Developing a scale to measure factors influencing skier's self-perceived group dynamics (FISSGD)

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Contents

1 Data Wrangling

For the interest of space, codes in this section will not be shown. Yet they are available in the .rmd file.

1.1 Read in the data

The data were collected across years 2022 (CARE panel, n=218) and 2023 (Students joining an avalanche course, n =59).

1.2 Combine 2022 and 2023 data

They were combined into one data set (n = 277). An index variable was generated as the unique identifier for each case.

1.3 Reomove cases

1.3.1 Remove careless responses (according to attention trap)

Q10_2 and Q10_5, as well as Q19_1 and Q19_4 were same questions with different wordings. If the responses had conflictory results between them, they would be regarded as careless responses and hence deleted (n = 24).

1.3.2 Remove cases who did not consent

Respondents who did not consent to participate were removed from the data (n = 4).

1.3.3 Remove cases with NA for if having a leader

Respondents who did not disclose if the ski group had a leader were removed from the data (n = 27).

1.4 Replace value of -99 with NA

-99 was used to label seen but unanswered questions. They were relabeled as NA.

1.5 Unify value labels

Values of some of the variables had been inconsistently labeled by Qualtrics. They were unified here.

1.6 Relabel variables

Properly label the variables so that the interpretation can be better managed. For the label, see Table 1.

1.7 Unify the direction of item wording

Four items of the SOCIAL were worded in negative direction (e.g. XXXX). Basic factor analysis attempts to identify latent variance through exploring the **co-variance** in measured variables. As such, the direction of the item wording (positive vs negative) does not influence the analysis. However, we still unify the results into same wording direction (positive) for the interest of easy interpretation.

1.8 Generate Norwegian variable labels

The survey was carried out in Norwegian and the initial language of text is Norwegian. Norwegian labels were created here.

2 Create data sets for analysis

Four data sets were created. They are a. 18 item with leader; b. 6 item with leader; c. 17 item without leader; d. 5 item without leader; 3. background. The case identifier is "index" variable across data sets.

2.1 Create with-leader and without-leader data-sets

Before generating 4 data sets, the data were first separated according to with (n = 104) or with-out leader (n = 118).

2.2 Remove cases with 50% NAs across major questions for each data sets

Within in each data set (with/without leader), cases with 50% NAs were removed from data. Three cases (#213,253,276) were removed from with-leader group; Four cases (#94, 252, 258, 275) were removed from without-leader group.

2.3 Create data set: 17 item without leader

Without-leader group respondents answered 22 out of 26 questions in the survey (the remaining 4 questions were about leader). Within the 22 questions, 17 were adapted from Zeiweiful's long version, 5 were from short version. They were further split into two data sets. They were subsequently referred to as without-leader long and without-leader short, respectively. The sample size is 114. According the publications, the

minimum sample size for an exploratory factor analysis should be 5 × (number of items). In our case, the without-leader group's long version analysis involves 17 items, indicating at least 17×5=85 samples. Our sample size meets this requirement.

2.4 Create data set: 5 item without leader

According the publications, the minimum sample size for an exploratory factor analysis should be 5 × (number of items). In our case, the without-leader group's long version analysis involves 5 items, indicating at least 5×5=25 samples. Our sample size meets this requirement.

2.5 Create data set: 20 item with leader

Without-leader group respondents answered all 26 questions in the survey. Among the questions, 20 were adapted from Zeiweiful's long version, 6 were from short version. They were further split into two data sets. They were subsequently referred to as with-leader long and with-leader short, respectively. The sample size is 101. According the publications, the minimum sample size for an exploratory factor analysis should be 5 × (number of items). In our case, the without-leader group's long version analysis involves 20 items, indicating at least 20×5=100 samples. Our sample size meets this requirement.

2.6 Create data set: 6 item with leader

According the publications, the minimum sample size for an exploratory factor analysis should be 5 × (number of items). In our case, the without-leader group's long version analysis involves 5 items, indicating at least 6×5=30 samples. Our sample size meets this requirement.

3 Check and impute NAs and IDNs

3.1 Discritpive statistics with number of NAs and IDNs for each item

Table 1: Descriptive statistics for with-leader group (long)

					Central tendency		Dispersion tendency	
var	Question	n*	n of IDN†	n of NA	Mean	Median	SD	Q1~Q3
i_leader2	The leader (formal or informal) communicated openly and clearly	100	2	1	4.3	4.0	0.8	4.0 ~ 5.0
i_leader3	Everyone could voice their concerns to the leader (formal or informal)	100	3	1	4.6	5.0	0.7	4.0 ~ 5.0
i_skill1	The least knowledgeable group member could conduct satisfactory avalanche assessments for this trip	101	1	0	3.2	4.0	1.3	2.0 ~ 4.0
i_skill2	There was no large gap in avalanche assessment skills between the group members	101	2	0	2.5	2.0	1.3	1.0 ~ 4.0
i_skill3	There was no important difference in skiing skill level between group members, given the terrain	101	1	0	2.9	3.0	1.4	2.0 ~ 4.0
i_skill4	All group members were equipped with standard avalanche safety equipment (beacon, shovel, probe) and trained in the use of it	101	2	0	4.3	5.0	1.1	4.0 ~ 5.0
i_orga1	The group members knew each other well	101	0	0	3.8	4.0	1.2	3.0 ~ 5.0
i_orga2	The group size was appropriate for the trip (time, difficulty)	100	1	1	4.5	5.0	0.8	4.0 ~ 5.0
i_orga3	The roles of the group members were clearly defined	101	1	0	3.2	3.0	1.2	2.0 ~ 4.0
i_comm1	Decisions concerning avalanche hazard were well discussed in the group	101	1	0	4.1	4.0	0.9	4.0 ~ 5.0
i_comm2	Everyone in the group understood the decisions that were made	101	4	0	4.1	4.0	1.0	4.0 ~ 5.0
i_comm3	Everyone voiced their concerns whenever they felt necessary	101	5	0	4.0	4.0	1.1	3.0 ~ 5.0
i_iden1	There were clear expectations of each group member	101	1	0	3.4	3.0	1.0	3.0 ~ 4.0
i_iden2	A reasonable alternative trip existed in case of disagreements	101	1	0	3.8	4.0	1.2	3.0 ~ 5.0
i_iden3	Everyone was happy with the decisions that were made	101	4	0	4.3	4.0	1.0	4.0 ~ 5.0
i_anom1	The group decisions at the decision points were unanimous	100	3	1	4.0	4.0	1.1	4.0 ~ 5.0
i_anom2	Someone tried to impress others.	101	1	0	4.1	4.0	1.0	4.0 ~ 5.0
i_anom3	Love stories were going on in the group	101	6	0	4.1	5.0	1.4	3.0 ~ 5.0
i_anom4	The presence of other groups impacted my group's decision making	101	2	0	4.1	5.0	1.2	3.0 ~ 5.0

* number of cases minus number of NA

† IDN: Don't know

Table 2: Descriptive statistics for without-leader group (long)

					Central tendency		Dispersion tendency	
var	Question	n*	n of IDN†	n of NA	Mean	Median	SD	Q1~Q3
i_skill2	There was no large gap in avalanche assessment skills between the group members	114	0	0	3.2	3.0	1.3	2.0 ~ 4.0
i_skill3	There was no important difference in skiing skill level between group members, given the terrain	114	0	0	3.6	4.0	1.3	2.0 ~ 5.0
i_skill4	All group members were equipped with standard avalanche safety equipment (beacon, shovel, probe) and trained in the use of it	114	1	0	4.5	5.0	1.0	4.0 ~ 5.0
i_orga1	The group members knew each other well	113	0	1	4.2	5.0	1.0	4.0 ~ 5.0
i_orga2	The group size was appropriate for the trip (time, difficulty)	113	1	1	4.6	5.0	0.8	4.0 ~ 5.0
i_orga3	The roles of the group members were clearly defined	113	5	1	3.2	3.0	1.4	2.0 ~ 5.0
i_comm1	Decisions concerning avalanche hazard were well discussed in the group	114	0	0	4.0	4.0	1.0	4.0 ~ 5.0
i_comm2	Everyone in the group understood the decisions that were made	114	1	0	4.3	5.0	0.9	4.0 ~ 5.0
i_comm3	Everyone voiced their concerns whenever they felt necessary	114	6	0	4.3	4.0	1.0	4.0 ~ 5.0
i_iden1	There were clear expectations of each group member	114	0	0	3.6	4.0	1.0	3.0 ~ 4.0
i_iden2	A reasonable alternative trip existed in case of disagreements	114	1	0	3.9	4.0	1.1	3.0 ~ 5.0
i_iden3	Everyone was happy with the decisions that were made	114	1	0	4.4	5.0	0.8	4.0 ~ 5.0
i_anom1	The group decisions at the decision points were unanimous	114	7	0	4.2	4.0	1.1	4.0 ~ 5.0
i_anom2	Someone tried to impress others.	114	2	0	4.2	4.0	1.1	4.0 ~ 5.0
i_anom3	Love stories were going on in the group	114	2	0	4.3	5.0	1.2	4.0 ~ 5.0
i_anom4	The presence of other groups impacted my group's decision making	114	1	0	3.8	4.0	1.4	2.0 ~ 5.0

* number of cases minus number of NA

† IDN: Don't know

Table 3: Descriptive statistics for with-leader group (short)

					Central tendency		Dispersion tendency	
var	Question	n*	n of IDN†	n of NA	Mean	Median	SD	Q1~Q3
i_skill0	The level of avalanche assessment and rescue skills differed greatly across the group.	101	2	0	2.7	2.0	1.4	2.0 ~ 4.0
i_orga0	The group was well-set up and organized for this trip	101	0	0	3.9	4.0	0.9	3.0 ~ 4.0
i_comm0	The communication in the group was good	101	1	0	4.4	4.0	0.7	4.0 ~ 5.0
i_iden0	The group was cohesive and had a shared vision	100	1	1	4.2	4.0	0.8	4.0 ~ 5.0
i_anom0	Social interactions in the group negatively impacted decision	101	3	0	4.4	5.0	1.0	4.0 ~ 5.0

* number of cases minus number of NA

† IDN: Don't know

Table 4: Descriptive statistics for without-leader group (short)

					Central tendency		Dispersion tendency	
var	Question	n*	n of IDN†	n of NA	Mean	Median	SD	Q1~Q3
i_orga0	The group was well-set up and organized for this trip	114	0	0	4.1	4.0	0.9	4.0 ~ 5.0
i_comm0	The communication in the group was good	114	0	0	4.3	5.0	1.0	4.0 ~ 5.0
i_iden0	The group was cohesive and had a shared vision	114	0	0	4.2	4.0	0.8	4.0 ~ 5.0
i_anom0	Social interactions in the group negatively impacted decision	113	3	1	4.3	5.0	1.0	4.0 ~ 5.0

* number of cases minus number of NA

† IDN: Don't know

3.2 Adress NA and IDN casewise

The number of NAs and IDNs were few in number comparing with the sample size for each data set. Hence, the NAs and IDNs were checked case-wise, and decisions for each case were made accordingly. Please go to file "NA_and_IDN.md" for full description. A quck summary here: case #82 (in without group) were removed due to high proportion of IDNs, while other cases with NAs/IDNs does not show much logical issue. These NAs/IDNs will be imputed by within-subgroup median.

