

# REASSESSING THE COMPETENCE MEASUREMENTS IN THE FINNISH DEFENCE FORCES

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## ABSTRACT

This paper discusses the competence measurements conducted in the Finnish Defence Forces during the last 10 years. During this time some 1200 persons have been assessed resulting in more than 6000 individual assessments. The data was factor-analysed. The original 91-item questionnaire had a factor structure with 4 main factors with 3-5 sub-factors each and a mean of 6 items per sub-factor. However, analysis of the data revealed only 8 main factors with one main factor having 4 sub-factors and the second having 2. The remaining six factors could not be divided. Some of the new factors are close to the old ones but in some cases the new factors are a combination of 2-3 old main factors and even more sub-factors. The new sub-factors consist of 2 - 16 items. The questions raised are: did something go wrong during the first analysis of the data or have the demands placed on the officers changed that much in ten years?

## INTRODUCTION AND HISTORY

The decision to develop an instrument for assessing competencies was done in the mid 1990's. It was concluded that assessments should be based on noticeable behaviour in the actual working environment. The development of the instrument (Armyfull<sup>®</sup>) with extensive testing took three years – from 1997 till 1999 (Johansson 2004, Vainikainen 1999).

The original (1999) instrument consists of 91 items divided into four main factors and 15 sub-factors (table 1). The assessments are made on a six point scale where the person assessing has to decide whether the person assessed exhibits very little or very much of the trait in question. Each sub-factor consists of 5 – 10 items interspersed within the questionnaire. Examples of the items are listed in table 2.

## METHOD

Since 2001 altogether 1240 persons have been assessed resulting in 6193 individual assessments. 5976 assessments had no missing values. One fifth of those are self-assessments. In the analyses no distinction was made between self-assessments and assessments of others. The amount of data is more than enough for a new evaluation of the instrument.

The data were fed into the computer and analysed using SPSS 15.0 statistical software. After initial checks of the data several variants of factor analysis were applied to the data.

Table 1. The original factor structure of the competence instrument.

| <b>I.<br/>MANAGEMENT OF<br/>PEOPLE</b>               | <b>II.<br/>MENTAL<br/>CAPACITY</b>          | <b>III.<br/>PROFESSIONAL<br/>CREDIBILITY</b> | <b>IV.<br/>DETERMINATION</b>               |
|--|---|--|--|
| 1. SKILLS IN HUMAN RELATIONS (5 items)               | 1. CREATIVITY AND INNOVATION (6 items)      | 1. COMMITMENT TO VALUES AND GOALS (5 items)  | 1. INDEPENDENCE (5 items)                  |
| 2. MENTAL FLEXIBILITY (8 items)                      | 2. KNOWLEDGE OF THE ORGANISATION (4 items)  | 2. BROAD KNOWLEDGE (EXTENSIVENESS) (4 items) | 2. RESOLUTE IN PURSUING MATTERS (10 items) |
| 3. ENCOURAGEMENT TO CO-OPERATION (9 items)           | 3. CAPABILITY TO LEARN AND CHANGE (5 items) | 3. ORGANISED ACTIVITY (6 items)              | 3. RESPONSIBILITY (5 items)                |
| 4. ENCOURAGEMENT TO SELF-PILOTING ACTIVITY (5 items) | 4. AWARENESS OF THE ESSENTIAL (7 items)     |  |  |
|  | 5. PROMOTION OF SMOOTH ACTION (7 items)     |  |  |

Table 2. Examples of items in the 1999 competence instrument.

| <b>Sub-factor</b>         | <b>Item</b>  |
|---------------------------|--|
| Skills in human relations | Copes with different people                            |
| Creativity and innovation | Develops and revises things                            |
| Organised activity        | Works systematically with good results                 |
| Independence              | Expresses his/her own opinions even if others disagree |

## RESULTS

### *Basic statistics*

The means of individual items were skewed to the right with a range from 4.09 to 5.05 and standard deviations from 0.697 to 0.965. All items were significantly correlated with correlations ranging from 0.230 to 0.676 ( $p < 0.001$ , 1-tailed). The whole scale (1 - 6) had been used in all items except eight. In the resting eight the scale had been used from two to six.

