Annex A

Methods and Tools
# Annex A

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EXECUTIVE SUMMARY

Name of method or tool etc: Situational Outlook Questionnaire (SOQ)

Type: Questionnaire

Abstract:

The Situational Outlook Questionnaire (SOQ) is an instrument originally conceptualised and developed by Ekvall (1983) and Ekvall et al. (1983) in Swedish as the ‘Creative Climate Questionnaire’ (CCQ) (with 50 items, 10 dimensions). The instrument has been translated, revised, refined and modified in the late 1980’s based on results of conceptual work and detailed validation studies which lead to the current version, now named Situational Outlook Questionnaire (SOQ).

The SOQ measures the perceptions of employees of the climate for creativity, innovation and their readiness for change within their immediate work environment in any type of organisation. The questionnaire consists of 53 items (including 3 open-ended questions) that assess 9 dimensions (with 5 items each) of organisational climate that foster or hinder creative behaviour and organisational change: Challenge & Involvement; Freedom; Trust / Openness; Idea Time; Playfulness / Humour; Conflict; Idea Support; Debate; Risk-Taking. The CCQ has one additional dimension: Liveliness/Dynamism.

The SOQ (as the CCQ) is intended to be used as a diagnostic tool to improve awareness and understanding of the organisation’s ability to support creativity and change. Organisational climate is conceptualised as a combination of various variables in the individual, the (working) group and the organisation that influence patterns of behaviour in any work environment. These behaviour patterns, together with associated feelings and attitudes characterise the atmosphere or quality of life in an organisation: the Organisational Climate. Organisational Climate is found to be an important factor that can stimulate or hinder change and innovation within an organisation and is therefore a main force of the organisation’s ability to change.

ProACT Process Model

Applicable to Phase and Main Activity:

References

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Website: http://www.cpsb.com/
E-mail: erik@cpsb.com
### General description

**Purpose of measurement / study**

The purpose is to measure the perceptions of employees of the climate for creativity, innovation and their readiness for change within their immediate work environment in any type of organisation.

**Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)**

Questionnaire (standardised)

**Effort required (time, people, equipment, resources); usability and practicability**

20-30 min to perform the measurement. Computer with statistical software for analyses. One person can perform all analyses. Time for analyses is dependent of the number of participants due to data administration and type of statistical analyses.

**Population – Demographic and or Professional Group for which the method is intended for**

Any employee.

**Object of measurement / study (individual, team, profession, department, company)**

Team, professional, department, and company. General remark: Data is gathered on individual level, but it is interpreted and analysed at team/company level

**Language (other than English)**

Original version (CCQ): Swedish, German, Norwegian and French. 
SOQ: German, Spanish, Norwegian, French, Dutch.

**Cost information / Copyrights / Agreements needed**

Copyright protected by developers.

For the CCQ: 10000 SEK (app. 1000 €) per year plus 15 SEK (app. 1.5 €) per questionnaire administered.

For the SOQ special conditions apply: The SOQ can only be administered by specially trained SOQ Practitioners that have received a 2-day training and certification program and passed the exam before signing an agreement and licence that allows using the tool.

Costs for the 2 day program and SOQ material are about 2000 €. The per use fee for the questionnaire including data collection, analysis, presentation of results, feedback etc and all materials is 55 USD/participant (CPSB info from website, 2009).
The questionnaire can be used to measure the change climate and readiness for change among affected staff to investigate the capacity of the organisation to cope with the change and make interventions. The most relevant change scenarios for which the questionnaire applies are:

- Consolidation, integration and outsourcing or services and units, e.g.:
  - consolidation (and / or implementation) of control centres
- Implementation of future operational concepts and systems, e.g. encompassing:
  - significant changes of roles and responsibilities in (operational) jobs;
  - more integrated ATM processes characterised by wide information sharing, enhanced CDM (Collaborative decision making);
  - new technologies (e.g. Data link, 4D trajectory based planning and control, support tools for separation delegated to flight crew, conflict resolution and collision avoidance automation support).
- Changes in organisational structure of the whole company, authority or units, e.g.:
  - corporate privatisation (i.e. restructuring, reorganisation);
  - integration of operations or services (i.e. civil/military; integrating units; creating new ways of working for example in matrix organisation etc.)
- Changes in organisational culture, e.g.:
  - safety reporting culture;
  - innovation and change readiness (i.e. improving or augmenting the climate for innovation and quality of life in the organisation).

Experiences of use in the ATM / safety industry / other industry context, including references / users

CCQ was used in the HUFA-project at two ATCCs in Sweden to measure the readiness for change ahead of the implementation of a new ATC system.


ProACT Process Model

Applicable to phase and activity of the ProACT Process Model

Communication, participation and involvement process
The questionnaire measures relevant communication and involvement aspects such as involvement and openness of communication.

Scoping phase
Risk and opportunities identification:
The readiness for change among the affected staff could be considered as a part of the risk and opportunities identification. An underdeveloped innovative climate could increase resistance for changes.

Evaluation Phase
Monitor and reinforce C&T process:
This measure should be done 1 year after the implementation the earliest and when interventions aiming to improve the organisational climate for innovation and change have stabilised. The measure can help to confirm that the interventions have had a lasting effect and in the direction and on the dimensions as intended.

Technical description

Description of the content / study
The questionnaire consists of 50 items covering 10 dimensions with five items each. The following dimensions are included: Challenge/ Motivation: The degree of emotional involvement, commitment and motivation in operations and goals; Freedom: The level of autonomy, discretion and initiative in behaviour exerted by individuals to acquire information, make decisions, etc.; Support for ideas: The degree to which new ideas and suggestions are attended to and treated in a supportive manner; Trust/Openness: The degree of emotional safety and openness found in relationships; Dynamism/Liveliness: The dynamics and eventfulness of life in the organisation; Playfulness/Humour: The display of spontaneity, ease, good natured joking and laughter; Debate: The expression and consideration of many different view-points, ideas and experiences; Conflicts: The presence of personal and emotional tensions or hostilities; Risk taking: The tolerance of ambiguity and uncertainty; Idea time: The amount of time people can use for elaborating new ideas.
### Context and Prerequisites for application

The questionnaire can be used at any time and any place. General advice to obtain a high response rate: the questionnaire is filled in during an allocated timeslot at work; the questionnaire is filled in during work hours (not leisure time).

### Equipment required for application

Requirements: paper, pencil, statistical software for analyses such as Microsoft Excel, SPSS or Statistica.

### Required user qualifications

A psychologist or human factors specialist is preferred. A human resources manager with familiarity of supervising questionnaire surveys and using simpler statistical methods is also appropriate.

### Requirements / constraint concerning conditions for use

No specific requirements or constraints.

General remarks:
- To obtain a high response rate the questionnaire should be filled in during an allocated timeslot at work; the questionnaire should be filled in during work hours (not leisure time).
- General information about the tool should be given to the participants. No further instruction and training are needed.
- Dependent on purpose of the measurement general feedback could both be given to the team and/or organisation, as well as specific feedback could be given to the individual as an intervening input to individual learning and development.

Confidentiality is dependent on the administration of the measurement and can be total.

### Measure / Response Types

The SOQ items are answered (paper & pencil) on a four-point scale: (0) not at all applicable, (1) applicable to some extent (2), fairly applicable (3) applicable to a high degree.

### Collected parameters and data format

**CCQ:** 50 items covering 10 dimensions with five items each calculated as mean scores for each dimension to get a summary score reflecting that scale.

**SOQ:** 53 items covering 9 dimensions (each 5 items plus 3 open ended questions). The overall score per each dimension is calculated by taking the mean per individual response/dimension and multiplying it by 100. The (theoretical) range per dimension is from 0 – 300. This procedure allows easier comparison across dimensions. The group results are presented as radar (or polar) diagrams and compared.

### Results obtained and interpretation

SOQ measures the following 9 climate dimensions:

1. Challenge and Involvement – The degree to which people are involved in daily operations, long-term goals, and visions
2. Freedom – The degree of independence shown by the people in the organization
3. Trust and Openness – The emotional safety in relationships
4. Idea-Time – The amount of time people can, and do, use for elaborating new ideas
5. Playfulness and Humour – The spontaneity and ease displayed within the workplace
6. Conflict – The presence of personal and emotional tensions (a negative dimension – in contrast to the debate dimension)
7. Idea-Support – The ways new ideas are treated
8. Debate – The occurrence of encounters and disagreement between viewpoints, ideas, experiences and knowledge
Description of use

**Figure / model**

![Diagram](image)

**Organisational RESOURCES**
- Structure & Size - People & Technology – Individ. Skills & Abilities
- Leadership – Organisational Culture – Needs & Individ. Styles
- Management Practices

**Organisational CLIMATE**

**Organisational & Psychological PROCESSES**
- Structure & Size - People & Technology – Skills & Abilities
- Leadership – Organisational Culture
- Management Practices etc.

**Organisational & Individual PERFORMANCE & WELL BEING**
- Quality – Innovation – Productivity
- Job Satisfaction – Well Being
- Management Practices etc.

Figure 1: Model depicting the central role of organisational climate for innovation and change and its effect on performance.

**Process description**

**General:**
Address the aim of the change and its transition supporting the organisation's strategy. Obtain the agreement of the works council and business management before starting the investigation. Make sure that this tool is appropriate to investigate the topic you are interested in and ensure you have enough units of the questionnaire and envelopes if you plan to process a postal investigation. Employees shall be informed of the investigation; its aim, the start and end date and further actions. Ensure anonymity (by using a coded system and voluntarism of the employees) is guaranteed. An information sheet, an informative presentation, or information posters at several places, e.g. notice board, intranet, e-mail can be used. Inform all employees to ensure the investigation is representative. Consider to contact the employees especially if you plan to process a postal interrogation before you start and affirm their commitment for their participation.

Ensure that every employee gets a unit of the questionnaire. If you are processing a postal interrogation you have to indicate the reply due date. The investigation shall be performed under standardised conditions if it is not a postal interrogation; every person has to be exposed to the same conditions (undisturbed setting, material, time etc.). Secure collecting boxes are available within the organisation if the employees got their questionnaires personally and place them in a non-apparent area to ensure anonymity. If the investigation is conducted by an outside consultant or researcher, guarantee anonymity, by preparing a pre-paid envelope together with the questionnaire so that employees can send their completed questionnaires directly back. This can also be used if the employees work at different geographical sites and/or administration of the questionnaire is at another geographical site. After data analysis, inform employees about the results and their interpretation including further actions. Respect the principles of social dialogue.

**Application Process Requirements for SOQ:**
The Creative Problem Solving Group (CPSB) that provides the SOQ licence and certificate to qualified practitioners who then can apply the instrument or provides application service to clients directly. The requirements (in brief) are:

1. There is clear and agreed upon plan to gather data from a clearly identified and specified target group using SOQ.
2. Participants understand why they take the SOQ and have instructions how to access the SOQ (i.e. internet).
3. Participants complete the SOQ, data is compiled and analysed and results are prepared for presentation.
4. Presentation of results is given first to senior management (the sponsor of the work) and the management team.
5. The Sponsor and management team understand the results and develop concrete and specific actions to improve the climate.

Note: In this process it is not foreseen to present the results to participants.
Situational Outlook Questionnaire (SOQ)  

**Evaluation**

**Strengths and Weaknesses of the tool**

**Strengths:**
Could be used to test the willingness and preparedness for change. The main strength of the tool is its long history of scientific development and maintenance/refinement as a measurement instrument. The instrument is used on an international scale and is available in other than English language.

This has led to a stable and consistent, and valid instrument that can provide valid insights into a highly sensitive and important core quality of organisations and or groups within an organisation. The available information on validity and statistics from various studies are helpful to understand and use the results.

**Weaknesses:**
Since the CCQ and SOQ are developed for business organisations and not with the characteristic settings in ATM in mind, some items can be understood as cumbersome for air traffic controllers.

The SOQ is a commercial product and is restricted as a property under a strict licensing and certification scheme which needs to be followed and adhered to. The costs associated with the use are not negligible. These conditions might prevent users from considering the use of the instrument.

**Alternative methods / tools**

This article describes another tool (KEYS) which is an organisational survey that assesses the climate for creativity and innovation that exists in a work group, division or organisation. The tool measures specific management practices that impact innovation.

**Possible combination with other methods / tools**
Possible to combine with most methods and tools. Good to be combined with interviews and observations to gain further insight into the CCQ / SOQ results.

**Psychometric / methodological integrity description**

**Objectivity / (or at least) demonstration**
Standardised Questionnaire.

**Reliability / (or at least) demonstration**
Homogeneity by Cronbach’s alpha results for the CCQ / SOQ from three studies (including one ATM study; Arvidsson et al (2005). Dimension/values in *italics* are for the additional scale in the CCQ only.

A value of > 0.80 as demanded by ISO 10075-3 for application in practice an for deriving decisions is not reached in all cases; especially the dimensions Risk taking and Freedom are markedly below 0.80.

<table>
<thead>
<tr>
<th>CCQ / SOQ Dimension</th>
<th>CCQ (reference sample)</th>
<th>CCQ (ATM sample)</th>
<th>SOQ (reference sample)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Challenge</td>
<td>0.81</td>
<td>0.74</td>
<td>0.81</td>
</tr>
<tr>
<td>Freedom</td>
<td>0.67</td>
<td>0.62</td>
<td>0.69</td>
</tr>
<tr>
<td>Support for ideas</td>
<td>0.88</td>
<td>0.88</td>
<td>0.83</td>
</tr>
<tr>
<td>Trust/Openness</td>
<td>0.76</td>
<td>0.76</td>
<td>0.71</td>
</tr>
<tr>
<td><em>Liveliness/Dynamic</em></td>
<td>0.76</td>
<td>0.78</td>
<td>--</td>
</tr>
<tr>
<td>Playfulness</td>
<td>0.70</td>
<td>0.78</td>
<td>0.78</td>
</tr>
<tr>
<td>Debate</td>
<td>0.67</td>
<td>0.72</td>
<td>0.82</td>
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<tr>
<td>Conflicts</td>
<td>0.84</td>
<td>0.85</td>
<td>0.72</td>
</tr>
<tr>
<td>Risk taking</td>
<td>0.66</td>
<td>0.55</td>
<td>0.52</td>
</tr>
<tr>
<td>Idea Time</td>
<td>0.78</td>
<td>0.73</td>
<td>0.81</td>
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</table>

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Validity / (or at least) demonstration

Most studies that report validity results of the SOQ concentrated on the convergent / discriminative validity of the instrument. It was shown that in a sample with 1,830 individuals from a variety of organisations all nine dimensions discriminated significantly between a group that reported a perceive conducive (supporting) creative climate in their organisation and others that reports a less supporting creative climate in their organisations (Isaksen & Lauer, 2001).

In another study SOQ consistently and significantly discriminated between two types of organisational experiences ('best' and 'worst' case) that individuals had experienced in the past (recollected memory) (Isaksen, Lauer, Ekvall and Brtz, 2000).

The factorial validity was also demonstrated in several studies; the results have lead inter alias to dropping one scale from the CCQ (Lifeliness/dynamism).

Description of methodological integrity and additional Evidence or Value that the tool or study provides

The questionnaire has demonstrated its value in the HUFA Project at two ATC Centres in Sweden. The CCQ and SOQ instruments have a sufficient high reliability and validity to be used as a measurement instrument that meets most requirements of ISO 10075-3:

Objectivity: Is ensured (standardised application and deriving results etc).

Reliability: Cronbachs Alpha is mostly used to demonstrate reliability of the CCQ/SOQ and shows that a number of scales consistently fail to reach the required value of 0.80 for tools that are applied in cases in which practical decisions are derived from the results. The lowest values are for the scales (dimensions) Freedom and Risk taking. Validity: The outcome of some studies on the validity show consistently good convergent and discriminative validity. The scales (dimensions) are shown to have good factorial stability in more than one study. The requirements of ISO 10075-3 regarding validity are fully met.

Sensitivity of measurement: Ensured (more than 3 steps / item in the answer categories).

Diagnosticity: The SOQ identifies differences between environments that show differences in innovation levels. Thus, it can be assumed that the instrument is capable of detecting (existing) differences correctly.

Generalisability: It was demonstrated that the SOQ has not a systematically reduced general applicability and can be applied in most organisations and staff groups provided that full anonymity is ensured.

Usability / Acceptance: The SOQ is recommended to be applied only by qualified practitioners. There are no known problems with the acceptance of the instrument.
Copenhagen Psychosocial Questionnaire (COPSOQ)

EXECUTIVE SUMMARY

Name of method or tool etc: Copenhagen Psychosocial Questionnaire (COPSOQ)

Type: Questionnaire

Abstract:

The Copenhagen Psychosocial Questionnaire (COPSOQ) is a questionnaire developed for assessing a broad variety of psychosocial factors at work that are or can be influenced by a change, like factors in the social work environment, in the quantitative, cognitive, emotional and other areas that the work environment and the work itself puts onto people, the personal importance of work (i.e. perceived quantitative or cognitive demand; meaning of work; predictability etc), the influence and room for decision taking that people have in their work environment, their coping style and sense of coherence on stress and individual health and the well being among employees and other job factors like job security and job satisfaction. The COPSOQ is a very complete and combined method that covers the main relevant workplace related factors.

The questionnaire is in the first instance a screening instrument developed and validated for practical use in organisational and enterprise settings and for making practical interventions in the workplace. The questionnaire can be used to screen the health status of the organisation aiming to detect areas that need to be improved and that could hold back the change process due to poor psychosocial health within the organization.

ProACT Process Model

Applicable to Phase and Main Activity:

References

Developer and source

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Source: http://www.arbejdsmiljoforskning.dk/Spørgeskemaer/Psykisk%20arbejdsmiljø.aspx

Year of development / publication, updates etc.

Original version (in Danish): 2000; 2002 and 2005

### General description

**Purpose of measurement / study**

The purpose of COPSOQ is to improve and facilitate research and practical interventions at the workplace.

The COPSOQ is a multidimensional instrument measuring a broad spectrum of psychological, social and workplace factors that impact health, vitality, and mental health and are related to behavioural and cognitive stress at the workplace.

The original questionnaire (COPSOQ I) is available in three different lengths: a long questionnaire for research use (141 items, 30 dimensions); a medium size questionnaire to be used by work environment professionals (95 items, 26 dimensions); a short version (44 items, 8 dimensions).

COPSOQ II is a revised version of COPSOQ I and has 41 dimensions in the full version with 128, 87 and 40 items respectively. The questionnaire(s) can be used to screen the health status of the organisation by detecting areas for improvement which could hold back the change process due to poor psychosocial health within the organisation.

**Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)**

Questionnaire (standardised).

**Effort required (time, people, equipment, resources); usability and practicability**

Depending on the version: from 30 minutes (long version) to 10 minutes (shortest version) are required. The questionnaire is easy to administer without special instruction.

**Population – Demographic and or Professional Group for which the method is intended for**

Employees from a wide spectrum of occupations and different work environments with different educational background; all age groups in the working population (mean age: 42.3 years; Std. deviation: 10.3 years; Male/Female distribution: 47.5 : 52.5%).

**Object of measurement / study (individual, team, profession, department, company)**

Individual

**Language (other than English)**

The original version is in Danish. Other language versions available are: Norwegian, Swedish, Flemish, German, Spanish, and Portuguese. Other translations are anticipated in the future.

**Cost information / Copyrights / Agreements needed**

The recently developed questionnaire COPSOQ II can be downloaded free of charge from the website. Psychometric and other information on the construction of the COPSOQ scales is available also free of charge on the same website.

### ATM specific mapping

**Guidance for use in the ATM Context**

The questionnaire does not apply to any specific change scenario; instead it could be used to screen the health status of the organisation by detecting areas for improvement which could hold back the change process due to poor psychosocial health within the organisation.

The questionnaire measures factors that are or can be influenced by a change (i.e. perceived quantitative or cognitive demand; meaning of work; predictability; job security etc) and measures factors which could be an outcome of any implemented change on self rated health (i.e. somatic and cognitive stress, burnout, depressive symptoms etc).

**Experiences of use in the ATM / safety industry / other industry context, including references / users**

COPSOQ (original version I) was used in the HUFA-project at two ATCCs in Sweden to measure the impact of change on psychosocial issues during an implementation of a new ATC system.


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ProACT Process Model

Applicable to phase and activity of the ProACT Process Model

**Scoping phase**

Change need analysis – Risk and opportunities identification:
The questionnaire can be used to screen the organisation's mental health status in order to find areas that need to be improved and to find areas that could hold back the change process due to poor psychosocial health.

**Implementation Phase**

Assess and ensure acceptance – Implement changes
The questionnaire can be used to monitor the impact of change on the measured factors and on health during the implementation phase to take mitigating actions if required.

**Evaluation Phase**

Monitor and reinforce the C& T process – Process and outcome assessment:
The questionnaire can be used to monitor the impact of changes on the measured factors and on staff health after the implementation for any lasting negative effects of the change to mitigate them or to check for any positive effects of the change on the psychosocial factors and health that support the change process and foster acceptance. To screen psychosocial factors as a part of the evaluation for checking the mental status of the organisation after the implementation.

Technical description

**Description of the content / study**

The Copenhagen Psychosocial Questionnaire (COPSOQ) is a questionnaire developed for assessing a broad variety of work related factors: psychosocial factors at work, factors in the social work environment, in the quantitative, cognitive, emotional and other demands that the work environment and the work itself puts onto people, the personal importance of work, the influence and room for decision that people have in their work environment, their coping style and sense of coherence on stress and individual health and well being among employees and other job factors like job security and job satisfaction. The COPSOQ is a very complete and combined method that covers the main relevant workplace related factors.

The questionnaire is in the first instance a screening instrument developed and validated for practical use in organisational and enterprise settings and for making practical interventions in the workplace. The instrument could be used to screen the health status of the organization to find areas that needs to be improved and that could hold back the change process due to poor psychosocial health within the organization.

A secondary purpose of the COPSOQ is in research and evaluation. The questionnaire exists in three different lengths: COPSOQ I (original version) is as a long questionnaire (mainly for research use) with 141 items (measuring 30 dimensions); a medium size questionnaire also exists to be used by work environment professionals (95 items, 26 dimensions); a short version does also exist to be used at workplaces (44 items, 8 dimensions); COPSOQ II has 128 (long version), 87 (medium version) and 23 (short version) items measuring on 41 (respectively 28 and 23 for the various versions) dimensions. The description of the included dimensions, together with the latest values on internal consistency (Cronbach’s alphas) is given in the box ‘Results obtained and interpretation’.

All scales in the long research version go from 0 to 100 with high values representing a high level of the concept being measured. Thus a high value on Social support implies good social support; while a high value on the Somatic stress scale indicates a high level of stress. All of the scales are constructed as simple averages with equal weights for the items and equal intervals between the response options.

The COPSOQ concept is a reliable and valid tool for workplace surveys, analytic research, interventions and international comparisons. The questionnaire seems to be comprehensive and to include most of the relevant dimensions according to several important theories on psychosocial factors at work. The three versions facilitate communication between researchers, work environment professionals and work places.

**Context and Prerequisites for application**

The questionnaire can be used at any time and any place. To increase participation and response rates, it is preferred that the questionnaire is filled in e.g. during an allocated timeslot at work.

**Equipment required for application**

Requirements: paper and pencil. For subsequent statistical analyses software tools such as Microsoft EXCEL, SPSS, or Statistica.

**Required user qualifications**

A psychologist or human factors specialist is preferred. A human resources manager with familiarity of supervising questionnaire surveys and using simpler statistical methods is also appropriate.
Copenhagen Psychosocial Questionnaire (COPSOQ)  

**Requirements / constraint concerning conditions for use**

No specific requirements or constraints.

General remarks:
- To obtain a high response rate the questionnaire should be filled in during an allocated timeslot at work; the questionnaire should be filled in during work hours (not leisure time).
- General information about the tool should be given to the participants. No further instruction and training are needed.
- Dependent on purpose of the measurement general feedback could both be given to the team and/or organisation, as well as specific feedback could be given to the individual as an intervening input to individual learning and development.
- Confidentiality is dependent on the administration of the measurement and can be total

**Measure / Response Types**

Mainly a 5-point scale in which 1=do not agree at all, 2=agree to some extent, 3=agree, 4=agree to a great extent and 5=fully agree but variations occurs as well as some 6-point scales.

**Collected parameters and data format**

Dimensions calculated as mean scores of the included items. All scales goes from 0 to 100 with high values representing a high level of the concept being measured.

**Results obtained and interpretation**

The result consists of average scores of 41 dimensions (long version of COPSOQ II) reflecting the psychosocial work environment. The 41 dimensions are described below; dimensions in italics are new dimensions added or changed in the COPSOQ II questionnaire. The values in brackets are Cronbach alphas (internal consistency of the scales) for the long version and respectively the medium size version. No coefficient means that the scale is not included in the medium size version.

Please note that in COPSOQ II a number of items were replaced by other to improve content and psychometric properties; in some scales the number of items were reduced (now 2 – 4 items / scale):

1. **Quantitative demands**: the quantitative demand and workload. (0.82 / 0.82)
2. **Work pace**: the demand in intensivity of the work in terms of working with a certain (fast) pace. (0.84 / 0.84)
3. **Cognitive demands**: demands related to decision making, memory, creativity and overview. (0.74 / --)
4. **Emotional demands**: demands dealing with emotional disturbance, understanding and compassion. (0.87 / 0.87)
5. **Demands for hiding emotions**: demand to hold back emotions, being kind to others regardless of others behaviour (0.57 / --)
   - Sensory demands: demands on sensorial and psycho-motor skills (in COPSOQ II completely removed).
6. **Influence at work**: possibilities to influence working environment and working conditions. (0.73 / 0.73)
7. **Possibilities for development**: development prospects that can affect health and comfort.
8. **Variation of work**: demands on repetitiveness / variation at work (2 items only) (0.50 / --)
   - **Degree of freedom at work**: (in COPSOQ II this scale has been completely removed).
9. **Meaning of work**: importance and implication of work for motivation and engagement at work. (0.74 / 0.74)
10. **Commitment to the workplace**: importance and liking / recommending workplace, intention to quit (0.77 / 0.77).
11. **Predictability**: being informed about future events within the organisation (0.74 / 0.74)
12. **Rewards (recognition)**: individual (personal) respect and recognition at the workplace (0.83 / 0.83)
13. **Role-clarity**: knowing the work objectives, responsibilities and expectations in the work (0.78 / 0.78).
14. **Role-conflicts**: contradictory work demands conflicting with the person’s ethics or values. (0.74 / 0.74)
15. **Quality of leadership**: development opportunities, staff satisfaction important, planning of work (0.89 / 0.89).
16. **Social support from supervisors**: supervisors listen to problems, asking about work, offer support (0.79 / 0.79).
17. **Social support from colleagues**: colleagues provide help, listen to own problems, ask about work (0.70 / 0.70).
18. **Feedback**: feedback on work related issues from colleagues and supervisors. (0.68 / 0.68)
   - **Social relations**: (in COPSOQ II this scale has been completely removed)
19. **Social community at work**: atmosphere, fellowship & cooperation at the workplace. (0.86 / 0.86)
20. **Job Insecurity**: worried to become unemployed, finding another job, transfer to another job (0.77 / --).
21. **Job satisfaction**: satisfaction with work prospects, physical working conditions, use of own ability. (0.82 / 0.82)
22. **Work – Family conflict**: negative effects of work – energy drain, time loss, too much work (0.80 / 0.80)
23. **Family – Work conflict**: private life affects work – energy drain, time loss in private life (0.79 / --)
24. **Trust – management**: trust of management towards employees, info sharing, expressing own views (0.80 / 0.80)
25. **Trust – between employees**: withholding info (between colleagues/ managers), trust to colleagues (0.77 / 0.77)
26. **Justice & respect**: fairness in solving problems, seriousness, appreciation of work, distribution of work (0.83 / 0.83)
27. **Social responsibility**: equal treatment male/female, race & religion diversity, elderly, disabled etc (0.63 / --)
28. **Self rated health**: assessment of own health (overall) (one item only)
29. **Sleeping troubles**: bad sleep patterns, wake up too early, interrupted sleep etc (0.86 / 0.86)
30. **Burnout**: feeling worn out, physically / emotionally exhausted, tiredness (0.83 / 0.83)
Copenhagen Psychosocial Questionnaire (COPSOQ)

31. **Stress**: problems relaxing, being irritable, tense, stressed (0.81 / 0.81)
32. **Depressive symptoms**: feeling sad, lack of self-confidence & interest, bad conscience / feeling guilty (0.78 / --)
   - General health: overall health among the personnel (in COPSOQ II removed / changed; see scale 28.)
   - Mental health: mental health among the personnel (in COPSOQ II changed; see scales 30. – 32.)
   - Vitality: vitality and energy experienced by the personnel (in COPSOQ II changed; see scales 30. – 32.)
33. **Somatic stress**: somatic stress symptoms – stomach pain, headache, muscle tension, palpitation (0.68 / --)
34. **Cognitive stress**: cognitive stress symptoms – concentration, thinking clarity, memory, decision making (0.83 / --)
   - Sense of coherence: experience of consistency and continuity also related to how the individual sees himself (in COPSOQ II changed/removed)
   - Problem focused coping: the individual's way of coping with different problems occurring at the workplace (in COPSOQ II this scale is renamed to Self-efficacy (see 35.)
35. **Self-efficacy**: coping with problems, achieving goals and sticking to plans, trust in own abilities, capability to find always solutions (0.80 / --)

Further items or dimensions measured (mostly as single items) are:
- sexual harassment at work,
- threats of violence,
- physical violence,
- bullying,
- unpleasant teasing,
- conflicts and quarrels,
- gossip and slander.