3.3 Sumarize data clensing

The full processes of data cleansing were summarized in the following flowchart.

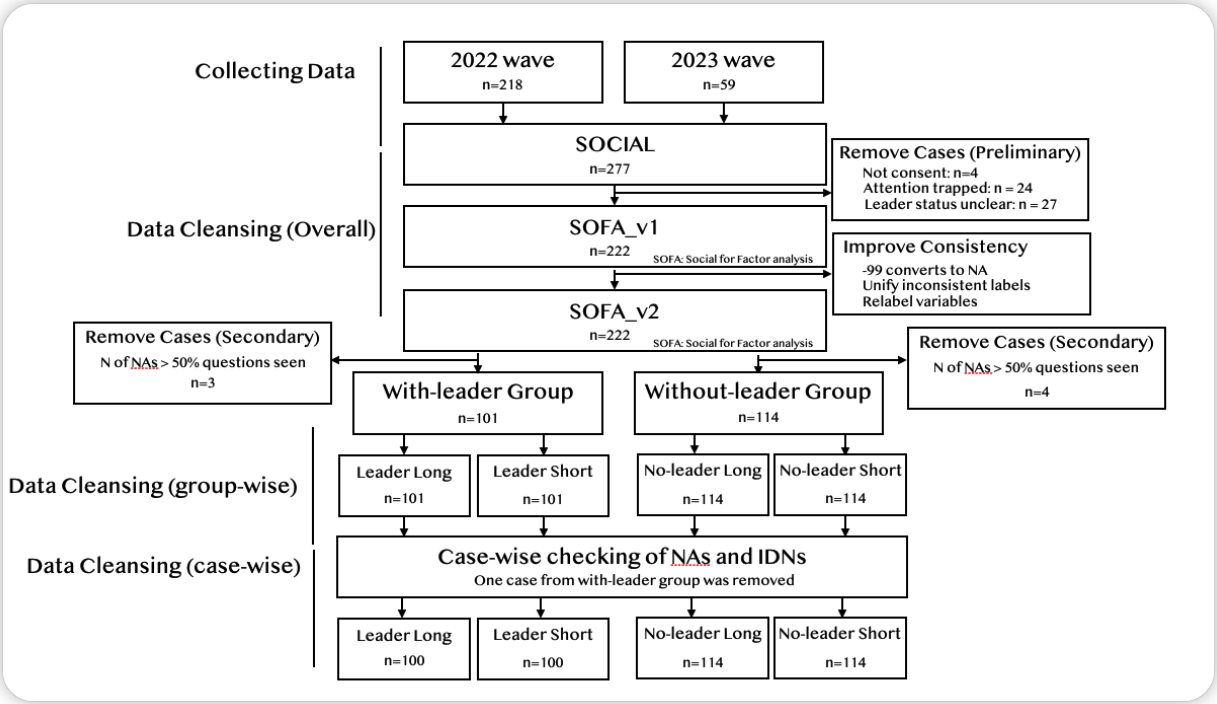


Figure 1: Flowchart for data cleansing

4 Visualization

4.1 Distribution

Since the data were collected from Likert scale, which usually skewed towards an end, I do not seek normality from these graphs. Instead, I scanned through the distributions to get a sense of the features of each item, such as left skewness (e.g. i_anom3), right skewness (e.g. i_skill4), kurtosis (e.g. i_orga3), polarization (e.g. i_skill3). These also shed light on skiers' overall performance pattern across sub-groups. To illustrate, it could be interesting to find that the organization of without-leader group wasn't rated notably lower than that of with-leader group. However, the skills were rated higher in without-leader group. This indicates people who ski without a leader are more confident in his and his teammates skiing/avalanche-forecasting skills. Of course, I hope for a normal distribution from the factor scores obtained by the following factor analysis.

Figure 2 Distributions of the item for with−leader group (long)

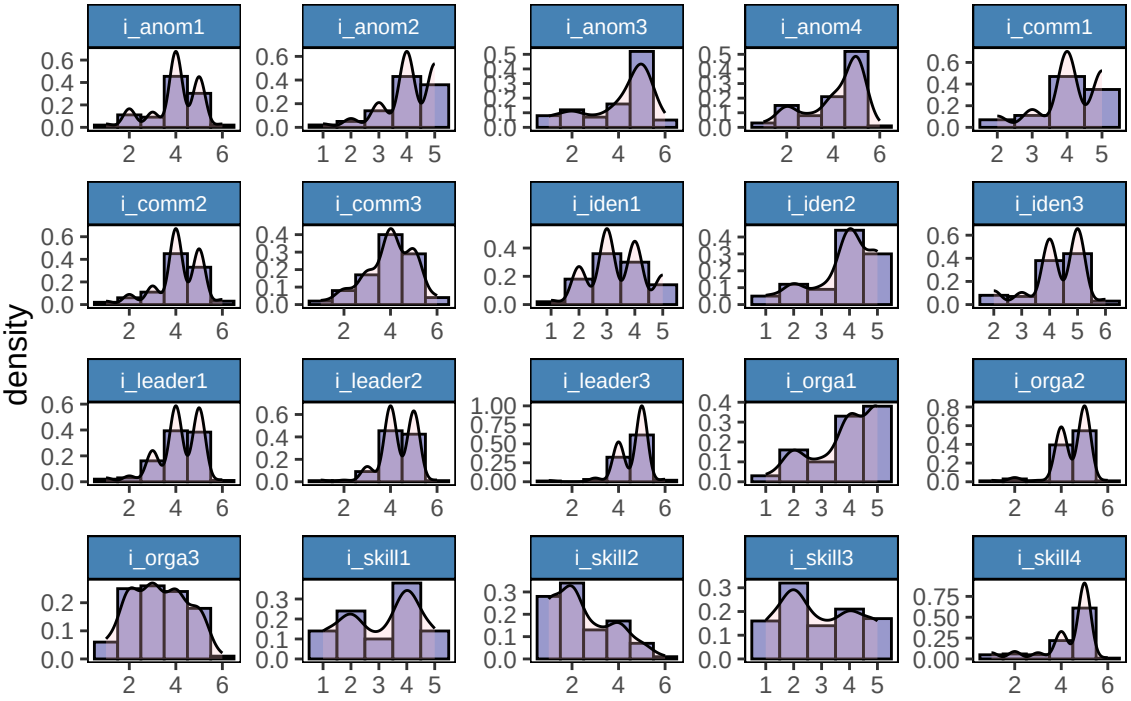


Figure 3 Distribtuions of the item for without−leader group (long)

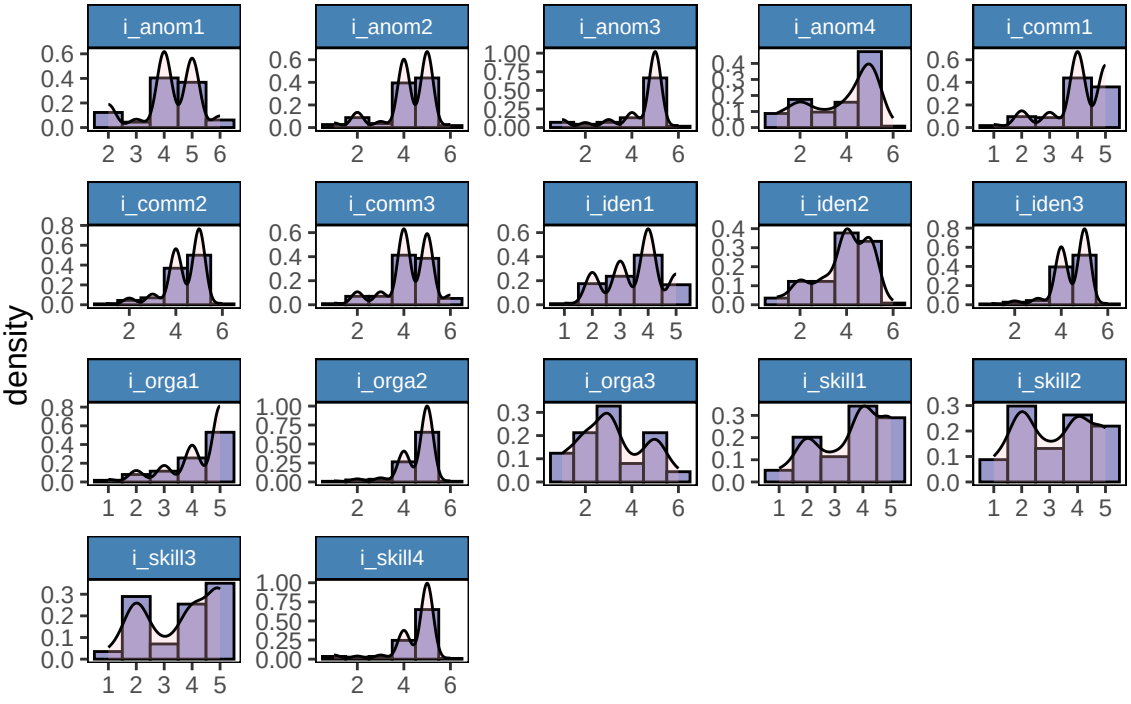


Figure 4 Distributions of the item for with−leader group (short)