### *Factor analyses*

The analyses were started by trying to replicate the four original main factors. Several variants of factor analyses were tried. Among others generalized least squares, unweighted least squares, and maximum likelihood methods were tried, all with Varimax rotation and Kaiser normalisation. The last two gave back only three factors with 50 - 54 items in the first factor,

26 - 27 in the second and 11 - 14 in the third. The generalized least squares method resulted in four factors with 51 items in the first, 25 in the second, 13 in the third, and 2 in the fourth factor. That factor structure retrieved is displayed in tables 3a - 3b. The more infrequently used rotation methods (e.g. Quartimax) resulted in only one or two factors.

Table 3 a. The retrieved first new factor in terms of the old factor structure. The Roman and Arabic numbers refer to the numbering in table 1.

**I. New factor**

| Item No | Main factor | Sub-factor | Item No | Main factor | Sub-factor |
|---------|-------------|------------|---------|-------------|------------|
| 83      | I.          | 3          | 30      | III.        | 2          |
| 91      | I.          | 4          | 46      | III.        | 2          |
| 32      | II.         | 2          | 13      | III.        | 3          |
| 37      | II.         | 2          | 21      | III.        | 3          |
| 62      | II.         | 2          | 24      | III.        | 3          |
| 49      | II.         | 3          | 28      | III.        | 3          |
| 77      | II.         | 3          | 47      | III.        | 3          |
| 89      | II.         | 3          | 7       | IV.         | 1          |
| 31      | II.         | 4          | 15      | IV.         | 1          |
| 33      | II.         | 4          | 17      | IV.         | 1          |
| 40      | II.         | 4          | 1       | IV.         | 2          |
| 48      | II.         | 4          | 3       | IV.         | 2          |
| 54      | II.         | 4          | 6       | IV.         | 2          |
| 58      | II.         | 4          | 8       | IV.         | 2          |
| 70      | II.         | 4          | 12      | IV.         | 2          |
| 18      | II.         | 5          | 14      | IV.         | 2          |
| 26      | II.         | 5          | 16      | IV.         | 2          |
| 27      | II.         | 5          | 22      | IV.         | 2          |
| 53      | II.         | 5          | 23      | IV.         | 2          |
| 79      | II.         | 5          | 38      | IV.         | 2          |
| 20      | III.        | 1          | 2       | IV.         | 3          |
| 25      | III.        | 1          | 4       | IV.         | 3          |
| 34      | III.        | 1          | 5       | IV.         | 3          |
| 51      | III.        | 1          | 9       | IV.         | 3          |
| 90      | III.        | 1          | 10      | IV.         | 3          |
| 29      | III.        | 2          |         |             |            |

From tables 3a and 3b it is clearly seen that the old factor structure does not hold. The first new factor (table 3a) is composed of items from all the old main factors and 13 of the 15 original sub-factors. Items in this new factor refer to how the person takes care of things and matters he is in charge of. It is a clear management factor.

The second new factor (table 3b) is a leadership factor (old: management of people) with only three items from other main factors. The third new factor again is a combination of items from all the old main factors. The items in this factor refer to how the person deals innovation, creativity, and challenges, e.g. item 35: *Recognises new possibilities to improve the organisation*, item 45: *Accepts new challenges* and item 11: *Expresses his/her opinion even though others disagree*. The two items in the new fourth factor refer to self-control. They are both from the old factor “management of people”.

Table 3b. The retrieved new factors II - IV in terms of the old factor structure. The Roman and Arabic numbers refer to the numbering in table 1.