**Description of use**

**Figure / model**

The figure below depicts the implicit relationship and direction of effects of some parameters in the COPSOQ model and approach. Kristensen assumes a positive influence from cognitive demands and a negative influence from other demands on outcome variables. Social parameters with the exemption of role conflict have a positive impact on outcome variables.

![Diagram](https://via.placeholder.com/150)

**Process description**

Address the aim of the change and its transition supporting the organisation’s strategy. Obtain the agreement of the works council and business management before starting the investigation. Make sure that this tool is appropriate to investigate the topic you are interested in and ensure you have enough units of the questionnaire and envelopes if you plan to process a postal interrogation. Employees shall be informed of the investigation; its aim, the start and end date and further actions. Ensure anonymity (by using a coded system and voluntarism of the employees) is guaranteed. An information sheet, an informative presentation, or information posters at several places, e.g. notice board, intranet, e-mail can be used. Inform all employees to ensure the investigation is representative. Consider to contact the employees especially if you plan to process a postal interrogation before you start and affirm their commitment for their participation. Ensure that every employee gets a unit of the questionnaire. If you are processing a postal interrogation you have to indicate the reply due date.
The investigation shall be performed under standardised conditions if it is not a postal interrogation; every person has to be exposed to the same conditions (undisturbed setting, material, time etc.). Secure collecting boxes are available within the organisation if the employees got their questionnaires personally and place them in a non-apparent area to ensure anonymity. If the investigation is conducted by an outside consultant or researcher, guarantee anonymity, by preparing a pre-paid envelope together with the questionnaire so that employees can send their completed questionnaires directly back. This can also be used if the employees work at different geographical sites and/or administration of the questionnaire is at another geographical site. After data analysis, inform employees about the results and their interpretation including further actions. Respect the principles of social dialogue.

The National Institute for Occupational Health (Copenhagen/Denmark) (Kristensen, 2005) has issued ‘Soft Guidelines’ on ‘How to get from survey to action’ for using COPSOQ (in the following shortened):

1. Never survey the work environment using COPSOQ (or other methods) unless it is clear that actions will be taken.
2. Answering the questionnaire is voluntary, but a 60% response rate is to be ensured to draw valid conclusions.
3. All respondents remain anonymous. If groups of staff are < 15 ask group members for their consent.
4. All employees have a right to see and discuss the results.
5. Management, supervisors and workers should participate and be committed during the entire (change) process.
6. Respect the difference between basic conditions of work that form part of the job (and accept that they cannot be changed) and others that can and should be changed.
7. There are no standard solutions to problems: They need to be developed locally and integrated in daily practice.
8. If interventions are made after using COPSOQ – repeat the survey to see if improvements were as intended.
9. The results from COPSOQ should be used as a tool to learn from and for open dialogue and development.

Evaluation

Strengths and Weaknesses of the tool

**Strengths:** Could be used to test how the work environment is affected by the change process and screen the ‘health’ and other outcome in groups / teams or the entire organisation ahead of a change in order to find obstacles and to address risks and acceptance problems. The results can be presented graphically with three different colours indicating good, moderate or poor work environment.

The major strength of the tool is its scientific development and maintenance as a measurement instrument on an even international scale. This has led to – compared to the number of scales – to a stable and consistent, economic instrument that can be used in a broad variety of formats and combinations with other instruments. Mean / standard deviations and other relevant statistics from validation samples can be used for information and comparison.

**Alternative methods / tools**

COPSOQ I and COPSOQ II are not developments from scratch but are based on well established and validated other measures and parts or entire scales from these other measures were used to create COPSOQ I.

For example:


**Possible combination with other methods / tools**

Can be combined with various methods and tools or with interviews

**Psychometric / methodological integrity description**

**Objectivity / (or at least) demonstration**

Standardised Questionnaire. COPSOQ is highly relevant for investigation of the psychosocial working environment.
The Copenhagen Psychosocial Questionnaire (COPSOQ) Annex A No: A-2

**Reliability / (or at least) demonstration**

Homogeneity of the scales is ensured by appropriate selection of items for the scales based on item content and item statistics, internal consistency measures (Cronbach’s alpha) and factor analyses. The reliability of the (rather short scales) is sufficiently high and has been demonstrated in several studies based on broad and controlled samples and is sufficiently high.

A value of > 0.80 as demanded by ISO 10075-3 is however not reached in all cases. The goal to have an economic instrument for application in practice whilst covering a broad area of related aspects in the scales had the drawback of lower consistency measures of some scales.

**Validity / (or at least) demonstration**

Construct validity is ensured by selection of items and scales from known other instruments or is based on relevant research findings and or has been scientifically checked (i.e. by explorative factor analysis). Recent studies with the COPSOQ I (only in German; Nuebling, M., Stoessel, H.M., Hasselhorn, M., Michaelis, M & Hofmann, F. (2005), Methoden zur Erfassung psychischer Belastung. Schriftenreihe der Bundesanstalt für Arbeitsschutz und Arbeitsmedizin. Dormund/Berlin/Dresden) confirmed the factorial validity of the underlying four factors as depicted in the figure in box ‘Figure / model’:

(1) Outcomes, (2) Support (social relations and leadership), (3) Influence and possibilities for development and (4) Demands. A confirmatory factor analysis and regression models with Outcome variables as criterion etc. all demonstrated the validity of the model and the scales. Detailed results are given in the study.

**Description of methodological integrity and additional Evidence or Value that the tool or study provides**

The COPSOQ instrument has a sufficient high reliability and validity to be used as a measurement instrument that meets most requirements of ISO 10075-3:

**Objectivity:** Is ensured (standardised application and deriving results etc).

**Reliability:** Cronbach’s Alpha is mostly used to demonstrate reliability and shows that a number of scales do not reach 0.80. This is mostly due to short to very short scales.

**Validity:** The outcome of various studies and in-depth-analysis of validity show that the COPSOQ is reaching a very high validity beyond the requirements in ISO 10075-3.

**Sensitivity of measurement:** Ensured (more than 3 steps /item in the answer categories.

**Diagnostics:** The COPSOQ identifies differences between different occupations that are known to exist or can be reasonably assumed. Thus, it can be assumed that the instrument is capable of detecting (existing) differences.

**Generalisability:** It was demonstrated that the COPSOQ has no systematically reduced generalisability. The consistency between occupational groups is different and the weight of the factors (demand factors, social and leadership factors, other etc) to outcome variables are different but the overall validity of the model (model fit) was maintained.

**Usability / Acceptance:** COPSOQ can be easily applied and there are no known problems with the acceptance of the questionnaire.
**Executive Summary**

Last update: 11/08/2010

**Name of method or tool etc:**  Leader Effectiveness and Adaptability Description (LEAD)

**Type:** Questionnaire

**Abstract:**

The Leader Effectiveness and Adaptability Description (LEAD) questionnaire is based on the Hersey-Blanchard Situational Leadership Theory (SLT). The original theory and the proposed model attempts to provide leaders with some understanding of the relationship between an effective leadership style and the level of maturity of their co-workers. Because abilities and motives among co-workers vary, the leader should have sensitivity and diagnostic ability to perceive and appreciate these differences and adapt his/her leadership style to be most effective.

The LEAD questionnaire aims to grasp the prominent leadership profile ('Telling', 'Selling', 'Participating', 'Delegating'). Effectiveness is measured by how close the preferred style is to the 'best' style in a described situation. It represents the leader's capability to adapt their leadership style in accordance with their followers' maturity (and thus followers needs), as indicated by their readiness to perform in a given situation which depends largely on 2 factors: follower knowledge, skills and or ability and motivation and or confidence.

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**ProACT Process Model**

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**References**

**Developer and source**

Original version / theory:

The original version is available via the website of the Center for Leadership Studies Inc. at: [http://www.situational.com](http://www.situational.com)

A more recent and further developed and modified version with 32 items was developed by Hans-Olof Holmkvist, Skandit AB, Sweden. hans.holmkvist@skandit.se

Phone: +46 70 545 9111

**Year of development / publication, updates etc.**


The Situational Leadership Theory and the LEAD questionnaire have been widely studied and used in a broad variety of circumstances and areas. The results were published in many international journals.
The LEAD questionnaire measures four prominent leadership styles (‘Telling’, ‘Selling’, ‘Participating’, ‘Delegating’) and the ‘flexibility’ (capability) of leaders to adapt their leadership style in accordance with the level of maturity of subordinates (followers).

The original questionnaire consists of 12 items, reflecting 12 different leadership situations reflecting different subordinate (follower) behaviour reflecting different levels of maturity. Each item is answered by choosing one of four response alternatives that each reflect one leadership style. The respondent is asked to choose the alternative that best describes his/her behaviour in each situation.

<table>
<thead>
<tr>
<th>General description</th>
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<tbody>
<tr>
<td><strong>Purpose of measurement / study</strong></td>
</tr>
<tr>
<td>The LEAD questionnaire measures four prominent leadership styles (‘Telling’, ‘Selling’, ‘Participating’, ‘Delegating’) and the ‘flexibility’ (capability) of leaders to adapt their leadership style in accordance with the level of maturity of subordinates (followers).</td>
</tr>
</tbody>
</table>

| **Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)** |
| Questionnaire (ipsative response format). |

| **Effort required (time, people, equipment, resources); usability and practicability** |
| The original version takes 10 min. The recent version developed by Holmkvist (2000) takes 20-30 minutes. No known constraints to the usability and practicability as a questionnaire. |

However, it is obvious that some leaders / respondents will find it difficult to respond to the situations based only on the few information about subordinate maturity and may consider the questionnaire as somewhat flawed compared to ‘real life’ situations in which more and complex information is available.

| **Population – Demographic and or Professional Group for which the method is intended for** |
| The Situational Leadership Theory and the LEAD questionnaire have originally been proposed and used for training purposes with leaders (see Hersey & Blanchard, 1974). Leaders can use the questionnaire for self assessment of their style and effectiveness. The LEAD questionnaire has also been used to assess (in a kind of 360-degree assessment) leader behaviour / expected response in the described situations. |

| **Object of measurement / study (individual, team, profession, department, company)** |
| Individual. |

| **Language (other than English)** |
| The original version is available in more languages than English. The revised version is currently available in Swedish. |

| **Cost information / Copyrights / Agreements needed** |
| The original version is available via the website of the Center for Leadership Studies Inc. at: http://www.situational.com A more recent and further developed and modified version with 32 items was developed by Hans-Olof Holmkvist, Skandit AB, Sweden. Costs are 30 € per participant. (160 €/h for consultant help if needed). Copyright: Hans-Olof Holmkvist, Skandit AB, Sweden. Contact: hans.holmkvist@skandit.se Phone: +46 70 545 9111 |
ATM specific mapping

Guidance for use in the ATM Context

It is obvious from the SLT and model that the demand for a more adaptive and situational varying style of leadership and support to subordinates is especially key in situations of change when subordinates are confronted with uncertainty and lack of skills or knowledge about the situation and what to do and when performance and motivation or confidence are at stake.

Almost all change scenarios that can create such a situation of unrest and challenge to the maturity of teams and hence need specific and adapted leadership support are relevant for LEAD.

Therefore, the most relevant change scenarios, where LEAD would apply are:

- Consolidation, integration and outsourcing of services and units, e.g.:
  - consolidation of control centres;
  - centralisation of services (e.g. maintenance, AIS).

- Implementation of future operational concepts and systems, e.g. encompassing:
  - Significant changes of roles and responsibilities in operational jobs;
  - More integrated ATM processes characterised by wide information sharing, enhanced CDM (Collaborative decision making).

- Implementation of international working structures, e.g.:
  - Functional Airspace Blocks (FAB);
  - Trans-national companies or working arrangements (e.g. EAD Group, Entry Point North).

- Implementation of future operational concepts and systems, e.g. encompassing:
  - Significant changes of roles and responsibilities in operational jobs.

- Harmonisation and mobility of staff, e.g.:
  - Transfer of operational staff to other states or in multinational working arrangements.

- Changes in organisational structure of whole companies, authorities or units, e.g.:
  - Corporate privatisation.

- Changes in organisational culture, e.g.
  - Safety reporting culture;
  - Innovation and change readiness.

Experiences of use in the ATM / safety industry / other industry context, including references / users

The further developed and modified version of LEAD has been used in the HUFA-project at two ATCCs in Sweden to measure leadership behaviour during a change process.


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### ProACT Process Model

**Applicable to phase and activity of the ProACT Process Model**

**Communication, participation and involvement process**

The questionnaire can be used in order to identify areas for improvement of leadership, relationship management based on communication and involvement/participation styles.

**Scoping phase**

Change need analysis – Risk and opportunities identification:

The questionnaire can be used to screen leadership behaviour in order to find areas that need improvements and to find aspects of leadership behaviour and leader/follower relationship that could be ineffective and hold back the change process. Check need and possibility to train managers in some behaviour areas that are considered more effective during a change situation.

**Implementation Phase**

Implement supporting structure:

Use LEAD to assess leadership style in relation especially to (identified) challenges that are prominent during the implementation and exchange with leaders on their experience and effectiveness of their behaviour during these turbulent times.

**Evaluation Phase**

Monitor and reinforce C&T process:

The questionnaire can be used to screen leadership behaviour as a part of the evaluation in order to see if the change goals concerning leadership behaviour and relationship have adapted to the situation and leaders have developed more effective leadership styles.

### Technical description

**Description of the content / study**

Leader Effectiveness and Adaptability Description (LEAD) is based on the Situational Leadership Theory and reflecting leadership behaviour from task and relationship behaviour.

**Task behaviour** is described as the extent to which leaders are likely to organize and define the roles of the members of their group, to explain what activities each has to do and when, where, and how tasks are to be accomplished.

**Relationship behaviour** is referring to the extent to which leaders are likely to maintain personal relationship between themselves and members of their group by opening up channels of communications, providing socio-emotional support and facilitating behaviour.

**Maturity** refers to the followers’ experience, willingness and ability to take responsibility for directing their own behaviour in relation to a specific task to be performed. Maturity is divided into 2 components: job maturity (related to the ability to do something) and psychological maturity (related to the willingness or motivation to do something). The level of maturity determines the appropriate combination of task and relationship behaviour for the leader (see figure below). The leadership style profile is thus a description of how task and relationship behaviour are used separately and in combination.

**Effective leadership behaviour** is appropriate to the current situation. Ineffective behaviour is inappropriate to the situation. Thus, leadership behaviour is a continuum rather and not of a ‘one size fits all’ nature. It is more or less effective depending on the current situation.

**Context and Prerequisites for application**

The questionnaire can be used at any time and any place. It is obvious that respondent to the LEAD should be honest and open to learn most from the results individually and collectively.

**Equipment required for application**

Requirements: paper, pencil and answer key for the styles in comparison to the ‘preferred’ answer.

**Required user qualifications**

A human resources manager with familiarity of supervising questionnaire surveys and using simple statistical methods is appropriate to administer and interpret the results.

The person should have an in-depth knowledge about the SLT and be fully aware of the pitfalls and correct ways in which the results of the LEAD can be interpreted or mis-interpreted.
Requirements / constraint concerning conditions for use

No specific requirements or constraints.

General remarks:
- No further instruction and training is needed.
- Feedback and support in the interpretation of the individual results to the individual as an intervening input to training, individual learning and development.
- General information about the background (SLT) the model etc should be given to the participants to understand the method, appreciate the findings and take the most helpful experience and learning from it.

Confidentiality.

Measure / Response Types

The Leader Effectiveness and Adaptability Description (LEAD) is an ipsative questionnaire; the response has to be given as a forced choice (1 out of 4) meaning that if one answer is chosen as the correct one, automatically the other 3 answers are considered as rejected. 12 items consist of descriptions of different leadership situation with subordinates.

In responding to different situations describing different levels of subordinate maturity (in their skills, ability, willingness or confidence) to which a leader should – according to the Situational Leadership Theory (SLT) – adapt his/her leadership behaviour. The final scores as per leadership style is the sum of chosen answers per leadership style and give the leadership profile of the person.

The effectiveness of the leadership style is measured by comparing the chosen leadership style per item to the (theoretical correct) leadership style which is considered most effective in the described situation. A perfect match is rated as a +2 whilst a perfect mismatch is rated as -2; for each situation a second best choice is rated as +1 and -1 respectively. The final effectiveness score can thus range from +24 to -24.

Collected parameters and data format

The original version of the questionnaire consists of 12 items which are presented below and are copied from: http://learn.uci.edu/media/F07/99114/LEADExercise.doc

Directions: Assume you are involved in each of the following 12 situations. For each situation, interpret key concepts in terms of the environment or situation in which you most often think of yourself as assuming a leadership role. Say, for example, an item mentions subordinates. If you think that you engage in leadership behavior most often as a manager at work, then think about your staff as subordinates.

If, however, you think of yourself as assuming a leadership role primarily as a parent, think about your children as your subordinates. READ each item carefully and THINK about what you would do in each circumstance. Then CIRCLE the letter of the alternative that you think would most closely describe your behavior in the situation presented. Circle only one choice.

Do not change the situational frame of reference from one item to another. Select one situation as the reference for all 12 questions.

1. Your subordinates have not been responding to your friendly conversation and obvious concern for their welfare. Their performance is in a tailspin.
   - Emphasize the use of uniform procedures and the necessity for task accomplishment.
   - Make yourself available for discussion but do not push.
   - Talk with subordinates and then set goals.
   - Be careful not to intervene.

2. The observable performance of your group is increasing. You have been making sure that all members are aware of their roles and standards.
   - Engage in friendly interaction, but continue to make sure that all members are aware of their roles and standards.
   - Take no definite action.
   - Do what you can to make the group feel important and involved.
   - Emphasize the importance of deadlines and tasks.

3. Members of your group are unable to solve a problem themselves. You have normally left them alone. Group performance and interpersonal relations have been good.
   - Involve the group and together engage in problem solving.
   - Let the group work it out.
   - Act quickly and firmly to correct and redirect.
   - Encourage the group to work on the problem and be available for discussion.

4. You are considering a major change. Your subordinates have a fine record of accomplishment. They respect the need for change.
   - Allow group involvement in developing the change, but do not push.
   - Announce changes and then implement them with close supervision.
   - Allow the group to formulate its own direction.
   - Incorporate group recommendations, but direct the change.
5. The performance of your group has been dropping during the last few months. Members have been unconcerned with meeting objectives. They have continually needed reminding to do their tasks on time. Redefining roles has helped in the past.
   A. Allow the group to formulate its own direction.
   B. Incorporate group recommendations, but see that objectives are met.
   C. Redefine goals and supervise carefully.
   D. Allow group involvement in setting goals, but do not push.

6. You stepped into an efficiently run situation. The previous administrator ran a tight ship. You want to maintain a productive situation, but would like to begin humanizing the environment.
   A. Do what you can to make the group feel important and involved.
   B. Emphasize the importance of deadlines and tasks.
   C. Be careful not to intervene.
   D. Get the group involved in decision making, but see that objectives are met.

7. You are considering major changes in your organizational structure. Members of the group have made suggestions about needed change. The group has demonstrated flexibility in its day-to-day operations.
   A. Define the change and supervise carefully.
   B. Acquire the group’s approval on the change and allow members to organize the implementation.
   C. Be willing to make changes as recommended, but maintain control of implementation.
   D. Avoid confrontation; leave things alone.

8. Group performance and interpersonal relations are good. You feel somewhat unsure about your lack of direction of the group.
   A. Leave the group alone.
   B. Discuss the situation with the group and then initiate necessary changes.
   C. Take steps to direct your subordinates toward working in a well-defined manner.
   D. Be careful of hurting boss-subordinate relations by being too directive.

9. Your superior has appointed you to head a taskforce that is far overdue in making requested recommendations for change. The group is not clear about its goals. Attendance at sessions has been poor; the meetings have turned into social gatherings. Potentially, the group has the skills to help.
   A. Let the group work it out.
   B. Incorporate group recommendations, but see that objectives are met.
   C. Redefine goals and supervise carefully.
   D. Allow group involvement in setting goals, but do not push.

10. Your subordinates, usually able to take responsibility, are not responding to your recent redefined of standards.
    A. Allow group involvement in redefining standards, but do not push.
    B. Redefine standards and supervise carefully.
    C. Avoid confrontation by not applying pressure.
    D. Incorporate group recommendations, but see that new standards are met.

11. You have been promoted to a new position. The previous supervisor was uninvolved in the affairs of the group. The group has adequately handled its tasks and direction. Group inter-relations are good.
    A. Take steps to direct subordinates toward working in a well-defined manner.
    B. Involve subordinates in decision making and reinforce good contributions.
    C. Discuss past performance with the group and then examine the need for new practices.
    D. Continue to leave the group alone.

12. Recent information indicates some internal difficulties among subordinates. The group has a remarkable record of accomplishment. Members have effectively maintained long-range goals and have worked in harmony for the past year. All are well qualified for the task.
    A. Try out your solution with subordinates and examine the need for new practices.
    B. Allow group members to work it out themselves.
    C. Act quickly and firmly to correct and redirect.
    D. Make yourself available for discussion, but be careful of hurting boss-subordinate relations.

The LEAD question situation example from the revised version of Holmkvist (2000) is as follows:

The project group that your leader is supervising has come to a dead end. The group has misunderstood parts of the project definition and puts the blame on poor briefing. Meetings are used for pseudo-activities. Alternative actions:
A. Your leader gathers the group and ensures that everybody who has any views is allowed to speak his mind. Your leader responds to misapprehensions, supports realistic proposals and shares her or his experience.
B. At a meeting your leader makes a point of bringing out the group’s own resources for solving the problems.
C. Your leader collects the group as soon as possible and finds out what has gone wrong. He or she clarifies the project description until convinced that everyone has understood.
D. Your leader helps the group to understand why the group has got into trouble and supports their own way of grappling with the problems.
Results obtained and interpretation

The questionnaire generates data concerning a leader’s leadership style profile (the frequency of four leadership styles S1-S4 used by the leader across the 12 (in the more recent, extended version of Holmkvist (2000) – 32) situations). This profile provides an overview of a leader’s task oriented and relationship oriented leadership behaviour (see Figure in box ‘Figure / model’).

Each situation described in the questionnaire further reflects a specific maturity level (M1-M4) of a group or an individual employee. The situation described corresponds to one of the alternative leadership actions which are considered to be most appropriate in the given situation according to situational leadership theory. Thus an M1 situation calls for an S1 leadership style, an M2 for an S2 and so on.

The leadership adaptability (effectiveness) score ranges from +2 to -2 and depends on the match between the situation described and the chosen alternative. A score of +2 is given when the leader has managed to adapt the leadership style to the situation, i.e. the chosen alternative matches the situation. A score of +1 to -2 is given when there is a mismatch between the described situation and the chosen alternative, and it is dependent on how inappropriate the chosen action is according to the theory.

The Holmkvist (2000) questionnaire provides additional measures referred to as “under task behaviour” and “over task behaviour”. This measure describes how a lack of leadership adaptability is constituted. When a leader does not manage to adequately adapt the leadership style, this measure describes if the leadership action is more or less task oriented than appropriate. The score ranges from 0 (no under or over task behaviour, i.e. perfect adaptability) to 3.

Each item in the questionnaire further concerns leadership in Group or Individual situations or in terms of Success or Hardship situations. The questionnaire therefore covers four types of situations: Group or Individual situations and situations characterized by Success or Hardship. Thus, the questionnaire makes it possible to analyze how the profile of the leadership style, the leadership style adaptability, and under and over task behaviour changes with the situation. The questionnaire can be used to measure the leaders’ view of their own leadership style but also as a tool to screen the co-workers’ assessment of their leaders’ leadership style.

Description of use

Figure / model

![Situational Leadership Model](image)

Figure 1: The situational leadership model (Hersey & Blanchard, 1969)
### Process description

**General:**
Address the aim of the change and its transition supporting the organisation's strategy. Obtain the agreement of the works council and business management before starting the investigation. Make sure that this tool is appropriate to investigate the topic you are interested in and ensure you have enough units of the questionnaire and envelopes if you plan to process a postal interrogation. Employees shall be informed of the investigation; its aim, the start and end date and further actions.

Ensure anonymity (by using a coded system and voluntarism of the employees) is guaranteed. An information sheet, an informative presentation, or information posters at several places, e.g. notice board, intranet, e-mail can be used. Inform all employees to ensure the investigation is representative. Consider to contact the employees especially if you plan to process a postal interrogation before you start and affirm their commitment for their participation. Ensure that every employee gets a unit of the questionnaire.

If you are processing a postal interrogation you have to indicate the reply due date. The investigation shall be performed under standardised conditions if it is not a postal interrogation; every person has to be exposed to the same conditions (undisturbed setting, material, time etc.). Secure collecting boxes are available within the organisation if the employees got their questionnaires personally and place them in a non-apparent area to ensure anonymity. If the investigation is conducted by an outside consultant or researcher, guarantee anonymity, by preparing a pre-paid envelope together with the questionnaire so that employees can send their completed questionnaires directly back. This can also be used if the employees work at different geographical sites and/or administration of the questionnaire is at another geographical site.

After data analysis, inform employees about the results and their interpretation including further actions.

### Evaluation

#### Strengths and Weaknesses of the tool

**Strengths:** The SLT and the LEAD is arguably the most well known theory and tool on leadership behaviour in relation to situational demand and has therefore a grand track record. The approach is easy to understand and has great face validity. The SLT and LEAD have shown to be effective in leadership training and elaborating on a number of interrelated leadership factors, like role and dynamics of leadership, subordinate expectations for leadership support, leadership effectiveness and decision making. It is a good tool for interventions and leadership development.

**Weakness:** Despite widespread use and application in research and practice the method has shown a number of weaknesses that limit the validity of the results (see box 'Validity').

#### Alternative methods / tools


### Possible combination with other methods / tools

The LEAD questionnaire can be combined with various methods and tools or with interviews. However, if combined, it is recommended to use conjointly:

- ‘Your Medarbetarskap’.
  Contact: Johan Jönsson, Work & Organizational Psychology Division, Department of Psychology, Lund University P.O. Box 213, SE-221 00 Lund, Sweden.  
  johan.jonsson@psychology.lu.se

- ‘Performance Readiness Style Match – Manager & Staff Member’.
  Contact: Center for Leadership Studies (http://www.situational.com).

### Psychometric / methodological integrity description

#### Objectivity / (or at least) demonstration

Standardized questionnaire

#### Reliability / (or at least) demonstration


In two administrations across a six-week interval 75% of managers tested maintained their dominant leadership style and 71% maintained the alternative style (contingence coefficient both .71 (sig. at .001)). The correlation between the adaptability scores (effectiveness) between both measures was .69 (sig. at .001) showing that the measure has moderate stability.
<table>
<thead>
<tr>
<th>Validity / (or at least) demonstration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construct validity: correlations between the LEAD and the Leadership Behaviour and Description Questionnaire (LDBQ) was .32 whilst with some other leadership instruments lower or no correlation was found. According to the Center for Leadership Studies (Hersey &amp; Blanchard, 1969) the 12 items validities for the adaptability scores was between 0.11 – 0.52.</td>
</tr>
<tr>
<td>There is no psychometric information available on the LEAD version with 32 items developed by Holmkvist (2000).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description of methodological integrity and additional Evidence or Value that the tool or study provides</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEAD has been described in: LEAD – Self Manual, Center for Leadership Studies Press and used in the HUFA project at two ATC Control Centres in Sweden (with the revised, 32 items version).</td>
</tr>
<tr>
<td>There is a dissertation thesis and a vast literature available from research and practical application which to a varying degree support the value of using the SLT / LEAD approach.</td>
</tr>
<tr>
<td>The LEAD has sufficient reliability and validity evidence to be used for the purpose of orientation (but not as a precise measure) (according to ISO 10075-3):</td>
</tr>
<tr>
<td><strong>Objectivity:</strong></td>
</tr>
<tr>
<td>Is ensured.</td>
</tr>
<tr>
<td><strong>Reliability:</strong></td>
</tr>
<tr>
<td>Test-retest reliability was used and is moderate.</td>
</tr>
<tr>
<td><strong>Validity:</strong></td>
</tr>
<tr>
<td>Some evidence on validity sufficient to accept the tool as a measure for orientation purpose. Sensitivity of measurement: ensured (more than 3 steps / item in the answer categories).</td>
</tr>
<tr>
<td><strong>Diagnosticity:</strong></td>
</tr>
<tr>
<td>There is evidence for the fact that the results obtained in the LEAD indicate differences between different styles of leadership behaviour and that profile relates in a differential way to behaviour and in the expected direction.</td>
</tr>
<tr>
<td><strong>Generalisability:</strong></td>
</tr>
<tr>
<td>Provided that full anonymity is ensured the scales should deliver valid results.</td>
</tr>
<tr>
<td><strong>Usability / Acceptance:</strong></td>
</tr>
<tr>
<td>The questionnaires are recommended to be applied by qualified practitioners. There are no known problems with the acceptance of the questionnaires.</td>
</tr>
</tbody>
</table>
**Performance Readiness Style Match – Manager & Staff Member (PRSM)**

**EXECUTIVE SUMMARY**

<table>
<thead>
<tr>
<th>Name of method or tool etc:</th>
<th>Last update: 12/08/2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Readiness Style Match – Manager &amp; Staff Member (PRSM)</td>
<td>Type: Questionnaire / checklist</td>
</tr>
</tbody>
</table>

**Abstract:**

The ‘Performance Readiness Style Match – Manager & Staff Member’ (PRSM) is based on the Hersey-Blanchard Situational Leadership Theory (SLT) (more fully described in A-3 LEAD). The basic assumption is that a leader must use different leadership styles – depending on the situation to be most effective. Leadership is the interaction between the readiness of followers and the amount of task guidance (task behaviour) and social support (relationship behaviour).