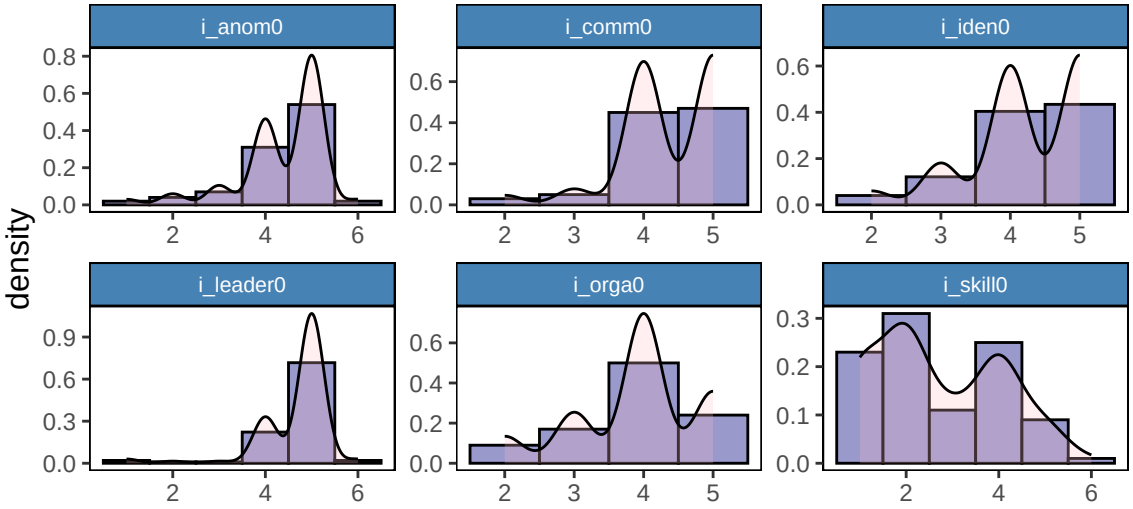
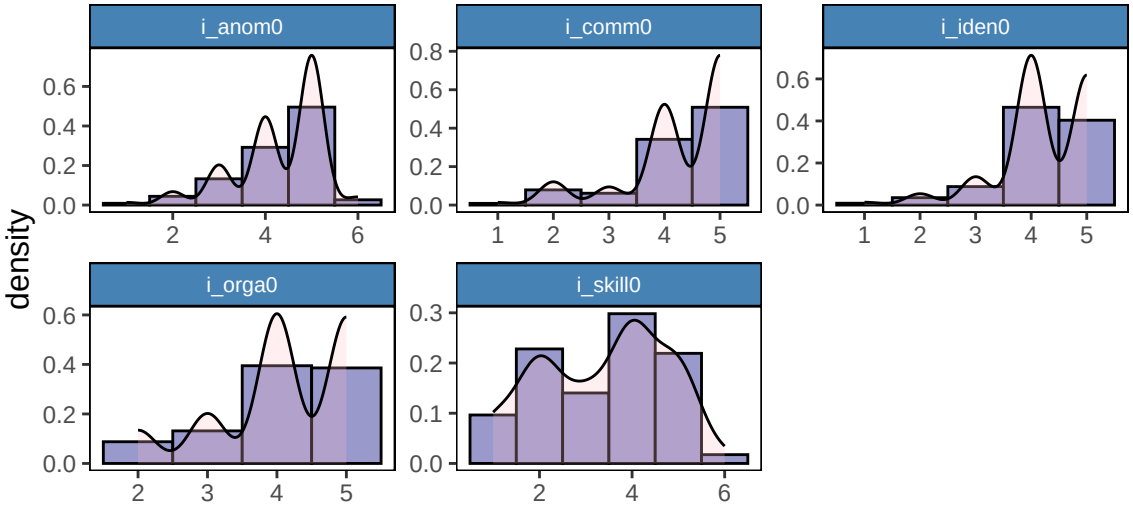


Figure 5 Distributions of the item for without−leader group (short)



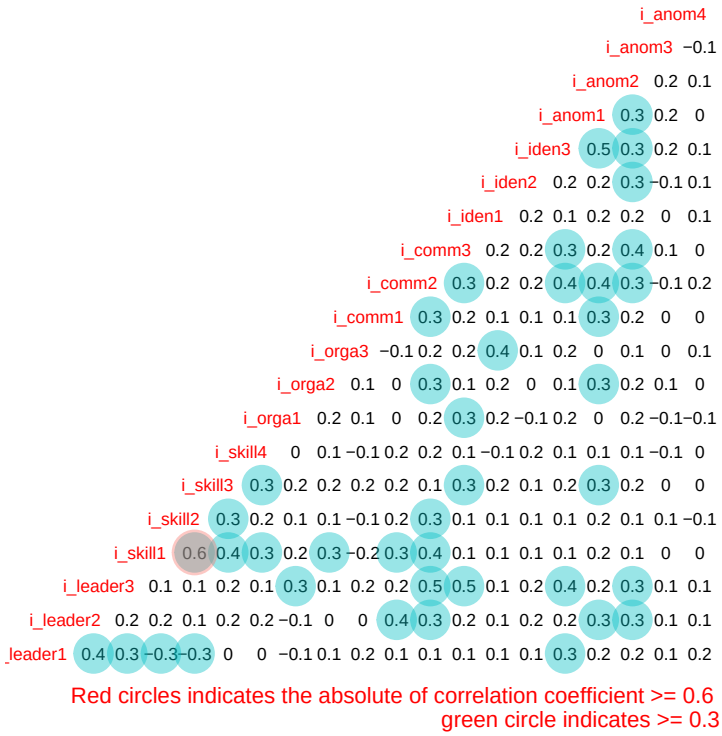
4.2 Correlation matrix

Correlation matrix was created for each of the four scales (2 long and 2 short). Pearson correlation coefficients were reported. Any coefficients 0.3 were highlighted in green circle; any coefficients 0.3 were highlighted in read circle.

There are several well-recognized criteria for checking factorability, including correlation matrix, KMO test, and Bartlett sphericity test. Here I checked the correlation. Other criteria were checked in the following section. We hope that the majority of the items have a correlation coefficient 0.3 with at least one other item, which suggest good factorability.

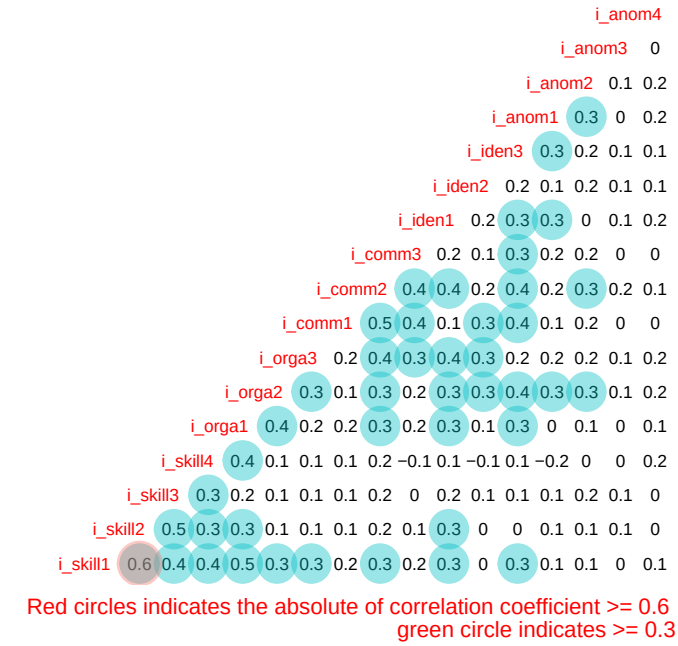
For with-leader group (long), it was observed that 18 of the 20 items correlated at least .3 with at least one other item, suggesting reasonable factorability. See figure 6.

Figure 6 Correlation matrix of the item for with−leader group (long)



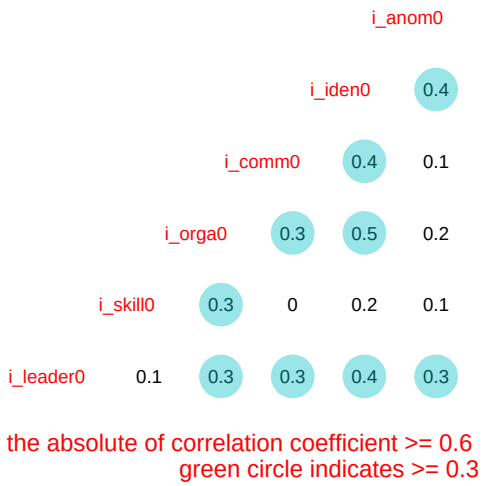
For without-leader group (long), it was observed that 16 of the 17 items correlated at least .3 with at least one other item, suggesting reasonable factorability. See figure 7.

Figure 7 Correlation matrix of the item for without−leader group (long)



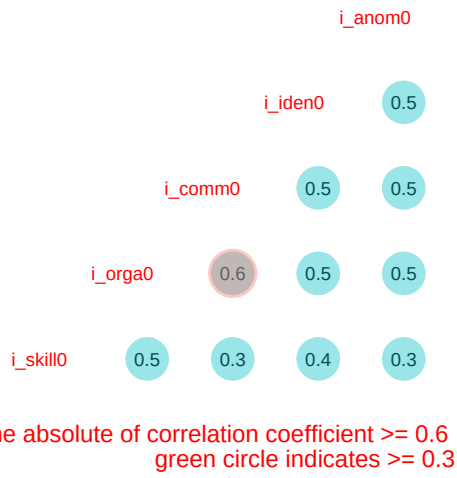
For with-leader group (short), it was observed that 6 of the 6 items correlated at least .3 with at least one other item, suggesting reasonable factorability. See figure 8.

Figure 8 Correlation matrix of the item for with−leader group (short)



For without-leader group (short), it was observed that 6 of the 6 items correlated at least .3 with at least one other item, suggesting reasonable factorability. See figure 9.

Figure 9 Correlation matrix of the item for without−leader group (short)



5 Factor analysis for with-leader group (long)

5.1 Check factoribility

The Kaiser-Meyer-Olkin measure of sampling adequacy was .68, above the commonly recommended value of .6. However, when the two items with <0.3 correlation with any other items were removed, the adequacy increased to 0.713, reaching "Good acceptable", see table 5 and 6.

