

## Validation of Career Choice Goals Scale on Indian Senior Secondary School Students using Network Psychometrics Approach

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### ABSTRACT

The 15 items Career goals scale developed by Graco (2016) was extended in the Indian context on 353 secondary school students and validated using network approach. While the default “*glasso*” approach of exploratory graph analysis (EGA) using “*EGAnet*” package of R 4.2.3 version, extracted two clusters, the “*TMFG*” approach extracted three factors, with both the networks having the same entropy estimate of -7.204. Following the principle of parsimony (Vandekerckhove et al., 2015), the two clusters network structure was retained, and also since it was in line with the original work of Seibert et al., (2013). Unique variance analysis did not report any node redundancy. The structural consistency estimates obtained of the “*extrinsic*” and “*intrinsic*” clusters, using “*bootnet*” package, were acceptable at 0.622 and 0.948 respectively. The package “*mgm*” was used to compute node predictability and “*qgraph*” package plotted the same. The ordinal confirmatory factor analysis using “*WLSMV*” estimator found acceptable goodness of fit estimates (cfi.robust=0.949; tli.robust=0.939; srmr\_bentler=0.038; rmsea.robust=0.061). The “*LASSO and EBIC*” techniques based regularized network structure and centrality indices plots were obtained. The edge weight accuracy confidence interval plot was found to be non-significant indicating trustworthy ordering of the edge weights in the network, obtained through the comparison of sample and bootstrapped data for 500 iterations. The correlation stability CS coefficient was above the minimum benchmark strength-wise at 0.283, obtained using “*qgraph*” package. The package “*psychTools*” provided the edge difference and the node difference plots. The educational and psychometric implications of

the findings with respect to the construct career choice goals and its literature are discussed.

**Keywords:** *Career Goals Scale, Career Choice Goals, Exploratory Graph Analysis (EGA), Network Approach, Ordinal Confirmatory Factor Analysis, Structural Consistency*

### **Introduction:**

The “*Social Cognitive Career Theory SCCT*” developed by Lent et al., (1994) is the vocational psychology analogue of the “*Social Cognitive Theory*” by Bandura (1986, 1997). The theory explains the interrelationship among various study related and work choice related decisions made by adolescents and young adults. Central to the parent theory is the variable of self-efficacy (Bandura, 1977) which was found to be associated with a host of variables associated with the academic and vocational enterprises (Hackett and Betz, 1981; Hackett, 1981) of the young individuals (Sheu et al., 2010; Betz, 2008; Lent, 2005; Swanson and Gore, 2000). One such variable of interest is the choice goals. The choice model of the SCCT mentions that individuals set goals to be after purposeful academic and vocation related tasks which are congruent to their interest, self-efficacy and expectations on the outcome of their choice actions. This aspect is also heavily influenced by the support or impediment received from the immediate environment of the subjects either socially or financially.

Literature on choice of career goals (Greenhaus, 2006) and tools to measure the same are very scarce especially in the Indian context. Seibert et al., (2013) developed a scale to measure this construct comprising of two factors, intrinsic and extrinsic career goals and 10 items based on the a strong theoretical underpinning (Deci and Ryan, 2000; Button, Mathieu and Zajac, 1996). But, less number of items per factor impacted the reliability of the scale. It was recommended that future studies develop a lengthier scale. Also, the wordings of the items 1, 5 and 8 required modification. Graco (2016) then developed the 15 items scale to measure career goals, addressing the limitations of Seibert et al., (2013) study. However, the scale extracted three dimensions, intrinsic, extrinsic and status, while developing the extended scale, and expressed lack of clarity on the extracted dimensions. Extrinsic and status were found to be highly correlated suggesting the original two dimensional factor structure of Seibert et al., (2013) study to be more valid.

The present study adopted the strengths of both the studies, administered the 15 items career goals scale on a fresh population of secondary school students, and applied

network approach based exploratory factor analysis (EGA) to extract factors. This exercise also addressed the limitations of both the studies simultaneously. While increased length of the scale enhanced the chances of obtaining better reliability estimates, application of state of the art factor extraction technique in the form of EGA, could put to rest the concerns regarding the actual dimensions of the construct career goals.

Also, a construct is either assumed to be either reflective or formative in its structure. In the former case, the latent variable reflects itself through its factors or dimensions which itself get reflected in their respective indicators which are the manifest variables. Here, the manifest variables are themselves assumed to be non-interaction with each other and are supposed to interact in their own right with their respective factor (Flores-Kanter et al., 2021). However such a perspective can be completely faulty. Instead, a construct by itself could be conceived as an outcome of a set of interconnected elements, making up a system with the construct being a network of these elements (Schmittmann et al., 2013). This fresh perspective also considers the data type of Likert-scale based questionnaire's data to be ordinal and employs appropriate correlation technique of polychoric correlation for the formulation of the clusters or factors in the network made up of nodes and edges (Epskamp, 2016).

The merits of the above mentioned aspects made it necessary to refine the career choice goals scale developed by Seibert et al., (2013) and modified by Graco (2016), in the Indian context, by extending the validation of the scale on a fresh and pertinent population of higher secondary school students (Witko et al., 2005).

## **METHODOLOGY**

### ***Sample and Procedure of Data Collection:***

The sample of the study comprised of 353 senior secondary school students from Agartala and its surrounding cities from the Indian state of Tripura. 169 participants (47.74%) were girls and 184 of them were boys (51.97%). 80 students (22.59) studied arts in 11<sup>th</sup> standard, 206 of them (58.19%) studied the same discipline in 12<sup>th</sup> standard. 43 subjects (12.14 %) studied science in 11<sup>th</sup> standard and 16 students (4.51%) pursued the same discipline in 12<sup>th</sup> standard. Only 8 students (2.25%) from commerce stream of 12<sup>th</sup> standard were the participants of the study. The average of the subjects was 16.5 years. Permission for data collection from schools of the region for the intended research was approved by the Director of secondary board education, Tripura state. The research work had the approval of the ethics committee of the university. The researcher personally

visited the schools of the regions and explained the purpose of the visit to the students. The head of the institution and the teacher in the class helped the researcher in the collection of the data during regular classroom session. All students voluntarily participated in the study after getting assured with the purpose of the data collection and anonymity of the data. The physical copies of the questionnaires were finally distributed to the subjects and they returned the filled forms in 15 to 20 minutes. The total sample size was 354 with no missing values.

### ***Instrument:***

The instrument used to measure career goals was developed by Graco (2016) as part of her Ph.D. work to address of the shortcomings of the original 10 items scale with two dimensions, intrinsic and extrinsic goals, developed by Seibert et al., (2013). The 15 items of the scale were divided into three dimensions, namely, intrinsic goals, extrinsic goals and status. The dimension "Status" was separately extracted from the dimension extrinsic goals. The first three items belonged to the dimension of extrinsic goals. The next five items belonged to status dimension and the remaining eight items belonged to intrinsic goals. The responses of the subjects were recorded using a five point Likert scale where 1 = strongly disagree and 5 = strongly agree. Sample items of scale belonging to each of the three factors are "*It is important to me to achieve financial success in my career*", "*It is important for me to be seen by others as a success in my career*", and "*It is important for me to continue to learn and grow over the course of my career*", respectively.