**Performance Readiness** is the extent to which a follower demonstrates the ability and willingness to accomplish a specific task; this readiness level is not a personality trait but changes from task to task. The leader has to observe and assess the readiness level of followers and to diagnose the performance readiness in two aspects: willingness and ability. The PRSM aims to measure performance readiness and so to identify the effective leadership style that best ‘matches’ readiness. The PRSM allows staff members and leaders to share this information about performance readiness (follower) and leadership style to build more effective working relationships. The PRSM can be used as a screening tool to diagnose the general situation among the staff, as well as an intervening tool between a staff member and its leader providing input to individual learning from own work situation and developing the staff-leader relationship.

Self ratings about the job maturity (**ability** to perform the objectives) and psychological maturity (**willingness** to perform the objectives) create one part of the results. The other part is the comparison between staff member maturity and the leader behaviour supporting the staff member. The interpretation gives a matching about the optimal leadership style (behaviour) to enhance staff member’s work performance and staff-leader relationship. This is important especially during change processes during which tasks, procedures, and other structural conditions might change to proactively manage affected staff members’ performance and staff-leader relationships.

**ProACT Process Model**

**Applicable to Phase and Main Activity:**

<table>
<thead>
<tr>
<th>Scoping Phase</th>
<th>Planning Phase</th>
<th>Implementation Phase</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**Developer and source**

**Original version / theory:** (See box ‘Developer and source’ in A-3 – LEAD). This scale was developed by: Paul Hersey, Kenneth H. Blanchard and Joseph W. Keilty; see for the (commercial) version of the scales: Center for Leadership Studies: [http://www.situationalstore.com/Detail.tpl?rnd=3222&cart=41F8AE12-4D26-4849-A598-6FEB26C383CF&sku=INSTRSM01](http://www.situationalstore.com/Detail.tpl?rnd=3222&cart=41F8AE12-4D26-4849-A598-6FEB26C383CF&sku=INSTRSM01)

**Year of development / publication, updates etc.**

1969 (theory), 1974 (LEAD), 1979 (Readiness)
Performance Readiness Style Match – Manager & Staff Member (PRSM)

General description

**Purpose of measurement / study**

The PRSM allows staff members and leaders to share this information about performance readiness (follower) and leadership style to build more effective working relationships.

**The four styles (S) of leadership are:**

- **S1 – Directing / Telling:** Leaders define the roles / tasks of followers and supervise them closely. Decisions are made by the leader and communicated from leader to follower (one-way).
- **S2 – Coaching / Selling:** Leaders define roles / tasks but seek ideas and suggestions from followers. Two way communication between leaders – followers.
- **S3 – Supporting / Participating:** Leaders pass day-to-day decisions to followers. They facilitate / participate in decision making but leave control of decision in follower’s hands.
- **S4 – Delegating:** Leaders delegate decisions and problem solving to followers, remain involved in the process but followers are responsible for controlling them. Followers decide when they want a leader should be involved.

**The four styles of follower readiness (development level, D) are:**

- **D1 – Low competence (ability) – high commitment (willingness):** Followers are either unable or unwilling to do the task. Lack of ability or of confidence in own ability to do the task could be the reason.
- **D2 – Some competence – some / variable commitment:** Followers may be unable but still confident or unable but willing to make an effort. The reason could be that the task is new to the follower.
- **D3 – High competence – variable commitment:** Follower might be either able or insecure or apprehensive to accomplish the task. Or he / she might be fully capable to do the task but unwilling to use the capability in te task.
- **D4 – High competence – high commitment:** Follower is both able and willing to perform the task. There is a high experience with the job and hence confidence in own ability to do the job well. Often Followers at this development (or maturity) level are more competent than their leader.

The PRSM aims to help to adapt both, the leadership style to the level of development of the followers. The ideal match is: S1 – D1, S2 – D2, S3 – D3, S4 – D4; situational factors must be taken into account and leaders should be able to adapt their style to the situation.

**Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)**

Questionnaire and checklist.

**Effort required (time, people, equipment, resources); usability and practicability**

20-30 minutes to perform the measurement. It could be collaborative process between a staff member and its supervisor. One person can perform all analyses. Time for analyses is dependent of the number of participants due to data administration. For intervening purposes personal feedback is given to the participants.

**Population – Demographic and or Professional Group for which the method is intended for**

Any employee.

**Object of measurement / study (individual, team, profession, department, company)**

Individual level.

**Language (other than English)**

English only.

**Cost information / Copyrights / Agreements needed**

2009 price: 1-50 units $8.95/unit; 51-150 units $8.41/unit; 151-250 units $7.88/unit; 251-350 units $7.34/unit; 351+ units $6.80/unit.
The relevant change scenarios where this questionnaire applies are:

- **Consolidation, integration and outsourcing or services and units, e.g.**:
  - consolidation of control centres;
  - centralisation of services (e.g. maintenance, AIS).

- **Implementation of future operational concepts and systems, e.g. encompassing**:
  - significant changes of roles and responsibilities in operational jobs;
  - more integrated ATM processes characterised by wide information sharing, enhanced CDM (Collaborative decision making).

- **Implementation of international working structures, e.g.**:
  - Functional Airspace Blocks (FAB);
  - Trans-national companies or working arrangements (e.g. EAD Group, Entry Point North).

- **Changes in organisational structure of whole companies, authorities or units, e.g.**:
  - Corporate privatisation.

- **Changes in organisational culture, e.g.**:
  - Safety reporting culture.

Experiences of use in the ATM / safety industry / other industry context, including references / users

No known experiences of use in the ATM Context.

### ProACT Process Model

#### Applicable to phase and activity of the ProACT Process Model

**Scoping phase**

Change need analysis - Risk & opportunities identification - Feasibility evaluation:
Can be used for diagnosing of the current situation; to identify roles, responsibilities and skill and to identify leader-staff member relationship.

**Planning Phase**

Project Objectives definition - Establish structure and resources - Risk & opportunities analysis - Implementation plan development:
Can be used to plan individual and organisational development, to plan roles and responsibilities, to reinforce collaboration and to plan new leader-staff member relationship.

**Implementation Phase**

Implement supporting structures – Assess and secure acceptance:
The questionnaire will help to diagnose the readiness for the changes when they are concrete and felt as a reality. Leaders need to adapt their style accordingly to foster confidence in the ability of staff to manage the tasks. Employees might need additional skills training to increase capability.

**Evaluation Phase**:

Monitor & reinforce C & T process:
Can be used to reinforce/enhance planned processes. It will also help leaders to adapt their leadership style after the change is implemented and employees have gained back their ability and commitment / confidence in their own capability after a period of low commitment / low competence. Changing back to a different leadership style is an important step after the change to avoid irritation and feelings of leaders being too directive and controlling still whilst staff is able to handle the problems and manage the tasks themselves.
## Technical description

### Description of the content / study

The staff member:
- Chooses the major objectives or responsibilities concerning his/her work (individually or in collaboration with the manager).
- Rates the leadership style that the leader/manager is applying while the staff member is performing the objective or responsibility.
- Determines for each objective the Development level (D) (job maturity = competence) and willingness (psychological maturity = commitment) he/she has to perform the tasks.

### Context and Prerequisites for application

The questionnaire can be used at any time and any place. To increase participation and response rates, it is preferable to complete the questionnaire during an allocated timeslot at work.

### Equipment required for application

Requirements: paper, pencil, statistical software for analyses such as Microsoft Excel, SPSS or Statistica.

### Required user qualifications

A psychologist, human factors, human resources or human performance specialist is preferred. A manager with familiarity of supervising intervening tools for the purpose of coaching on individual level is also appropriate.

### Requirements / constraint concerning conditions for use

No specific requirements or constraints.

General remarks:
- To obtain a high response rate the questionnaire should be filled in during an allocated timeslot at work; the questionnaire should be filled in during work hours (not leisure time).
- General information about the tool should be given to the participants. No further instruction and training are needed for participants to provide their response. The person administrating and proving feedback afterwards needs to be fully cognisant of the Situational Leadership Theory and the PRSM approach in particular.
- Dependent on purpose of the measurement general feedback could both be given to the team and/or organisation, as well as specific feedback could be given to the individuals (leaders and followers) as an intervening input to individual learning and development.
- Confidentiality: This tool is meant to help both, leaders and staff to develop an effective relationship in accordance with task demand and data is exchanged on a mutual trust basis.

### Measure / Response Types

Rating form of participant/individual selected objectives or responsibilities

### Collected parameters and data format

The staff member:
- Chooses the major objectives or responsibilities concerning his/her work (individually or in collaboration with the manager). The six (6) items (objectives or responsibilities) are considered to be the most important/major ones.
- Rates the leadership style that the leader/manager is applying while the staff member is performing the objective or responsibility.
- Determines (self scale) to each objective the ability (job maturity) and willingness (psychological maturity) he/she has to perform the tasks.

Finally there is an integration process between the readiness to perform the task by the staff member and the style of applied leadership from the leader/manager. Leadership style (rated by the staff member) according to the “Situational Leadership Theory (SLT)” by Hersey and Blanchard (1996). The leadership style is in association to the objective or responsibility chosen by the staff member.


### Results obtained and interpretation

No norms or cases due to the qualitative methodology. Assistance throughout the process and for interpreting results is provided in the form of tables, figures, and matrices. The outcome format is in different self-ratings. The comparison of the self-ratings gives the objective-specific match between the respondent’s maturity and the leader’s style, i.e. Performance Readiness Style Match – Manager & Staff Member.
Description of use

**Figure / model**

![Situational Leadership II](image)

Figure 1: The four Leadership Styles (see also the situational leadership model (Hersey & Blanchard, 1969) in A-3, box 'Figure / model' with the assigned Development levels (D 1 – D4)).

**Process description**

Address the aim of the change and its transition supporting the organisation’s strategy. Obtain the agreement of the works council and business management before starting the investigation. Make sure that this tool is appropriate to investigate the topic you are interested in and ensure you have enough units of the questionnaire and envelops if you plan to process a postal interrogation. Employees shall be informed of the investigation; its aim, the start and end date and further actions.

Ensure anonymity (by using a coded system and voluntarism of the employees) is guaranteed. An information sheet, an informative presentation, or information posters at several places, e.g. notice board, intranet, e-mail can be used. Inform all employees to ensure the investigation is representative. Consider to contact the employees especially if you plan to process a postal interrogation before you start and affirm their commitment for their participation. Ensure that every employee gets a unit of the questionnaire.

If you are processing a postal interrogation you have to indicate the reply due date. The investigation shall be performed under standardised conditions if it is not a postal interrogation; every person has to be exposed to the same conditions (undisturbed setting, material, time etc.).

Secure collecting boxes are available within the organisation if the employees got their questionnaires personally and place them in a non-apparent area to ensure anonymity. If the investigation is conducted by an outside consultant or researcher, guarantee anonymity, by preparing a pre-paid envelope together with the questionnaire so that employees can send their completed questionnaires directly back. This can also be used if the employees work at different geographical sites and/or administration of the questionnaire is at another geographical site.

After data analysis, inform employees about the results and their interpretation including further actions. Respect the principles of social dialogue.
## Evaluation

### Strengths and Weaknesses of the tool

**Strength:** The SLT itself is arguably the most well known theory on leadership style and behaviour in relation to situational demand and to follower Performance Readiness. The SLT and all developed / derived tools have a grand track record. The approach is easy to understand and to apply and has great face validity. Good to establish and understand a match between worker ability, work tasks, and leadership. Managers will be able to see the need for adapting their style in times of change the requirements for support from their staff and what behaviour they should show. Offers insight in need for management training.

**Weakness:** The SLT in general speaks about leadership style whilst in reality it is management style. Some of the assumptions are trivial. The SLT has found mixed results in various studies both in support and in contrast to the assumed relations. The As often in high face valid methods and theories they fall behind when it comes to ‘true’ validity in terms of being predictive for typical outcome variables.

**Methodological weakness:** Complex analysis procedure if used statistically for diagnosis or screening.

### Alternative methods / tools

Alternative methods and tools are not known. The SLT has a unique approach to follower – leader relationship.

### Possible combination with other methods / tools

Possible to combine with most methods and tools. Good to be combined with interviews and observations to gain further insight into the ‘Readiness Style Match – Manager & Staff Member’ results. Recommended to use conjointly:
- ‘Leader Effectiveness and Adaptability Description (LEAD)’. See A – 3.

### Psychometric / methodological integrity description

#### Objectivity / (or at least) demonstration

Not applicable.

#### Reliability / (or at least) demonstration

The typical reliability measures are not directly applicable due to the qualitative methodology and data. As the main aim of the PRSM is to intervene, to educate and develop skills and management styles primarily on individual level, the focus is not on stability in the scores but on changes in the scores between situations.

No formal reliability coefficients have been found in the literature.

#### Validity / (or at least) demonstration


**Content and face validity:** Content and face validity is established as the staff member (and the leader) with the most insight into the work situation chooses the objectives and responsibilities (items).

**Empirical validity:** There is ample but mixed evidence on differential and predictive validity of the SLT in general and the performance readiness in particular. There is some evidence for the fact that higher leadership scores are correlated with higher influence on the teams managed. On the other hand there is little support for the assumption that an appropriate match between leadership style and subordinate readiness results in higher levels of subordinate job satisfaction and performance and lower levels of job stress and intention to leave (Chen & Silverthorne, 2005).

#### Description of methodological integrity and additional Evidence or Value that the tool or study provides

The results are made up based on individual responses with a participant-specific qualitative perspective focussing on how the respondent understands and experiences the situation. The integrity is established at each time the tool is used as an effect of the relationship between the participating staff member and the leader.

The ‘Readiness Style Match – Manager & Staff Member’ questionnaire is relevant when studying job maturity (skill and willingness to handle given assignments) and leadership style.

The PRSM has unknown / not established reliability and the validity evidence available is mixed at best. The tool can at best be used for the purpose of orientation (and not as a precise measure of performance readiness / style match) in accordance with ISO 10075-3.

As an educational / learning exercise and tool and given the mixed validity evidence the qualitative methodology and data delivered by the PRSM is best used for the purpose of learning, intervening and adapting the process, training, and developing primarily.
### EXECUTIVE SUMMARY

<table>
<thead>
<tr>
<th>Name of method or tool etc:</th>
<th>Type:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Culture Measurement Toolkit (SCMT)</td>
<td>Questionnaire</td>
</tr>
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</table>

#### Abstract:

The SCMT for European ANSPs includes a questionnaire as part of a safety culture concept. The questionnaire provides a snapshot of the safety culture within the ANSP. The results of the questionnaire are used in a second phase in Workshops with ANSP personnel as an input for reflection why the state of safety culture was perceived as it was and to determine how safety could be improved in the organisation. The approach and toolkit was developed in close coordination with the FAA (US) with a view to raise the level of safety culture in European ANSPs prior to the changes due to the next generation of ATM (SESAR).

During situations of change and transition in ATM it is vital to identify and monitor / mitigate / avoid possible negative impact on the safety culture that ensures that safety issues receive the attention and support that is required to maintain a sufficient high level of safety and performance of the Safety Management System (SMS). The pressure to make these changes can lead to a degradation of safety unless a strong safety culture exists.

Safety culture is defined and conceptualised in the SCMT as the enduring priority and real commitment to safety by all levels in an organisation: the management, controllers, supervisors and technical support people and concerns their unwillingness to let production and capacity, cost –efficiency and other concerns outweigh the concerns for safety.

### ProACT Process Model

#### Applicable to Phase and Main Activity:

<table>
<thead>
<tr>
<th>Scoping Phase</th>
<th>Planning Phase</th>
<th>Implementation Phase</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication, participation and involvement</td>
<td>Communication, participation and involvement</td>
<td>Communication, participation and involvement</td>
<td>Communication, participation and involvement</td>
</tr>
<tr>
<td>Continuous evaluation and adaptation</td>
<td>Continuous evaluation and adaptation</td>
<td>Continuous evaluation and adaptation</td>
<td>Continuous evaluation and adaptation</td>
</tr>
</tbody>
</table>

### References

**Developer and source**

Contact information:
Dr Barry Kirwan
Eurocontrol Experimental Centre
91222 Bretigny-sur-Orge
France
http://www.eurocontrol.int/ee/public/standard_page/ETN_2010_2_SC.html

**Year of development / publication, updates etc.**

Description of development of the original version:
<table>
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<tr>
<th>General description</th>
</tr>
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<tbody>
<tr>
<td><strong>Purpose of measurement / study</strong></td>
</tr>
<tr>
<td><strong>The SCMT is under continued</strong></td>
</tr>
<tr>
<td><strong>Definition of Safety Culture summarises the factors involved:</strong></td>
</tr>
<tr>
<td><strong>Important Note:</strong></td>
</tr>
<tr>
<td><strong>Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)</strong></td>
</tr>
<tr>
<td><strong>Effort required (time, people, equipment, resources); usability and practicability</strong></td>
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<tr>
<td><strong>Population – Demographic and or Professional Group for which the method is intended for</strong></td>
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<tr>
<td><strong>Object of measurement / study (individual, team, profession, department, company)</strong></td>
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<tr>
<td><strong>Language (other than English)</strong></td>
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<tr>
<td><strong>Cost information / Copyrights / Agreements needed</strong></td>
</tr>
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</table>
The Change & Transition Tools Compendium

The relevant change scenarios where the Safety Culture Measurement Toolkit (SCMT) applies are:

- Implementation of future operational concepts and systems, e.g. encompassing:
  - Significant changes of roles and responsibilities in operational jobs. (This will possibly lead to changes in the working practices, change of responsibilities, skill requirements – requirements for training / qualification etc)

- Harmonisation and mobility of staff, e.g.:
  - Transfer of operational staff to other states or in multinational working arrangements. (This could require common training and competence schemes, integrated operation and management; revision of working practices, changes in skills requirements).

- Changes in organisational structure of whole companies, authorities or units, e.g.:
  - Civil/military integration of operations. (This will require changes in working practices, skills and training.)

- Certification and regulatory implementation activities, e.g.:
  - Implementation of harmonised safety management standards;
  - Implementation of harmonised/interoperable technology and procedural standards.

- Changes in organisational culture, e.g.:
  - Safety reporting culture. (This will also require different skills and qualification, two-way communication and just culture / no blame culture).

Experiences of use in the ATM / safety industry / other industry context, including references / users

Eurocontrol began studying safety culture in ATM in 2004 with studies on impacts new technologies on safety culture in ATM (Eurocontrol, 2005*) and developed a face valid (assessed by managers and ATCOs) version which was since undertaken further development and validation.

Eight ANSPs have until 2009 used the approach and the SCMT. Some ANSPs have used the approach to refine their safety strategies and or have used the results for improving their safety culture in a stepwise which includes a final 2nd measurement and strategic review; see Figure below:

![Figure 1: The Eurocontrol Safety Culture Survey approach / timing](http://www.eurocontrol.int/eec/public/standard_page/DOC_Report_2005_018.html)

The experience with the approach is reported to be good and the support from participating ANSPs is continuing.

### ProACT Process Model

**Applicable to phase and activity of the ProACT Process Model**

Continuous evaluation and adaptation process

The SCMT approach and survey can be used independent from a concrete current or planned change to assess the strength and robustness of the organisation’s safety culture that help to avoid negative effects of changes on safety and to maintain the level of safety. The results can indicate improvements or need for adaptations prior to change implementation.

### Scoping Phase

**Risk & Opportunity Identification:**

The SCMT approach can help to find out and in fact develop improved safety culture in preparation/before major changes are planned and implemented.

### Technical description

**Description of the content / study**

The 13 Safety Culture elements measured by the SCMT questionnaire (2009 version in: Mearns, K., Kirwan, B. & Kennedy, R.J. (2009)):

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>1.</td>
<td>Commitment to Safety</td>
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<tr>
<td>2.</td>
<td>Resources for Safety</td>
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<tr>
<td>3.</td>
<td>Responsibility for Safety</td>
</tr>
<tr>
<td>4.</td>
<td>Involving ATCOs in safety</td>
</tr>
<tr>
<td>5.</td>
<td>Management involvement in Safety</td>
</tr>
<tr>
<td>6.</td>
<td>Teaming for Safety</td>
</tr>
<tr>
<td>7.</td>
<td>reporting Incidents / Communicating Problems</td>
</tr>
<tr>
<td>8.</td>
<td>Learning from Incidents</td>
</tr>
<tr>
<td>9.</td>
<td>Blame &amp; Error Tolerance / Discipline and Punishment</td>
</tr>
<tr>
<td>10.</td>
<td>Communication about Procedural / Systems Change</td>
</tr>
<tr>
<td>11.</td>
<td>Trust within the Organisation</td>
</tr>
<tr>
<td>12.</td>
<td>Real Working Practices</td>
</tr>
<tr>
<td>13.</td>
<td>Regulatory effectiveness</td>
</tr>
</tbody>
</table>

### Context and Prerequisites for application

The SCMT can be used at any time in the work environment. To increase participation and response rates, it is preferred that the questionnaire is completed during an allocated timeslot at work.

### Equipment required for application

Paper, pencil, statistical software such as Microsoft Excel, SPSS or Statistica.

### Required user qualifications

A human factors specialist or industrial psychologist with good knowledge in organisational safety (Safety Management Systems) is required.

### Requirements / constraint concerning conditions for use

The anonymous and confidential nature of the data collected has to be stressed to alleviate problems providing open and honest answers. The SCMT will be disseminated to the ANSP senior management and from there cascaded down to supervisors and to the workforce to achieve their commitment and buy-in.

In practice, and as with other measures of high stake as in safety two factors for reluctance can be encountered: a reluctance of management that results could incriminate them and their failings in safety and secondly a fear of staff that the results will be ignored or ‘white washed’.

These are reasons why a high response rate is required to avoid extreme responses (too negative or too positive) and having a workshop to moderate responses and challenge them. Clear indications for failings in safety culture need to be addressed by management and must be put forward.

### Measure / Response Types

Rating scale (Likert-type) with 5 answer categories: (1) strongly disagree – (5) strongly agree.

### Collected parameters and data format

Nine safety culture aspects are represented by nine scales in the questionnaire: Learning, Reporting, Justness, Flexibility, Working situation, Communication, Safety-related behaviours, Attitudes to safety, Risk perception.

### Results obtained and interpretation

The outcome format can vary, depending on need and details desired. An average score can be calculated for each safety culture subscale or aspect. For each item the distribution of scores on the five-point scale can be calculated. It is also possible to do various group analyses e.g. analyses of scores for different work shifts or occupations.
<table>
<thead>
<tr>
<th>Figure / model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Process description</strong></td>
</tr>
<tr>
<td>The results from the SCMT questionnaire are collected and analysed by experts by / with Eurocontrol expert support; key issues of importance for safety culture are identified and fed back to Focus Groups (4 – 6 personnel from the ANSP) plus one facilitator, a note taker and an operational expert if required.</td>
</tr>
<tr>
<td>The Focus Groups (i.e. for different areas / professional groups) can provide in-depth and precise understanding of the results and can generate improvements measures. The results (a detailed report) are presented to management and all staff. Management determines which measures to incorporate into a strategic safety action plan, which is then implemented.</td>
</tr>
<tr>
<td>ANSPs may instead of using the Eurocontrol survey approach carry out the safety culture survey and using their own resources.</td>
</tr>
<tr>
<td><strong>Strengths and Weaknesses of the tool</strong></td>
</tr>
<tr>
<td>It is important that management shows commitment to enhancing safety culture and for performing the assessment. Care should be taken to avoid performing the safety culture assessment during a time when irritation exists in the organisation which can distort the validity of the results.</td>
</tr>
<tr>
<td>Employee involvement in the enhancement process is vital for a successful outcome of any safety improvement programme or intervention. Interviews can and should be conducted to provide qualitative data that could validate the quantitative data from the questionnaire survey, and to gain more in-depth knowledge about the interviewee’s perceptions and judgments of safety and safety culture.</td>
</tr>
<tr>
<td>Through the interviews, it is possible to collect examples of positive and negative expressions of safety culture that the interviewee has experienced in his/her work.</td>
</tr>
<tr>
<td><strong>Alternative methods / tools</strong></td>
</tr>
<tr>
<td>Other safety culture questionnaires are under development reflecting similar or slightly different aspects of safety culture.</td>
</tr>
<tr>
<td><strong>Possible combination with other methods / tools</strong></td>
</tr>
<tr>
<td>The SCMT may be used in combination with measures for organisational climate/culture as the Situational Outlook Questionnaire (SOQ) (Ekvall, 1990) and Psychosocial Work Environment measures (see: A_1 SOQ; A_2 COPSOQ).</td>
</tr>
<tr>
<td>Psychometric / methodological integrity description</td>
</tr>
<tr>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td><strong>Objectivity / (or at least) demonstration</strong></td>
</tr>
<tr>
<td>Objectivity is ensured for application and interpretation of the questionnaire (standardised instructions, scoring of items).</td>
</tr>
<tr>
<td><strong>Reliability / (or at least) demonstration</strong></td>
</tr>
<tr>
<td>No reliability figures were reported yet (still under development).</td>
</tr>
<tr>
<td><strong>Validity / (or at least) demonstration</strong></td>
</tr>
<tr>
<td>The SCMT is based on aspects of safety culture from literature and validated by managers and controllers in ATM. The questionnaire is based on a content validity approach, in which selection of items representing each safety culture aspect was assured. Further refinements have been made since the original version. The factorial validity of the SCMT was tested following first an exploratory and later confirmatory approach. The sample size was insufficient for deriving a conclusion on the factor structure. Concurrent, discriminative / convergent and predictive validity of the instrument have thus far not been systematically investigated.</td>
</tr>
</tbody>
</table>

**Description of methodological integrity and additional Evidence or Value that the tool or study provides**

The SCMT has been developed following a systematic way and based on established concepts that are considered well founded. The SCQ has not demonstrated its reliability and results can be used only as qualitative measures of the safety culture for use in focus groups. The instrument does not meet the requirements of ISO 10075-3.

| Objectivity: | Is ensured (standardised application and deriving results etc). |
| Reliability: | None. |
| Validity: | The instrument was developed based on existing and well established theoretical concepts (conceptual validity) and was validated by subject matter experts in ATM and has face validity. Whether the SCMT measures correctly what it aims to measure i.e. its concurrent validity was not established. There is no evidence for criterion related validity (external criterion). The Factorial validity could not be tested due to lack of sufficient sample sizes (> 300 staff / sample). |
| Sensitivity of measurement: | Not known. |
| Diagnosticity: | Not known. |
| Generalisability: | Not known. |
| Usability / Acceptance: | The SCQ can be easily applied and there are no known problems with the acceptance of the questionnaire. |

The questionnaire has been used in different environments. The tool can help to identify interventions in safety culture and improvements.
YOUR EMPLOYEESHIP

EXECUTIVE SUMMARY

Name of method or tool etc: Your Employeeship

Type: Questionnaire

Abstract:

Your Employeeship is a questionnaire both for screening purposes and for individual and collective learning and development. It can be used as a screening method to diagnose the general situation in an organisation or for intervention purposes with members in an existing team. The questionnaire assesses the work-oriented relationship behaviour based on task ability (technical skills to meet the requirements of assigned tasks) and social ability (the social capabilities to meet the requirements for social interactions that then task demands).

The results give staff members and leaders knowledge and understanding about their own and other fellow workers’ behaviour that helps to develop more effective working relationships. The assumption behind the tool is, that highly developed work-oriented relationships have a positive influence on organizational climate, organizational outcomes, and supports in the adaptation to new working conditions and requirements. During the early phases the results can give input about the psychosocial aspects “readiness” to handle the change. By following up on these results during the change process the tool provides input how the psychosocial aspects influence and are influenced by the change.

ProACT Process Model

Applicable to Phase and Main Activity:

References

Developer and source

Johan Jönsson: johan.jonsson@psychology.lu.se

Work & Organizational Psychology Division - Department of Psychology

Lund University, Sweden

P.O. Box 213

221 00 Lund, Sweden.