**II. New factor**

| Item No | Main factor | Sub-factor |
|---------|-------------|------------|
| 64      | I.          | 1          |
| 76      | I.          | 1          |
| 78      | I.          | 1          |
| 80      | I.          | 1          |
| 86      | I.          | 1          |
| 67      | I.          | 2          |
| 68      | I.          | 2          |
| 71      | I.          | 2          |
| 82      | I.          | 2          |
| 87      | I.          | 2          |
| 88      | I.          | 2          |
| 56      | I.          | 3          |
| 61      | I.          | 3          |
| 73      | I.          | 3          |
| 75      | I.          | 3          |
| 81      | I.          | 3          |
| 84      | I.          | 3          |
| 85      | I.          | 3          |
| 39      | I.          | 4          |
| 57      | I.          | 4          |
| 63      | I.          | 4          |
| 69      | I.          | 4          |
| 42      | II.         | 5          |
| 44      | II.         | 5          |
| 19      | III.        | 2          |

**III. New factor**

| Item No | Main factor | Sub-factor |
|---------|-------------|------------|
| 55      | I.          | 3          |
| 41      | II.         | 1          |
| 52      | II.         | 1          |
| 60      | II.         | 1          |
| 65      | II.         | 1          |
| 66      | II.         | 1          |
| 74      | II.         | 1          |
| 35      | II.         | 2          |
| 43      | II.         | 3          |
| 59      | II.         | 3          |
| 45      | III.        | 3          |
| 11      | IV.         | 1          |
| 36      | IV.         | 1          |

**IV. New factor**

| Item No | Main factor | Sub-factor |
|---------|-------------|------------|
| 50      | I.          | 2          |
| 72      | I.          | 2          |

After the abovementioned analysis all the old main factors were subjected to factor analysis. Table 4 shows an example of those analyses. The old factors do not hold. The new sub-factors consist of 2 - 3 old factors even though most of the items are from the old factors. The amount of items in each factor is also different. In most new factors there are 1 - 2 items more or less. In only one case the amount of factors is the same.

After this a new approach was adapted. All the items were subjected to factor analysis and the program was set to extract all eigenvalues over 1. Several different types of analysis were tried with very similar results. In the following are described the result when Generalised Least Squares was used as the extraction method and Varimax with Kaiser Normalisation as the rotation method.

The initial factor analysis returned eight factors with 41 items for the first factor, 22 for the second and 11, 8, 3, 2, 3, and 2 items for the resting 6 factors. The first two factors were further divided using the abovementioned method. For the 41 item first factor the program found four sub-factors and for the second it found two. The factor structure is displayed in tables 5 - 12 with some examples of the items.

Table 4. Factor analysis for the old factor II: “Mental capacity”. The numbers in parentheses indicate the change in the number of items (old -> new).

|  |                |  |                |
|--|----------------|--|----------------|
| <b>1. New sub-factor (6-&gt;8 items)</b> |                | <b>3. New sub-factor (5-&gt;6 items)</b> |                |
| Item no                                  | Old sub-factor | Item no                                  | Old sub-factor |
| 41                                       | 1              | 43                                       | 3              |
| 52                                       | 1              | 49                                       | 3              |
| 60                                       | 1              | 59                                       | 3              |
| 65                                       | 1              | 77                                       | 3              |
| 66                                       | 1              | 58                                       | 4              |
| 74                                       | 1              | 70                                       | 4              |
| 89                                       | 3              |  |                |
| 79                                       | 5              |  |                |
|  |                | <b>4. New sub-factor (7-&gt;5 items)</b> |                |
|  |                | Item no                                  | Old sub-factor |
|  |                | 31                                       | 4              |
|  |                | 33                                       | 4              |
|  |                | 40                                       | 4              |
|  |                | 48                                       | 4              |
|  |                | 27                                       | 5              |
| <b>2. New sub-factor (7-&gt;6 items)</b> |                |  |                |
| Item no                                  | Old sub-factor | <b>5. New sub-factor (4-&gt;4 items)</b> |                |
| 62                                       | 2              | Item no                                  | Old sub-factor |
| 54                                       | 4              | 32                                       | 2              |
| 18                                       | 5              | 35                                       | 2              |
| 26                                       | 5              | 37                                       | 2              |
| 44                                       | 5              | 42                                       | 5              |
| 53                                       | 5              |  |                |

As in the first analysis the first factor (tables 5a-5d) refers to management, i.e. how the person behaves in regard to things and matters. The first sub-factor (table 5a) deals with punctuality and the second (table 5b) with determination. The third sub-factor (table 5c) deals with information processing, and the fourth (table 5d) with clearness of communication. Except for one item from the old first factor this new main factor consists of items from the old main factors II-IV. Conceptually the items in the new factors make sense.