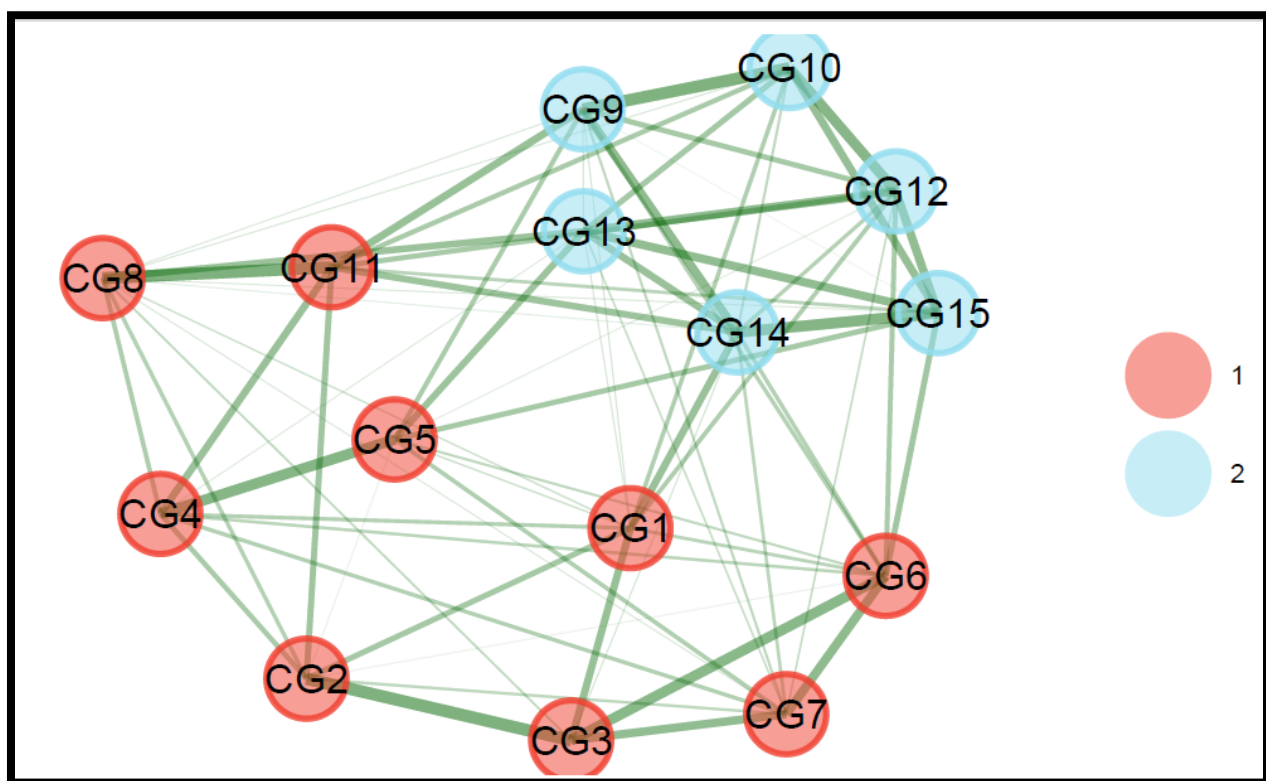
### ***Statistical Analysis***

The complete data analysis was conducted using the openware R core team (2016) / RStudio Ver. 4.2.3. Initially, the item analysis was conducted to look for redundancy of nodes in the scale using Unique variance analysis through the "*EGAnet*" package. It was followed by dimensional analysis or extraction of the clusters from the obtained data using the default "*glasso*" and the "*TMFG*" approaches of exploratory graph analysis for resolution of the structure of the nature through entropy estimates of both the approaches of EGA. The stability of the network was estimated using structural consistency exercise using the "*bootnet*" package. The package "*mgm*" was used to compute node predictability using  $R^2$  estimand and "*qgraph*" package plotted the same. The ordinal confirmatory factor analysis using "*WLSMV*" estimator was used to estimate the goodness of fit estimates. The "*LASSO and EBIC*" techniques based regularized network structure provided the final network structure. The characteristics of the accuracy and stability of the network were estimated through centrality indices plots, the edge weight accuracy confidence interval plot through

the comparison of sample and bootstrapped data for 500 iterations and through the estimation of correlation stability *CS*-coefficient using “*qgraph*” package. The package “*psychTools*” provided the edge difference and the node difference plots.

## RESULTS

In order to ensure mutualism of the nodes instead of shared variance between them (Mullen and Jones, 2021), unique variance analysis test (Christensen, Garrido and Golino, 2020) was conducted. None of the 15 nodes displayed redundancy with their weighted topological overlap (*wTO*) (Zhang and Horvath, 2005) below 0.2 when unique variance analysis test was conducted on the completed data.



*Fig. 1:* Network Structure of the Career Choice Goal Scale using glasso method on the first run of Exploratory Graph Analysis (EGA)

Node 11 belonging originally to intrinsic goals dimensions displayed split loading and loaded with the nodes of extrinsic goals dimension, and hence was deleted to re-run the EGA (Golino and Demetriou, 2017). Prior to conducting the EGA, since the node deletion exercise impacted the morphology of the construct’s network, the unique variance analysis test was again conducted on the data of the remaining 14 nodes or items of the scale. No node / item was found to be redundant. It was followed by a re-run of the Exploratory

graph analysis to extract the clusters of the construct career choice goals using glasso method.

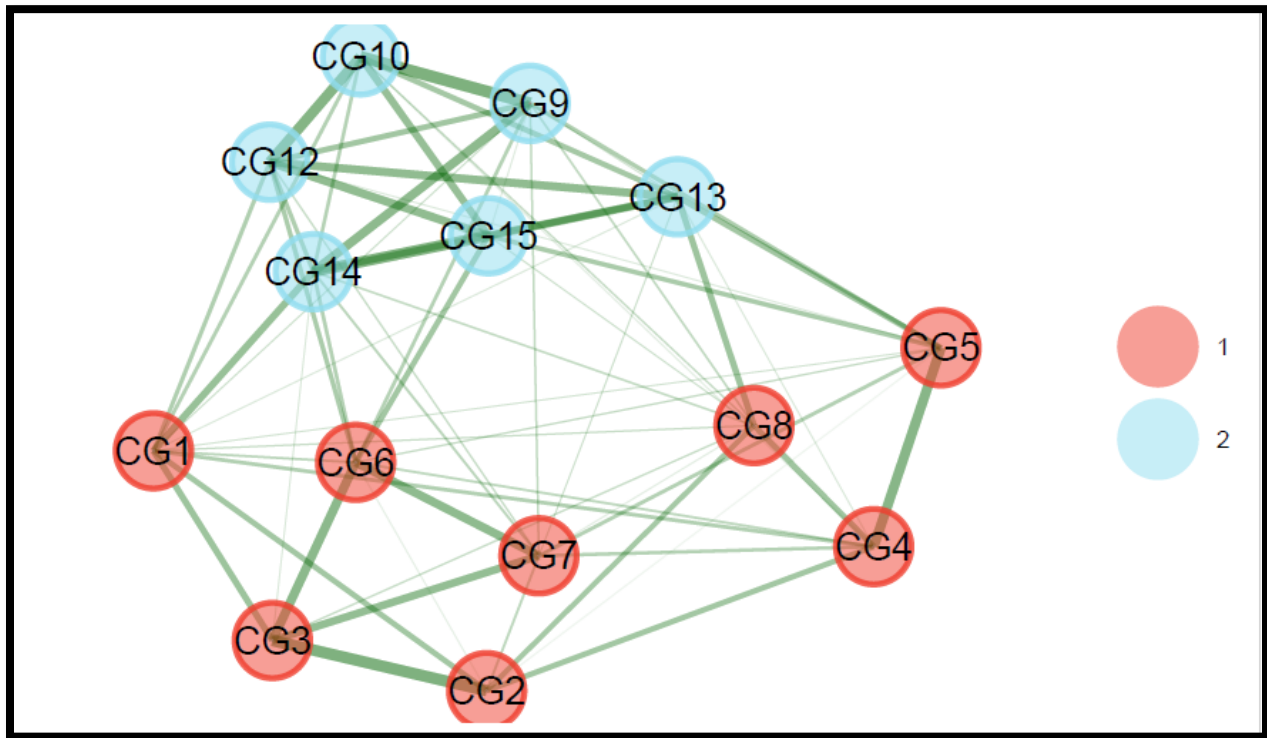


Fig. 2: Network Structure of the Career Choice Goal Scale using glasso method on rerun of Exploratory Graph Analysis (EGA)