Year of development / publication, updates etc.


Jönsson, J., Johansson, C. R., & Arvidsson, M. (2009b), Employeeship concept: A holistic model of work relationships focused on leader and follower behaviour. (Manuscript under revision.) A technical report about the development of the tool and an article based on empirical research are expected to be published in 2010.
Your Employeeship

<table>
<thead>
<tr>
<th>General description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose of measurement / study</strong></td>
</tr>
<tr>
<td>Your Employeeship is used to measure individual’s and team’s relationship behaviour based on task ability based on required technical skills to fulfil the requirements of the task and social ability, e.g. individual’s psychological maturity to handle social interactions that the situation demands. It allows staff members and leaders to gain knowledge and understanding about their own and fellow workers’ behaviour to build more effective working relationships. It is assumed that highly developed work-oriented relationships, i.e. developed employeeship, has a positive influence on organisational climate, organisational outcomes, and supports teams when adapting to new working conditions and requirements.</td>
</tr>
<tr>
<td><strong>Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)</strong></td>
</tr>
<tr>
<td>Questionnaire</td>
</tr>
<tr>
<td><strong>Effort required (time, people, equipment, resources); usability and practicability</strong></td>
</tr>
<tr>
<td>It takes about 30 minutes to finish the questionnaire (15 minutes for the short version). A computer with statistical software for analyses is needed. One person can perform all analyses. Time for analyses is dependent of the number of participants due to data administration and type of statistical analyses.</td>
</tr>
<tr>
<td><strong>Population – Demographic and or Professional Group for which the method is intended for</strong></td>
</tr>
<tr>
<td>Any employee.</td>
</tr>
<tr>
<td><strong>Object of measurement / study (individual, team, profession, department, company)</strong></td>
</tr>
<tr>
<td>Individual, team, professional, department, and company. General remark: Data is gathered on individual level, but it is often interpreted and analysed on team/company level.</td>
</tr>
<tr>
<td><strong>Language (other than English)</strong></td>
</tr>
<tr>
<td>Swedish and English</td>
</tr>
<tr>
<td><strong>Cost information / Copyrights / Agreements needed</strong></td>
</tr>
<tr>
<td>The questionnaire is currently available on paper and pencil. There is an ambition that it will be web-based. The copyright is protected by developer. No fee is applied for use for research without any commercial impact; analysis and interpretation of results will be performed according to an agreement. Fees are 10 € per participant/questionnaire for commercial use; analysis and interpretation of results will be performed according to an agreement. The questionnaires (short/long versions in English/Swedish) and the manual and scoring sheets can be downloaded from: <a href="http://www.psychology.lu.se/o.o.i.s/18851">http://www.psychology.lu.se/o.o.i.s/18851</a></td>
</tr>
<tr>
<td><strong>ATM specific mapping</strong></td>
</tr>
<tr>
<td>The relevant change scenarios where Your Employeeship applies are:</td>
</tr>
<tr>
<td>o Consolidation, integration and outsourcing of services and units, e. g.:</td>
</tr>
<tr>
<td>• consolidation of control centres;</td>
</tr>
<tr>
<td>• centralisation of services (e.g. maintenance, AIS).</td>
</tr>
<tr>
<td>o Implementation of international working structures, e.g.:</td>
</tr>
<tr>
<td>• Functional Airspace Blocks (FAB);</td>
</tr>
<tr>
<td>• Trans-national companies or working arrangements (e.g. EAD Group, Entry Point North).</td>
</tr>
<tr>
<td>o Implementation of future operational concepts and systems, e.g. encompassing:</td>
</tr>
<tr>
<td>• significant changes of roles and responsibilities in operational jobs;</td>
</tr>
<tr>
<td>• more integrated ATM processes characterised by wide information sharing, enhanced CDM (Collaborative Decision Making).</td>
</tr>
<tr>
<td>o Harmonisation and mobility of staff, e.g.:</td>
</tr>
<tr>
<td>• transfer of operational staff to other states or in multinational working arrangements.</td>
</tr>
<tr>
<td>o Changes in organisational structure of whole companies, authorities or units, e.g.:</td>
</tr>
<tr>
<td>• Corporate privatisation;</td>
</tr>
<tr>
<td>• Civil/military integration of operations.</td>
</tr>
<tr>
<td>o Changes in organisational culture, e.g.:</td>
</tr>
<tr>
<td>• Safety reporting culture;</td>
</tr>
<tr>
<td>• Innovation and change readiness.</td>
</tr>
</tbody>
</table>
**Experiences of use in the ATM / safety industry / other industry context, including references / users**

The questionnaire has been successfully used for research purpose at a European airport in 2008 and 2009. Several organisations (ANSP-airport departments (ATS, marshalling service), airline company, and ground handling company) working with turn-round processes participated. An article based on the empirical data is under revision and expected to be published in 2010.

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**ProACT Process Model**

<table>
<thead>
<tr>
<th>Applicable to phase and activity of the ProACT Process Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Continuous evaluation and adaptation process</strong></td>
</tr>
<tr>
<td>Can be used to verify the work-oriented relationships (social ability).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scoping Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change need analysis - Risk &amp; opportunities identification - Feasibility evaluation:</td>
</tr>
<tr>
<td>Can be used to identify the psychosocial aspects influencing the change.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Planning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social impact assessment - Risk &amp; opportunities analysis:</td>
</tr>
<tr>
<td>Can be used to measure the readiness for change and to determine expected implementation results.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Evaluation Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process &amp; outcome assessment:</td>
</tr>
<tr>
<td>Can be used to measure the quality of the process and the quality of the implementation results.</td>
</tr>
</tbody>
</table>

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**Technical description**

**Description of the content / study**

Your Employeeship measures specified aspects of employees' behaviour in terms of the Employeeship-Leadership-Relationship model (ELR). The two aspects of behaviour are dependent of task and social abilities. Social ability is the individual psychological maturity to handle social interactions when it comes to open and free communication, learning, as well as show and test emotions, attitudes and perceptions. Task ability is the required skills and competences that are needed for the given assignments.


**Context and Prerequisites for application**

The questionnaire can be used at any time and any place. To increase participation and response rates, it is preferred that the questionnaire is filled in during an allocated timeslot at work.

**Equipment required for application**

Paper and pencil, statistical software for analyses such as Microsoft Excel, SPSS, or Statistica

**Required user qualifications**

A psychologist or human factors, human resources and human performance specialist is preferred. A manager with familiarity of supervising questionnaire surveys and using statistical methods is also appropriate.

**Requirements / constraint concerning conditions for use**

No specific requirements or constraints.

**General remarks:**

- To obtain a high response rate the questionnaire should be filled in during working hours (not leisure time).
- General information about the aim of the questionnaire should be provided to participants. No further instruction and training are needed.
- Dependent on purpose of the measurement general feedback could be provided to the team and/or organisation, as well as specific feedback could be provided to the individual as an intervening input to individual learning and development.
- Confidentiality can be total but is dependent on the administration of the study and the questionnaire.
### Measure / Response Types

Each item is answered by one of five response alternatives. The alternatives describe different behaviour strategies of the respondent. The respondent is asked to choose the alternative that best describes the respondent’s expected behaviour in each situation.

### Collected parameters and data format

The questionnaire consists of 32 items (16 items in the short version). Each question reflects a specific work situation which is described to the respondent. Each item is answered by one of five alternatives. The alternatives describe different behaviour strategies (applicable to all employees independent of hierarchical level). The respondent is asked to choose the alternative that best describes the respondent’s expected behaviour in each situation.

### Example situation (item):

A young fellow worker who previously has worked with similar assignments is still shy and insecure in his role. He manages routine work well, but he often fails when he is handed autonomous work assignments.

### Alternative actions:

A. Ask how he experiences the work situation and support his way of structuring the work.  
B. Give advice and support so that he feels more secure in his new role.  
C. Ask how he values the work situation and give personal support.  
D. Give instruction and feedback on the work he performs.  
E. Let him learn from his mistakes and thus develop at his own pace.

### Results obtained and interpretation

The questionnaire assess the respondent’s Employeeship Style (ES) profile (the frequency of five employeeship styles “pre-mature employeeship style” and ES1-ES4 used by the respondent across 32 or 16 situations). This profile provides an overview of the respondent’s work-oriented and person-oriented employeeship behaviour.

**ES1**: task-professional employeeship style,  
**ES2**: collegial-professional employeeship style,  
**ES3**: socio-collegial employeeship style, and  
**ES4**: socio-emotional employeeship style.

Results showed that the assessed behaviours of the employeeship styles co-vary with organizational climate. Furthermore, combined results of employeeship styles and leadership styles have shown to co-vary more strongly with organisational climate than leadership behaviour as a separate variable.

Each situation of the questionnaire further describes a specific level of employeeship. The situation described corresponds to one of the alternative actions which are considered to be most appropriate according to the employeeship concept. Thus, a situation that describes a relationship of low developed employeeship calls for ES1 behaviour, the next level calls for ES2 and so on. The method provides a further measure of the respondent’s adaptability style (the respondent’s ability to adapt the employeeship style relative the situation).

The adaptability score ranges from +4 to 0 and depends on the match between the situation described and the chosen alternative. A score of +4 is given when the respondent has managed to adapt the employeeship style to the situation, i.e. the chosen alternative matches the situation. A score of +3 to 0 is given when there is a more or less mismatch between the described situation and the chosen alternative.

Additional measures referred to as “under-mature work-oriented behaviour” and “over-mature person-oriented behaviour” are provided. These measures describe how a lack of employeeship style adaptability is constituted. When a respondent does not manage to adequately adapt the employeeship style, they describe if the style behaviour is more or less work oriented or person oriented than appropriate. The score ranges from 0 (balance between work-oriented and person-oriented behaviour, i.e. perfect adaptability) to 3 for the over-mature scale (too much person-oriented behaviour) and 4 for the under-mature scale (too much work-oriented behaviour as well as lack of functioning employeeship).

Each item in the questionnaire further concerns employeeship in Group or Individual situations or in terms of Success or Hardship situations. The questionnaires cover four types of situations: Group or Individual situations and situations characterized by Success or Hardship. Thus, they make it possible to analyse how the profile of the employeeship style, the interaction style adaptability and under and over mature behaviour, change with a situation.
The Change & Transition Tools Compendium

Your Employeeship

Annex A No: A-6

Description of use

Figure / model

MATURITY of the relationship between co-workers (social ability and ableness)

INTERACTION STYLE of Employeeship

<table>
<thead>
<tr>
<th>Maturity</th>
<th>Immature</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
<th>Mature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IS1</td>
<td>IS2</td>
<td>IS3</td>
<td>IS4</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 1: The Employeeship Style (ES) profile**

The Figure above illustrates that employeeship is a continuum ranging from work-oriented to people oriented. Similarly leadership ranging from task oriented to people oriented leadership. The maturity of the relationship between co-worker measures the extent to which a culture of shared values, of common understanding, attitudes, emotions, and most important behaviours does exist. Employeeship is intended to facilitate development of efficient and productive work processes and in fact the entire social-technical (functional) system which includes human resources and related psychological and social aspects. This is achieved when the maturity level of the relationships between co-workers is augmented: from a (1) simple assignment of staff to a situation of staff fulfilling the assignment; (2) from a split between authority and responsibility to authority and responsibility are combined in the same person and according to the skills and training, experience a person has; (3) from a task oriented to a more relation oriented leadership style.

The Interaction Styles in the Employeeship in an ideal sense should correspond and be congruent to the leadership style to be effective. Discrepant employeeship and leadership styles will lead to uncertainty, anxiety and low motivation or irritation. The four Interaction styles are:

- **IS1** = Task-professional employeeship / leadership style works best in a work environment in which relationships are framed by clear and specific assignments and roles.
- **IS2** = Collegial – professional employeeship / leadership style works best in an environment in which tasks need to be performed in a collaborative way.
- **IS3** = Socio-collegial employeeship / leadership style works in situations in which shared values, attitudes, beliefs and behaviour matter professionally and are required to develop professionally and reach higher efficiency.
- **IS4** = Social-emotional employeeship / leadership style is required in a personal sense and is important for developing the organisation further and towards a high efficiency and quality level.

**Process description**

Make sure that the Employeeship questionnaire is the appropriate tool and that the information that it delivers is relevant to the problem in the change process at hand and that the results from the questionnaire will be used and are accepted as an input. Staff members and leaders should agree to act upon the results in developing a more efficient teamwork relationship.

Team members must be informed and should be fully involved and support the application. They should be informed in a way that ensures that they have control of the process and that the results obtained are personal and are not disclosed. If individuals agree only can their results be made available to other team members.

An information sheet, an informative presentation and consultation session in which all questions can be asked should be arranged. The commitment for the participation of the team should be affirmed.

After data analysis, inform team members about the results and their interpretation; include discussions on conclusions that could be drawn and on further steps that the team wants to take in improving team work efficiency.
## Evaluation

### Strengths and Weaknesses of the tool

**Assumed Advantages**: Good for interventions and collaborative learning and development. The tool measures employeeship styles important for collaboration in four types of situations – Success vs. Hardship and Group vs. Individual.

**Assumed Disadvantage**: Complex analysis procedure if used statistically as a diagnosis or screening instrument.

### Alternative methods / tools

Alternative methods or tools are not known.

### Possible combination with other methods / tools

Possible to combine with most methods and tools. Good to be combined with interviews and observations to gain further insight into the ‘Your Employeeship’ results. Good to be combined with leadership measurement for a holistic perspective from both top-down and bottom-up.

**Recommended to use conjointly**: ‘Leader Effectiveness and Adaptability Description (LEAD)’ (see A_3 in this Compendium). The combined use of Your Employeeship and LEAD showed to be more effective than the sole use of either employeeship or leadership assessments.

**Contact**: Hans-Olof Holmkvist, Skandit AB, Sweden.

hans.holmkvist@skandit.se
Phone: +46 705-45 91 11

‘Performance Readiness Style Match – Manager & Staff Member’. Contact: [http://www.situational.com](http://www.situational.com)

### Psychometric / methodological integrity description

#### Objectivity / (or at least) demonstration

Objectivity is ensured.

#### Reliability / (or at least) demonstration

Cronbach’s alpha for all 32 items / situations concerning the full version in a first study was .86 (N=128). Further stability tests by test-retest and Cronbach’s alpha is needed.

#### Validity / (or at least) demonstration

The given situations and alternative answers are theory based, the content of the alternative answers were created in one pilot study and verified in another pilot study in accordance to the levels of employeeship (pre-mature and ES1-ES4). Research has shown that communication, involvement, commitment, and relation-oriented aspects are important for successful change processes.

The construct is theory based. Empirical data is needed where it is possible to analyse employeeship relative to other constructs that are theoretically important to the function of employeeship (e.g. participation, communication, organizational citizenship behaviour). A concurrent validity study has not been done yet.

Congruence of behaviour between employeeship and leadership styles have a strong influence.

### Description of methodological integrity and additional Evidence or Value that the tool or study provides

Content validity is in correspondence to the governing theories as well as the pilot study conducted in 2007. Face validity was conducted in 2007 through pilot studies with employees from an ANSP, professors and students in psychology.

The items (situations) from the leadership questionnaire were altered in several ways: 1) leadership behaviour was replaced with own fellow worker behaviour based on task and social abilities, 2) task- and relation-oriented leadership style was replaced with work- and person-oriented employeeship style and, 3) the items are now based on terminology, perspectives and aspects emanated from the Employeeship-Leadership-Relationship model (ELR). The new set of items was then reviewed in a pilot study consisting of two ATM-employed human resources experts, seven professors and sixteen students in psychology. Item revisions were based upon the appropriateness of item content and the extent to which the item represented the corresponding aspect of the Employeeship-Leadership-Relationship model (ELR). In the same pilot study the participants wrote down their alternative action to each item. All answers were then arranged in five levels in accordance to the ELR model as well as the answers where standardised so that the same wording and meaning of the alternative actions will go through the whole tool. As a final step the seven professors in psychology reviewed the answers and provided input to the finalisation of the five levels represented in the alternative actions following on each item.

Face validity was established by directly reviewing the items. In each item the description depicts one of five levels of maturity and requires the respondent to choose the alternative action which most closely describes the respondent’s behaviour. The resulting action is then analysed and scored with respect to the style type and adaptability.

Content validity originates from the procedures employed to create the original set of items. The structure (see “Collected parameters and data format”) is benchmarked from a leadership questionnaire which has shown sufficient high level of reliability as well as logical and empirical validity (see Greene, J. F. (1980). LEAD – Self Manual. CA: Center for Leadership Studies Press).
The Team Climate Inventory (TCI) is a multidimensional measure of work group climate for innovation and performance. The 38 question TCI measures four factors which are shown to be predictive of effective team performance and which could most usefully benefit from positive interventions: (1) Team Vision - clarity, perceived value, sharedness and attainability; (2) Participative Safety - decision-making, information sharing, interaction frequency and safety; (3) Support for Innovation - articulated and enhanced support; (4) Task Orientation - commitment to excellence, appraisal and task orientation.

The potential uses of the TCI include: Team climate surveys for organisations as part of organisational development interventions; Team climate diagnosis and development of interventions; Team innovation and creativity interventions to enhance innovative potential; Measuring team development and changes in group climate over time; Selection of new team members and their induction into the team.

The TCI is provided with normative data from both public and private sectors and a scoring disc computer program.

ProACT Process Model

Applicable to Phase and Main Activity:

References

Developer and source

- **Publisher**: PreVisor (UK) Source: ACERShop Online: [http://shop.acer.edu.au/acer-shop/group/TCI](http://shop.acer.edu.au/acer-shop/group/TCI)

Year of development / publication, updates etc.

### General description

**Purpose of measurement / study**

The TCI measures the climate for innovation and team performance in a team or work group.

**Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)**

Questionnaire (38 items long version and a 14 items short version).

**Effort required (time, people, equipment, resources); usability and practicability**

15 minutes (short versions (14 items)) or 20 min (long version) to complete the instrument. Computer with statistical software for analyses. One person can perform all analyses.

**Population – Demographic and or Professional Group for which the method is intended for**

Working organisations in general designed to measure teams and work groups at different levels.

**Object of measurement / study (individual, team, profession, department, company)**

Team

**Language (other than English)**

Swedish, Norwegian, Italian, Finnish, German (short versions)

**Cost information / Copyrights / Agreements needed**

Complete Version: TCI Starter Set: £230.00 including 25 administrations of the questionnaire, in addition £176 per 25 administrations. The items and psychometric results are in Anderson & West (1998). A short version (14 items) based on Kivimäki & Elovinio (1999) is provided in the box ‘Figure / Model / Items’ below.

### ATM specific mapping

**Guidance for use in the ATM Context**

The questionnaire does not apply to any specific change scenario; instead it could be used to screen the innovative status within different team as a part of the Scoping face in order to find out the preparedness for change.

**Experiences of use in the ATM / safety industry / other industry context, including references / users**

The TCI has been used in the HUFA-project at two ATCCs in Sweden to study teams during the implementation of a new ATC system.


Marcus Arvidsson, marcus.arvidsson@psychology.lu.se

Phone: +46 70 7924651

### ProACT Process Model

**Applicable to phase and activity of the ProACT Process Model**

Scoping Phase

Risk and opportunities identification:

The readiness for change within different teams is considered as a part of the risk and opportunities identification. An underdeveloped innovative climate could increase resistance for change.

### Technical description

**Description of the content / study**

The Team climate inventory was developed to measure work group climate for innovation within teams and working groups in any kind of organisation. The questionnaire consists of 46 items that loads onto 13 sub-factors, which in turn load onto four second order factors of climate and one social desirability response factor.

The main scales are Participative safety (information sharing, safety, influence and interaction frequency); Support for innovation (articulated support and enacted support); Vision (clarity, perceived value, sharedness and attainability); Task orientation (excellence, appraisal and ideation).

The potential uses of the TCI include Team climate surveys for organisations as part of organisational development interventions; Team climate diagnosis and development interventions; Team innovation and creativity interventions to enhance innovative potential; Measuring team development and changes in group climate over time and Selection of new team members and their induction into the team. The TCI is provided with normative data from both public and private sectors and a scoring disc computer program.
The Change & Transition Tools Compendium

Team Climate Inventory (TCI)

Annex A No: A-7

Context and Prerequisites for application

The questionnaire can be used at any time and any place. To obtain a high response rate, the questionnaire should be filled in during working hours (not leisure time).

Equipment required for application

Paper and pencil, statistical software for analyses such as Microsoft Excel, SPSS, or Statistica

Required user qualifications

A psychologist or human factors specialist is preferred. A human resources manager being familiar of supervising questionnaire surveys and using simpler statistical methods is also appropriate

Requirements / constraint concerning conditions for use

No specific requirements or constraints.

General remarks:
- To obtain a high response rate the questionnaire should be filled in during working hours (not leisure time).
- General information about the aim of the questionnaire should be provided to participants. No further instruction and training are needed.
- Dependent on purpose of the measurement general feedback could be provided to the team and/or organisation, as well as specific feedback could be provided to the individual as an intervening input to individual learning and development.
- Confidentiality can be total but is dependent on the administration of the questionnaire.

Measure / Response Types

5-point scale from 1=not at all to 5= completely.

Collected parameters and data format

Original version: 46 items covering 4 main dimensions and 13 sub dimensions calculated as mean scores on included items. The Finnish short version includes 14 items in the same four dimensions.

Results obtained and interpretation

The result consists of average scores of 13 dimensions relevant for innovative team climate.

The four main scales are as follows: (1) Vision (clarity, perceived value, sharedness and attainability); (2) Participative safety (information sharing, safety, influence and interaction frequency); (3) Support for innovation (articulated support and enacted support); (4) Task orientation (excellence, appraisal and ideation).

Description of use

Figure / model

Items of short version (14 items) based on a study from Kivimäki & Elovaïnio (1999), subscale correlation with original version in brackets; data from 2 samples):

Subscale 1: Vision (4 items) (r = .91 / .97)
1. How far are you in agreement with (the team’s) objectives?
2. To what extent do you think your team’s objectives are clearly understood by other team members?
3. To what extent do you think your team’s objectives can actually be achieved?
4. How worthwhile do you think these objectives are to the organisation?

Subscale 2: Participatory Safety (4 items) (r = .85 / .92)
5. We have a ‘we are in it together’ attitude.
6. People keep each other informed about work-related issues in the team.
7. People feel understood and accepted by each other.
8. There are real attempts to share information throughout the team.

Subscale 3: Support for Innovation (3 items) (r = .91 / .93)
9. People in this team are always searching for fresh, new ways of looking at problems.
10. In this team we take the time needed to develop new ideas.
11. People in the team co-operate in order to help develop and apply new ideas.

Subscale 4: Task Orientation (3 items) (r = .85 / .92)
12. Are team members prepared to question the basis of what the team is doing?
13. Does the team critically appraise potential weaknesses in what it is doing in order to achieve the best possible outcome?
14. Do members of the team build on each other’s ideas in order to achieve the best possible outcome?
Process description

Address the aim of the change and its transition supporting the organisation’s strategy. Obtain the agreement of the works council and business management before starting the investigation. Make sure that this tool is appropriate to investigate the topic you are interested in. Employees shall be informed of the investigation, its aim, the start and end date and follow-up actions.

Ensure anonymity by using a coded system. An information sheet, an informative presentation, or information posters at several places, e.g. notice board, intranet, e-mail can be used. Ensure the investigation is representative. Consider to contact the employees especially if you plan to process a postal interrogation before you start and affirm their commitment for their participation.

For postal dissemination indicate the deadline date for reply. The investigation should be performed under standardised conditions if it is not a postal interrogation; every person has to be exposed to the same conditions (undisturbed setting, material, time etc.).

Secure collecting boxes are available within the organisation if the employees got their questionnaires personally and place them in a non-apparent area to ensure anonymity. If the investigation is conducted by an outside consultant or researcher, guarantee anonymity, by preparing a pre-paid envelope together with the questionnaire. This can also be used if the employees work at different geographical sites and/or administration of the questionnaire is at another geographical site.

After data analysis, inform employees about the results and their interpretation including further actions. Respect the principles agreed for staff surveys in social dialogue (consultation/information arrangements between social partners).

Evaluation

Strengths and Weaknesses of the tool

Strength: It is a valid test to measure the willingness and preparedness for change within work groups or team in the organisation conducting change. The team has to be well defined and well established in order to get reliable and valid results.

Weakness: The response scale has 5 answer categories (with a ‘middle’ category).

Alternative methods / tools

Alternative methods or tools measuring team climate are not known.

Possible combination with other methods / tools

Can be combined with various methods and tools or with interviews. If the wider organisational climate is of concern an Organisational Climate Measure (OCM) can be used.

A reliable and valid version of OCM was developed by Patterson, M. West, M. Shackleton, V., Lawthom, R. Maitlis, S., Robinson, D. Dawson, J. & Wallace, A. (2004), Development & Validation of an Organizational Climate Measure. Aston Business School Research Papers. The article including validation evidence and the questionnaire tool can be obtained from: Viv Shackleton, Aston Business School, Aston University, Birmingham B4 7ET, UK.

This instrument consists of 17 scales divided into four broad categories: Human Relations (Autonomy; Integration; Participation; Supervisory Support; Training; Welfare); Open Systems (Innovation & Flexibility; Outward Focus; Reflexivity); Rational Goal (Clarity of Organisational Goals; Efficiency; Effort; Performance Feedback; Pressure to Produce; Quality); and Internal Process (Formalisation; Tradition).

Psychometric / methodological integrity description

Objectivity / (or at least) demonstration

Standardised questionnaire. TCI is highly relevant for measure the innovative climate at team level.

Reliability / (or at least) demonstration

Cronbach’s alpha is reported in:

<table>
<thead>
<tr>
<th>Study</th>
<th>Scale 1</th>
<th>Scale 2</th>
<th>Scale 3</th>
<th>Scale 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anderson &amp; West (1998) long version (n = 150)</td>
<td>.94</td>
<td>.89</td>
<td>.92</td>
<td>.92</td>
</tr>
<tr>
<td>Kivimäki &amp; Eloainio short version (n = 1495 / n = 771)</td>
<td>.84 / .86</td>
<td>.85 / .85</td>
<td>.86 / .85</td>
<td>.79 / .82</td>
</tr>
</tbody>
</table>
An exploratory factor analysis in Anderson & West (1998) based on a version with 61 items revealed 5 factors (factor 5 was called 'Interaction frequency'). Both, a four and five factor solution were supported by a subsequent confirmatory factor analysis. A confirmatory factor analysis (CFA) (structural equation modelling) study reported in Anderson & West (1998) using the 38 items form in an independent samples (health care, oil workers, social support teams, psychiatric support teams) supports both a four and five factor model with correlated factors. The authors preferred the five factor solution with a 4 item subscale ‘Interaction Frequency’ as fifth subscale (not included in the short version reported above). Predictive validity was also reported in West & Anderson (1996). In 26 hospitals the TCI was administered and 6 month afterwards naïve as well as expert rated the implementation of innovations on several dimensions: overall innovativeness; number of innovations implemented; radicalness of innovations; magnitude; novelty and administrative effectiveness as criteria and a combined TCI scores (as per scale) were used to predict these criteria; the outcome (significant predictors > criteria) are given in the following table:

<table>
<thead>
<tr>
<th>TCI Subscales (predictors)</th>
<th>Innovation scores (criteria) – significant effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>(3) Support for Innovations</td>
<td>Overall innovation (46% explained variance in this criterion)</td>
</tr>
<tr>
<td>(3) Support for Innovations</td>
<td>Innovation novelty</td>
</tr>
<tr>
<td>(2) Participatory Safety</td>
<td>Number of innovations</td>
</tr>
<tr>
<td>(2) Participatory Safety</td>
<td>Team self-reported innovativeness</td>
</tr>
<tr>
<td>(4) Task Orientation</td>
<td>Administrative effectiveness</td>
</tr>
</tbody>
</table>

Consensual (convergent) and discriminative validity was also tested using inter alias one-way ANOVAs within each of the five samples of teams (total = 148 teams) showing that from the 25 (5 teams x 5 TCI Subscales) only in two cases the F-ratio was < 1.00 and in 22 cases the F-ratio was significant at p</= .05; this supports the discriminative and convergent validity of the instrument.


The TCI has a sufficient high reliability and validity to be used as a measurement instrument that meets most requirements of ISO 10075-3 and is thus one of the best studied and psychometric sound instruments in the area of team climate with supportive evidence at team / group level:

**Objectivity:** Is ensured (standardised application and deriving results etc).

**Reliability:** Cronbachs Alpha is in almost all studies, including the short version > 0.80. Given the short scales this is a good result also for the short version (14 items),

**Validity:** The outcome of various studies and in-depth-analysis of validity show that the TCI is reaching sufficient high validity in terms of factorial, discriminative / convergent and predictive validity.