Table 5a. First main factor, first sub-factor. The Roman and Arabic numbers refer to the numbering in table 1.

|                                    |   |                 |                |
|------------------------------------|---|-----------------|----------------|
| <b>1. Main factor - Management</b> |   | Old main factor | Old sub-factor |
| <b>1. Sub-factor: Punctuality</b>  |   |                 |                |
| Item 18                            | Makes his/her decisions at the right moment | II              | 5              |
| Item 26                            |   | II              | 5              |
| Item 53                            |   | II              | 5              |
| Item 24                            | Works systematically and with good results  | III             | 3              |
| Item 3                             |   | IV              | 2              |
| Item 12                            |   | IV              | 2              |
| Item 23                            |   | IV              | 2              |
| Item 38                            | Ends what he/she has started                | IV              | 2              |
| <b>8 items</b>                     |   |                 |                |

Table 5b. First main factor, second sub-factor. The Roman and Arabic numbers refer to the numbering in table 1.

| <b>1. Main factor - Management</b>                |  | Old main factor | Old sub-factor |  |
|---|--|-----------------|----------------|--|
| <b>2. Sub-factor: Determination, decisiveness</b> |  |                 |                |  |
| Item 13   | Is able to work with several projects simultaneously | III             | 3              |  |
| Item 47   |  | III             | 3              |  |
| Item 1  | Is decisive in his/her actions                       | IV              | 2              |  |
| Item 8  |  | IV              | 2              |  |
| Item 14   |  | IV              | 2              |  |
| Item 16   |  | IV              | 2              |  |
| Item 22   |  | IV              | 2              |  |
| Item 2  |  | IV              | 3              |  |
| Item 4  |  | IV              | 3              |  |
| Item 5  |  | IV              | 3              |  |
| <b>10 items</b>                                   |  |                 |                |  |

Table 5c. First main factor, third sub-factor. The Roman and Arabic numbers refer to the numbering in table 1.

| <b>1. Main factor - Management</b>           |   | Old main factor  | Old sub-factor |   |
|--|---|--|----------------|---|
| <b>3. Sub-factor: Information processing</b> |   |  |                |   |
| Item 83                                      | Knows how the different processes in the defence forces affect his/her own organisation | I  | 3              |   |
| Item 32                                      |   | II   | 2              |   |
| Item 37                                      |   | II   | 2              |   |
| Item 62                                      |   | II   | 2              |   |
| Item 49                                      |   | II   | 3              |   |
| Item 77                                      |   | II   | 3              |   |
| Item 89                                      |   | II   | 3              |   |
| Item 54                                      |   | II   | 4              |   |
| Item 58                                      |   | II   | 4              |   |
| Item 70                                      |   | II   | 4              |   |
| Item 79                                      |   | II   | 5              |   |
| Item 25                                      |   | Sets sub-goals that are in synchrony with the intentions of the defence forces | III            | 1 |
| Item 90                                      |   |  | III            | 1 |
| Item 46                                      |   |  | III            | 2 |
| Item 21                                      |   |  | III            | 3 |
| Item 28                                      |   |  | III            | 3 |
| <b>16 items</b>                              |   |  |                |   |

Also as in the first analysis the second main factor (tables 6a-6b) is one of leadership with altogether 22 items. The first sub-factor (table 6a) deals with the promotion of co-operation and the second (table 6b) with how he/she communicates with the other members of the work community. Except for three all items were retrieved from the old first factor (management of people).

Table 5d. First main factor, fourth sub-factor. The Roman and Arabic numbers refer to the numbering in table 1.

|  |   | Old main factor | Old sub-factor |
|--|---|-----------------|----------------|
| <b>1. Main factor - Management</b>               |   |                 |                |
| <b>4. Sub-factor: Clearness of communication</b> |   |                 |                |
| Item 91  | Gives a clear picture of the situation as a whole | I               | 4              |
| Item 31  | Expresses him-/herself clearly and understandably | II              | 4              |
| Item 33  |   | II              | 4              |
| Item 40  |   | II              | 4              |
| Item 48  |   | II              | 4              |
| Item 27  |   | II              | 5              |
| <b>6 items</b>                                   |   |                 |                |

