases a broad distribution with peaks at both low and high ends of the scale. High scores in Conscientiousness typically correlate with being organized and dependable, while lower scores may indicate impulsiveness or lack of reliability.
- **4.1.4 Neuroticism (N):** The Neuroticism scores highlight a varied distribution but are concentrated around -20 to -15 and -10 to -5 score range. Participants scoring high in Neuroticism may experience emotional instability or anxiety, whereas those with lower scores might exhibit emotional stability and calmness.
- **4.1.5 Openness to Experience (O):** Analysis of Openness to Experience scores indicates a concentration around the middle range from about 10-20 score range. High scorers in Openness often embrace new experiences and ideas, while lower scorers may suggest preference for routine or conventional approaches.



4.2 Time Spent Distribution: The distribution of time spent completing the personality test is crucial for understanding participant engagement. A histogram depicting the time spent reveals out of 109 sample data, 65 spent time more than 4 minutes while filling the questionnaire. This information is vital for assessing the overall commitment and engagement level of participants.

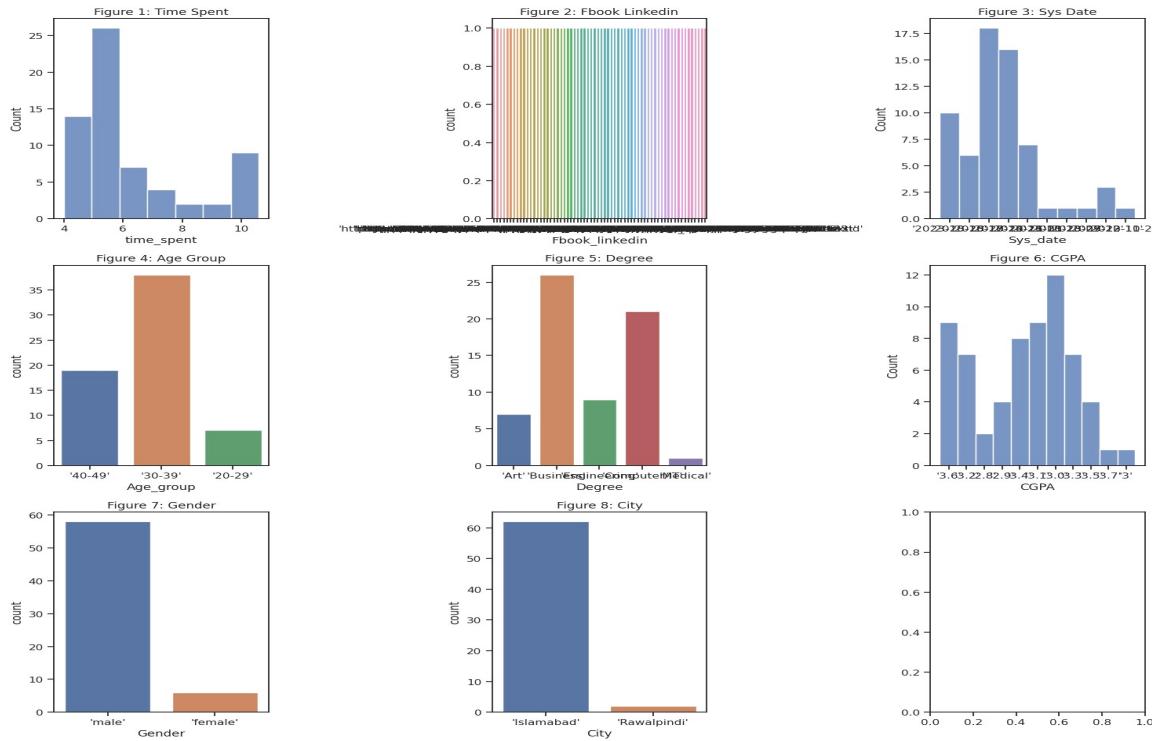
4.3 Demographic Analysis:

Here are the results based on the figure you provided:

- 4.3.1 Age Group:** Demographic analysis based on age groups illustrates a higher concentration of participants in the 20-29 age bracket. Different age cohorts may display distinct patterns in personality traits, with younger individuals potentially being more open to experience or adaptable. Age group of 30-39 years participated more compare to 40-49.
- 4.3.2 Education or Degree:** Exploring personality traits across educational backgrounds reveals diverse patterns of traits among different fields of study. Participants with a background in Engineering/Computer Science demonstrate specific tendencies in personality scores while Business related professionals participated more compare to other fields.