**Sensitivity of measurement:** Ensured (more than 3 steps /item in the answer categories.

**Diagnosticsity:** The TCI identifies differences between different teams.

**Generalisability:** --

**Usability / Acceptance:** The TCI can be easily applied and there are no known problems with the acceptance of the questionnaire.
## EXECUTIVE SUMMARY

<table>
<thead>
<tr>
<th>Name of method or tool etc:</th>
<th>Type:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hourglass Model</td>
<td>Web based questionnaire; Change process model</td>
</tr>
</tbody>
</table>

**Abstract:**

The Hourglass Model is designed to set right some communication and interaction problems in order to increase participation and empowerment among employees, supervisors and managers. It consists of four stages: i.e. preparatory, investigatory, implemental and evaluative stage. These four stages are divided in five phases: individual, fellow-worker group, occupational/professional group, department and company phase.

At each stage a question technique called polarization is applied implying that answers to the questions aim to uncover dissonance or mental conflicts hence forcing the individual to act in order to reduce the tension. Polarizing and “action releasing potentials” are generated in order to facilitate communication and interaction among participants in later phases of the Hourglass Model and to initiate changes and development based primarily on inner motivational forces.

The user designs and adapts the web based questionnaire with respect to five features: question theme, question aspect, question alternative, actor, and time perspective.

### ProACT Process Model

### References

**Developer and source**

**Developer:** Prof. Dr. Curt R Johansson (Lund University, Lund/SE)

**Contact Person:**

Johan Jönsson  
Work & Organizational Psychology Division  
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Lund University, Sweden  
P.O. Box 213  
221 00 Lund, Sweden.  
johan.jonsson@psychology.lu.se
### General description

**Purpose of measurement / study**

Internet based questionnaire for organisational, personnel and knowledge development, and for intervention that can be designed and adapted by users with regard to their needs. The Hourglass Model is a process tool.

**Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)**

Internet based questionnaire and change process model.

**Effort required (time, people, equipment, resources); usability and practicability**

Approximately 30-60 minutes to answer the questions. Usually a year or more is required to develop an organisation, its management and employees for their committed to achieve agreed short and long term goals for the organisation and its members.

**Population – Demographic and or Professional Group for which the method is intended for**

Any employee. The user designs and adapts the Hourglass® Model with respect to the groups that will investigate and develop their organization and their way of working.

**Object of measurement / study (individual, team, profession, department, company)**

Individual, team, profession, department and company

**Language (other than English)**

Texts in Swedish; computer presentation in Swedish and German; web tool in Swedish. The method can be translated into any language, if required.
### ProACT Process Model

#### Applicable to phase and activity of the ProACT Process Model

**Communication, participation and involvement process**

The ProACT® is a process tool designed for organisational, personnel and knowledge development, and for intervention involving individuals, groups and management within an organization in a systematic manner.

**Planning phase**

Implementation plan development – Social impact assessment:
The result from the inventory phase could be used as base for developing the implementation plan and assess the social impacts of change.

**Implementation phase**

Access and secure acceptance:
The Model is based on a bottom up approach that involves all employees affected by the changes. This approach enhances the employees understanding for the change project, their motivation for change and their acceptance level.

#### Technical description

**Description of the content / study**

The ProACT Process Model is designed to set right some communication and interaction problems in order to increase participation and empowerment among employees, supervisors and managers.

The ProACT Process Model has four stages: the Preparatory stage, the Investigatory stage, the Implemental stage and the Evaluative stage.

These four stages are divided in five phases: individual, fellow-worker group, occupational/professional group, department, and company phase. At each stage a question technique called polarization is applied implying that answers to the questions aim at uncover dissonance or mental conflicts hence forcing the individual to act in order to reduce the tension. See box ‘Figure / model’ for a picture of the stages / phases.

Polarizing and “action releasing potentials” are generated in order to facilitate communication and interaction among participants in later phases of the Hourglass process, and to initiate changes and development based primarily on inner motivational forces.

The user (i.e. change expert) designs and adapts the web based questionnaire with respect to five features: question theme, question aspect, question alternative, actor, and time perspective.

**Context and Prerequisites for application**

Can be used at any time and any place.

**Equipment required for application**

Can be used as a paper and pencil tool but preferably as a web based tool.
Required user qualifications

The Hourglass Model requires in-depth knowledge about the theoretical background of the model and also training in using the method. Applicable by HR specialist responsible for organisational, personnel and knowledge development - trained to design and adapt the tool and analyse and communicate the results.

Requirements / constraint concerning conditions for use

No specific requirements or constraints.

General remarks:
- To obtain a high response rate the questionnaire should be filled in during working hours (not leisure time).
- General information about the aim of the questionnaire should be provided to participants. No further instruction and training are needed.
- Dependent on purpose of the measurement general feedback could be provided to the team and/or organisation, as well as specific feedback could be provided to the individual as an intervening input to individual learning and development.
Confidentiality can be total but is dependent on the administration of the questionnaire.

Measure / Response Types

Open answers: the respondents formulate their answers in their own way without any restrictions; the answers can be rank ordered.

Collected parameters and data format

Automatic and manual categorisation of answers.

Results obtained and interpretation

The results are presented in tabular or graphic form.

<table>
<thead>
<tr>
<th>Description of use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stage</strong></td>
</tr>
<tr>
<td>Preparatory</td>
</tr>
<tr>
<td>Implemental</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Evaluative</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Process description</th>
</tr>
</thead>
<tbody>
<tr>
<td>There are four stages in the Hourglass process:</td>
</tr>
<tr>
<td>1. Preparatory stage:</td>
</tr>
<tr>
<td>Anchoring the project in the organization, establishing a project team comprising managers and employees, defining project goals, making a budget and a time schedule for the project;</td>
</tr>
<tr>
<td>2. Investigatory stage:</td>
</tr>
<tr>
<td>Identifying environmental and organizational risks, problems, possibilities and future prospects applying a bottom-up approach starting from an individual level and ending at company level;</td>
</tr>
<tr>
<td>3. Implemental stage:</td>
</tr>
<tr>
<td>Working out a strategic core plan for actions to be implemented top-down based on the results of the investigatory stage, and making a budget and time schedule for the realization of the strategic plan;</td>
</tr>
<tr>
<td>4. Evaluative stage:</td>
</tr>
<tr>
<td>Evaluating outcomes by turning the Hourglass and start a new investigatory stage.</td>
</tr>
</tbody>
</table>
The investigatory and the implemental stages are divided in five phases:

1. **Individual phase:**
   - Aiming at the investigatory stage at personal development in the job and respectively operative changes of the job at the implemental stage;

2. **Fellow-worker group phase:**
   - Aiming at the investigatory stage at social development respectively changes in collaboration and teamwork at the implemental stage;

3. **Occupational group phase:**
   - Aiming at the investigatory stage at development of professional competence and skills respectively changes in training and supervision at the implemental stage;

4. **Department group phase:**
   - Aiming at the investigatory stage at commercial development and increased competitiveness respectively tactical changes at the implemental stage

5. **Company group phase:**
   - Aiming at the investigatory stage at organizational development and strengthening of the company position respectively strategic changes at the implemental stage.

The topics to be investigated are decided by the project team, it is the responsibility of the research team or a consultancy team to formulate questions referring to these topics in such a way that the answers uncover dissonance or mental conflicts (cf. Festinger, 1957), hence forcing people to act individually or in groups in order to reduce the tension. Polarizing and “action releasing potentials” are generated by contrasting answers in order to facilitate communication and interaction among participants in later phases of the process and to initiate changes on an individual level as early as possible in the development of the project.

<table>
<thead>
<tr>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strengths and Weaknesses of the tool</strong></td>
</tr>
<tr>
<td><strong>Strength:</strong> The Hourglass Model is a tool for achieving real change and development of individuals, groups and organisations and not only for surveying and mapping an organisation. It combines a bottom-up approach in the investigatory stage with spontaneous, rapid, restricted, conservative and evolutionary changes with an on top-down approach in the implemental stage characterized by planned, time-consuming, far-reaching, radical and revolutionary changes.</td>
</tr>
<tr>
<td><strong>Weakness:</strong> Use of the Hourglass Model is time consuming as change and development of individuals, groups and organisations require that people have time to be committed to change their attitudes, values, habits and behaviour to create value, competitiveness and well-being for both, the organisation and the individuals.</td>
</tr>
<tr>
<td>It requires that individual employees as well as supervisors and top management are involved in the development process.</td>
</tr>
<tr>
<td><strong>Alternative methods / tools</strong></td>
</tr>
<tr>
<td>As far as known, no equivalent tool exists for change and development of individuals, groups and organisations but action science according to Argyris and Schön can also be used.</td>
</tr>
<tr>
<td><strong>Possible combination with other methods / tools</strong></td>
</tr>
<tr>
<td>The Hourglass Model can be used in combination with other methods/tools depending on the change project.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Psychometric / methodological integrity description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectivity / (or at least) demonstration</strong></td>
</tr>
<tr>
<td>The Hourglass Model is a tool with criteria for development and change/ intervention decided by the users.</td>
</tr>
<tr>
<td><strong>Reliability / (or at least) demonstration</strong></td>
</tr>
<tr>
<td>It is highly relevant for implementing change and development both for individuals and organisations.</td>
</tr>
<tr>
<td><strong>Validity / (or at least) demonstration</strong></td>
</tr>
<tr>
<td>The Hourglass Model has successfully been used in change projects.</td>
</tr>
<tr>
<td><strong>Description of methodological integrity and additional Evidence or Value that the tool or study provides</strong></td>
</tr>
<tr>
<td><strong>Technical reports/manuscripts:</strong></td>
</tr>
<tr>
<td>1) Johansson, C. R. (2001). Att utveckla och att utvecklas. Arbets- och organisationsspsychologi, Institutionen för psykologi; Change@Work; Lund universitet (in Swedish);</td>
</tr>
</tbody>
</table>
Controller Acceptance Rating Scale (CARS)

EXECUTIVE SUMMARY

Name of method or tool etc: Controller Acceptance Rating Scale (CARS)

Type: Decision tree type rating scale

Abstract:

The Controller Acceptance Rating Scale (CARS) is a simple, scalar measure and indicator of satisfactory human-system performance. It measures operational acceptability of the system or some of its components as being seen as effective and suitable by controllers who participate in the development of new tools or important changes.

CARS was developed at NASA Ames as a measure of acceptability of Decision Support Tools (DST) in ATM. CARS uses an adapted version of the Cooper-Harper Scale for pilot assessment of handling of aircraft. The key categories for controller evaluation of the system are: Controllability – Tolerability – Satisfaction – Desirability (Acceptability).

The air traffic controller rates how well the overall system (software, hardware and user) is working. Each controller is asked to rate the system according to his own experience, from his particular sector position.

CARS results provide a numerical record of development progress and software acceptance during development and implementation of software changes during operational evaluation or in operational settings considered ready for daily use in operations.

ProACT Process Model

Applicable to Phase and Main Activity:

References

Developer and source

Katherine K. Lee
Aviation Systems Division
NASA Ames Research Center
Mail Stop 210-4
Moffett Field, CA 94035
USA
Contact: Victoriana.A.Delossantos@nasa.gov

Year of development / publication, updates etc.

### General description

**Purpose of measurement / study**

CARS intends to provide developers and assessors of a new or revised ATM system or system component with a means to determine, how well controllers can work and perform together in controlling traffic during simulations of the operational system before putting it into daily use.

The scale used in CARS uses four levels of ratings: Controllability – Tolerability – Satisfaction - Acceptability of a system.

**Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)**

Cooper & Harper Rating Scale with four main levels of ratings related to ten sub-levels of ratings.

The scale is depicted in the box ‘Figure / Model’. Detailed description of development of the Cooper & Harper ratings scale can be found in: Harper, R.P. & Cooper, G.E. (1984), Handling qualities and pilot evaluation. 1984 Wright Brothers Lectureship in Aeronautics. [http://www.mae.wmich.edu/faculty/Ro/ME540/FQ.pdf](http://www.mae.wmich.edu/faculty/Ro/ME540/FQ.pdf)

**Effort required (time, people, equipment, resources); usability and practicability**

After an initial instruction to fill in the rating form will take below 5 minutes. The instruction text can be handed out as a backup. Only the form (1 page) and pencils are needed, making the CARS highly usable and practicable for use in the field.

**Population – Demographic and or Professional Group for which the method is intended for**

Air Traffic Controller.

**Object of measurement / study (individual, team, profession, department, company)**

Individual. However, the individual ratings can be grouped / collated at higher levels (e.g. team, shift, unit or experimental / simulator run etc) if required.

**Language (other than English)**

English only.

**Cost information / Copyrights / Agreements needed**

Free of charges.

### ATM specific mapping

**Guidance for use in the ATM Context**

The most relevant change scenarios where CARS applies are:

- Consolidation, integration and outsourcing of services and units, e.g. remote operations and maintenance settings.
- Implementation of future operational concepts and systems, e.g. encompassing:
  - significant changes of roles and responsibilities in operational jobs;
  - more integrated ATM processes characterised by wide information sharing, enhanced CDM (Collaborative Decision Making);
  - significantly increasing automation of tasks or functions;
  - new technologies (e.g. Data link, 4D trajectory based planning and control, support tools for separation delegated to flight crew, conflict resolution and collision avoidance automation support).
- Certification and regulatory implementation activities, e.g.:
  - implementation of harmonised/interoperable technology and procedural standards.
The Change & Transition Tools Compendium

Controller Acceptance Rating Scale (CARS)  

### Experiences of use in the ATM / safety industry / other industry context, including references / users

The Controller Acceptance Rating Scale (CARS) was created at NASA Ames (Lee & Davis 1996) for the purpose of evaluating the Final Approach Spacing Tool FAST. It was modelled after the Cooper-Harper scale known from cockpit research and rearranged in some regards to be applicable in research with air traffic controllers.

It was later used also for evaluating other decision support tools (DST) as the passive Final Approach Spacing Tool pFAST and the User Request Evaluation Tool URET by MITRE (see Lee, Kerns, Bone & Nickelson, 2001) or most recently in the research on the FAA’s Very High Frequency Digital Link Mode3 System VDL3 (Sollenberger, McAnulty & Kerns 2003, which is also the source for the example shown below).


### ProACT Process Model

#### Applicable to phase and activity of the ProACT Process Model

Communication, participation and involvement process

CARS contributes to the involvement of affected staff, here controllers, in a change project affecting the operational system and human – system performance.

Continuous evaluation and adaptation process

CARS allows to adapt/modify the planned change during implementation. Controller involvement is required from initial software / hardware development in simulations until preparation for the operational test.

Planning phase

Project objectives definition: CARS allows to include the objectives of ATCO’s

Implementation phase

Access and secure acceptance – implement changes: CARS contributes to the acceptance of the change by ATCO’s and supports an easier implementation of the change.

Evaluation Phase

Monitor & reinforce C & T processes – Process & outcome assessment: CARS results might play a role in reinforcing the C & T processes and the outcome assessment, thus supporting the definition of objectives in a new change project.

### Technical description

#### Description of the content / study

The rating scale requires the air traffic controller to make statements about controllability, tolerability, satisfaction and acceptability of a system. The instruction and steps in which controllers perform the ratings are described in the box ‘Figure/model’ below. In addition, the level of confidence with the rating itself has to be indicated and comments can be written.

#### Context and Prerequisites for application

During short brakes in simulation trials or field work.

#### Equipment required for application

Only a written instruction, rating forms and a pencil are needed.

#### Required user qualifications

General understanding of Human Factors.

#### Requirements / constraint concerning conditions for use

No principle constraints exist. However some training of controllers in using the rating scale and following strictly the instructions to achieve reliable results is required.
Controller Acceptance Rating Scale (CARS)

Measure / Response Types

A ten-point rating scale with ‘1’ indicating the worst and ‘10’ indicating highest human-system performance (corresponding to respective levels of non-acceptance / acceptance). In addition a three point scale from ‘A’ to ‘C’ expresses the level of confidence (‘A’: highest) with the ratings indicated. Comments can be given.

Collected parameters and data format

Rating scale score, confidence rating, Text (written comment).

Results obtained and interpretation

Each rating reflects a certain path through the decision tree of the scale, for instance ‘6’ equals:
1. Yes, the system is safe and controllable.
2. Yes, adequate system performance is attainable with tolerable workload.
3. No, the system is not satisfactory without improvement. Improvement is needed. Deficiencies warrant further improvement. Moderately objectionable deficiencies exist. Use of advisories requires considerable compensation to achieve adequate performance.
   This can be further explained by written comments.

Description of use

Figure / model

![Diagram of CARS Rating Scale](image)

**Figure 1: CARS Rating Scale (as developed by Lee & Davis, 1996).**

Instructions and examples of deriving a rating:

The controller is instructed to start the rating process from the START arrow on the top of the diagram and to first determine if the system was controllable. If the answer to this decision box is NO the outcome as in the first rating box is that improvements to the system are mandatory. An uncontrollable system would imply safety violations such as near misses or collisions or generally an inability to maintain separation.

If the answer to this decision box is YES, the controller goes at the next level of the rating to the second box: Tolerability in terms of performance and workload. If the answer is NO – deficiencies in the system and an inability to achieve adequate performance with tolerable workload. The controller will now rate to what degree the system was deficient.

If the answer was YES the controller would assess the system as manageable with reasonable workload. The controller continues to the third level: Satisfaction. Still, the controller might not be satisfied with the performance of the system and experience deficiencies when answering NO – still some compensation from the controller is required (3 levels). If the answer was YES the last level considers the system as acceptable in general but still might find some deficiencies that are ‘unpleasant’ (3 levels).
### Process description

Controllers have to be trained how to use CARS. Also a written instruction should be made available in case no HF expert is present to be asked for details. CARS can then be administered directly after a certain period of work or, after some familiarity with the scale is achieved, it can be administered in parallel. It can be administered repeatedly, e.g. to compare different levels of task load or different systems or to describe a development over time.

### Evaluation

#### Strengths and Weaknesses of the tool

CARS is relatively simple to administer and results are easy to interpret. However providing only few data points makes validation complicated. Repeated measurement is possible with CARS.

#### Alternative methods / tools

No alternative methods or tools are known.

#### Possible combination with other methods / tools

CARS has been used together with a variety of methods, for instance the NASA TLX.

### Psychometric / methodological integrity description

#### Objectivity / (or at least) demonstration

Standardised rating scale.

#### Reliability / (or at least) demonstration

CARS scores showed good to excellent inter-rater reliability in terms of controller consistency and agreement (Intra class correlations: ICC consistency: .74 - .78, ICC Absolute Agreement: .77 - .81).

#### Validity / (or at least) demonstration

**Concurrent / predictive validity:** CARS ratings were significantly correlated with controller self-reported ratings of amount of efforts required to accomplish ten controlling tasks and negatively correlated with the difficulty reported of managing and controlling traffic feed. Multiple regression with the five NASA TLX variables (mental demand, temporal demand, performance support; overall effort and satisfactions vs. frustration) measures delivered a $R^2_{adj} = .36$, $p < .01$ suggesting that the Task Load as measured by TLX explains 36% of the variance in the CARS ratings. It is to be noted that all five indexes were significantly correlated with CARS with the highest correlation between CARS and TLX/5 – ‘Satisfaction vs. frustration’ ($r = .52$, $p<.0001$).

**Discriminative validity:** CARS proved being sensitive to experimental changes of operational settings as the intra-class correlations (see Reliability) indicate: CARS was effective in allowing controllers to consistently discriminate between different levels of acceptability represented in then different operational conditions that they were exposed to.

### Description of methodological integrity and additional Evidence or Value that the tool or study provides

The Controller Acceptance Rating Scale (CARS) was created by Human Factors experts at NASA Ames Research Center for the development and evaluation of Decision Support Tools in ATM. CARS has been researched and further developed over a period of at least five years by well known institutions as NASA Ames, MITRE and FAA. It is subject of scientific publications and can be assessed as successful development for the measurement of air traffic controller acceptance:


CARS has a sufficient high reliability and validity to be used as a measurement instrument that meets most requirements of ISO 10075-3:

- **Objectivity:** Is ensured (standardised application and deriving results etc).
- **Reliability:** Inter-class correlations (ICC) is used to demonstrate reliability between .74 and .81.
- **Validity:** The outcome of some studies with main7y workload as predictor of the CARS rating (in concurrent mode) show some evidence on validity in the predictive sense and discriminative validity.
- **Sensitivity:** Ensured (more than 3 steps /item in the answer categories of the BARS).
- **Diagnosticity:** The CARS identifies differences between different operational traffic conditions and objective demand imposed on the operators.
- **Generalisability:** Not known.
- **Usability / Acceptance:** CARS can be easily applied and there are no known problems with the acceptance of the rating scale.
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EXECUTIVE SUMMARY

<table>
<thead>
<tr>
<th>Name of method or tool etc:</th>
<th>Type:</th>
</tr>
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<tbody>
<tr>
<td>Fleishman Job Analysis Survey (FJAS)</td>
<td>Questionnaire</td>
</tr>
</tbody>
</table>

Abstract:

The Fleishman Job Analysis Survey (FJAS) is a long established Job Analysis Tool for the description of jobs and tasks in respect to required abilities and skills. It provides a common taxonomy of definitions of those abilities and skills which can be used by experts to assess tasks in regard to the requirements on those skills and abilities using Behaviour Anchored Rating Scales (BARS).

The FJAS consists of a total of 73 knowledge and skill scales for a variety of abilities from the cognitive, the psychomotor and the sensory domain as well as interactive and social domains. The method assumes that jobs / tasks can be differentiated by their skills / abilities that are required to perform them and that people, who know the job well (i.e. job incumbents, supervisors) can make reliable and valid assessments of the required skills / abilities.

The FJAS can be applied for all kinds of jobs but has a strong history in the aviation context. It reflects 4 decades of research on mental abilities. Factor analytic studies helped support the identification and description of a total of 52 various abilities. The FJAS provides a handbook proposing tests that might be used for selection. Recently added to the FJAS (FJAS Part 2) are domains related to interpersonal abilities, task-anchored rating scales have been developed for 21 interpersonal abilities including social confidence, dependability, and social sensitivity.

ProACT Process Model

Applicable to Phase and Main Activity:

References

Developer and source

Edwin A. Fleishman, Management Research Institute (MRI)
11304 Spur Wheel Lane
Potomac, MD 20854 - USA
Tel: +1 301 299 9200 Email: MRIEAF@aol.com

Year of development / publication, updates etc.


### General description

**Purpose of measurement / study**

The FJAS determines the levels of knowledge, skills, and abilities (KSAs) required for performing a wide range of jobs / tasks. Each KSA is clearly defined and spans human abilities concerning cognitive, psychomotor, physical, and sensory-perceptual performance. Experienced employees (Subject matter experts) use behaviourally-anchored rating scales to determine how relevant each KSA is to their job.

**Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)**

Survey Questionnaire; the FJAS consists of a series of “behaviourally anchored” 7-point rating scales (BARS).

**Effort required (time, people, equipment, resources); usability and practicability**

40 to 90 minutes including instruction, depending on number of scales used.

**Population – Demographic and or Professional Group for which the method is intended for**

Experienced employees familiar with the job’s tasks rate the level of each ability required to perform it. Completed by a panel of Subject Matter Experts, each survey can accommodate up to 25 raters.

**Object of measurement / study (individual, team, profession, department, company)**

FJAS measures the individual KSAs required by a person (a job incumbent) performing the job tasks. However data can be aggregated e.g. across positions, units or groups to compare job requirements.

**Language (other than English)**

English; German version available since 2010 (see box ‘Year of development’)

**Cost information / Copyrights / Agreements needed**

The price is calculated as per job (up to 25 raters); for the F-JAS 1 price is 176,00 USD; for the F-JAS 2 (Interpersonal Scales) 143,00 USD. In addition the valuable Handbook of Human Abilities (Fleishman and Reilly) and the Taxonomies of Human Performance (Fleishman & Quaintance) will require another $100.00. Available online at [http://www.managementresearchinstitute.com/f-jas.aspx](http://www.managementresearchinstitute.com/f-jas.aspx)

The complete German Version including manuals and scales costs 244,75 EURO.

### ATM specific mapping

**Guidance for use in the ATM Context**

The most relevant change scenarios where the FJAS can be applied are:

- Consolidation, integration and outsourcing of services and units, e. g.:
  - remote operations and maintenance settings;

- Implementation of future operational concepts and systems, e.g. encompassing:
  - significant changes of roles and responsibilities in operational jobs;
  - more integrated ATM processes characterised by wide information sharing, enhanced CDM (Collaborative Decision Making);
  - significantly increasing automation of tasks or functions;
  - new technologies (e.g. Data link, 4D trajectory based planning and control, support tools for separation delegated to flight crew, conflict resolution and collision avoidance automation support).

- Harmonisation and mobility of staff, e.g.:
  - Application of regulations concerning operational competence (e.g. ESARR 5, common ATCO license).

- Certification and regulatory implementation activities, e.g.:
  - implementation of harmonised/interoperable technology and procedural standards.
  - implementation of harmonised competence regulations.

**Experiences of use in the ATM / safety industry / other industry context, including references / users**


### ProACT Process Model

<table>
<thead>
<tr>
<th>Applicable to phase and activity of the ProACT Process Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scoping phase</strong></td>
</tr>
<tr>
<td>Feasibility evaluation:</td>
</tr>
<tr>
<td>FJAS can be used to assess potential changes in the knowledge, skills, and abilities required to perform a task.</td>
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<td></td>
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<tr>
<td><strong>Planning phase</strong></td>
</tr>
<tr>
<td>Feasibility evaluation:</td>
</tr>
<tr>
<td>FJAS can be used to assess potential changes in the knowledge, skills, and abilities required to perform the tasks in a planned scenario.</td>
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<tr>
<td></td>
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<tr>
<td><strong>Implementation phase</strong></td>
</tr>
<tr>
<td>Implement changes:</td>
</tr>
<tr>
<td>FJAS can be used to support the implementation of a change by measuring the ability to cope with a change.</td>
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<td></td>
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<tr>
<td><strong>Evaluation Phase</strong></td>
</tr>
<tr>
<td>Monitor &amp; reinforce C &amp; T processes – Process &amp; outcome assessment:</td>
</tr>
<tr>
<td>FJAS can be used to verify the knowledge and skills acquired and to review the tasks of ATCO's.</td>
</tr>
</tbody>
</table>

### Technical description

**Description of the content / study**

73 scales covering the domains of cognitive, psychomotor, (physical) and sensory abilities as well as interactive/social and knowledge/skills scales. FJAS is delivered with a detailed ‘Administrators Guide’ (Fleishman & Reilly 1992a) and the ‘Handbook of human abilities’ (Fleishman & Reilly 1992) providing some theoretical background and lists of validated tests measuring a certain abilities including reference data of test providers. In 1996 the FJAS Part 2 was published offering additional social/interpersonal abilities.

The Ability Requirements Taxonomy covers five areas (covered also by BARS):
- Cognitive (21 Scales)
- Psychomotor (10 Scales)
- Physical (9 Scales)
- Sensory/perception (12 Scales)
- Social/inter-personal skills and abilities (21 Scales)

**Context and Prerequisites for application**

Application usually not during task performance, experience in the job to be assessed is required.

**Equipment required for application**

FJAS booklet, administrators guide, pencil.

**Required user qualifications**

Some basic understanding in Human Factors to be able to administer the FJAS. A set of FJAS-1and/or FJAS-2 booklet (incl. administrator guide) has to be purchased.

**Requirements / constraint concerning conditions for use**

The researcher can decide which scales are applicable to the job in question.

**Measure / Response Types**

Ratings between 1 and 7 behaviourally anchored ratings scales; see for an example box ‘Figure / model’.

**Collected parameters and data format**

Mean ratings per scale.

**Results obtained and interpretation**

The level to which certain ability is required in the job under question is measured, with all results being at above scale average meaning that this ability is relevant for the job and thus should be tested. For interpretation norms are provided.
### Description of use

#### Figure / model

![Figure 1: FJAS scale example listed courtesy E.A. Fleishman](image)

The FJAS-1 assesses on 73 different scales tapping a comprehensive range of capacities in 5 domains as indicated in box 'Description of the content / study'; an example for the 21 scales in the Cognitive Domain Scales only is given below:

<table>
<thead>
<tr>
<th>COGNITIVE Scales (1-7)</th>
<th>COGNITIVE Scales (8-14)</th>
<th>COGNITIVE Scales (15-21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal Understanding</td>
<td>Perception of Problems</td>
<td>Speed of Closure</td>
</tr>
<tr>
<td>Written Understanding</td>
<td>Mathematical Reasoning</td>
<td>Flexibility of Closure</td>
</tr>
<tr>
<td>Verbal Expression</td>
<td>Numerical Skills</td>
<td>Spatial Orientation</td>
</tr>
<tr>
<td>Written Expression</td>
<td>Deductive Reasoning</td>
<td>Figurative Imagination</td>
</tr>
<tr>
<td>Ideas</td>
<td>Inductive Reasoning</td>
<td>Perceptual Speed</td>
</tr>
<tr>
<td>Originality</td>
<td>Ordering Information</td>
<td>Selective Attention</td>
</tr>
<tr>
<td>Memory</td>
<td>Categorical Flexibility</td>
<td>Simultaneous Information Processing</td>
</tr>
</tbody>
</table>

#### Process description

Minimal resources are required for administration.
After a detailed instruction the subjects work through the material individually.