Table 5: Level of acceptance of the Kaiser-Meyer-Olkin (KMO) value

KMO value	Level of acceptance
Above 0.90	Superb
0.80 to 0.90	Great
0.70 to 0.80	Good
0.50 to 0.70	Mediocre
Below 0.50	Unacceptable

Table 6: Results of KMO test of sampling adequacy for with-leader group (long)

Item	KMO	if correlation acceptable*
i_leader1	0.633	Yes
i_leader2	0.707	Yes
i_leader3	0.751	Yes
i_skill1	0.661	Yes
i_skill2	0.697	Yes
i_skill3	0.730	Yes
i_skill4	0.762	Yes
i_orga1	0.580	Yes
i_orga2	0.521	Yes
i_orga3	0.533	Yes
i_comm1	0.807	Yes
i_comm2	0.722	Yes
i_comm3	0.809	Yes
i_iden1	0.632	Yes
i_iden2	0.608	Yes
i_iden3	0.706	Yes
i_anom1	0.732	Yes
i_anom2	0.810	Yes
i_anom3	0.364	No
i_anom4	0.546	No
Overall	0.687	
Selected†	0.713	

* having>0.3 correlation coefficient with at least one other item

† excluing i_anom3 and i_anom4

Table 7: Results of bartlett test for with-leader group (long)

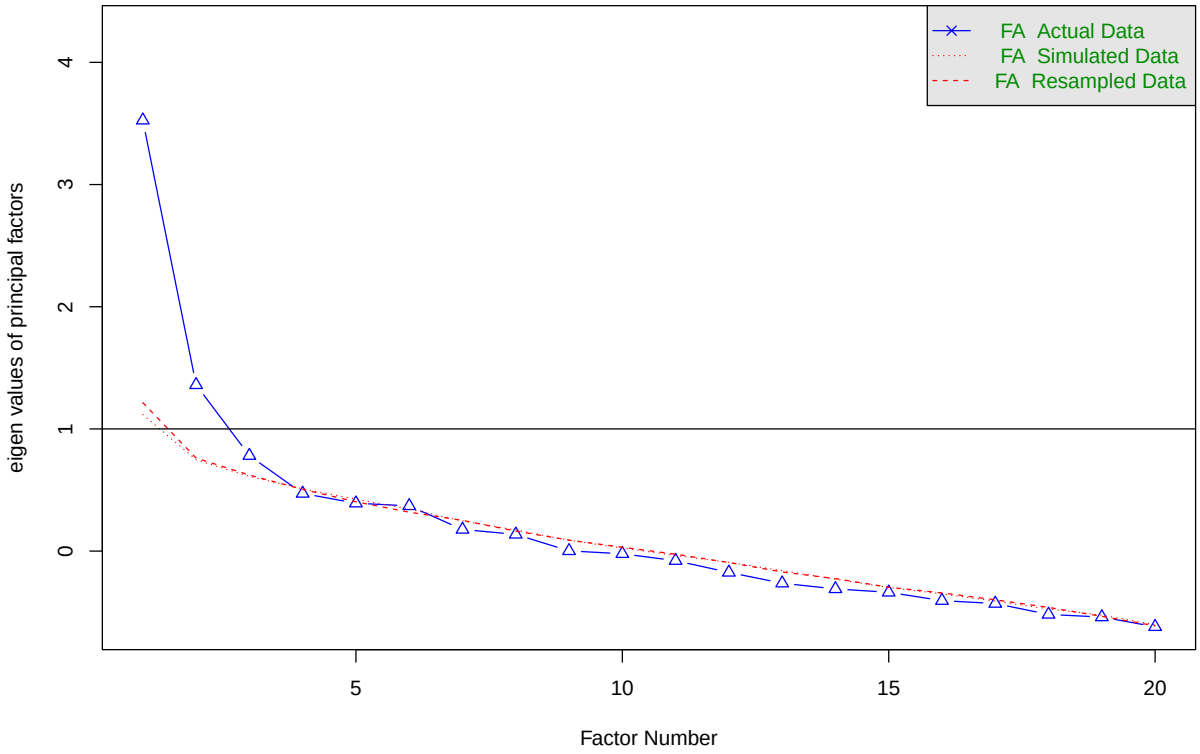
Dataset	Chi-square	p-value	DF
Overall	518.942	<0.001	190
Select*	483.671	<0.001	153

* excluing i_anom3 and i_anom4

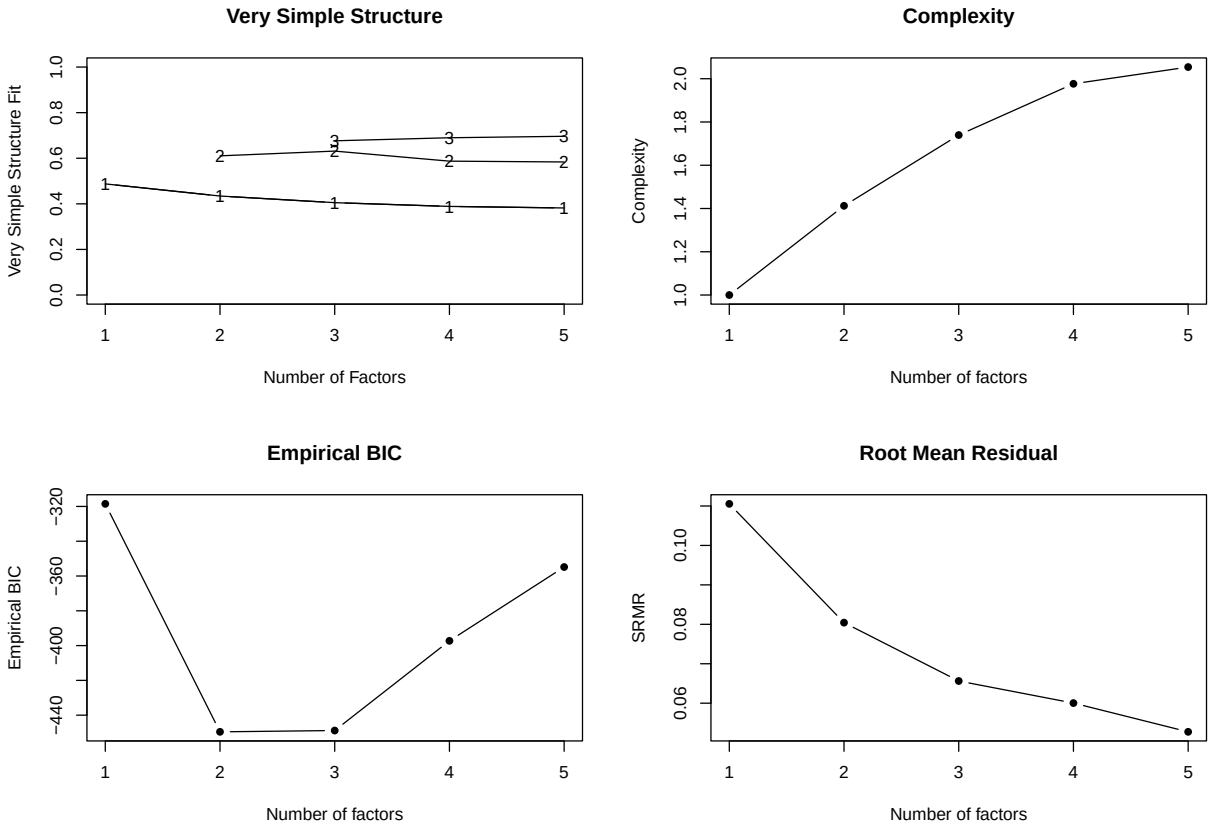
Bartlett's test of sphericity was significant (2 (190) = 518.94, p < .001), suggesting that there is a certain redundancy between the variables that we can summarize with a few number of factors.

5.2 Explore number of factors

Figure 9. Scree plot for with−leader group (long)




```
## Parallel analysis suggests that the number of factors =  3  and the number of components =  NA
```




```
##
## Number of factors
## Call: vss(x = x, n = n, rotate = rotate, diagonal = diagonal, fm = fm,
##     n.obs = n.obs, plot = FALSE, title = title, use = use, cor = cor)
## VSS complexity 1 achieves a maximimum of 0.49  with  1  factors
## VSS complexity 2 achieves a maximimum of 0.63  with  3  factors
## The Velicer MAP achieves a minimum of 0.02  with  2  factors
## Empirical BIC achieves a minimum of  -449.58  with  2  factors
## Sample Size adjusted BIC achieves a minimum of  -38.79  with  5  factors
##
## Statistics by number of factors
##   vss1 vss2   map dof chisq    prob sqresid  fit RMSEA  BIC SABIC complex
## 1 0.49 0.00 0.022 170   302 1.8e-09    18.5 0.49 0.088 -481    56     1.0
## 2 0.43 0.61 0.020 151   200 4.9e-03    14.1 0.61 0.056 -496   -19     1.4
## 3 0.41 0.63 0.022 133   159 6.0e-02    11.7 0.68 0.043 -453   -33     1.7
## 4 0.39 0.59 0.026 116   136 1.0e-01    10.6 0.71 0.040 -398   -32     2.0
## 5 0.38 0.58 0.030 100   106 3.2e-01     9.4 0.74 0.022 -355   -39     2.1
##   eChisq  SRMR eCRMS eBIC
## 1    464 0.111 0.117 -319
## 2    246 0.080 0.090 -450
## 3    164 0.066 0.078 -449
## 4    137 0.060 0.077 -397
## 5    106 0.053 0.073 -355
```

5.3 Explore factor solutions

5.3.1 Explore 5-factor solution

Figure 10. Five−factor solution, with−leader group (long)

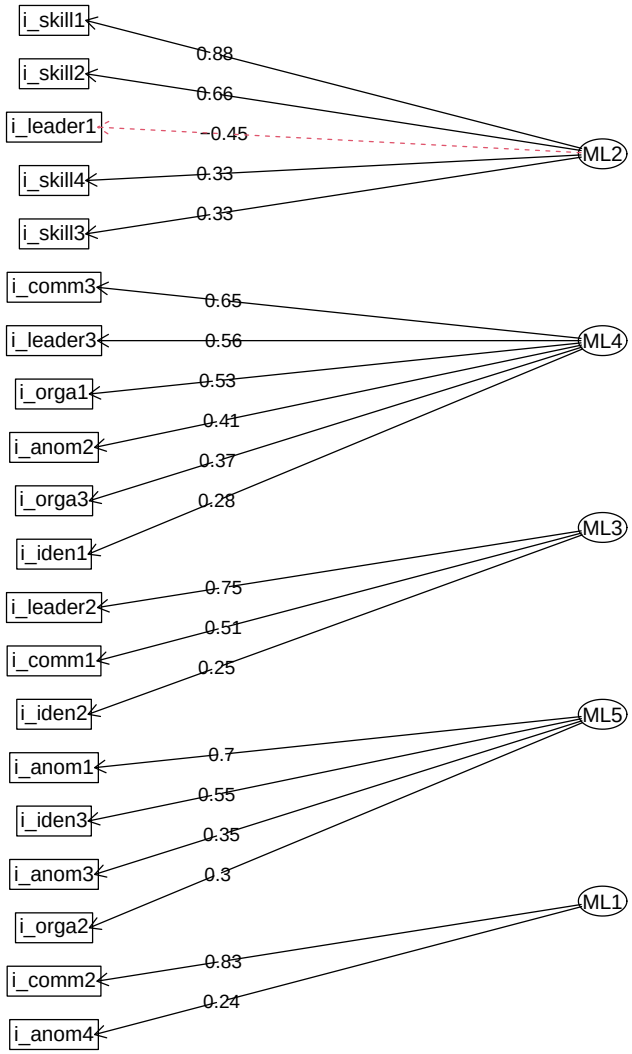


Table 8: Factor loadings of the 5-factor solution for with-leader group (long)