- **4.3.3 CGPA:** Correlating personality scores with CGPA provides insights into academic performance's potential relationship with certain traits. Higher CGPA scores may align with conscientiousness and discipline, while lower CGPA scores may indicate creativity and flexibility.
- **4.3.4 Gender:** Analyzing personality scores based on gender exposes variations between male and female participants. Gender-based differences in personality traits are evident in aspects like agreeableness or neuroticism. Males participated more than females.
- **4.3.5 City:** Examining personality traits in different cities unveils regional variations in trait distributions. Participants from Islamabad city may exhibit distinct patterns in personality characteristics.

Following is the frequency distribution of various columns highlighted as histogram:-



4.4. Data Visualization:

4.4.1. Boxplot Analysis:

Boxplot analysis serves as a powerful visual tool to understand the distribution of data, especially when examining outliers and central tendencies. In the context of our study, boxplots were created to analyze outliers with respect to time spent. The results revealed two extreme outlier was removed, and the remaining six outliers were adjusted by taking the mean score. Refer different stages performed and highlighted in the graphs above.

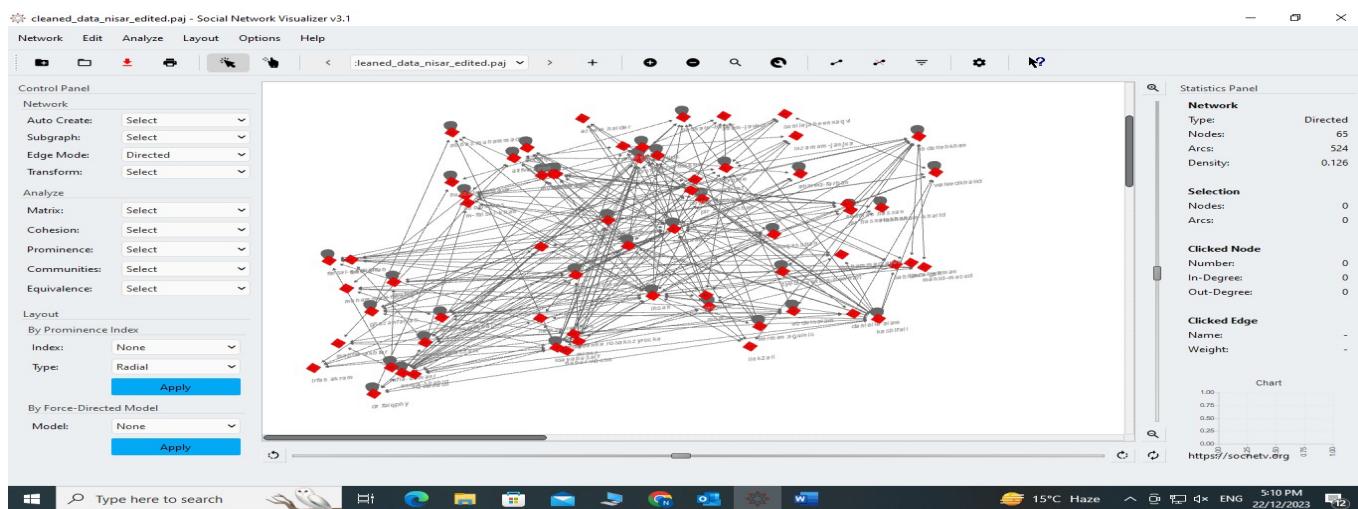
4.4.2. Radar Charts:

Radar charts offer a comprehensive visualization of multiple variables in a single graph. In our study, radar charts were employed to illustrate the personality scores across the Big Five traits. The radar charts indicate the mean scores highlighted in the figure 0 above.