### Evaluation

#### Strengths and Weaknesses of the tool

The FJAS provides a full picture on relevant abilities and skills required to perform a task.

#### Alternative methods / tools

- Task analysis
- Critical Incident Technique
- Position Analysis Questionnaire (PAQ)

#### Possible combination with other methods / tools

Possible to combine with other tools, like the SHAPE tools.

### Psychometric / methodological integrity description

#### Objectivity / (or at least) demonstration

Detailed administrators guide, standard answer sheet, automated scoring available.

#### Reliability / (or at least) demonstration

A summary of available results from reliability studies of the F-JAS are given in Kleinmann, Manzey, Schumacher & Fleishman (2010) (German F-JAS Version, Manual):

- **Inter-Rater Reliability** in several studies with > 15 raters gave coefficients between .80 - .90 or even higher. The correlations between job incumbents and supervisors and to a lesser extent to external job analysts were also high indicating that the assessments of the abilities using the F-JAS were sufficiently independent from type of raters.

Validity / (or at least) demonstration

Construct Validity: The FJAS scales are based on factor-analytical studies of abilities and skills; the FJAS provides a consistent, plausible and well to interpret pattern of ability requirements. In several studies it was demonstrated that profiles of abilities derived independently from each other were highly similar. On the other side, existing differences between different tasks / jobs lead to different ability profiles in the FJAS (this was demonstrated in studies with civic pilots (first officers vs captains) and ATCOs (APPr and ACC controllers).

Content Validity: This assumes that the FJAS covers all relevant abilities / skills required in a job to a high extent. This was also demonstrated in several studies with different jobs / job levels. Raters used about 80% of the scales available to describe the jobs in terms of required abilities. On the other side could 80% of the tasks performed by job incumbents be assigned to any of the 52 core abilities.

Predictive Validity: This was demonstrated in studies which used the (mean) FJAS score as predictor to predict the actual task performance of persons in a performance test as a criterion. It could also be shown that predictor tests selected based on FJAS profiles were valid predictors for task performance in the tests (Fleishman, E.A. & Mumford, M.D. (1991), Evaluating classifications of job behaviour: A construct validation of the ability requirement scales. Personnel Psychology, 44, 523-575.

Sample sizes of N >=20 raters are reported to lead to stable valid information (in terms of mean ratings) about job requirements. However, there are no specific validity studies (i.e. concurrent validity) of the FJAS.

Description of methodological integrity and additional Evidence or Value that the tool or study provides

The author is internationally known for his research and professional contributions. Encyclopaedia articles and many publications document the validity and reliability and application experience for the material. Below a result of using F-JAS in the context of a data link simulation study at DFS is shown (Eißfeldt et al., 1999). Blue bars are representing the relevance of cognitive abilities in the current ATC experience of N=28 subjects, the red bars are referring to their experience after 4 simulation runs in a future ATM data-link simulation.

The F-JAS has a sufficient high reliability and validity to be used as a measurement instrument and meets most requirements of ISO 10075-3:

Objectivity: Is ensured (standardised application and deriving results etc).

Reliability: Inter-Rater and Split-half reliability results from various studies gave high – to very high reliability coefficients.

Validity: The outcome of some studies on the validity show good construct, content and predictive validity in a number of studies; the F-JAS covers job requirements of different jobs and tasks to a high degree. The requirements of ISO 10075-3 regarding validity are fully met.

Sensitivity of measurement: Ensured (more than 3 steps / item in the answer categories of the BARS).

Diagnostically: The FJAS identifies differences and similarities between jobs; the instrument is capable of detecting (existing) differences correctly.

Generalisability: The widespread use and existing evidence from a broad area of application show, that the F-JAS has no systematically reduced generalisability and can be applied for all jobs.

Usability / Acceptance: There are no known problems with the acceptance of FJAS. The applicability in ATM and generally in aviation has been demonstrated in various studies.
## EXECUTIVE SUMMARY

<table>
<thead>
<tr>
<th>Name of method or tool etc:</th>
<th>Type:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Scanning Methodology (SAF SCAN)</td>
<td>MS Excel questionnaire and guidance material</td>
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</tbody>
</table>

### Abstract:

The Safety Scanning Methodology was developed to proactively address and manage safety related issues in a structured process. The Methodology consists of questions set in the Safety Scanning Tool SST and the Safety Method Review Tool SMRT which are available as MS EXCEL spreadsheets with automatic reporting function. In addition, guidance material on the use of the Methodology is available.

The Safety Scanning Methodology and its MS Excel tool is built upon 21 ‘Safety Fundamentals’ and basic regulatory principles in the four safety perspectives of Safety Regulation, Safety Management; Operational Safety; and Safety Architecture and Technology. Safety Fundamentals are generically usable for any type of system. They are essential criteria for a safe design / development as they take a ‘cybernetic’ view on regulatory requirements. They enable that safety deficiencies can be detected that could lead to insufficient safety performance at an early stage of design and development. They help to avoid late identification of insufficient safety performance, non-approval of certification of a system, extra work to meet safety requirements or total failure of a change project.

The Methodology is primarily intended to be used by Competent Authorities to evaluate safety and safety regulatory risks related to a Change Process. However, all aviation stakeholders intending to conduct a Change Process should use the set of safety fundamentals defined in the methodology and reproduced in the MS Excel questionnaire as a benchmark to fulfil the safety regulatory requirements related to the introduction of a Change.

### ProACT Process Model

#### Applicable to Phase and Main Activity:

![ProACT Process Model Diagram](image)

- **Decision gates**
- **Communication, participation and involvement**
- **Continuous evaluation and adaptation**

### References

#### Developer and source

EUROCONTROL


User guidance material has been developed and is available on request from EUROCONTROL.
Contact: henk.korteweg@eurocontrol.int Brussels/Eurocontrol HQ.

#### Year of development / publication, updates etc.

2006 and 2010.
### General description

<table>
<thead>
<tr>
<th>Purpose of measurement / study</th>
</tr>
</thead>
<tbody>
<tr>
<td>The aim of the Safety Scanning Methodology (SAF SCAN) is to provide a structured approach and framework based on Safety Fundamentals to fulfill safety regulatory requirements and to enhance the verification process for safety related Changes by Competent Authorities and other Aviation Stakeholders.</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)</th>
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<tbody>
<tr>
<td>The Methodology consists of questions set in the Safety Scanning Tool SST and the Safety Method Review Tool SMRT which are available as MS EXCEL spreadsheets with automatic reporting function. In addition, guidance material on the use of the Methodology is available.</td>
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<table>
<thead>
<tr>
<th>Effort required (time, people, equipment, resources); usability and practicability</th>
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</thead>
<tbody>
<tr>
<td>One day is required by participants for a major change.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Population – Demographic and or Professional Group for which the method is intended for</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Methodology is primarily intended for Competent Authorities helping them to fulfill their safety oversight function with regard to the introduction of safety related Changes.</td>
</tr>
<tr>
<td>However, all aviation stakeholders intending to conduct a Change Process should use the set of safety fundamentals defined in the methodology as a benchmark to fulfill the safety regulatory requirements related to the introduction of a Change.</td>
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</table>

<table>
<thead>
<tr>
<th>Object of measurement / study (individual, team, profession, department, company)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Methodology can be used universally at all levels, e.g., from individual to team level within a single organization up to multi-stakeholder environments on national, regional (e.g. FAB), pan-European or Global level.</td>
</tr>
<tr>
<td>Objective of the benchmarking is an iterative built-up of a total system safety view which provides sufficient assurance for introducing a change in a safe manner and in accordance with safety regulatory requirements.</td>
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</table>

<table>
<thead>
<tr>
<th>Language (other than English)</th>
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<tbody>
<tr>
<td>English only</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost information / Copyrights / Agreements needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Methodology including its related guidance material is protected by EUROCONTROL intellectual property rights and is free of charge for the Civil Aviation Community.</td>
</tr>
<tr>
<td>The Methodology, the Safety Scanning Tool SST, the Safety Method Review Tool SMRT which are available as MS EXCEL spreadsheets and the supporting guidance material are available on request from: <a href="mailto:henk.korteweg@eurocontrol.int">henk.korteweg@eurocontrol.int</a></td>
</tr>
</tbody>
</table>

### ATM specific mapping

<table>
<thead>
<tr>
<th>Guidance for use in the ATM Context</th>
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</thead>
<tbody>
<tr>
<td>The relevant change scenarios where the Safety Scanning Methodology (SAF SCAN) could be applied are:</td>
</tr>
<tr>
<td>Consolidation, integration and outsourcing of services and units, e.g.:</td>
</tr>
<tr>
<td>• consolidation of control centres;</td>
</tr>
<tr>
<td>• centralisation of services (e.g. maintenance, AIS);</td>
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<tr>
<td>• remote operations and maintenance settings;</td>
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<tr>
<td>• outsourcing of services (e.g. development, maintenance).</td>
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<tr>
<td>Implementation of international working structures, e.g.:</td>
</tr>
<tr>
<td>• Functional Airspace Blocks (FAB);</td>
</tr>
<tr>
<td>• Trans-national companies or working arrangements (e.g. EAD Group, Entry Point North).</td>
</tr>
<tr>
<td>Implementation of future operational concepts and systems, e.g. encompassing:</td>
</tr>
<tr>
<td>• significant changes of roles and responsibilities in operational jobs;</td>
</tr>
<tr>
<td>• more integrated ATM processes characterised by wide information sharing, enhanced CDM (Collaborative Decision Making);</td>
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<td>• significantly increasing automation of tasks or functions;</td>
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<tr>
<td>• new technologies (e.g. Data link, 4D trajectory based planning and control, support tools for separation delegated to flight crew, conflict resolution and collision avoidance automation support).</td>
</tr>
</tbody>
</table>
Harmonisation and mobility of staff, e.g.:
- Application of regulations concerning operational competence (e.g. ESARR 5, common ATCO license).

Changes in working conditions, e.g.:
- new shift/rostering cycles and working hours (e.g. to flexibly adapt to variations in traffic amount);
- new organisational or social structures and/or processes.

Changes in organisational structure of whole companies, authorities or units, e.g.:
- Civil/military integration of operations.

Certification and regulatory implementation activities, e.g.:
- certification as ATM service provider or training provider;
- implementation of harmonised safety management standards;
- implementation of harmonised competence regulations;
- implementation of harmonised/interoperable technology and procedural standards.

Changes in organisational culture, e.g.:
- Safety reporting culture.

Experiences of use in the ATM / safety industry / other industry context, including references / users

The Safety Scanning Methodology has been used by the SESAR Consortium during the SESAR Definition Phase and by the Dutch Competent Civil Aviation Authority for the introduction of Changes in the Dutch Airspace organisation and management.

It is currently used by EUROCONTROL, amongst others, in the Aircraft call sign identification project (ACID).

### ProACT Process Model

#### Applicable to phase and activity of the ProACT Process Model

The Safety Scanning Methodology could be useful for the following processes:

**Continuous evaluation and adaptation process**

The Methodology provides information on safety fundamentals the Competent Authority should address or have addressed by a licensee or a overseen party.

**Scoping phase**

Change need analysis – Stakeholder analysis - Risk & opportunities identification – Feasibility evaluation:

The Methodology analyses the scope of a change and the related safety and safety regulatory needs. It also analyses the actors affected (multi-stakeholder environment assessment) and specifically the structural needs and capabilities of the Competent Authority. Application of the Methodology assists in identifying safety issues that need to be resolved to make the Change acceptable from a Safety perspective.

**Planning phase**

Project objectives definition - Establish structures and resources - Risk and opportunities analysis – Feasibility evaluation:

The Methodology supports common goal setting for all stakeholders involved. The Methodology enables the licensee or the overseen party to provide justifications to the Competent Authority on the proposed change. Information is provided on how and what the Competent Authority should then analyse to agree to the proposed change. The Methodology addresses the safety regulatory institutional and the aviation organisational framework.

**Implementation phase**

Assess & secure acceptance:

The Methodology aims at the acceptance of a change by the Competent Authorities on evidence based and verifiable information provided by a licensee or an overseen party.

**Evaluation phase**

Monitor & reinforce C & T process:

The Methodology addresses methods on how to monitor the safety performance of a change after by the Competent Authority.
**Technical description**

**Description of the content / study**

The Safety Scanning Methodology and its MS EXCEL tool is built upon 21 ‘Safety Fundamentals’ and basic regulatory principles in the four safety perspectives of Safety Regulation, Safety Management; Operational Safety; and Safety Architecture and Technology.

Safety Fundamentals relate directly to safety regulatory requirements. As such, they are helpful for the initial and progressive identification of safety and safety regulatory risks resulting from a Change. The level of detail of the output of this risk identification is commensurate with the growing level of maturity of these concepts during their development. Progressive application of the Safety Fundamentals as from the scoping of a Change Process the means to identify deficiencies relevant for the safety oversight and safety regulatory tasks and contribute to the oversight argument a Competent Authority needs to provide (primarily to itself) for approval or acceptance of a Change and its implementation. The Safety Fundamentals are defined as follows:

### Safety Fundamentals for Safety Regulation:

**Regulatory principles for Independent Oversight**

Independent Oversight comprises that the standards of safety to be achieved should be approved and monitored (i.e. oversight) by a competent body acting in the public interest, which is independent of service providers and designers/producers.

**Structural needs – Legal mandate & Ability for Ensuring a Safe Standard**

Ensuring a Safe Standard comprises the duty of all service providers and designers/producers to take all reasonable precautions to ensure that their services or products are safe.

**Implementation needs for Responsibility for Safety**

Responsibility for Safety builds on the understanding that the prime responsibility for the safety of a service or product rests with the service provider or designer/producer.

**Needs for new regulations**

Safety regulations need to be kept up to date in order to reflect the state of the art in safety. Usually (outside ATM) five years after publication, standards are reviewed to determine whether revision is necessary.

### Safety Fundamentals for Safety Management:

**Understanding and Openness in the Safety Policy**

Understanding and Openness is defined as the degree to which both the commitment to safety and setting out the strategic safety aims is performed in such a way that all opinions and considerations within an organization or from other organizations are taken into account in the safety policy. Understanding and Openness are essential elements of an effective safety culture and are key requirements to an SMS and the safety oversight confidence in the operation of an SMS. They need to be established by appropriate safety education.

**Completeness and Freedom from bias in Safety Planning**

Completeness and Freedom from bias are defined as the appropriateness of the aims of the organization, the resources and management structure chosen and the processes established in order to come to the best safety-related solution.

**Responsibility and Practicability in the Planning of safety achievement**

Responsibility and Practicability are defined as the detailed means of translating the plan into reality by means of clear responsibilities for and practicability in safety achievement. The fundamental Responsibility could either address responsibilities within networks or complex systems or legislative responsibilities.

**Detectability and Feedback in the Planning of safety assurance**

Detectability and Feedback are defined as the detectability of safety issues by continuously monitoring safety performance (feedback) in order to realize safety assurance.

**Responsiveness and Learning in the Planning of safety promotion**

Responsiveness and Learning are defined as the way of ensuring a continuous improvement process, timely corrective actions (responsiveness) and dissemination of lessons learned (learning) Promotion.
Safety Fundamentals on Safety Performance – Operational Safety Aspects:

**Procedures**
Procedures describe what is required by the human operators to deliver a service, i.e., the processes to operational support. It includes definition of roles and responsibilities, procedure structure, content, detail, and realism. From the regulatory point of view it is necessary to clearly identify the responsibilities of different actors: e.g. the airspace designers, the inspectors for in flight calibration, the AIS providers and the providers of digital data to avionics, in relation to instrument flight procedures.

**Competence**
Competence is defined as the capabilities of the staff working on the technical and procedural aspects of the system. It could be competence of controllers, pilots but also engineering, maintenance and other safety related staff, management, regulators or competent safety oversight authorities.

**Human-machine interaction**
Human-machine interaction is defined as the quality of the interaction between the system and the human resources required to operate it and to provide the intended service.

**Operating Environment**
The Operating Environment is defined as the conditions under which the system operates such as variations of weather conditions, type and amount of traffic, airspace classification, etc.

**Organization**
Organization is defined as the managerial aspects of the working environment.

**Communication**
Communication is defined as the interaction between people, also including aeronautical telecommunication.

**Reliability**
Reliability is defined as the overall safety performance, including the potential of recovering from unwanted situations or failures in time.

Safety Fundamentals on Safety Performance – Safety Architecture and Technology:

**Transparency**
Transparency describes the ability to specify clearly, what the system is intended to do, and to perform consistently as specified. Transparency therefore is strongly linked to predictability and clarity. From the safety regulatory point of view this includes a clear identification of the legal responsibilities (e.g. of the Galileo designer as distinct from the service provider of the Galileo signal in space).

**Redundancy**
Redundancy is defined as the use of independent components performing the same function, protecting the total system against breakdown due to single component failures (single point of failure). In turn these independent components can be based on the same technology (e.g. duplicated engines or duplicated ILS transmitters) or on dissimilar technologies (e.g. radar plus ADS or line-of-sight data link plus satellite data link). From the safety regulatory point of view some responsibilities (e.g. decisions on obligations to equip address to both air operators and ANSPs, or protection of the aeronautical frequency bands or of the aerodrome surroundings) belong to governmental prerogatives, either at national or EU level.

**Interdependence**
Interdependence is defined as the degree to which the system interacts in an (un-) intended manner with other systems (which may result e.g., in common cause failures or propagation of errors into adjacent systems).

**Functionality**
Functionality is defined as the correctness, consistency and un-ambiguity of the behaviour of the system.

**Integrity**
Integrity is defined as the trustworthiness of the system outputs, i.e. their freedom from errors given correct input (fail-safe principle; absence of errors of commission).

**Maintainability**
Maintainability is defined as the ability to maintain the system in working order throughout its life. This includes preventive maintainability, on-line maintenance, and reparability. From the safety regulatory point of view it includes defining which organisations and which persons have the privilege of maintaining the system in, or returning the system to service. This scope is totally sufficient for the aircraft case as maintenance takes place when the aircraft is not flying. In ATM/ANS, additionally, the systems may be maintained or re-configured during real-time operations without interruption of service. This latter aspect has to be considered in addition in ATM/ANS.
Context and Prerequisites for application

The Safety Scanning Methodology and its MS EXCEL questionnaires should be applied by two facilitators supported by a team of relevant stakeholders. The facilitator draws on his/her competencies to help the scanning team to formulate, specify and achieve goals.

Equipment required for application

Standard office equipment (laptop, MS EXCEL) with Windows 95 as a minimum is required. The use of a meeting room is advisable.

Required user qualifications

A sound general knowledge on the subject, including an understanding of its scope and boundaries is necessary to understand what the experts can contribute.

Requirements / constraint concerning conditions for use

No specific requirements or constraints for use are known.

Measure / Response Types

The answers are recorded to the questions asked in the MS Excel tool and the responsibilities, actions and time lines are defined.

Collected parameters and data format

Collected parameters and the data format are not prescribed, as the MS Excel questionnaire does not include predefined answers.

Results obtained and interpretation

The results of the Safety scanning session will automatically be presented in the form of a report which includes spider diagrams. These diagrams transform the answers on the questions concerning the Safety Fundamentals into a graphical representation of safety impact of the Subject of discussion and provide the basis for a comparison between the safety impact as displayed by the Ms Excel tool and the estimated safety impact as determined in the main part of the facilitation session. Four different diagrams are presented, showing the different safety perspectives, e.g. Regulation framework; Safety management; Operational safety; Safety architecture and their corresponding Safety Fundamentals.

Description of use

Figure / model

Figure 1: Screenshot of the Safety Scanning Methodology MS Excel questionnaire tool
### Process description

The Scanning process is depicted below:

<table>
<thead>
<tr>
<th>Preparation</th>
<th>Main Part</th>
<th>Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Content preparation (Safety Scanning Tool, Subject of Discussion)</td>
<td>- Warm-up (Purpose, clarifications)</td>
<td>- Standardise results according to guidelines</td>
</tr>
<tr>
<td>- Event preparation (Group profile, infrastructure, time)</td>
<td>- Use the Tool (Mediate questions and document answers)</td>
<td>- Handing over of the document to stakeholders</td>
</tr>
</tbody>
</table>

The report constitutes the safety register for the assessed Change.

An example of the report is given below:

**Introduction**

This Safety Register (edition 1) is the result of a Safety Scanning exercise conducted by……..

**Aim of the Safety Register**

The aim of the Safety Register is to identify safety and safety related issues (i.e. safety considerations) that are yet to be considered to enable the safe and timely implementation of the ……….. The Safety Register does not constitute a safety assessment. It does however identify what is yet to be done and assigns responsible actors to undertake the identified safety related activities.

By indicating a (estimated or confirmed) deadline for resolution of the identified safety considerations, the programme manager is enabled to make a transparent planning by assisting him to identify possible project risks related to a planned implementation date.

**Safety Scanning Event and Participants**

This Safety Scanning event took place on …….. at ……. in ……..

The event started at ……. and ended at ……. With deduction of lunch and coffee breaks, ….. hours were spent on the exercise.

Participants to the meeting were:

- Programme team:
  - Programme Manager
  - Team expert
  - Team expert
  - Safety Manager

- Support:
  - Exercise Moderator

- Observers:

  **Verification for follow-up and verification**

  The raised “safety considerations” in this safety register contain either;
  - References of tasks yet to be completed
  - Assignment of responsibilities for completion of the tasks

  In order to allow follow-up or verification of completion of the raised safety considerations it is recommended to provide where applicable document references.
These references can be considered as traceable “evidence” that a safety consideration can be closed successfully.

Examples of such evidence could be:
• Document references such as the conceptual documents
• Studies that confirm verification of e.g. regulatory compliance
• Agreed meeting minutes that confirm decisions
• Etc.

The benefit of such references is threefold;
• It allows the Programme Manager to close this issue
• It allows the customer to not re-doing the work at the implementation side
• It enables a more pragmatic review by a Competent Authority which should allow for a smoother approval process

The following has been generated by the Safety Scanning Tool on ........ at ......hrs. The users are invited to add their own Safety scanning analysis and conclusions, and change the layout of the report to the desired format.

User details
Name:)
Email address:
Title of the Subject addressed:
Subject Description:
Key documents available to the Subject:

Results
The results are presented in the form of spider diagrams

Conclusions
Enter your conclusions here ...

References
Enter your references here .

Safety Register
General
Setting the context:
1 What is the level of maturity of the Subject?
1.1 Who is affected by the Subject and why?
1.2 Has the goal of the Subject been jointly set by the stakeholders?
1.3 How much would the implementation of the Subject change the functionality and the boundaries of the current situation?
1.4 Are there any constraints for implementation of the Subject?

Regulation framework
Regulatory Principles
2 Does the institutional safety regulatory framework relate to Responsibility When the Subject in a clear and unambiguous way?

.........
### Safety Scanning Methodology (SAF SCAN)

<table>
<thead>
<tr>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strengths and Weaknesses of the tool</strong></td>
</tr>
<tr>
<td>The Safety Scanning report provides useful information on the aspects of safety oversight by competent authorities. It is therefore a valuable resource for competent authorities and licensees in Civil Aviation. The Methodology can be applied proactively as from an early stage in a Change process.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alternative methods / tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>No alternative tools or methods are being identified.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Possible combination with other methods / tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Safety Scanning methodology can be combined with any failure-based risk assessment and mitigation methodology. The Safety Scanning methodology is fully compliant and can be used in conjunction with ‘Regulatory Aspects of Management of Change’ described in Annex D, D-8.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Psychometric / methodological integrity description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectivity / (or at least) demonstration</strong></td>
</tr>
<tr>
<td>The Safety Scanning Methodology is as objective, reliable and valid as the data input and scenario information.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Reliability / (or at least) demonstration</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The Safety Scanning Methodology has, in pilots and in actual use, demonstrated the delivery of a reliable picture on the current safety situation in the operational environment.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Validity / (or at least) demonstration</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>It can be assumed that content validity of the tool is given.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Description of methodological integrity and additional Evidence or Value that the tool or study provides</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The Safety Scanning Methodology is under constant development and has shown evidence of its value in practical applications. The Safety Fundamentals, on which the methodology is based on, were derived from various safety related industrial areas which have proven its validity.</td>
</tr>
</tbody>
</table>
**EXECUTIVE SUMMARY**

<table>
<thead>
<tr>
<th>Name of method or tool etc:</th>
<th>Solutions for Human – Automation Partnerships in European ATM (SHAPE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type:</td>
<td>Questionnaires</td>
</tr>
</tbody>
</table>

**Abstract:**

Solutions for Human-Automation Partnerships in European ATM (SHAPE) deals with the impact of new automation on the air traffic controller. A set of questionnaires has been developed which serves to assess the effect of automation on controller workload, situation awareness, teamwork, and trust in the system.

These questionnaires are:
- Assessing the Impact of Automation on Mental Workload (AIM),
- Situation Awareness for SHAPE (SASHA),
- SHAPE Automation Trust Index (SATI), and
- SHAPE Teamwork Questionnaire (STQ).

**ProACT Process Model**

[Diagram showing ProACT Process Model]

**References**

Developer and source


Further information can be obtained from: mailto: Doris.Dehn@eurocontrol.int

Year of development / publication, updates etc.

2007 (Revised version)
### General description

#### Purpose of measurement / study

The questionnaires serve to assess the impact of new ATC systems, tools, or procedures on workload, situation awareness, teamwork and trust of the air traffic controller.

#### Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)

Questionnaires

#### Effort required (time, people, equipment, resources); usability and practicability

It takes about 5 minutes (AIM-s, STQ-s, SASHA, SATI) to 10 minutes (AIM-I, STQ-I) to fill in the questionnaires. Questionnaires have been revised and evaluated focusing especially on usability and practicability.

#### Population – Demographic and or Professional Group for which the method is intended for

Air Traffic Controllers

#### Object of measurement / study (individual, team, profession, department, company)

Individual

#### Language (other than English)

English only

#### Cost information / Copyrights / Agreements needed

The questionnaires are free of charge at: [http://www.eurocontrol.int/humanfactors/public/standard_page/SHAPE.html](http://www.eurocontrol.int/humanfactors/public/standard_page/SHAPE.html). EUROCONTROL asks the user to register before downloading the questionnaires and sign an agreement to reference the questionnaires in any publicly released documents.

### ATM specific mapping

#### Guidance for use in the ATM Context

The most relevant change scenarios for which Solutions for Human – Automation Partnerships in European ATM (SHAPE) applies are:

- Implementation of future operational concepts and systems, e.g. encompassing:
  - significant changes of roles and responsibilities in operational jobs
  - more integrated ATM processes characterised by wide information sharing, enhanced CDM (Collaborative decision making)
  - significantly increasing automation of tasks or functions;
  - new technologies (e.g. Data link, 4D trajectory based planning and control, support tools for separation delegated to flight crew, conflict resolution and collision avoidance automation support).

- Harmonisation and mobility of staff, e.g.:
  - transfer of operational staff to other states or in multinational working arrangements;

- Consolidation, integration and outsourcing of services and units, e.g.:
  - remote operations and maintenance settings.

- Certification and regulatory implementation activities, e.g.:
  - implementation of harmonised/ interoperable technology and procedural standards.

#### Experiences of use in the ATM / safety industry / other industry context, including references / users

The SHAPE questionnaires have been used in concept validation studies run by EUROCONTROL and at some Air Navigation Service Providers in Europe.
## ProACT Process Model

### Applicable to phase and activity of the ProACT Process Model

The SHAPE questionnaires require the ATCO to have been exposed to the implementation of a new concept or system. In earlier stages of the project this can be a simulator, in later stages it can be an operational system.

### Planning phase

**Risk & opportunities analysis – Feasibility Evaluation:**
The questionnaires can be used to assess the feasibility of new automation in terms of its impact on Mental Workload, Situation Awareness, Trust and Teamwork. Depending on the results, changes to new automation may be needed.

### Implementation phase

**Access and secure acceptance – implement changes:**
The questionnaires can be used to assess the acceptance of new automation in terms of its impact on Mental Workload, Situation Awareness, Trust and Teamwork. Depending on the results, changes to new automation may be needed.

### Evaluation Phase

**Process & outcome assessment:**
The questionnaires can be used to assess the implementation of the new automation to assure that the intended benefits are realised.

## Technical description

### Description of the content / study

#### Assessing the Impact of Automation on Mental Workload (AIM)
The short version, AIM-s, consists of 16 items which are not divided into scales. The long version, AIM-l, consists of eight scales with four items each (i.e. 32 items).

These scales are:

1. Building and Maintaining Situation Awareness
2. Monitoring of Information Sources
3. Memory Management
4. Managing the Controller Working Position
5. Diagnosing and Problem Detection
6. Decision Making and Problem Solving
7. Resource Management and Multi-Tasking
8. Team Awareness

#### SHAPE Teamwork Questionnaire (STQ)
The short version, STQ-s, consists of 12 items which are not further divided into scales. The long version, STQ-l, comprises six scales with four items each (i.e. 24 items).