Table 6a. Second main factor, first sub-factor. The Roman and Arabic numbers refer to the numbering in table 1.

|                                    |  | Old main factor | Old sub-factor |
|------------------------------------|--|-----------------|----------------|
| <b>2. Main factor - Leadership</b> |  |                 |                |
| <b>1. Sub-factor: Co-operation</b> |  |                 |                |
| Item 64                            |  | I               | 1              |
| Item 56                            | Shows respect for the work community and the individuals | I               | 3              |
| Item 61                            |  | I               | 3              |
| Item 73                            |  | I               | 3              |
| Item 75                            |  | I               | 3              |
| Item 81                            | Promotes good spirit in the work community               | I               | 3              |
| Item 84                            |  | I               | 3              |
| Item 85                            |  | I               | 3              |
| Item 39                            |  | I               | 4              |
| Item 63                            |  | I               | 4              |
| Item 42                            |  | II              | 5              |
| Item 44                            | Promotes fast communication in his/her organisation      | II              | 5              |
| Item 19                            |  | III             | 2              |
| <b>13 items</b>                    |  |                 |                |

Table 6b. Second main factor, Second sub-factor. The Roman and Arabic numbers refer to the numbering in table 1.

|                                     |   | Old main factor | Old sub-factor |
|-------------------------------------|---|-----------------|----------------|
| <b>2. Main factor - Leadership</b>  |   |                 |                |
| <b>2. Sub-factor: Communication</b> |   |                 |                |
| Item 76                             |   | I               | 1              |
| Item 78                             | Is easy to approach even when the matter is difficult | I               | 1              |
| Item 80                             |   | I               | 1              |
| Item 86                             |   | I               | 1              |
| Item 68                             |   | I               | 2              |
| Item 71                             | Tolerates criticism and admits when being wrong       | I               | 2              |
| Item 82                             |   | I               | 2              |
| Item 87                             |   | I               | 2              |
| Item 88                             |   | I               | 2              |
| <b>9 items</b>                      |   |                 |                |

Table 7. Third main factor. The Roman and Arabic numbers refer to the numbering in table 1.

| <b>3. Main factor - Creativity and flexibility</b> |  | Old main factor | Old sub-factor |
|--|--|-----------------|----------------|
| Item 55  | Encourages to express new different ideas and thoughts | I               | 3              |
| Item 41  |  | II              | 1              |
| Item 52  |  | II              | 1              |
| Item 60  |  | II              | 1              |
| Item 65  |  | II              | 1              |
| Item 66  |  | II              | 1              |
| Item 74  | Develops and improves things and procedures            | II              | 1              |
| Item 35  |  | II              | 2              |
| Item 43  |  | II              | 3              |
| Item 59  |  | II              | 3              |
| Item 45  | Accepts new challenges                                 | III             | 3              |

**11 items**

The third main factor (table 7) is one of creativity and flexibility. Most of the items come from the old creativity sub-factor (II/1) but there are also items from other sub-factors and the management of people and professional credibility main factors.

The new factor “Courage” (table 8) incorporates items from the old “Determination” main factor. Most of them are from the old sub-factor “Independence”.

Table 8. Fourth main factor. The Roman and Arabic numbers refer to the numbering in table 1.

| <b>4. Main factor - Courage</b> |  | Old main factor | Old sub-factor |
|---------------------------------|--|-----------------|----------------|
| Item 7                          |  | IV              | 1              |
| Item 11                         |  | IV              | 1              |
| Item 15                         |  | IV              | 1              |
| Item 17                         |  | IV              | 1              |
| Item 36                         | Expresses his/her opinion openly even in the presence of superiors | IV              | 1              |
| Item 6                          |  | IV              | 2              |
| Item 9                          |  | IV              | 3              |
| Item 10                         |  | IV              | 3              |

**8 items**

The new factor “Commitment” (table 9) retains only three items of the original five in the old “Commitment to values and goals” sub-factor. The two remaining items are found in the “Information processing” sub-factor of the new “Management” main factor (table 5c).