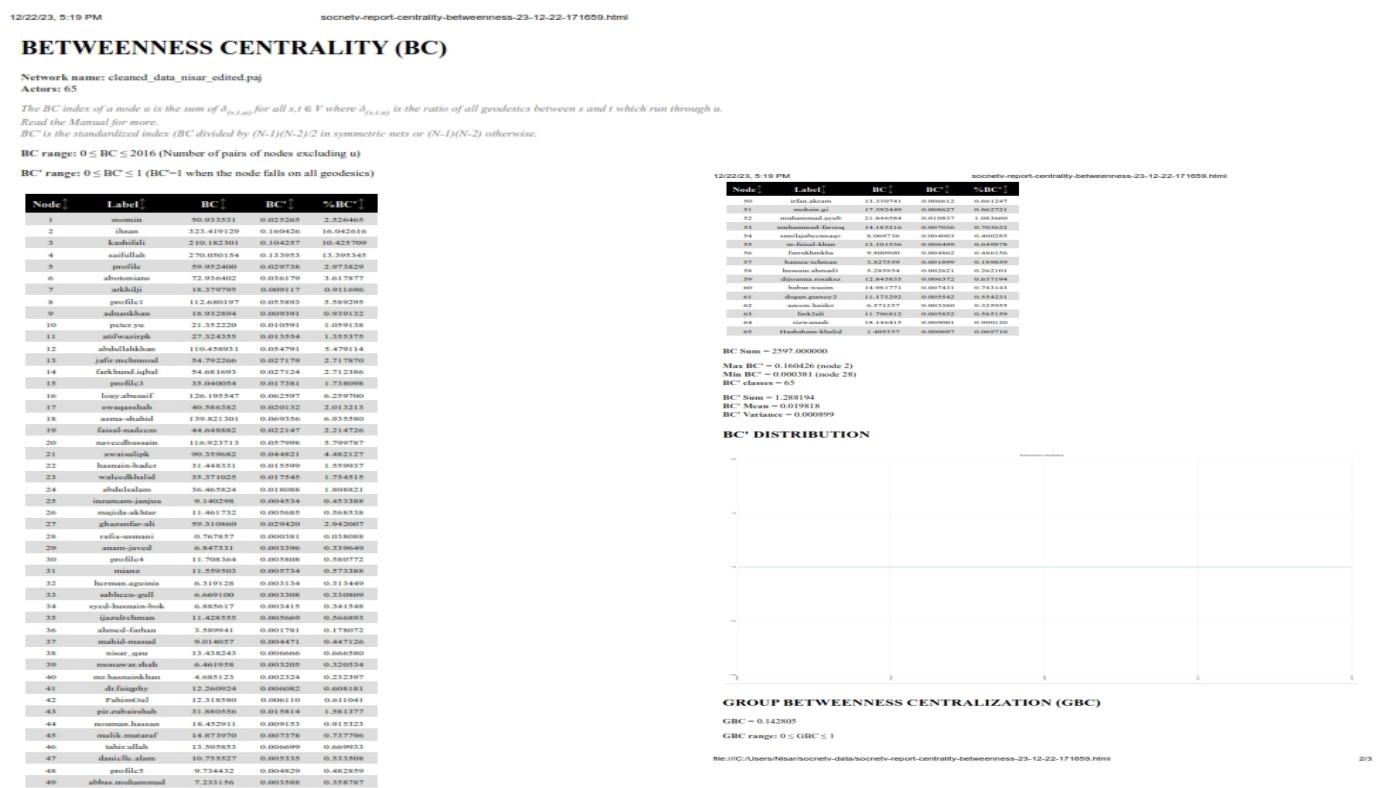