Item	ML2	ML4	ML3	ML5	ML1
i_leader1	-0.448		0.407		
i_leader2			0.747		
i_leader3		0.556			
i_skill1	0.88				
i_skill2	0.665				
i_skill3	0.327	0.321			
i_skill4	0.333				
i_orga1		0.527			
i_orga2					
i_orga3		0.368			
i_comm1			0.511		
i_comm2	0.385	0.303			0.833
i_comm3		0.649			
i_iden1					
i_iden2					
i_iden3				0.549	
i_anom1				0.704	
i_anom2		0.413	0.323		
i_anom3				0.345	
i_anom4					

5.3.2 Explore 4-factor solution

Figure 11. Four−factor solution, with−leader group (long)

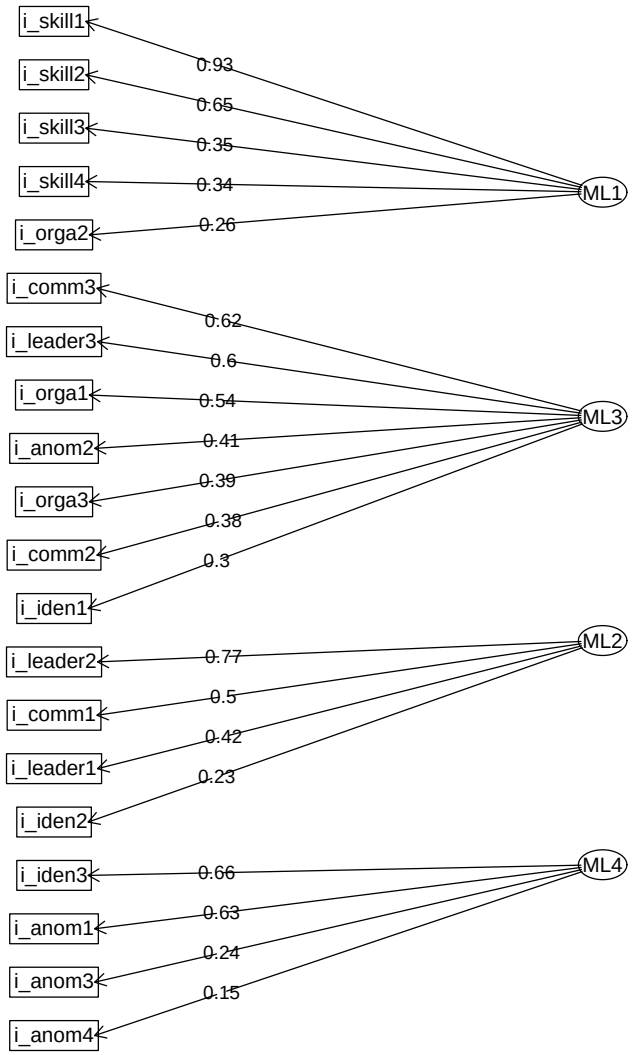


Table 9: Factor loadings of the 4-factor solution for with-leader group (long)

Item	ML1	ML3	ML2	ML4
i_leader1	-0.4		0.42	0.334
i_leader2			0.768	
i_leader3		0.598		
i_skill1	0.93			
i_skill2	0.653			
i_skill3	0.348			
i_skill4	0.338			
i_orga1		0.542		
i_orga2				
i_orga3		0.389		
i_comm1			0.5	
i_comm2	0.363	0.382		0.374
i_comm3		0.616		
i_iden1				
i_iden2				
i_iden3		0.342		0.656
i_anom1				0.627
i_anom2		0.41	0.303	
i_anom3				
i_anom4				

5.3.3 Explore 3-factor solution

Figure 12. Three−factor solution, with−leader group (long)

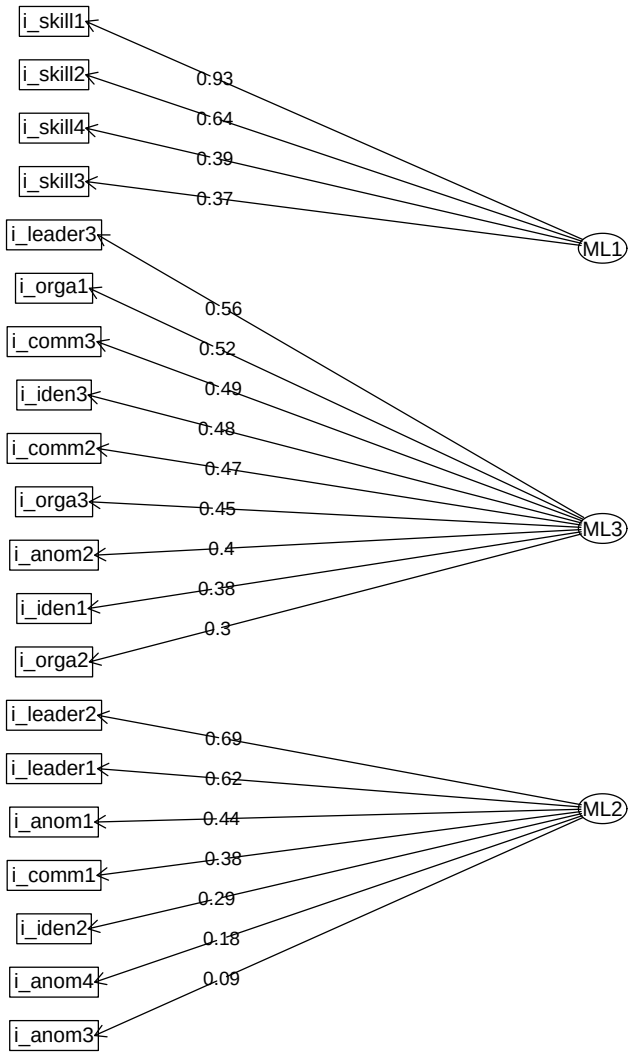


Table 10: Factor loadings of the 3-factor solution for with-leader group (long)

Item	ML1	ML3	ML2
i_leader1			0.615
i_leader2			0.689
i_leader3		0.556	0.322
i_skill1	0.929		
i_skill2	0.638		
i_skill3	0.369		
i_skill4	0.392		
i_orga1		0.518	
i_orga2		0.301	
i_orga3		0.445	
i_comm1	0.358		0.384
i_comm2	0.403	0.471	0.31
i_comm3		0.494	
i_iden1		0.378	
i_iden2			
i_iden3		0.484	0.37
i_anom1			0.435
i_anom2		0.398	0.387
i_anom3			
i_anom4			

5.3.4 Finetune 3-factor solution

Figure 13. Fine−tuned three−factor solution, with−leader group (long)

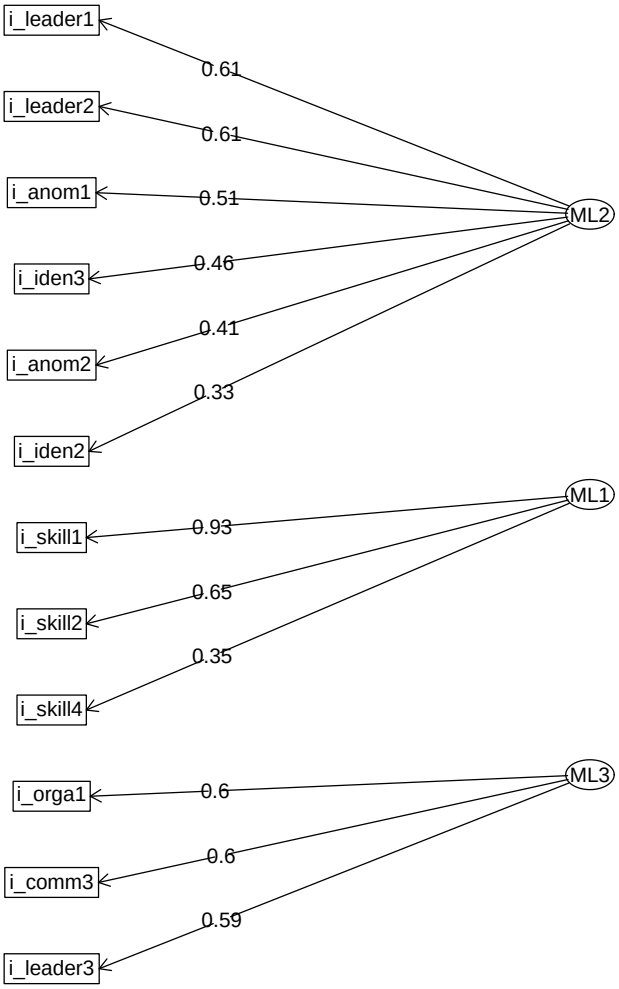


Table 11: Factor loadings of the 3-factor solution for with-leader group (long)

Item	ML2	ML1	ML3
i_leader1	0.614	-0.356	
i_leader2	0.613		
i_leader3	0.344		0.589
i_skill1		0.925	
i_skill2		0.651	
i_skill4		0.355	
i_orga1			0.598
i_comm3			0.596
i_iden2	0.332		
i_iden3	0.46		0.388
i_anom1	0.515		
i_anom2	0.414		0.402

5.3.5 Explore 2-factor solution

Figure 14. Two−factor solution, with−leader group (long)