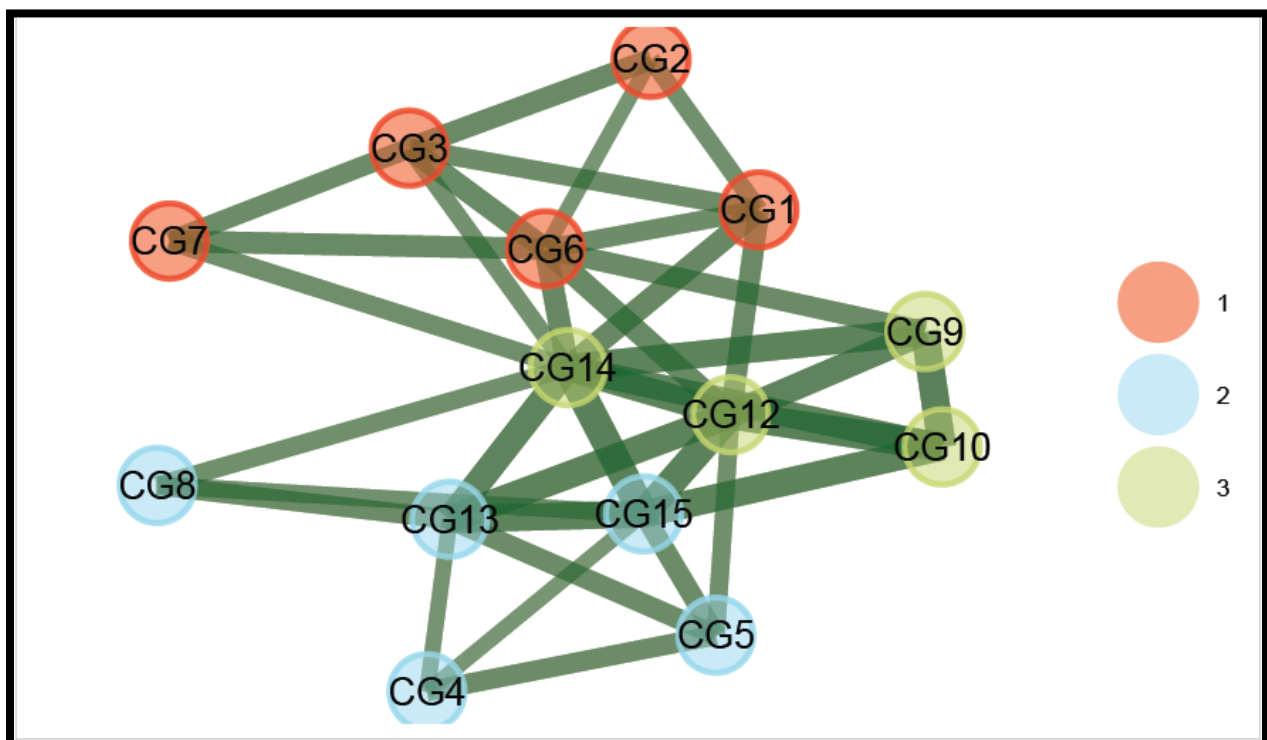


Fig. 3: Network Structure of the Career Choice Goal Scale using *TMFG* method of Exploratory Graph Analysis (EGA)

While the default “*glasso*” approach of exploratory graph analysis (EGA) extracted two clusters Gaussian graphical model network, the “Triangulated Maximally Filtered Graph *TMFG*” approach (Massara et al., 2016; Christensen et al., 2018) extracted three clusters network with both the networks having the same entropy estimate of -7.204. Giving preference to the principle of parsimony during model comparison (Vanderkerckhove et al., 2015) and owing to its strong theoretical underpinning (Deci and Ryan, 2000; Button, Mathieu and Zajac, 1996; Amabile, Hill, Hennessey and Tighe, 1994; Hackman and Oldham, 1980; Seibert, 2013), the two clusters representing the involved latent variables (Golino and Epskamp, 2017), in the network structure of career choice goals construct was chosen for further analysis. Also, one of the limitations of the study by Greco (2016) was the lack of clarity on the separate existence of the dimension status from the dimension External goals.