Table 9. Fifth main factor. The Roman and Arabic numbers refer to the numbering in table 1.

| <b>5. Main factor - Commitment</b> |  | Old main factor | Old sub-factor |
|------------------------------------|--|-----------------|----------------|
| Item 20                            | Is committed to common goals of the defence forces | III             | 1              |
| Item 34                            |  | III             | 1              |
| Item 51                            |  | III             | 1              |

**3 items**

The sixth main factor “Broad knowledge” (table 10) retained only two of the original four items. The other two are found in tables 5c and 6a.

Table 10. Sixth main factor. The Roman and Arabic numbers refer to the numbering in table 1.

|   |   | Old main factor | Old sub-factor |
|---|---|-----------------|----------------|
| <b>6. Main factor - Broad knowledge</b> |   |                 |                |
| Item 29                                 | Has gained broad knowledge by occupying many jobs that require different skills | III             | 2              |
| Item 30                                 |   | III             | 2              |
| <b>2 items</b>                          |   |                 |                |

The new factor “Self-control” (table 11) is comprised of three items from the old sub-factor “Mental flexibility”. The rest are found in table 6b (Communication).

Table 11. Seventh main factor. The Roman and Arabic numbers refer to the numbering in table 1.

|                                      |   | Old main factor | Old sub-factor |
|--------------------------------------|---|-----------------|----------------|
| <b>7. Main factor - Self-control</b> |   |                 |                |
| Item 50                              | Remains calm and unemotional even in stressful situations | I               | 2              |
| Item 67                              |   | I               | 2              |
| Item 72                              |   | I               | 2              |
| <b>3 items</b>                       |   |                 |                |

The new factor “Trusting the subordinates” (table 12) is comprised of two items from the old sub-factor “Encouragement to self-piloting activity”. The rest are found in tables 5d “Clearness of communication” and 6a “Co-operation”.

Table 12. Eighth main factor. The Roman and Arabic numbers refer to the numbering in table 1.

|   |  | Old main factor | Old sub-factor |
|---|--|-----------------|----------------|
| <b>8. Main factor - Trusting the subordinates</b> |  |                 |                |
| Item 57   | Lets his/her subordinates work independently when the goals and guidelines have been agreed on | I               | 4              |
| Item 69   |  | I               | 4              |
| <b>2 items</b>                                    |  |                 |                |

## SUMMARY AND CONCLUSIONS

This first analysis of the competence instrument is based on all the accepted assessments. There was no differentiation between others’ assessments or self-assessments nor was there any differentiation between superiors, peers or subordinates. Whether there are any differences between those groups remains to be seen in later analyses.

From the initial analyses it was clearly seen that the initial factor structure did not hold. Trying to replicate the original four main factor structures was a clear failure. The first factor was

composed of items from all the old main factors and 13 of the 15 original sub-factors. The second factor came very close to the original first factor (management of people). It had only three items from other main factors. The third new factor again was a combination of items from all the old main factors. The fourth factor had only two items.

Trying to replicate the sub-factor structure of the old main factors did not help either. The results were very mixed in terms of the old sub-factors. After this a new approach was adapted. All the items were subjected to factor analysis and the program was set to extract all eigenvalues over 1. Several different types of analysis were tried with very similar results. The initial factor analysis returned eight factors with 41 items for the first factor, 22 for the second and 11, 8, 3, 2, 3, and 2 items for the remaining 6 factors. The first two factors were further divided using the abovementioned method. For the 41 item first factor the program found four sub-factors and for the second it found two. The two first factors were named “Management” and “Leadership”. Some of the new ones retained their old names but new names had to be coined also.

It is not exactly known how the developers of the original instrument arrived at the four main and fifteen sub-factors structure. It is known that the amount of assessments was not as large as it could have been as the original program required lots of manual work. It is also possible that the original sample deviated from the later assessment. The instrument itself has functioned very consistently over the years with means varying very little from sample to sample. Later analyses will show whether there are any differences between earlier and later assessments.

The analyses show clearly that we have a major revision of the instrument in front of us. That work is scheduled for the years 2011 – 2012. The new instrument should be operational in late 2012.

## **REFERENCES**

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