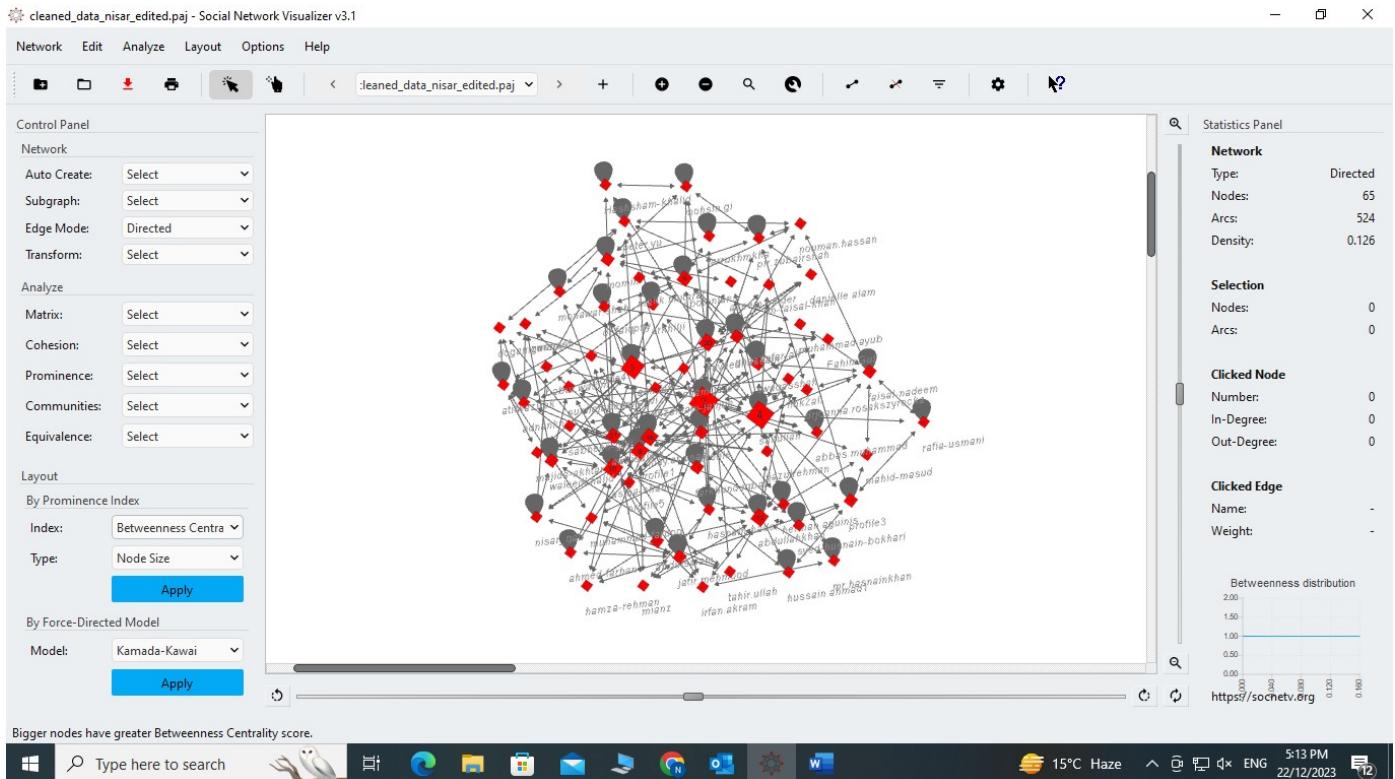
4.5. Network Graphs:

Network graphs visually represent relationships and connections within a dataset. In this study, network graphs were constructed to explore the associations between individual facebook and linkedin friends. The network graphs showcase 65 nodes with 524 arcs demonstrated in Social Network Visualizer (SocNetV) tool. Analyzed Betweenness Centrality, Closeness Centrality, Degree Centrality, Degree Prestige, IR Closeness Centrality, Page Rank Prestige, Power Centrality, Stress Centrality through Directed and Un-Directed graphs. Results are shown below.

4.5.1. General (Directed Graph)

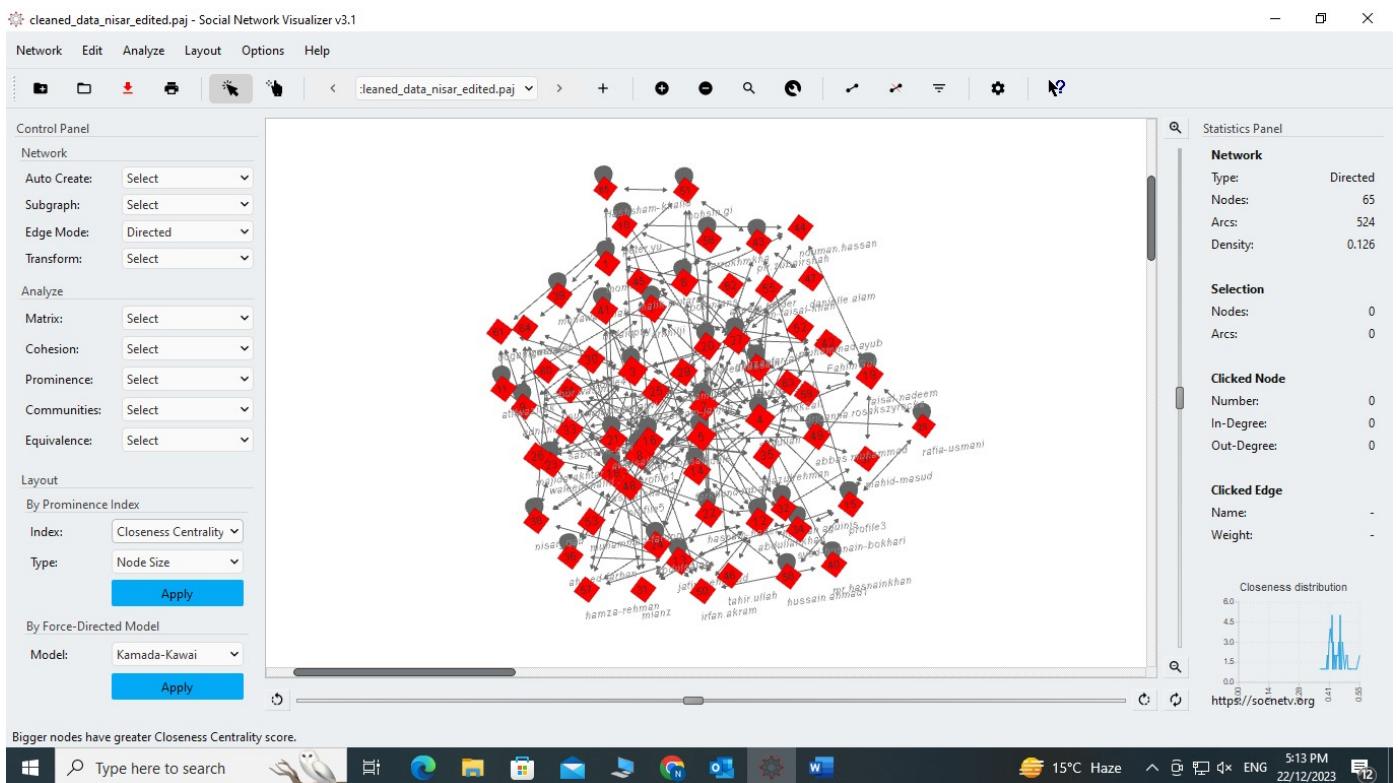


4.5.3. Betweenness Centrality



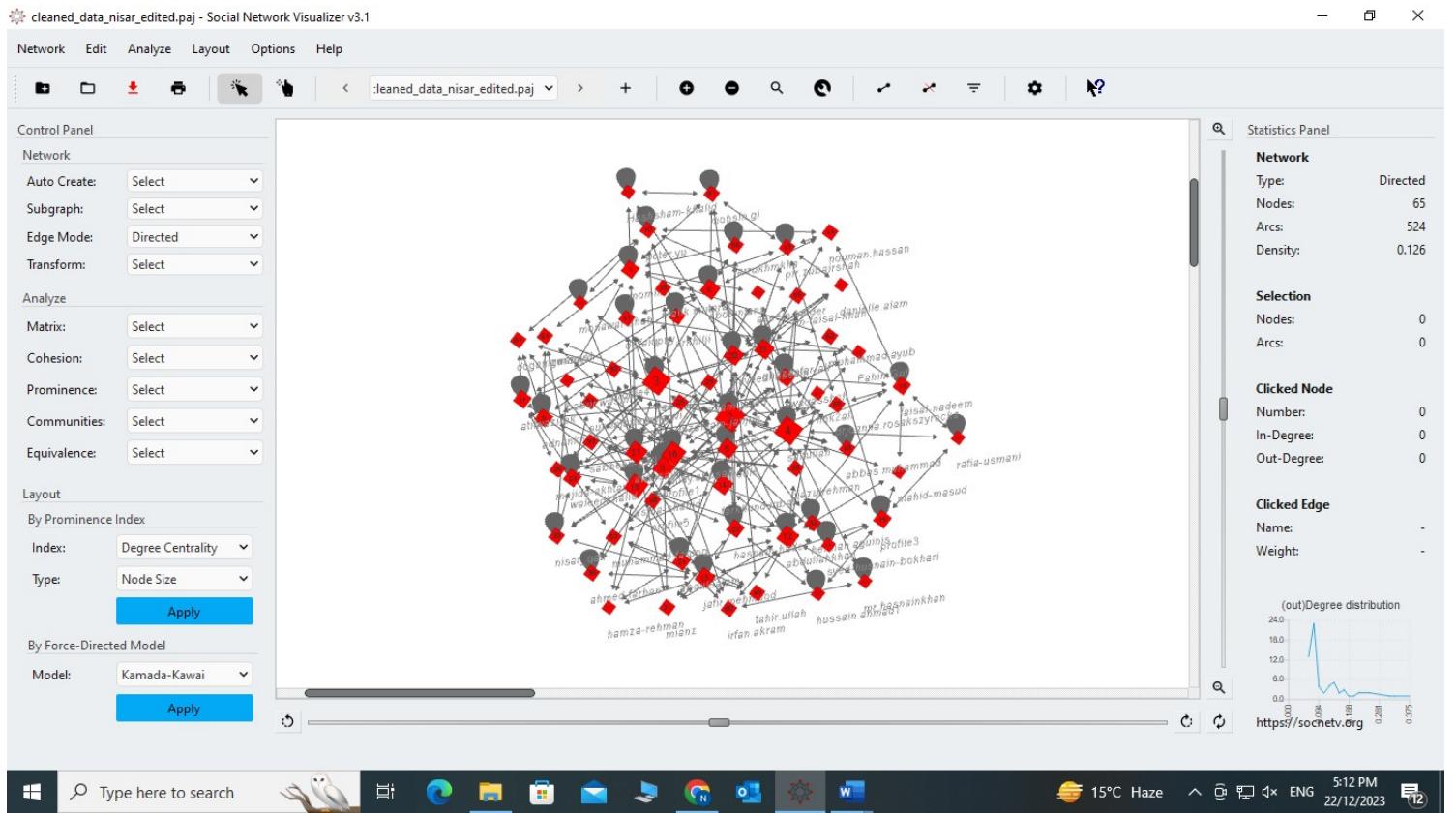
BC Sum = 2597.000000
Max BC' = 0.160426 (node 2)
Min BC' = 0.000381 (node 28)
BC' classes = 65
BC' Sum = 1.288194
BC' Mean = 0.019818
BC' Variance = 0.000899