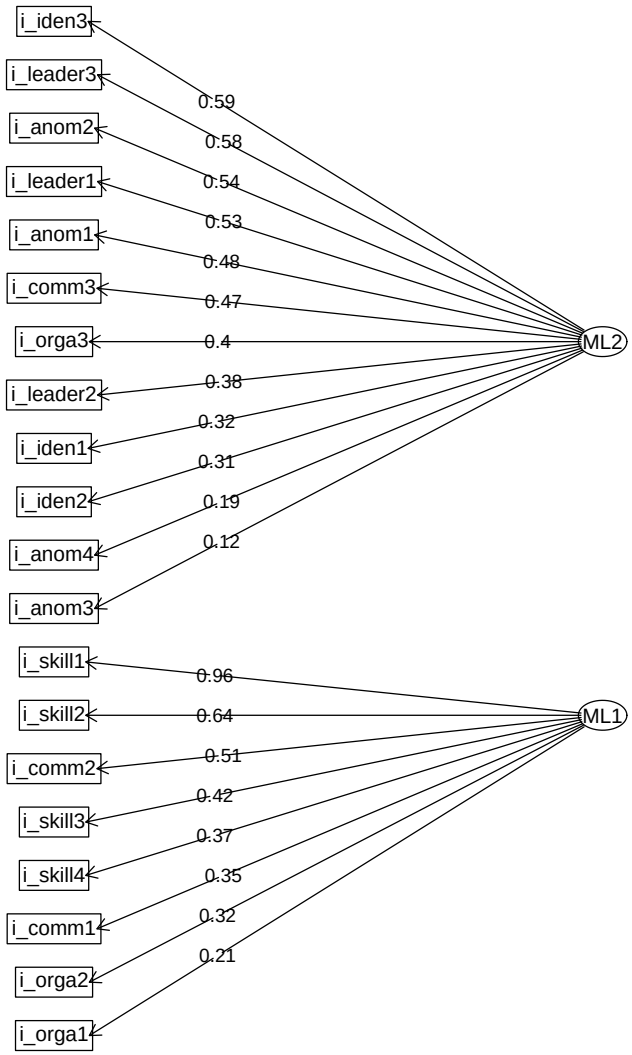


Table 12: Factor loadings of the 2-factor solution for with-leader group (long)

Item	ML2	ML1
i_leader1	0.528	
i_leader2	0.385	
i_leader3	0.581	
i_skill1		0.957
i_skill2		0.635
i_skill3		0.416
i_skill4		0.374
i_orga1		
i_orga2		0.322
i_orga3	0.397	
i_comm1		0.348
i_comm2	0.467	0.509
i_comm3	0.47	
i_iden1	0.324	
i_iden2	0.313	
i_iden3	0.591	
i_anom1	0.477	0.318
i_anom2	0.537	
i_anom3		
i_anom4		

5.3.6 Finetune 2-factor solution

Figure 15. Fine−tuned two−factor solution, with−leader group (long)

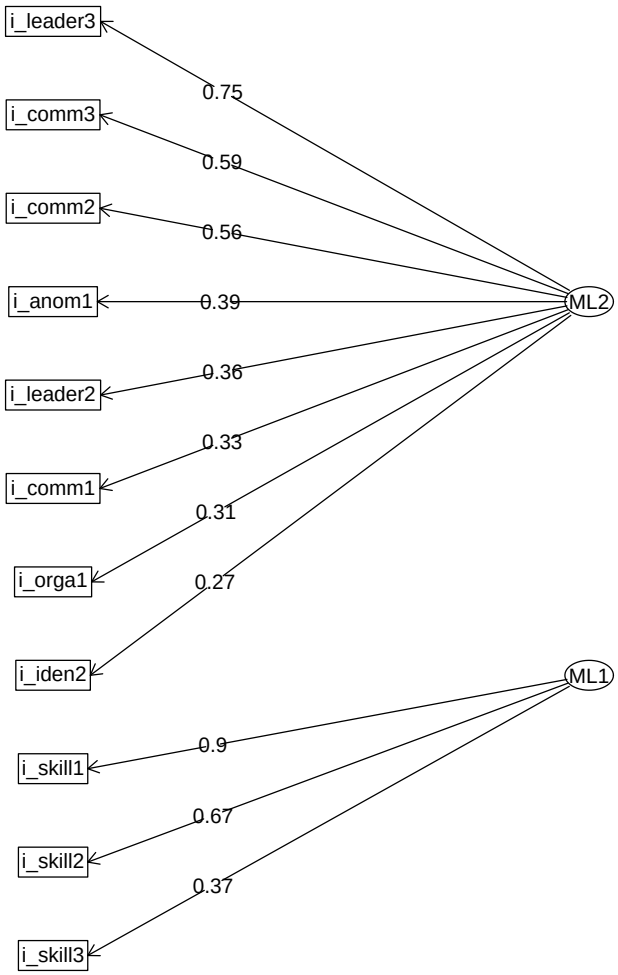


Table 13: Factor loadings of the 3-factor solution for with-leader group (long)

Item	ML2	ML1
i_leader2	0.361	
i_leader3	0.755	
i_skill1		0.898
i_skill2		0.671
i_skill3		0.37
i_orga1	0.312	
i_comm1	0.332	
i_comm2	0.559	0.382
i_comm3	0.593	
i_iden2		
i_anom1	0.386	

Table 14: Comparison between factor solutions, with-leader (long)

	CumulativeVariance
2-factor(tuned)	0.329
2-factor	0.265
3-factor(tuned)	0.403
3-factor	0.317
4-factor	0.352
5-factor	0.396

Table 15: Final items for 3 factor solution, with-leader group (long)

	Item
ML2: Leadership Quality	
i_iden2	A reasonable alternative trip existed in case of disagreements
i_leader3	Everyone could voice their concerns to the leader (formal or informal)
i_anom1	The group decisions at the decision points were unanimous
i_leader1	The leader (formal or informal) was the best suited person in the group to make the decisions.
i_leader2	The leader (formal or informal) communicated openly and clearly
i_comm3	Everyone voiced their concerns whenever they felt necessary
i_comm2	Everyone in the group understood the decisions that were made
ML3: Planning	
i_orga1	The group members knew each other well
i_skill1	The least knowledgeable group member could conduct satisfactory avalanche assessments for this trip
ML1: Skill	
i_skill2	There was no large gap in avalanche assessment skills between the group members
i_skill4	All group members were equipped with standard avalanche safety equipment (beacon, shovel, probe) and trained in the use of it

Table 16: Results of KMO test of sampling adequacy for with-leader group (short)

	KMO
i_leader0	0.808
i_skill0	0.639
i_orga0	0.727
i_comm0	0.755
i_iden0	0.700
i_anom0	0.783
Overall	0.735

Table 17: Results of bartlett test for with-leader group (short)

Chi-square	p-value	DF
94.2	<0.001	15

5.4 Comparison between factor solutions, with-leader (long)

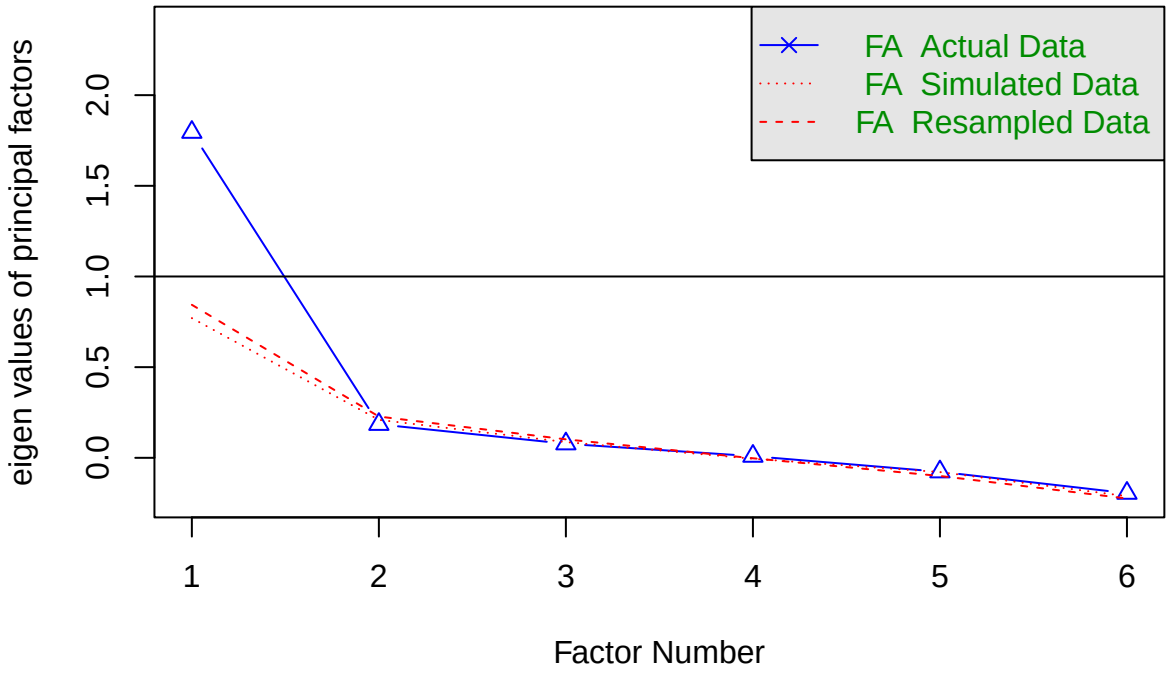
5.4.1 Check the factor connotation for 3-factor solution (fine-tuned)

6 Factor analysis for with-leader group (short)

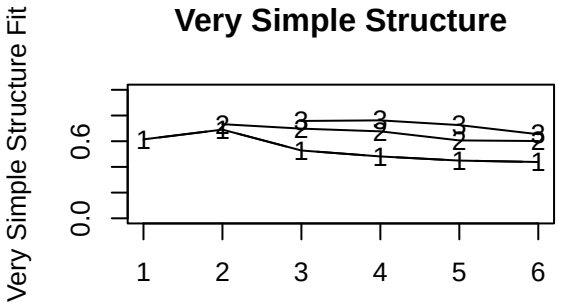
6.1 Check factoribility

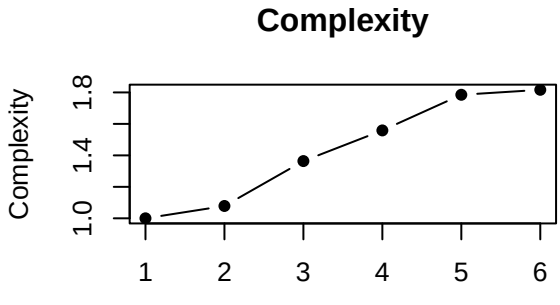
6.2 Explore number of factors

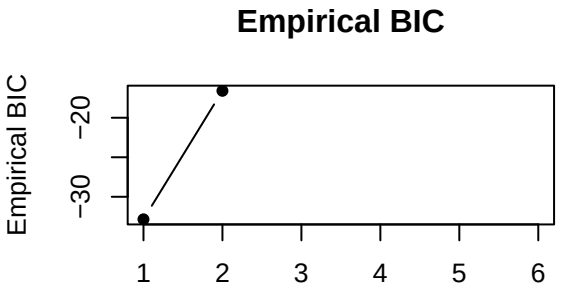
figure 14. Scree plot, wiht−leader group (short)