The six scales used in the STQ-l are:

1. Team situational Awareness
2. Team Roles & Responsibilities
3. Team Co-operation
4. Team Climate
5. Team Error Management
6. Team Communication

#### Situation Awareness for SHAPE (SASHA)
SASHA consists of six items which are not divided into individual scales.

#### SHAPE automation Trust Index (SATI)
SATI consists of six items which are not divided into individual scales.


### Context and Prerequisites for application

The SHAPE questionnaires require the participant to have first hand-experience with a new system, tool or concept. Therefore, an ATC simulator or (pre-) operational system with the new system, tool or concept is required.

### Equipment required for application

Paper and pencil questionnaires. Each questionnaire consists of an instruction sheet (for the participant) the questionnaire and a data scoring sheet (for the researcher/analyst). An Excel spreadsheet can be used for the calculation of scores form the raw data.
### Required user qualifications
Psychological testing skills and basic HF knowledge.

### Requirements / constraint concerning conditions for use
Air traffic controllers, to be used in the context of simulations or operational tests.

### Measure / Response Types
Responses are collected on 7-point Likert scales ranging from 0 (none/never) to 6 (extreme/always).

### Collected parameters and data format
For each questionnaire, scores will be averaged to get an overall score. The long versions of the questionnaires (i.e. AIM-I and STQ-I) also yield separate scores for each sub-scale.

### Results obtained and interpretation
- **AIM-s**: Overall workload score, ranging between 0 and 6.
- **AIM-I**: Overall workload score and scores for 8 subscales, all ranging from 0 to 6.
- **STQ-s**: Overall teamwork score, ranging between 0 and 6.
- **STQ-I**: Overall teamwork score and scores for 6 subscales, all ranging from 0 to 6.
- **SASHA**: Overall situation awareness score, ranging between 0 and 6.
- **SATI**: Overall score for trust in an ATC system, ranging between 0 and 6.

All results need to be analysed in comparison to a baseline system (usually the system, tool or procedure currently in use). That is, a questionnaire has to be applied at least twice: once for the baseline system and once for the new system. Results are to be interpreted in terms of significant differences in scores obtained for the two systems.

### Description of use

#### Assumptions:
- Addressing the aim
- Agreement of the works council and business management
- Make sure the tool is appropriate

#### Precautions:
- Units of the questionnaire (for postal interrogation: envelopes)
- Employees shall be informed

#### Investigation:
- Standardised conditions
- Collecting boxes (for postal interrogation: re-send)

#### Results:
- Employees have to be informed about the results and further actions

#### Process description
Make sure that this tool is appropriate for your investigation and ensure you have enough units of the questionnaire and envelopes if you plan to process a postal interrogation. Employees shall be informed of the investigation; its aim, the start and end date and further actions. Ensure anonymity (by using a coded system and voluntarism of the employees) is guaranteed. An information sheet, an informative presentation, or information posters at several places, e.g. notice board, intranet, e-mail can be used. Inform all employees to ensure the investigation is representative. Consider to contact the employees especially if you plan to process a postal interrogation before you start and affirm their commitment for their participation.

Ensure that every employee gets a unit of the questionnaire. If you are processing a postal interrogation you have to indicate the reply due date. The investigation shall be performed under standardised conditions if it is not a postal interrogation; every person has to be exposed to the same conditions (undisturbed setting, material, time etc.). Secure collecting boxes are available within the organisation if the employees got their questionnaires personally and place them in a non-apparent area to ensure anonymity.

If the investigation is conducted by an outside consultant or researcher, guarantee anonymity, by preparing a pre-paid envelope together with the questionnaire so that employees can send their completed questionnaires directly back. This can also be used if the employees work at different geographical sites and/or administration of the questionnaire is at another geographical site. After data analysis, inform employees about the results and their interpretation including further actions. Respect the principles of social dialogue.
Solutions for Human – Automation Partnerships in European ATM (SHAPE)

Annex A No: A-12

The Change & Transition Tools Compendium

Strengths and Weaknesses of the tool

Strengths:
The SHAPE questionnaires have been demonstrated as easy to use in ATC simulations and operational tests. All questionnaires show satisfactory internal consistency (all $\alpha$’s > 0.70).

Weaknesses:
Due to the limited number of items, the SATI and SASHA should be combined with a more extensive interview or de-briefing.

The validation process is not completed yet. For this reason, results obtained using the questionnaires should be cross-checked with other sources of information (such as interviews, logging of simulator data, etc.).

Alternative methods / tools

NASA-TLX (Hart & Staveland, 1988) and Instantaneous Self-Assessment (ISA, Jordan, 1992) are workload self-rating techniques that can be used in simulation (alternative to AIM, but not capturing detailed ATC tasks).

SART is a situation awareness self-rating technique (alternative to SASHA, but not tailored to ATC task).

Possible combination with other methods / tools

Combination with other data sources (such as interviews, de-briefings, and logging of simulator data) is recommended.

Psychometric / methodological integrity description

Objectivity / (or at least) demonstration

Standardised Questionnaires.

Reliability / (or at least) demonstration

<table>
<thead>
<tr>
<th>Test</th>
<th>Scales</th>
<th>Cronbach $\alpha$ (Scale)</th>
<th>Cronbach $\alpha$ (Overall)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIM-I</td>
<td>1. Building &amp; Maintaining SA</td>
<td>0.86</td>
<td>0.97</td>
</tr>
<tr>
<td></td>
<td>2. Monitoring of Information Sources</td>
<td>0.86</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Memory Management</td>
<td>0.74</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Managing the CWP</td>
<td>0.68</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Diagnosing &amp; Problem Detection</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6. Decision Making &amp; Problem Solving</td>
<td>0.81</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7. Resource Management &amp; Multitasking</td>
<td>0.73</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8. Team Awareness</td>
<td>0.86</td>
<td></td>
</tr>
<tr>
<td>AIM-s</td>
<td>N/A</td>
<td>N/A</td>
<td>0.95</td>
</tr>
<tr>
<td>STQ-I</td>
<td>1. Team Situation Awareness</td>
<td>0.78</td>
<td>0.88</td>
</tr>
<tr>
<td></td>
<td>2. Team Roles &amp; Responsibilities</td>
<td>0.87</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Team Co-operation</td>
<td>0.86</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Team Climate</td>
<td>0.86</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Team Error Management</td>
<td>0.72</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6. Team Communication</td>
<td>0.77</td>
<td></td>
</tr>
<tr>
<td>STQ-s</td>
<td>N/A</td>
<td>N/A</td>
<td>0.76</td>
</tr>
<tr>
<td>SASHA</td>
<td>N/A</td>
<td>N/A</td>
<td>0.83</td>
</tr>
<tr>
<td>SATI</td>
<td>N/A</td>
<td>N/A</td>
<td>0.83</td>
</tr>
</tbody>
</table>

Validity / (or at least) demonstration

The selection of items in the questionnaire (reflecting various aspects of the construct under investigation) served to ensure construct validity. In empirical studies, AIM, SASHA and STQ were shown to be sensitive towards experimental manipulations of traffic load, controller role, or the allocation of tasks within the controller team (and thus behaved in a theoretically expected way).

In addition, there is evidence for convergent validity of the AIM: the AIM showed a pattern of results consistent with ISA ratings and NASA TLX scores.

Description of methodological integrity and additional Evidence or Value that the tool or study provides

Systematic psychometric development especially developed for the ATM context. A user guide is also available.
**CRIOP®: A scenario based method for Crisis Intervention and Operability analysis**

### EXECUTIVE SUMMARY

<table>
<thead>
<tr>
<th>Name of method or tool etc:</th>
<th>CRIOP®: A scenario based method for Crisis Intervention and Operability analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Methodology</td>
</tr>
</tbody>
</table>

**Abstract:**

CRIOP is a methodology that contributes to verification and validation of the ability of a control centre to safely and efficiently handle all modes of operations including: start up, normal operations, maintenance and revision maintenance, process disturbances, safety critical situations and shut down.

The key elements of CRIOP are Checklists covering relevant areas in design of a Control Centre (CC) and Scenario Analysis of key scenarios for risk analysis allowing investigating possible (potential) accidents in detail. The method is applied in a Learning Arena where the workforce with operating experience, designers and management can meet and evaluate the optimal Control Centre.

A CRIOP analysis is initiated by a preparation and organisation phase, to identify stakeholders, gather necessary documentation, establish analysis group and decide when the CRIOP analysis should be performed.

The CRIOP methodology must be used at the right times during design and operation of a control centre. The recommendations are to perform the CRIOP analysis at:

1. The first time during analysis or conceptual development
2. The second time during detailed design
3. The third time after one year of operating experience.

### ProACT Process Model

#### Applicable to Phase and Main Activity:

### References

**Developer and source**

SINTEF Technology and Society  
S P Andersens veg 5  
7465 Trondheim,  
NORWAY  
Website: http://www.criop.sintef.no

**Year of development / publication, updates etc.**

A first version of CRIOP started in 1990 and was fully developed in 2003 and 2004, with minor adjustment done in 2008. The method is described in full detail in a report dated 2008:  
www.criop.sintef.no/The%20CRIOP%20report/CRIOPReport.pdf
### General description

**Purpose of measurement / study**

CRIOP is a methodology used to verify and validate the ability of a control centre to safely and efficiently handle all modes of operations. The objective of CRIOP has been to combine relevant material in a “best practice” checklist. The focus of the methodology was on the human aspects in terms of conditions for successful crisis handling.

**Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)**

The key elements of CRIOP are Checklists covering relevant areas in design of a Control Centre (CC), Scenario Analysis of key scenarios for risks and a Learning Arena where the workforce with operating experience, designers and management can meet and evaluate the optimal CC.

A CRIOP analysis is initiated by a preparation and organisation phase, to identify stakeholders, gather necessary documentation, establish analysis group and decide when the CRIOP analysis should be performed.

**Effort required (time, people, equipment, resources); usability and practicability**

The scope of a CRIOP® analysis is usually between two to five days. The participation from experienced control room operators and the CRIOP® analysis in itself could influence the design, and budget, of the Control Centre.

A CRIOP® analysis could be organised as a project, reporting to the steering committee of the project. In the steering committee both the operator and the contractor should be represented – making it possible to adjust the solution within the scope (time and budget) of the project.

**Population – Demographic and or Professional Group for which the method is intended for**

The target of the method is not a group of people, but system performance. It is important, however, to identify the key stakeholders to be involved in the analyses. The key stakeholders relevant for the analysis are illustrated being:

<table>
<thead>
<tr>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Licensee (Board)</td>
</tr>
<tr>
<td>2. Operator</td>
</tr>
<tr>
<td>3. Contractor</td>
</tr>
<tr>
<td>4. Sub-Contractor</td>
</tr>
</tbody>
</table>

**Object of measurement / study (individual, team, profession, department, company)**

The methodology can be applied to central control rooms at, for example nuclear power plants, driller’s cabins, crane or train / ship control rooms and other types of cabins, onshore, offshore, emergency control-rooms.

The CRIOP methodology can also be used for control centres / cabins such as the driving cabin of a train or the bridge of a boat. The present CRIOP methodology is customised for offshore control centres (oil platforms).

**Language (other than English)**

English only

**Cost information / Copyrights / Agreements needed**

The methodology is available for free. Cost of running a CRIOP® will depend upon a number of factors.
ATM specific mapping

Guidance for use in the ATM Context

The relevant change scenarios where CRIOP could apply are:

- Consolidation, integration and outsourcing of services and units, e.g.:
  - consolidation of control centres;
  - remote operations and maintenance settings.

- Implementation of future operational concepts and systems, e.g. encompassing:
  - significant changes of roles and responsibilities in operational jobs;
  - more integrated ATM processes characterised by wide information sharing, enhanced CDM (Collaborative Decision Making);
  - significantly increasing automation of tasks or functions;
  - new technologies (e.g. Data link, 4D trajectory based planning and control, support tools for separation delegated to flight crew, conflict resolution and collision avoidance automation support).

- Changes in organisational structure of whole companies, authorities or units, e.g.:
  - civil/military integration of operations.

- Certification and regulatory implementation activities, e.g.:
  - implementation of harmonised/interoperable technology and procedural standards.

Experiences of use in the ATM / safety industry / other industry context, including references / users

The CRIOP methodology has been used in the Norwegian oil industry and in rail transportation and not yet in ATM. However, the methodology can be customised for other applications.

ProACT Process Model

Applicable to phase and activity of the ProACT Process Model

Communication, Participation and Involvement process

The CRIOP method is a method designed to involve all relevant stakeholders including professional staff groups / operators in the design, development and implementation/operation of the system.

Scoping phase

Risk & opportunities evaluation:

CRIOP should be used as to evaluate the design processes for a control room. The potential for improvements is naturally largest during the early phases of the design process.

Planning phase

Risk & opportunities analysis:

CRIOP should be used as to analyse the final proposed design processes for a control room helping to avoid non-acceptance by affected staff.

Evaluation Phase

Process & outcome assessment:

CRIOP can be used to verify the process outcome in a control room.

Technical description

Description of the content / study

CRIOP consists of four major work tasks and checks during these phases the following areas:

<table>
<thead>
<tr>
<th>Step</th>
<th>Work</th>
<th>Areas checked</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>Prepare and organise the CRIOP Analysis</td>
<td>-Layout / Working environment;</td>
</tr>
<tr>
<td>(2)</td>
<td>General Analysis / Checklist Review</td>
<td>-Control- and safety systems, man-machine-interfaces;</td>
</tr>
<tr>
<td>(3)</td>
<td>Scenario Analysis</td>
<td>-Job organisation; Procedures and work description;</td>
</tr>
<tr>
<td>(4)</td>
<td>Implementation and Follow-up of Actions</td>
<td>-Training and competence;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-E-Operations / remote operations / integrated operations</td>
</tr>
</tbody>
</table>
The CRIOP methodology must be used at the right times during design and operation of a control centre. The recommendations are to perform the CRIOP analysis the first time during analysis or conceptual design, the second time during detailed design, and the third time after one year of operating experience.

Recommendations concerning the control room are easier to implement if the analysis is performed early in design. Major changes in control room layout will for instance rarely be made after start-up of the installation, because this has major economic consequences. On the other hand, several questions are not applicable if the analysis is carried out too early, because certain design issues may not be settled. Therefore, the timing of the CRIOP analysis will be crucial and evaluating this is a high priority item.

**Equipment required for application**

Only described feature regarding equipment is: “Arrange satisfactory physical conditions of the meeting room (enough size, useful equipment for graphical presentations, enough workplace for each attendee, good room climate”).

**Required user qualifications**

A typical analysis group consists of the following personnel:

- Two (ideally three) control room operators; at least one operator should be a senior with long experience. (preferably they have different experience and background);
- An instrument engineer;
- A process engineer;
- A facilitator with good understanding of human factors issues, preferably a human factors specialist;
- Meeting reporter – a note taker with good understanding of human factors issues, to document issues and points from the analysis.

**Requirements / constraint concerning conditions for use**

The first activities in the CRIOP® analysis are to:

- State preconditions for study
- Plan and decide on the “timing” of the analysis
- Establish the analysis group (organise the work)
- Collect relevant documentation
- Work load assessment
- Practical considerations (facilitate the group process)

**Measure / Response Types**

Checklist.

**Collected parameters and data format**

Checklist scoring consists of yes – no – n.a. (not applicable).

**Results obtained and interpretation**

Checklist scoring consists of yes – no – n.a. (not applicable).
Description of use

A CRIOP® analysis is initiated by a preparation and organisation phase, in order to identify stakeholders, gather necessary documentation, establish analysis group, decide the scope and size of the analysis and decide when the CRIOP® should be performed.

The two main phases in the CRIOP® analysis are:

1. A General Analysis (GA) with checklists to verify that the control centre satisfies the stated requirements based on best industry practice. This is a standard design review of the CC.

2. A Scenario Analysis of key scenarios performed by an experienced team from to validate that the control centre satisfies the implied needs. The Scenario analyses helps to analyse new accidents that may happen in the future rather than at the summary level of the traditional technical risk analysis. The analyses help to identify issues to be elaborated and solved later such as remedial actions that will stop a scenario from developing.

CRIOP® specifies that workers, management and the design team should meet to discuss key scenarios and the checklists, in an environment supporting open and free exchange of experience. Experience from operations should be discussed with the design team and management.

Issues found in co-operation should be resolved with management. The goal is to achieve double loop organisational learning as oppose to single loop organisational learning, by taking action to change the “governing variables” as CC design, procedures or work organisation.

The group process should focus on a good co-opting process and a possibility to change these governing variables.

Figure 1: The main step in the CRIOP methodology

### Evaluation

#### Strengths and Weaknesses of the tool

The main advantages of the CRIOP® method are the ability of reducing costs and risks in the design process. This is described in more detail at: [http://www.criop.sintef.no/CRIOP%20in%20short/The%20advantages.htm](http://www.criop.sintef.no/CRIOP%20in%20short/The%20advantages.htm)

#### Alternative methods / tools

Different standards and guidelines that CRIOP is based upon.

#### Possible combination with other methods / tools

Use of CRIOP® presupposes that there has been or will be used a structured design process such as ISO-11064.

#### Psychometric / methodological integrity description

**Objectivity / (or at least) demonstration**

The systematic process and application guidance/best practices used ensure that results have minimised level of bias.

**Reliability / (or at least) demonstration**

The initial methodology was a result of the CRIOP project, “Crisis Intervention in Offshore Production”, taking place in the period 1985-90, with support from Norsk Hydro, Saga and Elf. Some of the key events since the development of CRIOP in the 1990’s have been:

- **1990**: CRIOP used as preferred methodology since at Norsk Hydro (On Oseberg C, Troll B, Njord, Visund, Troll C, Oseberg Sør, Oseberg D, Grane).
- **1990**: New regulation of Norwegian offshore industry, new standards such as NORSOK.
- **1997**: CRIOP is recommended as a preferred methodology in NORSOK S002, Rev 3.
- **2000**: NPD (Norwegian Petroleum Directorate) is increasing focus on Man Machine interfaces and Human Factors (HF), ISO 11064 (Ergonomic design of control centres).
- **2001**: New NORSOK standard I-002 on SAS systems.
- **2002**: NPD published new HSE rules and regulations. These include requirements for analysis, systematic end user involvement, alarm handling, validation and verification, competence, reduction of human errors and Man Machine Interface in Control Rooms.
- **2003**: NPD published guidelines for validating and verifying HF in Control Rooms.
- **2004**: New version of NORSOK S-002, Revision 4. Based on the use of the CRIOP® methodology in the petroleum industry, Norsk Hydro decided to initiate a revision of the methodology in 2003.
## Validity / (or at least) Demonstration

The new CRIOP methodology is based on best practices and methods that have shown their validity either as standards or in practice. The methodology is under continuous improvement through experience from several CRIOP analyses done in 2004, among others at Snøhvit /Statoil, Visund/Statoil /Norsk Hydro and Oseberg Feltsenter /Norsk Hydro. The methodology is considered as content valid with high acceptance and practical value for improvements.

The user experience was discussed with an expert team. The experience from the pilots has been included in the revised version of CRIOP.

## Description of Methodological Integrity and Additional Evidence or Value that the Tool or Study Provides

The checklist in CRIOP has been developed based on:

- Existing international standards and guidelines such as ISO 11064, NUREG0700, EEMUA #191, IEC 61508. (NUREG 0700 alone contains around 700 pages. A Selection of the most important issues from NUREG and other standards has been performed based on empirical studies.)

- All relevant requirements in NPD regulations as Activity Regulations-AR, Facilities Regulation-FA, Management Regulations-MR, Frame Regulations-FR, and YA-711. The goal has been to ensure that all relevant NPD regulations have been taken into account when we have performed a CRIOP analysis.

- Best practice in the industry

- NORSOK S-002 rev 4, NORSOK I-002 (NPD regulations and YA-711 supersede NORSOK.)

- User requirements, wanting to have relevant materials in the CRIOP checklists

The e-operations checklist is based on relevant ICT and SAS standards, ISO/IEC 27002 (former ISO 17799) and ANSI/ISA-99.
**EXECUTIVE SUMMARY**

<table>
<thead>
<tr>
<th>Name of method or tool etc:</th>
<th>Type:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Factors Engineering Program Review Model</td>
<td>Review methodology for Human Factors Engineering Programs</td>
</tr>
</tbody>
</table>

**Abstract:**

This methodology is used by the staff of the Nuclear Regulatory Commission to review the human factors engineering (HFE) programs of applicants for construction permits, operating licenses, standard design certifications, combined operating licenses, and for license amendments. The purpose of these reviews is to verify that accepted HFE practices and guidelines are incorporated into the applicant’s HFE program.

The review methodology provides a basis for performing reviews that address the twelve elements of an HFE program: HFE Program Management, Operating Experience Review; Functional Requirements Analysis and Function Allocation, Task Analysis, Staffing, Human Reliability Analysis, Human-System Interface Design, Procedure Development, Training Program Development, Human Factors Verification and Validation, Design Implementation, and Human Performance Monitoring. Each review element is divided into four sections: Background, Objective, Applicant Submittals, and Review Criteria.

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### ProACT Process Model

#### Applicable to Phase and Main Activity:

<table>
<thead>
<tr>
<th>Scoping Phase</th>
<th>Planning Phase</th>
<th>Implementation Phase</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>X X X</td>
<td>X</td>
<td>X X X</td>
</tr>
</tbody>
</table>

- Decision gates
  - Communication, participation and involvement
  - Continuous evaluation and adaptation

---

### References

**Developer and source**

U.S. Nuclear Regulatory Commission (NRC) (2004), Human Factors Engineering Program Review Model. (NUREG-0711, Rev. 2)

Washington, DC: NRC, Office of Nuclear Regulatory Research.

The publication is available on:


**Year of development / publication, updates etc.**

Published in 2004.
# General description

**Purpose of measurement / study**

The purpose of the review methodology is to verify that accepted Human Factors Engineering (HFE) practices and guidelines are incorporated into the applicant’s HFE program.

**Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)**

Review methodology for Human Factors Engineering Programs – Checklist with descriptions of acceptance criteria.

**Effort required (time, people, equipment, resources); usability and practicability**

Due to its large scope and level of detail the review methodology is estimated to require a large effort both concerning time, people and resources. Subparts of the methodology can be used individually and the effort can thus be reduces accordingly.

The review methodology is well structured and organised and should be easy and practical to use.

**Population – Demographic and or Professional Group for which the method is intended for**

The review methodology is intended for nuclear regulators staff, but could also be useful for engineering staff.

**Object of measurement / study (individual, team, profession, department, company)**

The object of the review is typically new nuclear power plants (i.e. at company level).

**Language (other than English)**

English only

**Cost information / Copyrights / Agreements needed**

A report describing the review methodology is available for free. Costs of conducting a review process or to use criteria to guide engineering processes vary.

## ATM specific mapping

**Guidance for use in the ATM Context**

The review methodology is developed for HFE programs of applicants for construction permits, operating licenses, standard design certifications, combined operating licenses and for license amendments. It has some value for similar ATM scenarios.

The relevant change scenarios where the Human Factors Engineering Program Review Model applies are:

- Consolidation, integration and outsourcing of services and units, e.g.:
  - consolidation of control centres.

- Harmonisation and mobility of staff, e.g.:
  - Application of regulations concerning operational competence (e.g. ESARR 5, common ATCO license).

- Certification and regulatory implementation activities, e.g.:
  - certification as ATM service provider or training provider;
  - implementation of harmonised safety management standards;
  - implementation of harmonised competence regulations;
  - implementation of harmonised/interoperable technology and procedural standards.

**Experiences of use in the ATM / safety industry / other industry context, including references / users**

Developed for the nuclear industry.
The Human Factors Engineering Program Review Model should be used for system design processes in a control room. If this is the case, then it could be applied to the following phases:

**Scoping Phase:**
Change need analysis – Risk & opportunities identification – Feasibility evaluation:
The review methodology covers HFE Team and Organisation, HFE Process and Procedures and HFE Issues Tracking.

**Planning Phase:**
Project objectives definition - Project proposal development – Social impact assessment - Risk & opportunities analysis – Feasibility evaluation – Implementation plan development:
The review methodology covers operating experience review, functional requirements analysis and functional allocation, task analysis, staffing and qualifications, human reliability analysis, human-system interface design, procedure development, training program development and human factors verification and validation.

**Implementation Phase:**
Implement changes:
The review methodology covers design implementation.

**Evaluation Phase:**
Monitor and reinforce C &T processes:
The review methodology covers human performance monitoring.

### Description of the content / study

The human factors engineering (HFE) staff of the Nuclear Regulatory Commission’s (NRC’s) Office of Nuclear Reactor Regulation (NRR) evaluates HFE programs of applicants for construction permits (CPs), operating licenses (OLs), standard design certifications (DCs), combined operating licenses (COLs), and for license amendments.

The purpose of these reviews is to verify that accepted HFE practices and guidelines are incorporated into the applicant’s HFE program. The HFE review includes the design process, the final design, its implementation, and ongoing performance monitoring. The reviews support public health and safety by verifying that accepted HFE practices and guidelines are incorporated into the design.

The review model reflects a top-down approach for conducting an NRC safety evaluation so that the significance of individual topics may be seen in relationship to the high-level goal of plant safety. Top-down refers to an approach starting at the "top" with the plant's high-level mission goals and dividing them into the functions necessary to achieve the goals. Personnel tasks are analyzed to identify the alarms, displays, procedures, and control that will be required for task performance. The detailed design (of the HSI, procedures, and training) is the "bottom" of the top-down process. The HFE safety evaluation is broad-based and includes normal and emergency operations, maintenance, as well as test, inspection, and surveillance activities.

The HFE Program Review Model consists of twelve review elements:
1. HFE Program Management
2. Operating Experience Review
3. Functional Requirements Analysis and Function Allocation
4. Task Analysis
5. Staffing and Qualifications
6. Human Reliability Analysis
7. Human-System Interface Design
8. Procedure Development
9. Training Program Development
10. Human Factors Verification and Validation
11. Design Implementation

Each of these elements is divided into four sections:
1. Background - A brief explanation is given of the rationale and purpose of each element.
2. Objective - The review objective(s) of the element is defined.
3. Applicant Submittals - Materials to be provided for the NRC’s review are listed.
4. Review Criteria - The acceptance criteria for the review elements are provided.
### Context and Prerequisites for application
The review is based upon two reports submitted by the applicants.
- An implementation plan gives the applicant's proposed methodology for meeting the acceptance criteria of the element.
- A results summary report gives the results of the applicant's efforts related to each element.

### Equipment required for application
No specific equipment is required

### Required user qualifications
The review model requires the setup of an "HFE design team. A listing of required staff and their minimum qualifications and descriptions of typical contributions to the HFE design and implementation process is described in the annex of the document.

### Requirements / constraint concerning conditions for use
Except the user qualifications, neither other specific requirements nor constraints exist.

### Measure / Response Types
The review model entails checklists specifying acceptance criteria for each of the 12 review elements.

### Collected parameters and data format
Not mentioned

### Results obtained and interpretation
The review model matches the review criteria and the two reports submitted by the applicants.

---

**Figure / model**

<table>
<thead>
<tr>
<th>Planning and Analysis</th>
<th>Design</th>
<th>Verification and Validation</th>
<th>Implementation and Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFE Program Management</td>
<td>Human-System Interface Design</td>
<td>Human Factors Verification and Validation</td>
<td>Design Implementation</td>
</tr>
<tr>
<td>Operating Experience Review</td>
<td>Procedure Development</td>
<td></td>
<td>Human Performance Monitoring</td>
</tr>
<tr>
<td>Functional Requirements Analysis and Function Allocation</td>
<td>Training Program Development</td>
<td></td>
<td></td>
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<tr>
<td>Task Analysis</td>
<td></td>
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<tr>
<td>Staffing &amp; Qualification</td>
<td></td>
<td></td>
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<tr>
<td>Human Reliability Analysis</td>
<td></td>
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</tbody>
</table>

### Process description
The review model is organized into twelve elements. These elements are arranged in four activities as shown in the figure above. Each element is divided into four sections:
- **Background**, where a brief explanation of the rationale and purpose is provided for each element.
- **Objective**, where the review objective(s) of the element is defined.
- **Applicant Submittals** - In general, applicants are expected to submit two reports for NRC review:
  - An implementation plan gives the applicant's proposed methodology for meeting the acceptance criteria of the element.
  - A results summary report gives the results of the applicant's efforts related to each element.
- **Review Criteria**, which contain the acceptance criteria for design process products and for the final design review.
### Evaluation

**Strengths and Weaknesses of the tool**

The Human Factors Engineering Program Review Model represents a detailed and systematically approach to Human Factors engineering programmes and provides comprehensive descriptions of methods and criteria. The review model’s focus is on the results of different activities rather than the description of how to perform these activities in detail.

**Alternative methods / tools**

Each chapter specifies a list of references for further information.