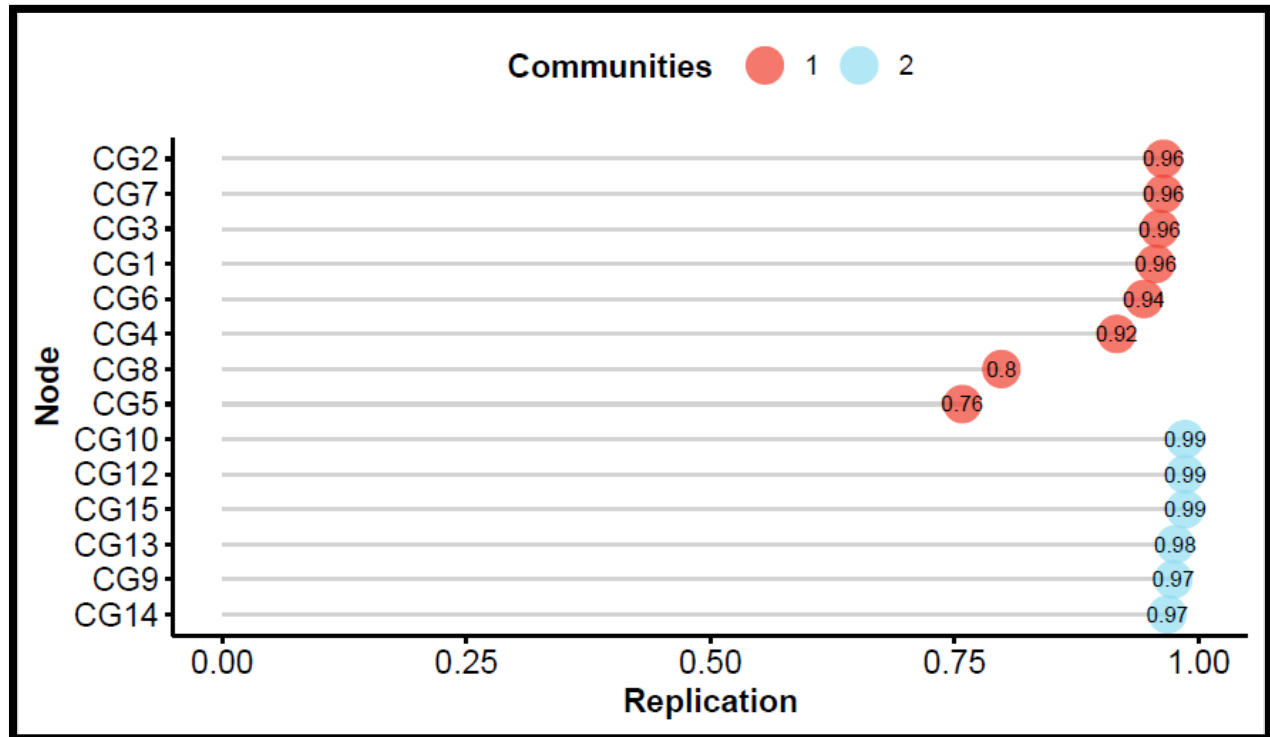


Fig. 4: Structural Consistency of the Career Choice Goal Scale Network

All nodes of the intrinsic career goals nearly loaded on their respective cluster retaining their intactness when compared in the 500 iterated bootstrapped samples.

However, certain nodes of the cluster extrinsic career goals like the node 5 and 8 displayed intactness with their cluster relatively lesser times at 76% and 80% respectively. Overall, the structural consistency (Christensen et al., 2020) of the intrinsic career goals cluster with nodes 9, 10, 12, 13, 14 and 15 was 0.948. It implies that all these nodes of the second cluster displayed nearly 95% of structural intactness when searched in multiple bootstrapped samples generated from the original sample data. However, this estimate for the first cluster extrinsic career goals with nodes 1, 2, 3, 4, 5, 6, 7 and 8 under it was 0.622, indicating display of intactness of the nodes with their cluster for 62% times.

**Table 1: Estimation of Node Predictability:**

S.No.	Item	R <sup>2</sup>
1	CG1	0.324
2	CG2	0.228
3	CG3	0.29
4	CG4	0.239
5	CG5	0.271
6	CG6	0.336
7	CG7	0.28
8	CG8	0.249
9	CG9	0.401
10	CG10	0.447
11	CG12	0.457
12	CG13	0.389
13	CG14	0.453
14	CG15	0.461

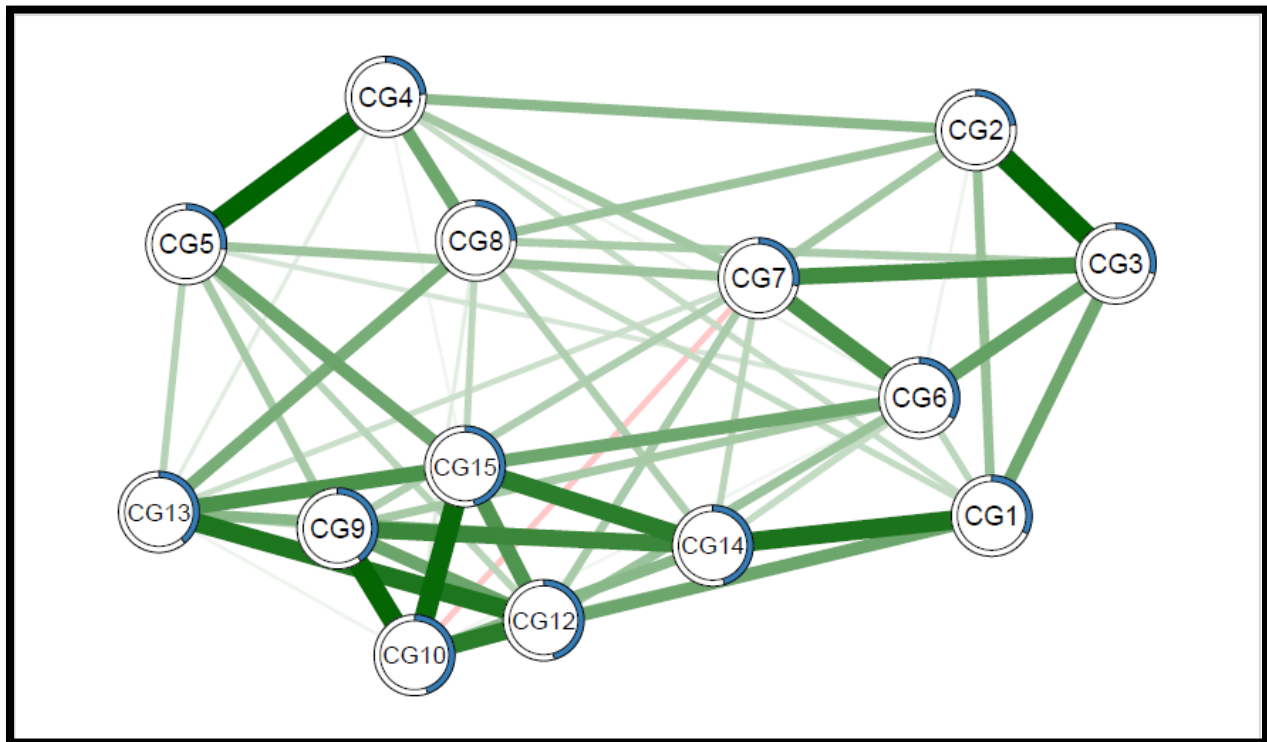


Fig. 5: Node Predictability Plot of the Career Choice Goal Scale Network

Node predictability (Mullen and Jones, 2021; Haslbeck and Waldorp, 2018; Haslbeck and Fried, 2017) was estimated using “*mgm*” package (Haslbeck and Waldorp, 2020) and plotted using “*qgraph*” package, which represented the extent of variance in a node by all other nodes surrounding it in terms of the estimand  $R^2$ . Node 12 emerges as the most important element in the network with 45.7% of its variance explained by the nodes surrounding it as shown in Table 1. Nodes 7 and 10 shared a negative relationship between them. Nodes of the cluster “intrinsic choice goals” were very strongly related to each other, in comparison to the nodes of the cluster “extrinsic choice goals”.

Table 2: Goodness of Fit Estimation of based on Network Loadings:

S.No.	Estimand	Benchmark of the Estimand	Standard MI based Estimate	Robust WLSMV based Estimate	Remark on Goodness of Fit
1	CFI	0.95	0.996	0.949	Good
2	TLI	0.95	0.996	0.939	Good
3	RMSEA	0.08	0.032	0.061	Good
4	SRMR	0.05	0.047	0.038	Good

All the obtained estimates on treating the data to be interval and ordinal data type reveal fine goodness of fit, with their values satisfying the accepted benchmarks, indicating an overall robustness of the obtained network and its loading as shown below:

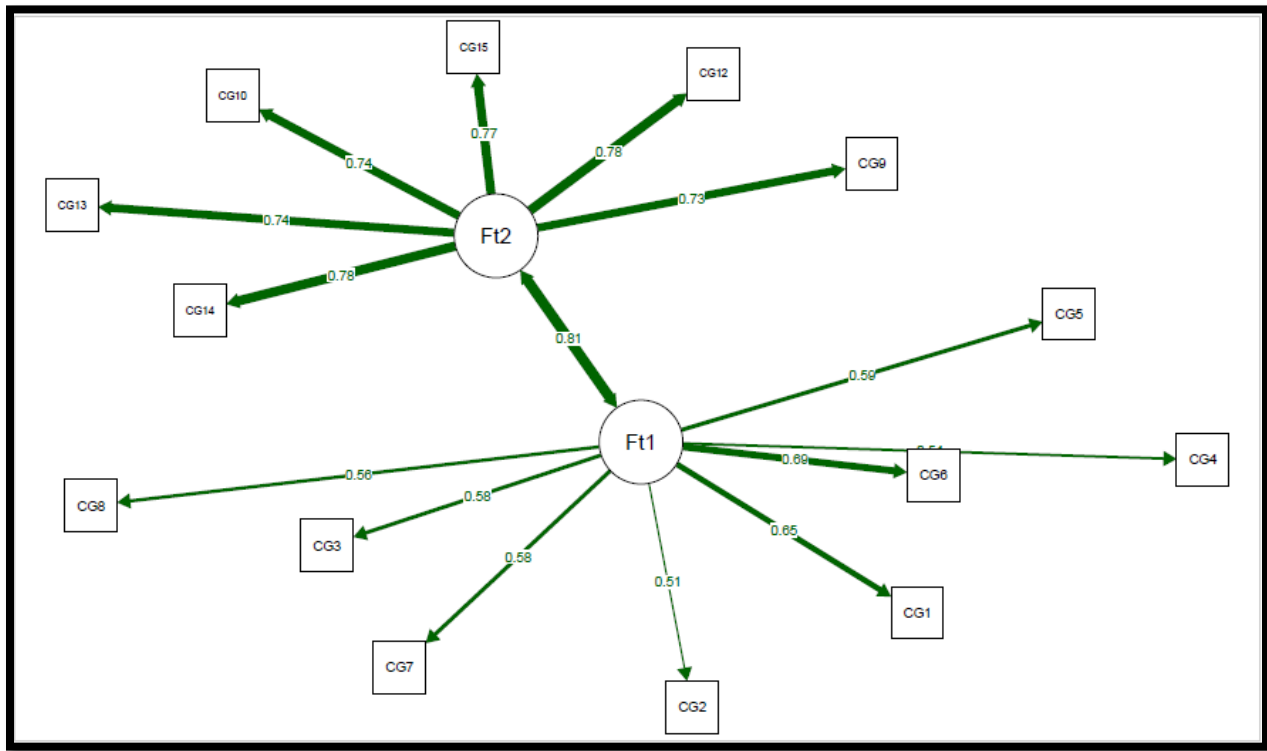


Fig. 6: Network Loadings Plot of the Career Choice Goal Scale

Both the clusters are strongly related to each other through a loading of 0.81. Nodes 1 to 8 belonging to the cluster extrinsic career choice goals and nodes 9, 10, 12, 13, 14 and 15 of the cluster intrinsic career choice goals displayed the following loadings:

Table 3: Network Loadings of the Career Choice Goals Network:

S.No.	Cluster	Node	Loading
1	<i>Extrinsic Choice Goal</i>	CG1	0.65
2		CG2	0.51
3		CG3	0.58
4		CG4	0.54
5		CG5	0.59
6		CG6	0.69
7		CG7	0.58
8		CG8	0.56
9	<i>Intrinsic Choice Goal</i>	CG9	0.73
10		CG10	0.74
11		CG12	0.78
12		CG13	0.74

13		CG14	0.78
14		CG15	0.77

The regularized network structure obtained through the “EGICglasso” technique finally revealed the morphology of the network as shown below:

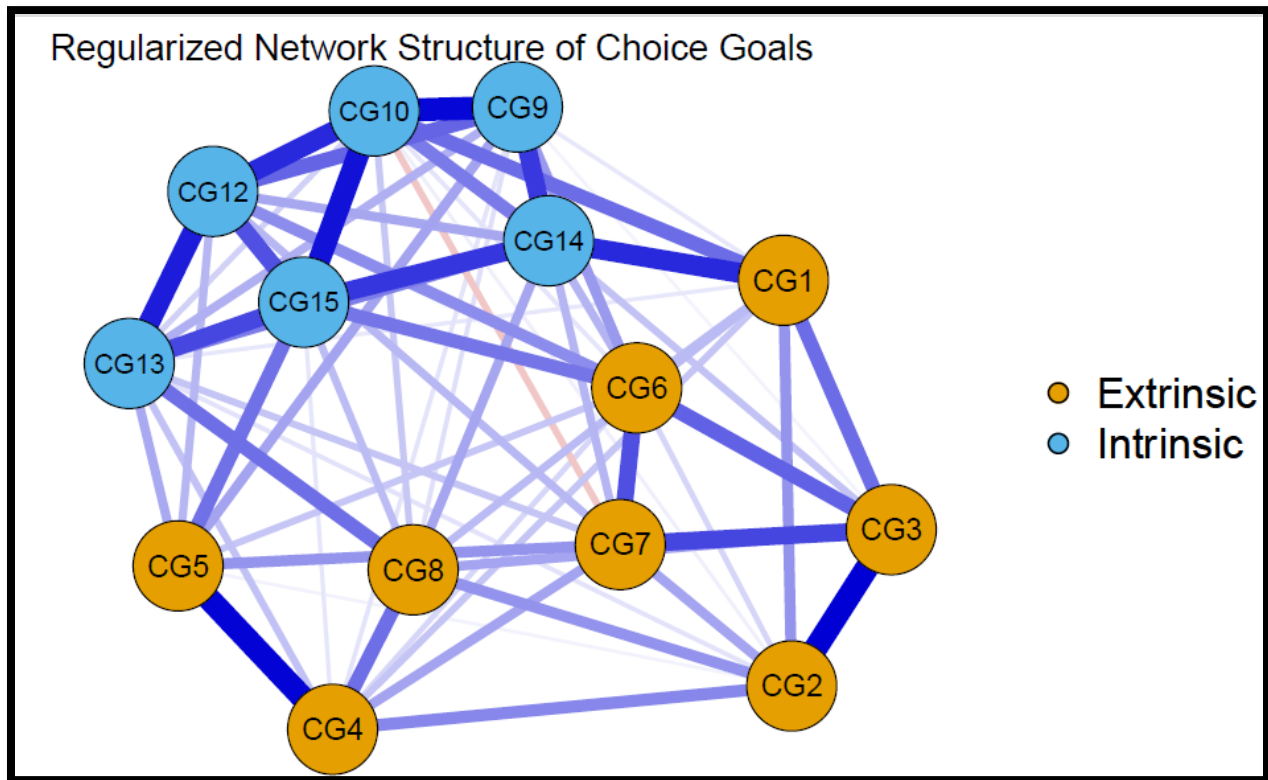


Fig. 7: Regularized Network Structure Plot of the Career Choice Goal Construct

The characteristics of the network through the estimands of Centrality indices like strength, closeness, betweenness and expected influence graphically are shown below:

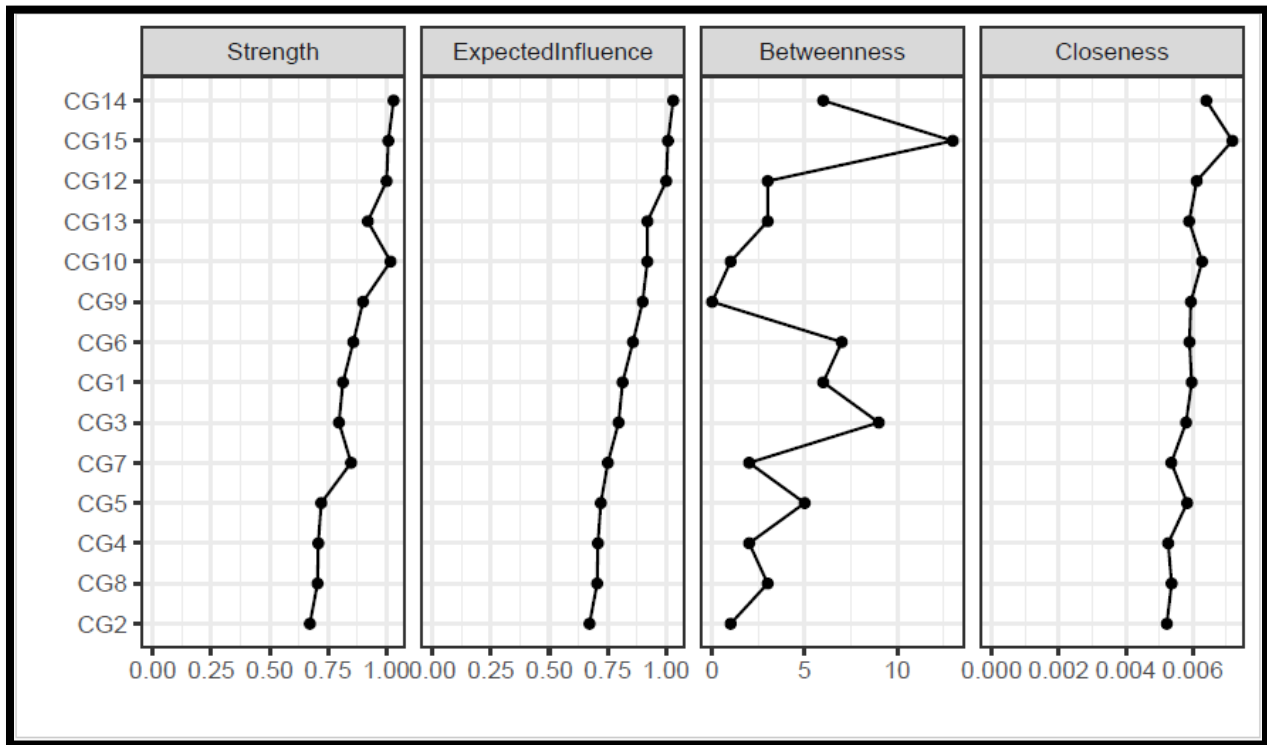
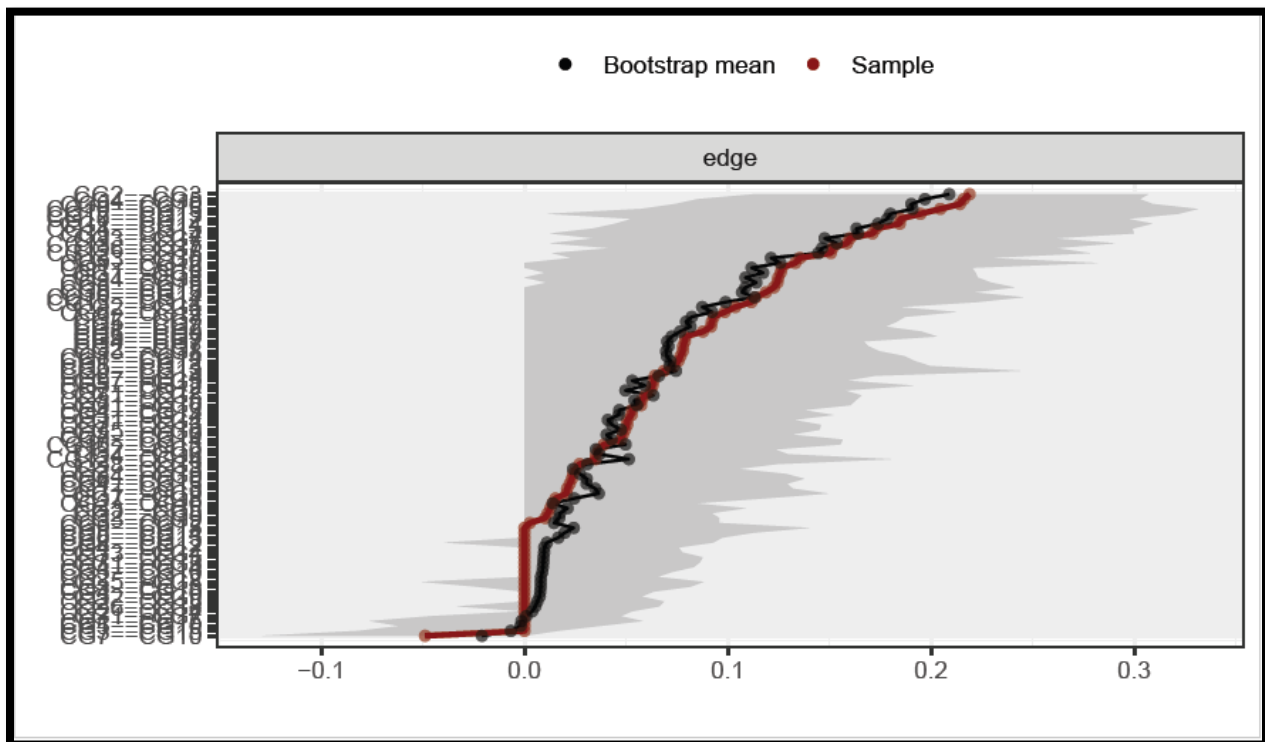


Fig. 8: Centrality Indices Plot of the Career Choice Goal Construct

The direct and indirect connectivity of nodes of the network with their surrounding nodes in the network as quantitatively observed from the estimates of strength and closeness reveal the relative robustness of the network’s basic properties. The accuracy of the ordering of the edges of the network for 95% confidence interval obtained through the comparison of these ordering in the sample and bootstrapped data is graphically shown below:



*Fig. 9:* Edge Weight Accuracy Confidence Interval Plot of the Career Choice Goal Construct

From the figure 9, we observe that the lower bound of the confidence interval is -0.1 and its upper bound is 0.1 and hence the value zero is within this interval, indicating a non-significant result obtained from the edge weight accuracy estimation exercise. This non-significant result indicates that there is not much difference between the ordering of the edges, in decreasing order of their strength, obtained from the sample data and the bootstrapped data. Hence, the ordering of these edges in the network can be expected to be replicable in future studies. The edge connecting the node 2 with node 3 is the strongest in the network. Node 7 of cluster 1 and node 10 of cluster 2 are negatively correlated. Further clarity can be obtained from the edge difference test plot shown at the end of the result section.