4.5.4. Closeness Centrality



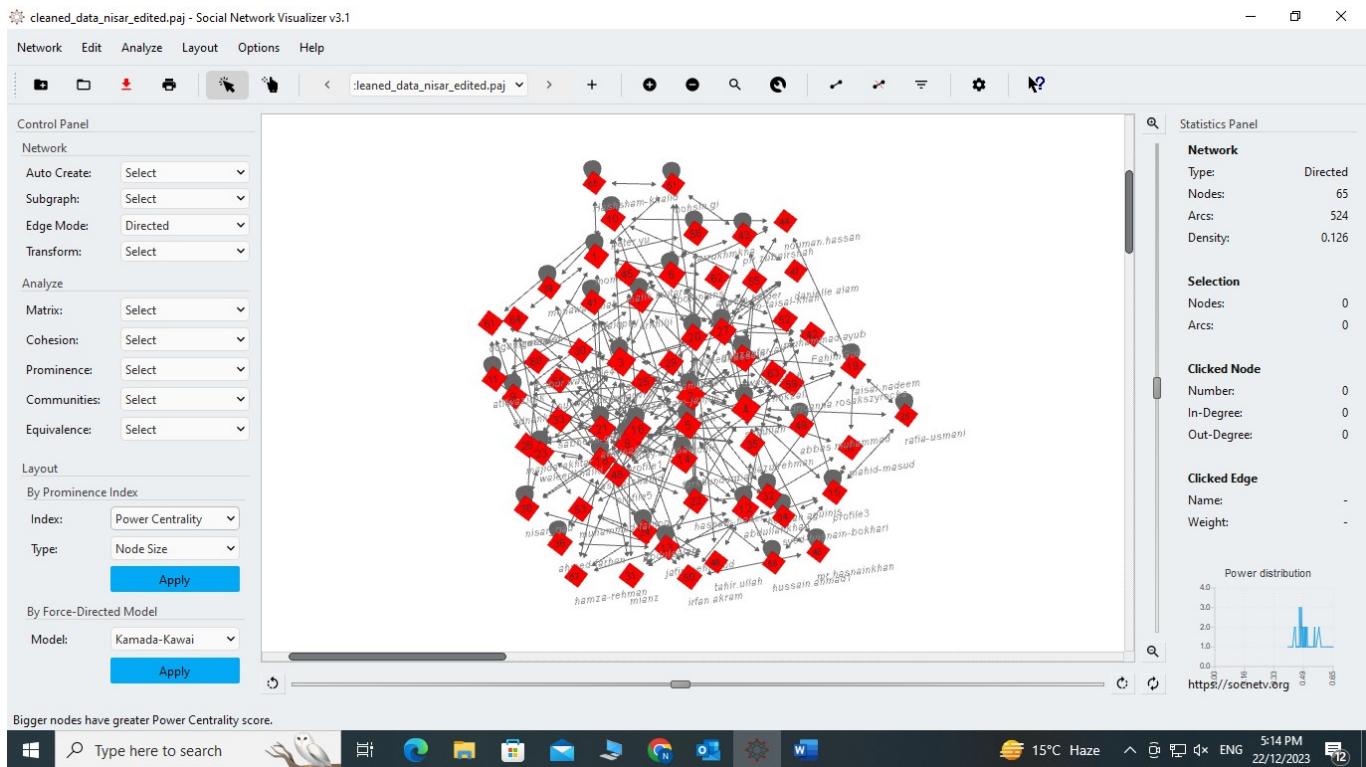
CC Sum = 0.454724
Max CC' = 0.551724 (node 2)
Min CC' = 0.372093 (node 65)
CC' classes = 34
CC' Sum = 29.102349
CC' Mean = 0.447728
CC' Variance = 0.001406

4.5.5. Degree Centrality



DC Sum = 485.000000
Max DC' = 0.375000 (node 2)
Min DC' = 0.062500 (node 28)
DC' classes = 15
DC' Sum = 7.578125
DC' Mean = 0.116587
DC' Variance = 0.004748

4.5.8. Power Centrality



PC Sum = 2058.500000
Max PC' = 0.651042 (node 2)
Min PC' = 0.402344 (node 65)
PC classes = 48
PC' Sum = 32.164062
PC' Mean = 0.494832
PC' Variance = 0.002356

4.5.9. CLIQUE CENSUS (CLQs)

Actors: 65

A clique is the largest subgroup of actors in the social network who are all directly connected to each other (maximal complete subgraph). SocNetV applies the Bron-Kerbosch algorithm to produce a census of all maximal cliques in the network and reports some useful statistics such as disaggregation by vertex and co-membership information.

Maximal Cliques found: 157

5. Conclusion: In conclusion, this study sheds light on the intricate interplay between personality traits and various demographic factors. The comprehensive analysis of Extroversion, Agreeableness, Conscientiousness, Neuroticism, and Openness to Experience scores, coupled with demographic correlations, provides a rich understanding of individual differences. These findings not only enhance self-awareness but also offer valuable insights for career guidance, facilitating more informed decisions. As individuals navigate their personal and professional journeys, recognizing the impact of personality on choices becomes instrumental for growth and success.