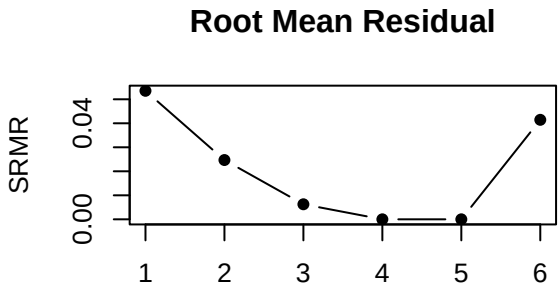



```
## Parallel analysis suggests that the number of factors =  1  and the number of components =  NA
```










```
##
## Number of factors
## Call: vss(x = x, n = n, rotate = rotate, diagonal = diagonal, fm = fm,
##     n.obs = n.obs, plot = FALSE, title = title, use = use, cor = cor)
## VSS complexity 1 achieves a maximimum of 0.69  with  2  factors
## VSS complexity 2 achieves a maximimum of 0.73  with  2  factors
## The Velicer MAP achieves a minimum of 0.05  with  1  factors
## Empirical BIC achieves a minimum of  -32.85  with  1  factors
## Sample Size adjusted BIC achieves a minimum of  -5.89  with  1  factors
##
## Statistics by number of factors
##   vss1 vss2   map dof   chisq prob sqresid  fit RMSEA BIC SABIC complex  eChisq
## 1 0.61 0.00 0.047   9 7.1e+00 0.62     3.3 0.61     0 -34  -5.9     1.0 8.6e+00
## 2 0.69 0.73 0.119   4 1.6e+00 0.81     2.3 0.73     0 -17  -4.2     1.1 1.8e+00
## 3 0.53 0.70 0.233   0 9.6e-02   NA     2.1 0.76    NA  NA    NA     1.4 1.2e-01
## 4 0.48 0.68 0.431  -3 5.0e-11   NA     1.8 0.79    NA  NA    NA     1.6 6.8e-11
## 5 0.45 0.61 1.000  -5 0.0e+00   NA     1.6 0.81    NA  NA    NA     1.8 5.3e-16
## 6 0.44 0.60    NA  -6 4.8e+00   NA     2.9 0.65    NA  NA    NA     1.8 5.2e+00
##      SRMR eCRMS eBIC
## 1 5.4e-02 0.069  -33
## 2 2.5e-02 0.048  -17
## 3 6.3e-03    NA   NA
## 4 1.5e-07    NA   NA
## 5 4.2e-10    NA   NA
## 6 4.1e-02    NA   NA
```

6.2.1 Explore 2-factor solution

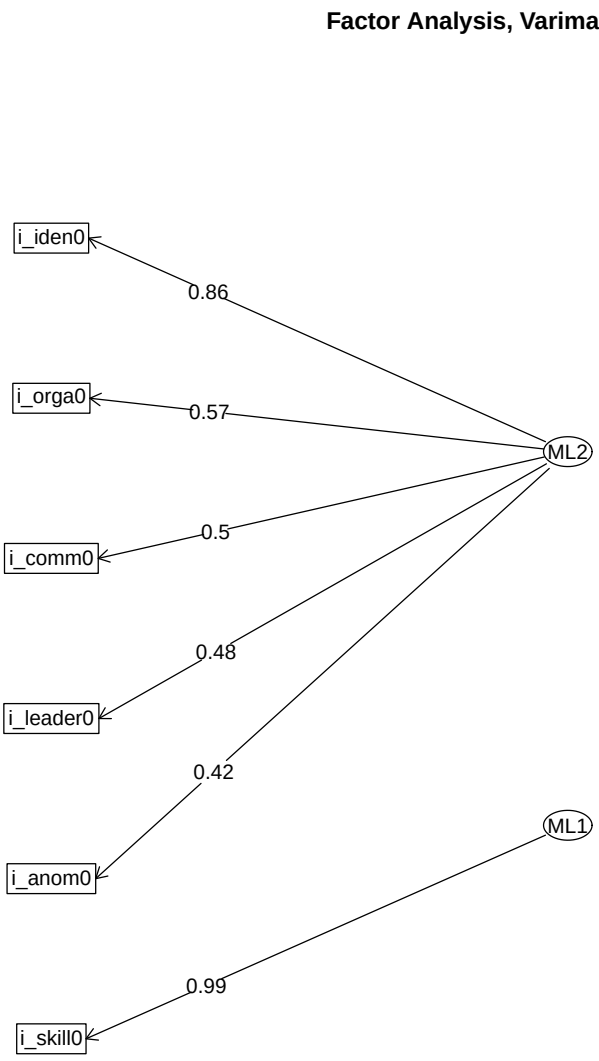


Table 18: Figure 16. Factor loadings of the 5-factor solution for with-leader group (short)

Item	ML2	ML1
i_leader0	0.485	
i_skill0		0.993
i_orga0	0.566	
i_comm0	0.504	
i_iden0	0.855	
i_anom0	0.421	

6.2.2 fine-tune 2-factor solution

Figure 17. Fine−tuned two−factor solution, with−leader group (short)

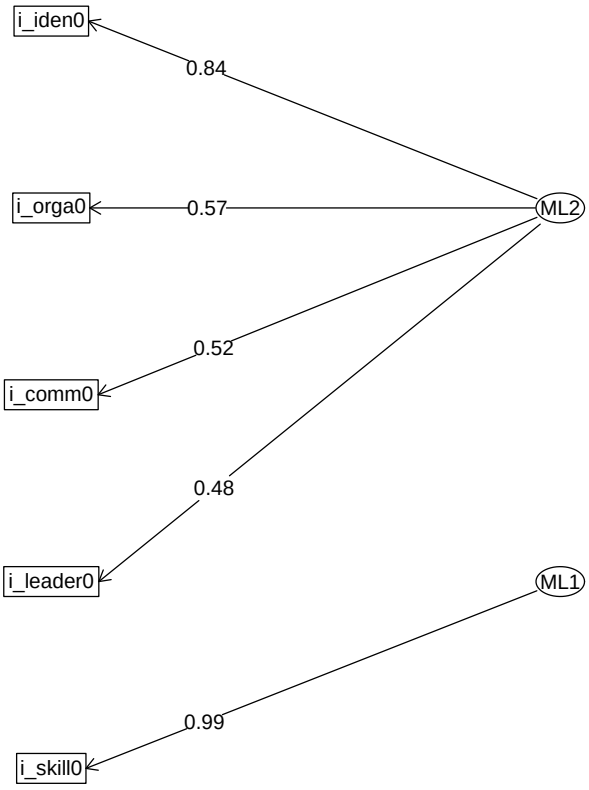


Table 19: Factor loadings of the 3-factor solution for with-leader group (long)

Item	ML2	ML1
i_iden0	0.838	
i_comm0	0.522	
i_leader0	0.483	
i_orga0	0.574	
i_skill0		0.993

6.2.3 Explore 3-factor solution

Figure 18. Three−factor solution, with−leader group (short)

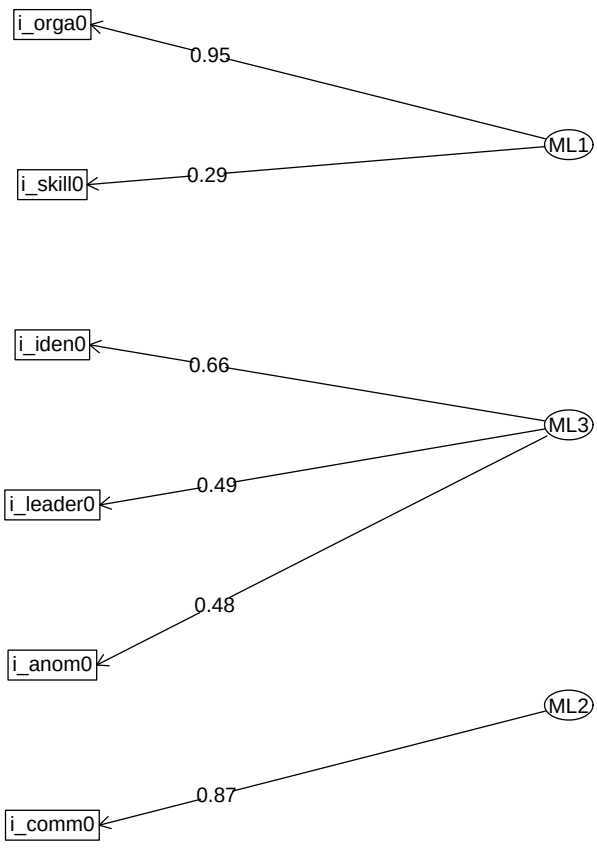


Table 20: Factor loadings of the 5-factor solution for with-leader group (long)

Item	ML1	ML3	ML2
i_leader0		0.487	
i_skill0			
i_orga0	0.947		
i_comm0			0.869
i_iden0	0.311	0.664	
i_anom0		0.478	

Table 21: Results of KMO test of sampling adequacy for without-leader group (short)

	KMO
i_skill0	0.805
i_orga0	0.808
i_comm0	0.799
i_iden0	0.820
i_anom0	0.793
Overall	0.805

Table 22: Results of bartlett test for with-leader group (short)