The stability of the network can be graphically and quantitatively studied through the correlation stability plot and the Correlation-stability CS coefficient, as discussed below:

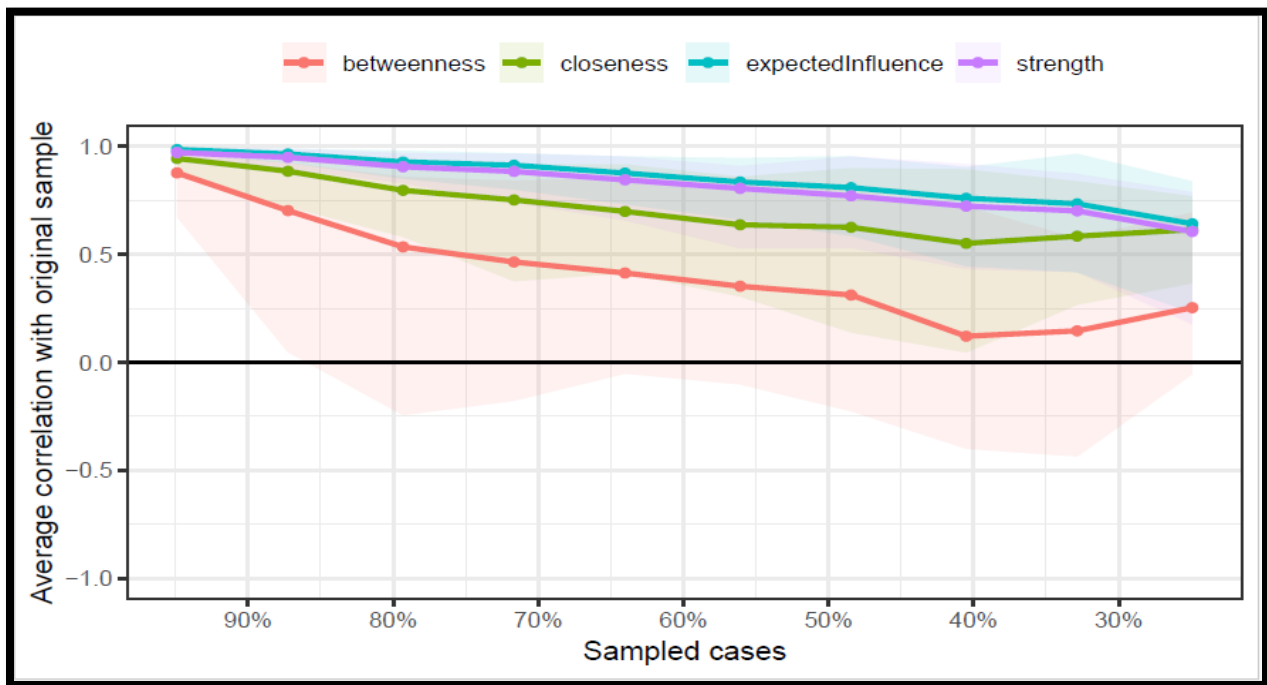


Fig. 10: Correlation Stability Plot of the Career Choice Goal Construct

The correlation between the network obtained from 353 sample subjects (100% cases) and the network obtained on successively reducing the cases or subjects of study is computed under the “*case-dropping*” technique with respect to the strength characteristic of the network. There is a steady decline in the correlation on reducing the sample size as since the obtained CS-coefficient is 0.283 which is just above the minimum acceptable benchmark of 0.25-0.5 (Epskamp and Fried, 2018).

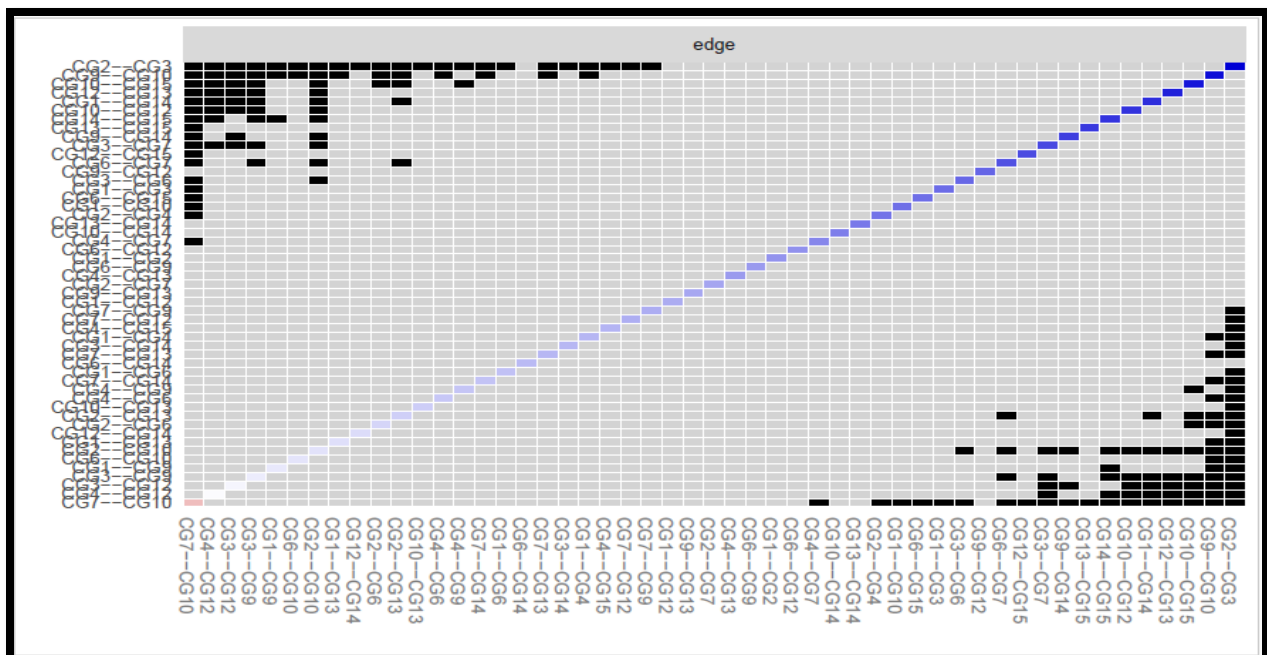


Fig. 11: Edge Difference Test Plot of the Career Choice Goal Construct; Black boxes represent significant differences between the edges; Grey boxes represent the non-significant differences between the edges; the blue boxes in the diagonal of the matrix represent the edges in the decreasing order of their strength. The edge connecting the node 2 with node 3 is the strongest in the network. Node 7 of cluster 1 and node 10 of cluster 2 are negatively correlated.