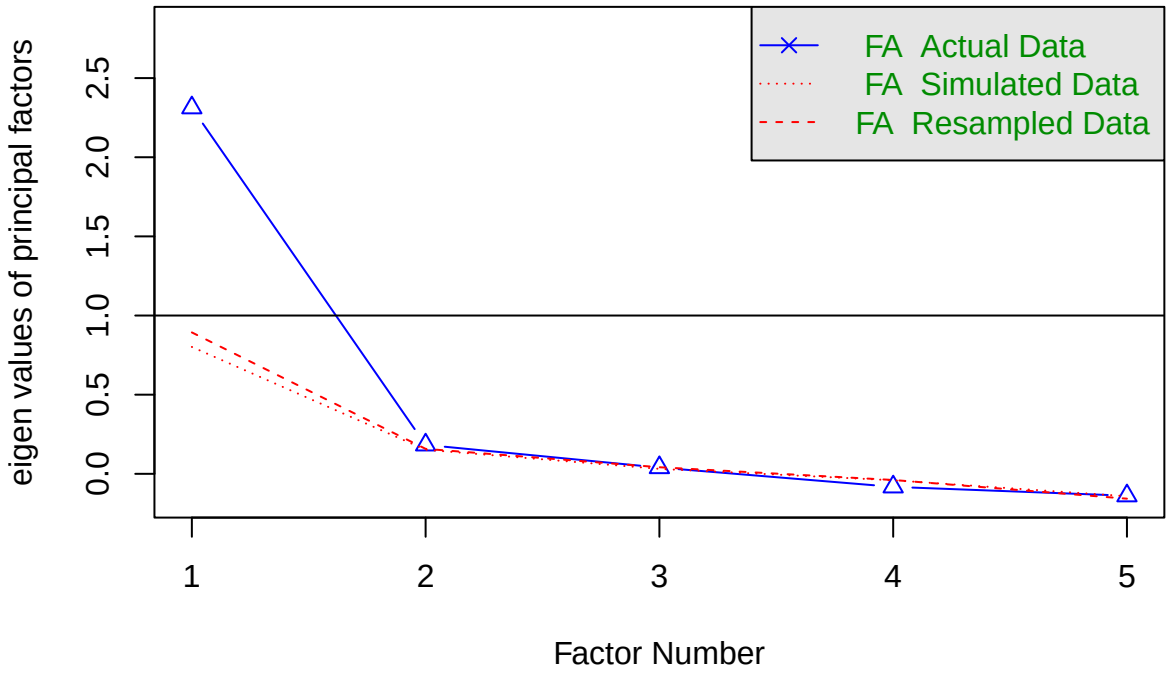
Chi-square	p-value	DF
172.282	<0.001	10

7 Factor analysis for without-leader group (short)

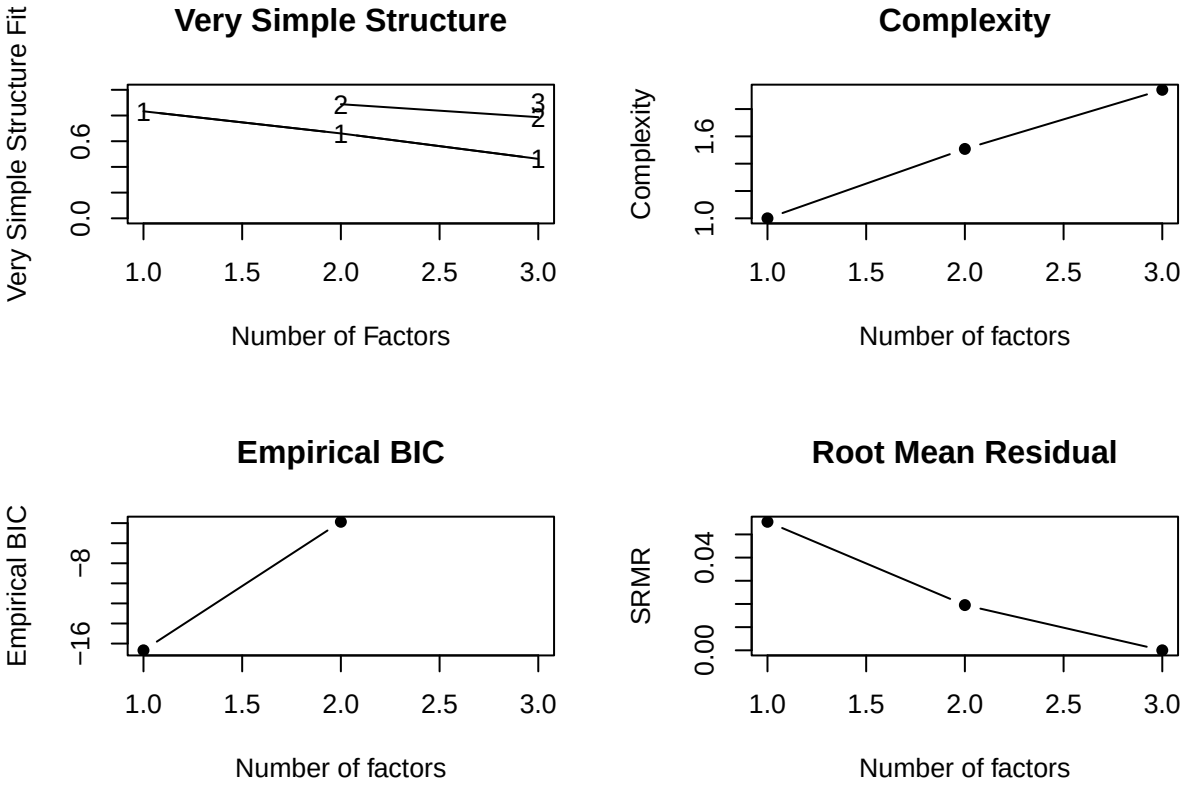
7.1 Check factoribility

7.2 Explore number of factors

figure 14. Scree plot, wiht−leader group (short)




```
## Parallel analysis suggests that the number of factors =  1  and the number of components =  NA
```

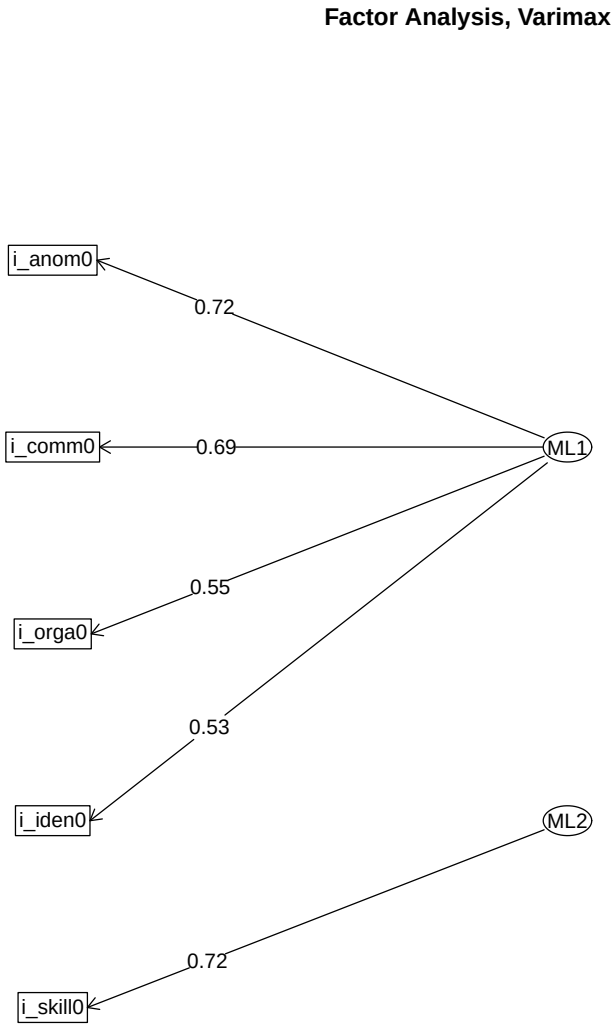



```
##
## Number of factors
## Call: vss(x = x, n = n, rotate = rotate, diagonal = diagonal, fm = fm,
##     n.obs = n.obs, plot = FALSE, title = title, use = use, cor = cor)
## VSS complexity 1 achieves a maximimum of 0.83  with  1  factors
## VSS complexity 2 achieves a maximimum of 0.89  with  2  factors
## The Velicer MAP achieves a minimum of 0.08  with  1  factors
## Empirical BIC achieves a minimum of  -16.67  with  1  factors
## Sample Size adjusted BIC achieves a minimum of  0.44  with  2  factors
##
## Statistics by number of factors
##   vss1 vss2   map dof   chisq  prob sqresid  fit RMSEA   BIC SABIC complex
## 1 0.83 0.00 0.076   5 1.0e+01 0.067    1.55 0.83 0.096 -13.4  2.42     1.0
## 2 0.66 0.89 0.188   1 2.0e+00 0.156    1.04 0.89 0.094  -2.7  0.44     1.5
## 3 0.46 0.79 0.389  -2 3.1e-12    NA    0.92 0.90    NA    NA    NA     1.9
##    eChisq    SRMR eCRMS  eBIC
## 1 7.0e+00 5.5e-02 0.078 -16.7
## 2 8.7e-01 2.0e-02 0.062  -3.9
## 3 1.2e-12 2.3e-08    NA    NA
```

Table 23: Figure Factor loadings of the 5-factor solution for without-leader group (short)

Item	ML1	ML2
i_skill0		0.72
i_orga0	0.546	0.513
i_comm0	0.691	
i_iden0	0.53	0.48
i_anom0	0.721	

7.2.1 Explore 2-factor solution



s ### Explore 3-factor solution

Figure Three−factor solution, without−leader group (short)

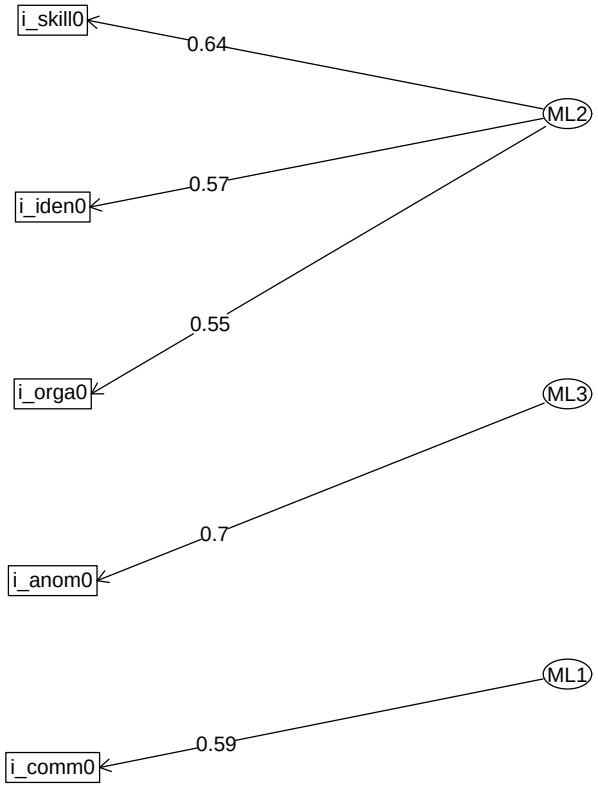


Table 24: Factor loadings of the 5-factor solution for with-leader group (long)

Item	ML2	ML3	ML1
i_skill0	0.637		
i_orga0	0.551	0.301	0.448
i_comm0		0.444	0.594
i_iden0	0.574	0.479	
i_anom0		0.702	0.307