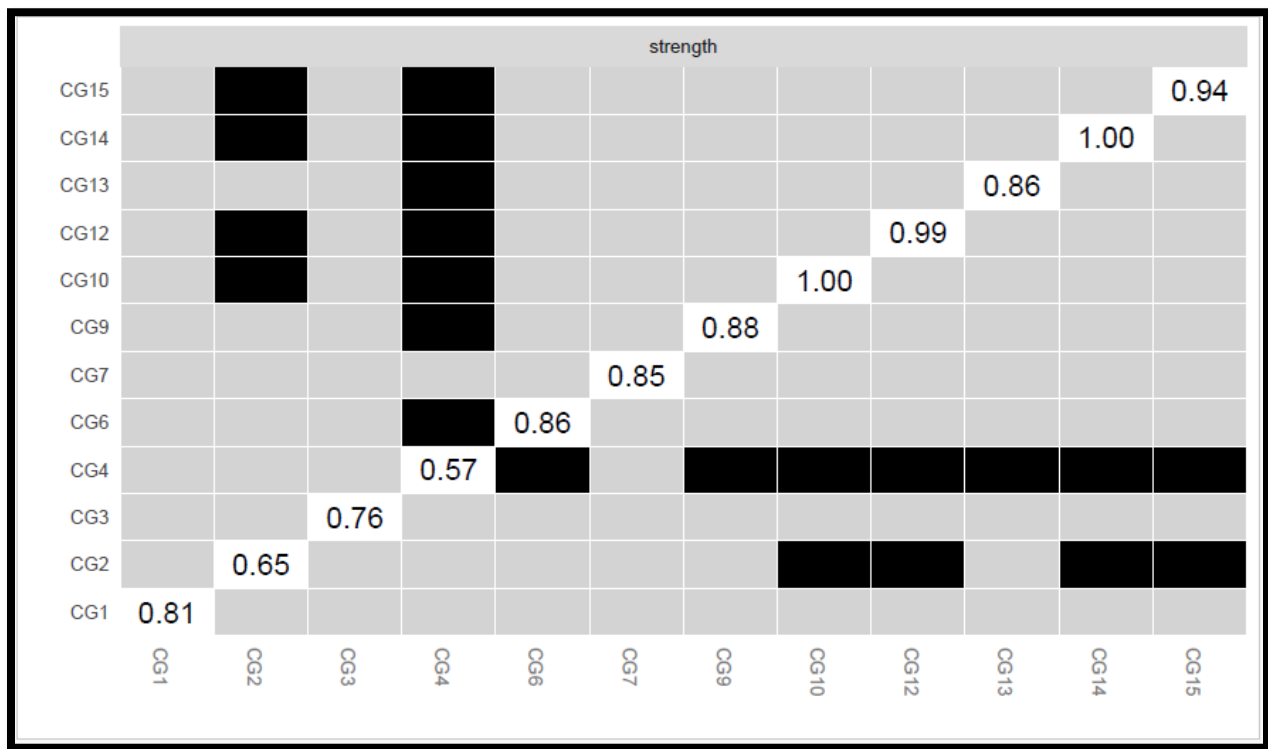


Fig. 12: Strength-wise Node Difference Test Plot of the Career Choice Goal Construct; Black boxes represent significant differences between the nodes; Grey boxes represent the non-significant differences between the nodes. Nodes 10 and 14 are the strongest ones and node 4 is the weakest one in the network.

**Discussion:**

The construct of Career goals is defined as “the primary ends toward which an individual’s effort is directed within a chosen profession or an occupation, Colakoglu and Caliguiri, 2012, p. 264)” and plays a critical role in the development of career-wise identity of an individual in his or her formative years (Ismail and Lu,2014). The present study tried to address the shortcomings of Seibert et al., (2013) and Graco (2016) works pertaining to an instrument measuring this variable, and hence contribute towards Indian career psychology research at senior secondary school level. In the former study, two clear dimensions of career goals scale were obtained, but the scale lacked reliability owing to the less number of factors per dimensions. In the latter study, though the number of

items of the scale increased to 15, there was a lack of clarity due to the extraction of three factors from this study (contrary to the previous study), in which two of the factors, extrinsic choice goals and status, were found to be highly correlated, apart from the other factor intrinsic career goals. According to the theory of Deci and Ryan (1985), the intrinsic career goals satiated the inner psychological needs of autonomy, relatedness, competence and growth, and the extrinsic career goals pertained to getting rewards and praises from others. Graco (2016) did mention status could be considered as a part of extrinsic career goals, but decided to award it a separate status of a factor based on the work of Tajfel and Turner (1987) and Turner et al., (1987).

The obtaining of poor reliability estimates due to the less number of items per factor in Seibert et al., (2013) study is a well-documented limitation of the internal consistency reliability estimate Cronbach's alpha (Nunnally and Bernstein, 1994; Streiner, 2003; Tavakol and Dennick, 2011). Also, the model fit estimates of the confirmatory factor analysis conducted by Graco (2016) reported poor goodness of fit estimates for factor structure of career goals construct, further necessitating conducting of a study on the psychometrics of the career goals scale using a fresh approach of dimension extraction and reliability estimations.

Exploratory graph analysis (EGA) (Golino and Epskamp, 2017), ordinal confirmatory factor analysis (Rosseel, 2012) and structural consistency (Golino et al, 2021) under the network approach were selected to resolve these above mentioned issues of career choice goals, which is a different and a better approach in comparison to the traditional latent variable modeling approach (Ramos-Vera et al., 2023; Golino and Demetriou, 2017). Two clusters were obtained which represented the extrinsic and intrinsic factors of career goals in line with Siebert et al. (2013) study. The ordinal estimates of confirmatory factor analysis were high enough to indicate fine goodness of fit. The structural consistency estimates of the two clusters were also quite acceptable. The stability and accuracy estimates of the network obtained in terms of plots and quantitative values also suggested a fairly robust and stable network of career related choice goals construct. Moreover, the entropy estimates finally resolved the lack of clarity on the number of dimensions or clusters associated with the studied construct, whose determination is a difficult task in its own right (Preacher and MacCallum, 2003; Ruscio and Roche, 2012; Velicer and Jackson, 1990).

However, one of the nodes of the scale by Graco (2016) - Node 11 - "*I am willing to gain experience through a wide variety of jobs or work assignments*" - displayed split

loading. It originally belonged to the cluster of intrinsic career goals but loaded on the extrinsic career goals cluster on the first run of exploratory graph analysis. It was deleted as per the rules of conducting exploratory graph analysis (EGA) by Golino and Demetriou (2017). A possible reason for the poor performance of this node can be due to its low relatedness with the subjects of present the study, the senior secondary school students, who were yet in the nascent stage of career self-management, struggling to identify a relatable career of interest (Ismail and Lu, 2014), let alone thinking about being associated with variations in jobs or work assignments for having higher vocational experiences. Also, these subjects could possess an early notion that others or external factors might provide the opportunity to gain a variety of vocational experiences instead of trusting their own abilities to choose worthy vocations, causing the loading of this node on to extrinsic career goals cluster.

One of the limitations of the present study is that it did not conduct separate data analysis on items of the scale treating them to belong either to long term goals or to short term goals as was mentioned by Garco (2016). Not distinction in this regard was made in this study, whose implications on the validity of the study remains to be seen. Most of the students belonged to the arts stream, followed by the science stream with a handful of students from the commerce stream. This heterogeneity in the sample subjects also stands as another limitation of this study. Also, the present study was conducted in the north-eastern state of Tripura, which is culturally distinct from its surrounding six other sister states, let along the entire culturally diverse country of India. The advanced model of the Social Cognitive Career Theory by Lent and Brown (2006) outlines the importance of cultural values, belonging to the environmental factors, on the formation of career goals. This fact indicates towards the possible limited validity of this work and also opens avenues for further replication studies in other parts of the country outside the state of Tripura. Also, network structure invariance test through node comparison test (NCT) (van Borkulo et al., 2021) with respect to gender and culture needs to be conducted to find out the stability of the obtained network in subjects belonging across these vital demographic groups. A worthy enterprise would also be adapting the items of this scale towards the development of science career choice goals scale and validating this instrument using senior secondary students of science stream as subjects who would in all possibility take up Science, technology, engineering and mathematics related courses to eventually pursue STEM careers in future. Such an exercise can extend the career psychology research into the realms of STEM education and associated careers research.

**Conclusion:**

The present study tried establish the psychometric properties of career goals scale by Graco (2016) using the robust state of the art technique of network approach in the Indian context. It is hoped that this scale adaptation exercise would not only increase the cross-cultural validity of the scale, but also would further its ecological validity from college undergraduates to senior secondary school students, along with increasing the pace of career psychology research in general and career self-management variable based research specifically in the developing societies of India, and eventually contribute towards the increase the scant edifice of career choice goal literature.

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