**Possible combination with other methods / tools**

NRC states that other NUREGs can/should be used when appropriate. See website: [http://www.nrc.gov/reading-rm/doc-collections/nuregs/](http://www.nrc.gov/reading-rm/doc-collections/nuregs/)

<table>
<thead>
<tr>
<th>Psychometric / methodological integrity description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectivity / (or at least) demonstration</strong></td>
</tr>
<tr>
<td>The review model was first published in 1994 and revised in 2002. The document includes changes made in response to public comments.</td>
</tr>
<tr>
<td><strong>Reliability / (or at least) demonstration</strong></td>
</tr>
<tr>
<td>Reliability is not reported directly.</td>
</tr>
<tr>
<td><strong>Validity / (or at least) demonstration</strong></td>
</tr>
<tr>
<td>Validity is not reported directly.</td>
</tr>
</tbody>
</table>

**Description of methodological integrity and additional Evidence or Value that the tool or study provides**

The review model has been developed by the United States Nuclear Regulatory Commission and is used by Nuclear Power plants based in the US.
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### EXECUTIVE SUMMARY

<table>
<thead>
<tr>
<th>Name of method or tool etc:</th>
<th>LAMPS (Long-term ATCO Manpower Planning Simulation) and CHAMP (Collaborative Harmonised ATCO Manpower Planning)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type:</td>
<td>Guidance Material (CHAMP); Software Package (LAMPS)</td>
</tr>
</tbody>
</table>

**Abstract:**

LAMPS is a simulation tool which models the variables that contribute and influence the controller staff inflow (recruitment, selection and training), throughput (use of controllers in the operational environment and in other areas in which controller expertise is required) and outflow (i.e. due to retirement, change of career) in a long-term (up to 15 years) planning timeframe. The LAMPS tool takes the factors that influence the relationship between traffic demand and operational controller staff into account. The complex interplay between the variables is modelled in the software.

CHAMP promotes a participative and interactive process for the planning cycle where all parties are involved and can contribute. ANSPs are facing uncertainties and changes in the controller working environment (technical and procedural changes), the working conditions (i.e. working hours, breaks, shift cycles) and in training (i.e. legal requirements) or legislation (i.e. licensing requirements) are the norm and are directly or indirectly impacting on the availability of staff. Planning of ATCOs is a complex and dynamic process and requires the inputs from various sources and the participation of people inside and outside the OPS environment.

CHAMP gives guidance for a participative process involving all parties as required and helps to take a long-term perspective where the staffing impacts from changes are reflected in realistic scenarios, whereby LAMPS reflects the changes in the respective variables and simulates the changed situation.

### ProACT Process Model

**Applicable to Phase and Main Activity:**

![ProACT Process Model Diagram](image)

### References

**Developer and source**

European Organisation for the Safety of Air Navigation (EUROCONTROL)  
Rue de la Fusée 96  
1130 BRUSSELS - BELGIUM  

**Year of development / publication, updates etc.**

2000 – 2003; CD-ROM for LAMPS and CHAMP Process guidance material are available.
## General description

### Purpose of measurement / study

LAMPS supports the long term Air Traffic Controller (ATCO) manpower planning. The complexity of staffing and staff planning and the need to adequate numbers of ATCO’s in Air Navigation on a long-term basis requires ANSPs to use advanced tools and develop profound expertise in the operational, the recruitment, training, staff allocation and staff scheduling areas. Each of these areas is dynamic, has a number of sub-processes and influencing variables to control and to manage. The aim of Lamps is to keep this dynamic balance under control and to identify impacts that create an imbalance in the supply and availability of controllers early enough to avoid a shortfall of controllers as well as an unreasonable high surplus.

The purpose of LAMPS is to:
- Configure the actual working environment accordingly so that it reflects the changes in the ATC environment correctly as it exists today;
- To develop / agree with social partners or with the technical or OPS managers on a likely scenario for the future and identify the variables that change in the current situation;
- To run a simulation with these changes and see how it impacts the overall manpower requirements (ATCOs available and required) over a longer period. The outcome can be used to develop plans on what has to change to respond to it and again to verify it.

CHAMP promotes a participation and collaboration process for the application of the LAMPS tool within an ANSP. Only participation and collaboration of all affected parties enables to develop a harmonised and coordinated approach for solutions that are feasible, commonly supported and work in practice.

CHAMP also describes the influencing variables, e.g. changes in working practices (i.e. sector manning), traffic demand (i.e. predicted traffic increase), other operational requirements (i.e. opening and closing time of sectors); controller productivity (i.e. increase of traffic handling capability due to technical changes), working conditions that govern the provision of ATS (i.e. shift start and end times, length of shifts, breaks, effective working hours in position, leave, legal requirements for example ESARRS etc having and impact on adequate manpower planning.

### Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)

Guidance Material and Simulation Software

### Effort required (time, people, equipment, resources); usability and practicability

A person with pre-knowledge about controller manpower planning, recruitment, training and shift rostering of staff will need a minimum of 14 days training and exercises to appropriately use the software tool, to appreciate the usefulness and gain greater benefits from it.

### Population – Demographic and or Professional Group for which the method is intended for

Air Traffic Controllers

### Object of measurement / study (individual, team, profession, department, company)

The LAMPS software can be applied for sector groups, teams and up to the entire controller workforce at an ANSP, including TWR staff.

### Language (other than English)

English only

### Cost information / Copyrights / Agreements needed

Free of Charge for ANSP’s in the ECAC member states. For other interested parties, a 100 EURO fee is charged.

## ATM specific mapping

### Guidance for use in the ATM Context

LAMPS and CHAMP have been explicitly developed for ATM. They include all variables to be taken into account for manpower planning of operational staff in ATM.

The most relevant change scenarios for which it applies are:
- Changes in working conditions
  - New shift/rostering cycles and working hours (e.g. to flexibly adapt to variations in traffic amount)
  - New remuneration schemes
  - New organisational or social structures and/or processes
Experiences of use in the ATM / safety industry / other industry context, including references / users

Four Case Studies were done in ANSPs and with different changes or business cases. The general findings are available on: [http://www.eurocontrol.int/humanfactors/public/standard_page/manpowerplanning.html](http://www.eurocontrol.int/humanfactors/public/standard_page/manpowerplanning.html)

### ProACT Process Model

**Scoping Phase:**
Feasibility evaluation:
LAMPS and CHAMP provide first indications of impacts on manpower planning.

**Planning Phase:**
Social impact assessment - Risk & opportunities analysis – Feasibility evaluation – Implementation plan development:
LAMPS and CHAMP help to project manpower needs and social impacts, to identify the risk associated with shortage of controllers and to plan the training and intake plan.

**Implementation Phase:**
Implement supporting structures – Implement training – Access & secure acceptance – Implement changes:
LAMPS and CHAMP support the implementation and adaptation of training plan and in time recruitment and allocation of required staff. The CHAMP process also covers involvement and participation of affected staff.

**Evaluation Phase:**
Process & outcome assessment:
LAMPS and CHAMP identify the controls for the action plans and provide early warnings as to whether the conditions are evolving favourably or not. Their application ensures that action plans are on track and being accomplished within budget and timeframe.

### Technical description

**Description of the content / study**

LAMPS is a generic prototype dynamic simulation model of ATCO Manpower planning which has as its core a PC-based interface that uses graphs and tables to show the results of interactive simulation of various ATCO manpower scenarios. It shows future manpower requirements in detail and thus facilitates planning. The model takes into account all variables influencing the in-flow, through-flow and out-flows of ATCOs over time. In addition, the model allows the ATCO traffic handling capacity to be modelled, thus indicating the number of ATCOs needed, taking into account training requirements, refresher training, quality aspects, availability of technical environment, etc., over a chosen time horizon. LAMPS is based on system dynamic concepts, and runs under VENSIM® (VENtana SIMulator) and Sable® software. The model can be easily amended and refined, as appropriate, to reflect specific local requirements and conditions. The software runs on any PC.

CHAMP promotes a process to understand the long term impact of ATCO Manpower Planning decisions and aims to build awareness and confidence in a collaborative planning process using the LAMPS tool. The process informs on how to use feedback concepts to explain the relationship between the different variables in ATCO Manpower Planning.

### Context and Prerequisites for application

Using the LAMPS software tool needs appropriate training to understand the processes involved. Training courses for the LAMPS software tool and the CHAMP Process are provided as e-learning courses.

### Equipment required for application

A standard PC and MS Excel. The LAMPS tool on a CD and runs under VENSIM (VENtana SIMulator) software which comes with the CD.
Required user qualifications

LAMPS requires expertise in manpower planning, training and career processes in an operational Air Traffic environment and in-depth knowledge about the required data. Good general human resources management knowledge is also required.

Requirements / constraint concerning conditions for use

No constraints are known.

Measure / Response Types

Various input parameters in different measurement formats are required, like number of training spaces in different training phases; success rate in different phases of training; length of training phases; number of days leave; average sickness days; retirement age, age distribution of controllers; training days and other absences on duty; traffic volume, operational requirements (sectors open) etc.

Collected parameters and data format

Utilisation of training places over time in different phases of training (number of training spaces used in comparison to available training places); utilisation and requirements for OJT; controller margin (under-coverage / over-coverage of controllers over time in relation to requirements etc. All data is available as MS Excel tables and in graphical format.

Results obtained and interpretation

The results indicate current under- or overstaffing and future needs. Depending on the variables, projections up to 15 years in advance can be made.

Description of use

Figure / model

LAMPS provides the possibility to configure the Inflow/Throughflow/Outflow processes with real or simulated data to lookup the results.
**Process description**

To implement the LAMPS tool and to get the maximum benefits out, the LAMPS tool needs to be embedded within a collaborative process. This should lead to improvements in how ATCO manpower planning issues are discussed and avoid a situation where isolated solutions are taken.

To create this collaborative environment, skills and processes are needed to enable OPS managers/experts, HR managers, training managers, manpower planners, etc., to work together to visualise and rehearse ATCO manpower planning scenarios, construct and test strategies to arrive at the most viable solution. An environment where all the players in the ATCO manpower planning process work together to find the optimum solutions.

The CHAMP process requires a cross-functional approach with representatives from OPS, Training, Human Resources and OPS support. CHAMP offers a process to bring all the players together to think creatively yet systematically about possible future environments and to develop scenarios and devise alternative strategies for ATCO manpower planning. This collaborative planning process involves six stages:

1. Review the Current Situation
2. Assess Future Challenges
3. Identify the Long-term Impact
4. Devise Alternative Strategies
5. Evaluate Strategies
6. Decide on Actions Needed

It is advisable to include and consult social partners at an early stage to get their views and gain acceptance for solutions. The principles of a participative process in which staff representatives provide inputs and are consulted as part of a formal social dialogue should be respected.

**Evaluation**

**Strengths and Weaknesses of the tool**

The strength of LAMPS and CHAMP is that it provides excellent collaboration facilities to get different views on board for learning about the organisation by exploring, discovering and experimenting. Developing an ATCO MP plan is seen as an ongoing, continuous and flexible process.

LAMPS helps to predict the number of ATCOs required and available and to understand the driving forces in manpower planning better by providing a long-term view and by simulating the future.

CHAMP helps to facilitate the cooperation and collaboration between the different partners involved and supports the social dialogue.

LAMPS is not an easy to learn and use tool and requires training and careful use. It requires reliable and valid data from various parties which might not be available or parties concerned might not be able to provide.

LAMPS does not provide a short-term roster planning method and simulation that would allow a simulation of changes in working conditions in accordance with granted leave, breaks, days off, other duties outside OPS etc in respect to adopted shift rules and allowed cycles.

**Alternative methods / tools**

There are no alternative or comparative tools known. Some new roster planning tools (for example the EUROPlanner Rostering tool © provided by ATS Data [http://www.ats-data.com](http://www.ats-data.com)) allow rolling out a shift cycle and simulate the impact (unassigned shifts, unassigned other duties, breaks and leave planning etc).

**Possible combination with other methods / tools**

For obtaining best results, LAMPS should be combined with a roster planning tool allowing planning and simulating various solutions on shift cycles, in reflection to changed or adapted shift rules and legal and other requirements (i.e., social requirements, health and safety requirements).
<table>
<thead>
<tr>
<th>Psychometric / methodological integrity description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectivity / (or at least) demonstration</strong></td>
</tr>
<tr>
<td>LAMPS is as objective, reliable and valid as the data input and scenario information.</td>
</tr>
<tr>
<td><strong>Reliability / (or at least) demonstration</strong></td>
</tr>
<tr>
<td>LAMPS has, in pilots and in actual use, demonstrated the delivery of a reliable picture on the current manpower situation in the operational environment. The current situation in terms of an existing shortage or surplus is reliably mirrored based on current input parameters.</td>
</tr>
<tr>
<td><strong>Validity / (or at least) demonstration</strong></td>
</tr>
<tr>
<td>Content validity of the tool can be assumed to be given. LAMPS has been constructed based on best available insights into the manpower process and interrelations between variables. It is based on proven / measured relations and logic. Then outcome of predicted manpower requirements based on a set of given parameters and predicting a given current manpower situation demonstrated that LAMPS does have some (concurrent) validity. No long-term (predictive) validity study has been done yet.</td>
</tr>
<tr>
<td><strong>Description of methodological integrity and additional Evidence or Value that the tool or study provides</strong></td>
</tr>
<tr>
<td>The simulation of complex relations as in manpower planning and the requirement taking a long-term perspective is a given fact in ATC. The availability of licensed ATCOs holding correct ratings and rating endorsements is a key factor for providing the capacity as demanded. An unreasonable surplus of manpower is economically not sustainable whilst a shortfall of ATCO manpower is a serious hampering factor for capacity and growth. A tool, like LAMPS that helps to understand the complex relationship between variables in the planning process is important to have. But it is the collaborative working together between all parties in the ATC, supported by the CHAMP process, which makes it work.</td>
</tr>
</tbody>
</table>
### Executive Summary

<table>
<thead>
<tr>
<th>Name of method or tool etc:</th>
<th>Type:</th>
</tr>
</thead>
<tbody>
<tr>
<td>FactBack® Survey method and analysis tool</td>
<td>Questionnaire (free text) / &quot;Auto-interview&quot;</td>
</tr>
</tbody>
</table>

**Abstract:**

The FactBack® Survey method and analysis tool is a survey method and analysis tool for collecting, structuring and analysing subjective perceptions, experiences and opinions recorded by respondents in free text. The data/information collection is not based on predefined questions, but relies on respondent reflection on an openly formulated survey questionnaire. The data collection method rests on pedagogic principles of proactively involving respondents in a reflective rather than reactive (questionnaires) process in response to a given situation or issue.

It aims to gain insight into how one or different groups perceive a defined situation or stages in a development process. The purpose is to monitor stakeholders’ perception of “current reality” at the different phases of change process.

Due to its unique design, the tool offers a very high degree of flexibility with respect to scope of surveys and languages. The survey is unique in offering a method for comparing qualitative information and quantitative values of/ amongst groups.

### ProACT Process Model

#### Applicable to Phase and Main Activity:

<table>
<thead>
<tr>
<th>Scoping Phase</th>
<th>Planning Phase</th>
<th>Implementation Phase</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

#### Decision gates

- Communication, participation and involvement
- Continuous evaluation and adaptation

### References

**Developer and source**

FactBack AS, PO Box 173, N 1751 HALDEN, Norway  
Website: [http://www.factback.no](http://www.factback.no)  
mailto: info@factback.no

**Year of development / publication, updates etc.**

1996, but continuously developed, adapted and updated to new applications/ requirements by FactBack AS.
## General description

### Purpose of measurement / study

The tool allows respondents to convey their subjective qualitative information (perceptions) and for each respondent to perform a self-evaluation for each and all perceptions on a number of key parameters reflecting attitude, ability to influence/excerpt control as well as perception of management concurrence.

The analysis will offer information about unprompted individual and group awareness related to a given situation, and provides measurements on how the respondent perceptions affects the individual’s and the group’s attitude in different stages of a change process. The individual and group cognition regarding change is specifically quantified by measuring the affective reactions to change related to each of the perceptions described by each respondent.

### Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)

The method and tool may be described as a “cross-over” between questionnaire and interview; The survey is based on a neutrally, openly formulated survey question. The respondent qualitative feedback is the result of a reflective process where the respondent “asks him/herself”: “What do I think?”.

### Effort required (time, people, equipment, resources); usability and practicability

**Planning:** No question battery required, and hence low resource requirement compared to questionnaire preparation.

**Feedback time:** Approximately 30 minutes. No specific requirements other than basic PC skills.

**Analysis:** All information automatically structured in the group report, and hence low resource requirement compared to interview transcription analysis.

### Population – Demographic and or Professional Group for which the method is intended for

Applicable to any individual or group in any organisational structure.

### Object of measurement / study (individual, team, profession, department, company)

Individual or group.

### Language (other than English)

Danish, French, German, Norwegian, Swedish.

### Cost information / Copyrights / Agreements needed

No information is available.

## ATM specific mapping

### Guidance for use in the ATM Context

The tool is totally flexible with regard to qualitative mapping and analysis of any change and transition context where insight into respondent subjective qualitative opinions and corresponding measures of attitudes is required. Respondent awareness can be influenced by “prompting statements” describing specific feedback areas of interest. Further, the tool may be adapted to suit specific scenarios by altering the scope of the survey question as illustrated in the example questions below. Therefore, the most relevant change scenarios for which it applies are:

- **Consolidation, integration and outsourcing of services and units, e.g.:**
  - remote operations and maintenance settings;
  - outsourcing of services (e.g. development, maintenance).

- **Implementation of future operational concepts and systems, e.g. encompassing:**
  - new technologies (e.g. Data link, 4D trajectory based planning and control, support tools for separation delegated to flight crew, conflict resolution and collision avoidance automation support).

- **Harmonisation and mobility of staff, e.g.:**
  - transfer of operational staff to other states or in multinational working arrangements.

- **Changes in working conditions, e.g.:**
  - new shift/rostering cycles and working hours (e.g. to flexibly adapt to variations in traffic amount).

- **Changes in organisational structure of whole companies, authorities or units, e.g.:**
  - Civil/military integration of operations.

- **Changes in organisational culture, e.g.:**
  - Safety reporting culture.
FactBack® Survey method and analysis tool

Experiences of use in the ATM / safety industry / other industry context, including references / users

The tool has not yet been used in the ATM context, but is used in surveys for oil/ process/ general industry, research institutions, local government, service industry.

ProACT Process Model

Scoping Phase:
Stakeholder analysis:
The survey and analysis tool provide insight in current reality perceived by individual stakeholders and/or stakeholder groups.

Planning Phase:
Social impact assessment:
The survey and analysis tool provides an overview of respondent perceptions about current reality and felt impact of the change at individual level.

Implementation Phase:
Access & secure acceptance:
The survey and analysis tool provides insight of current perceptions of staff satisfaction level.

Evaluation Phase:
Process & outcome assessment:
The survey and analysis tool help to assess the change process by analysing the organisational culture.

Technical description

Description of the content / study

With the FactBack® survey and analysis tool, the respondents are requested to assess a given situation process or project. The respondent assessment is based on an open, neutrally formulated survey question and the respondents record their feedback as free text statements. Each respondent subsequently qualifies her/his own assessment statements by prioritising, rating (4 parameters) and structuring the feedback in predefined subject categories. The respondent may link proposals (e.g. improvement proposals) to her/his statements. Scoring is done on Likert scales.

The survey questions for ATM could be as follows:
“What is your opinion about our execution of the maintenance procedures at present? What are you satisfied with, and/or what are you not satisfied with?”
“How does the modified procedure on “Data link” affect your job and your working situation? What are you satisfied with, and/or what are you not satisfied with?”
“How do you experience your job and working arrangements at this new site? What are you satisfied with, and/or what are you not satisfied with?”
“How do you experience working according to the new shift? What are you satisfied with, and/or what are you not satisfied with?”
“How do you experience working arrangements on night shifts? What are you satisfied with, and/or what are you not satisfied with?”
“How do you experience the effect of integrating civil and military operations on your job and working situation? What are you satisfied with, and/or what are you not satisfied with?”
“What is your opinion about the ATC’s safety reporting (since new procedures were introduced)? What are you satisfied with, and/or what are you not satisfied with?”

The data analysis report generates numeric quantitative results, some of which also in graphic diagrams as well as a structured presentation of statements and proposals. The supporting software tool allows for the overall survey administration and monitoring, including management of respondents and respondent populations/groups. With individual passwords, respondents participate via internet.

Context and Prerequisites for application

The FactBack® survey and analysis tool helps where insight into respondent subjective qualitative opinions and corresponding measures of attitudes is required. There are no prerequisites for application.

Equipment required for application

The survey requires access to the FactBack® software programme.

Required user qualifications

No methodological qualifications are required. Basic HF knowledge is desirable.
**Requirements / constraint concerning conditions for use**

In cases where respondent privacy or confidentiality is an issue, surveys should be managed by an independent 3rd party, accepted by the stakeholder groups. Respondents shall be informed about the nature of the survey, and how their in-put will appear in the collective group reports. Group reports with less than 5 respondents are, in such cases, not produced.

**Measure / Response Types**

Likert scales with end point descriptions only.

**Collected parameters and data format**

Parameters from respondent scoring of the Likert scales are calculated combining different parameters; the score for degree/ strength of satisfaction/ dissatisfaction combined with the score for degree of importance. In order to prevent the strong influence of extreme values in small population, group index values are based on median values.

**Results obtained and interpretation**

The data analysis report generates numeric quantitative results, a set of group index values as well as plain statistical information about feedback parameters and number of respondents involved.

The final group report automatically generates graphic diagrams showing overall satisfaction (drive) composed by positive and negative vector, a unique attitude diagram displaying individual respondent and group results, and a coping diagram displaying individual respondent and group results.

The group report also provides a respondent-based, ranked presentation of all statements and proposals structured under each of the predefined feedback categories.

**Description of use**

**Figure / model**

The enclosed figure illustrates cognitive steps in a change process.

**Sensation**
This can be seen as corresponding to the Scoping Phase of the ProACT Process Model.

At this phase the management / organisation senses that "something" might not be appropriate, suitable, or optimal. Typically questions are asked. This may be an unforeseen sensation, or a sensation linked to a give project/ process.

**Awareness**
Decisions have been made to investigate. The focus is on describing how stakeholders experience current reality related to the sensation / problem/ situation/ project.

**Energy Mobilisation**
The outcome of the FactBack (current reality awareness) survey is shared, analysed and used as a foundation for understanding underlying causes, identifying possible solutions, prioritisation and planning of activities.

**Action**
The stage where firm decisions are made and the selected activities are implemented.
**Change**
The stage where new behaviour is adopted.

**Closure**
The stage when experience is evaluated /assessed. In a successful change process the transition to the “new current reality” is standardised. In a less successful change process, relevant issues are identified and subject to further evaluation and adaptation (Ref. this Cycle of Change and the ProACT Process Model).

**Action-Reaction short-cut**
This part of the diagram is included to illustrate common, undesirable attempts to obtain change: a) Sensation generates spontaneous action, b) which leads to unpredictable changes, c) which are not recognised as related to the initial sensation of the initiator.

**The Demming model**
The change and transition process can also be seen to follow the same principles as described for quality improvement by Dr. E. Demming.

**Process description**
The process is very similar to that of administration of web-based questionnaires, except that the need to develop batteries of questions for different scopes / scenarios and respondent languages is almost eliminated.

Respondent password information is distributed from the survey software, as is management of response frequency and reminder follow-up.

The report (described under other paragraphs in this summary) is normally accompanied by a consultant evaluation report/ management summary.

### Evaluation

**Strengths and Weaknesses of the tool**

<table>
<thead>
<tr>
<th>I. Survey planning and preparation - Advantages v. questionnaires:</th>
</tr>
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<tbody>
<tr>
<td>o A single survey question allows detailed subjective feedback considered by the respondent to be relevant.</td>
</tr>
<tr>
<td>o Short preparation time and low preparation cost.</td>
</tr>
<tr>
<td>o Flexible with respect to scope and evaluation of situations, processes and projects.</td>
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</table>

<table>
<thead>
<tr>
<th>II. Survey planning and preparation - Advantages v. interviews:</th>
</tr>
</thead>
<tbody>
<tr>
<td>o No interview disposition required</td>
</tr>
<tr>
<td>o Enables (efficient) qualitative surveys of large populations</td>
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</table>

<table>
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<tr>
<th>III. Survey participation - Advantages v. questionnaires:</th>
</tr>
</thead>
<tbody>
<tr>
<td>o Requires a deeper involvement from the respondents</td>
</tr>
<tr>
<td>o No irrelevant questions are presented</td>
</tr>
<tr>
<td>o Individual participant report upon completion of survey</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>IV. Survey participation - Advantages v. interviews:</th>
</tr>
</thead>
<tbody>
<tr>
<td>o Cost efficient qualitative information/ data collection</td>
</tr>
<tr>
<td>o No interviewer – interviewee influence</td>
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</table>

<table>
<thead>
<tr>
<th>V. Survey analysis - Advantages:</th>
</tr>
</thead>
<tbody>
<tr>
<td>o Multi dimension/ parameter analysis of qualitative information</td>
</tr>
<tr>
<td>o Eliminates fixed question bias (questionnaires), interviewer bias (interviews)</td>
</tr>
<tr>
<td>and peer influence bias (focus group surveys)</td>
</tr>
</tbody>
</table>

Feedback from organisations that have used FactBack, are very positive, both in terms of low start-up barriers and informative outcome. Some points to the fact that the survey process itself has a beneficial effect on the actual change/ improvement process at the root of the change initiative.

Collecting free text information, with very little bias, offers a unique insight into the vocabulary and culture of respondent groups/ stakeholders. This opens for further analysis of how the words used, and the statements offered, fits with expected organisational aims/ culture. Also, and in some cases, the actual lack of highly expected words or issues, help the analysis and understanding of a given situation.

All statements and related parameters may be subject to selection and filtration for further analysis of specific statement-parameter relationship.
### Alternative methods / tools

No single tool. Combination of questionnaire and interviews.

### Possible combination with other methods / tools

Could be a valuable foundation for deeper interviews (unless repeated with a more detailed scope). Could be combined with other, objective indicators, such as absenteeism. Other organisational commitment and/or satisfaction evaluation studies.

### Psychometric / methodological integrity description

#### Objectivity / (or at least) demonstration

The concept objectivity is founded on the absence of bias in the form of influencing or limiting questions used in fixed question questionnaires.

Further, the concept can be described as “reflection interview” which is totally free from the bias resulting from interviewer-interviewee interaction as well as subsequent data selection and presentation.

This allows for fully comparative evaluations of qualitative information, also free from the effects of different and subjective interviewers.

The survey result provides the foundation for a fully objective analysis and evaluation of the survey data.

#### Reliability / (or at least) demonstration

The concept reliability is based on consistent participant confirmations of their situation awareness as reflected by indicators generated for overall situation assessment and for indicators of each qualitative factor.

#### Validity / (or at least) demonstration

The foundation for the method and analysis tool is research published by B. Shalit: Shalit Perceptual Organisation and Reduction Questionnaire (SPORQ), Report No 3: Validity FOA report C 55036-H6, November 1979 (FOA = Research unit, Military Defence, Sweden).

**Description of methodological integrity and additional Evidence or Value that the tool or study provides**

References are provided on request.
The IO MTO document provides guidance for performing and reviewing the MTO (Man – Technology Organisation) activities in early design phases for construction or refurbishment projects where allocation between human, machine and/or different physical locations of personnel are of concern.

The purpose of these activities is to ensure that the human factors principles are followed and that requirements for allocation of functions, design considerations and organisational structure are systematically analysed and evaluated.

References

Developed by the Institute for Energy Technology (IFE) and partners, on behalf of BP Norge AS, Norsk Hydro ASA, ConocoPhillips Norway AS, Statoil AS
Website: http://www.ife.no
Contact details: Asgeir Drøivoldsmo, mailto: Asgeir.Droivoldsmo@hrp.no
Phone: +47 6921 2294

Year of development / publication, updates etc.

2006
A Guideline to best practice for Function Analysis and Allocation in Integrated Operations (IO-MTO)  
Annex A No: A-17

### General description

**Purpose of measurement / study**

The aim of the IO-MTO method is to provide a practical engineering and analysis guideline for the MTO aspects of early design/planning phases in new or refurbished installations for petroleum production on the Norwegian continental shelf (NCS).

The specific goal of the method is to provide a framework for Function Analysis and optimal Function Allocation (FA&A), i.e. to find the best practice in allocating functions between onshore and offshore or between man and machine agents. In addition, the relationship between FA&A, data gathering and design of organization and work processes are included.

**Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)**

Guideline, best practice and method

**Effort required (time, people, equipment, resources); usability and practicability**

Relative large efforts required for data collection regarding time and people (and thus cost).

**Population – Demographic and or Professional Group for which the method is intended for**

Personnel on new or refurbished installations for petroleum production on the Norwegian continental shelf.

**Object of measurement / study (individual, team, profession, department, company)**

Individual and organisation

**Language (other than English)**

English only

**Cost information / Copyrights / Agreements needed**

The IO MTO method is the intellectual property of IFE and partners. External consultancy by IFE is required during the change process.

### ATM specific mapping

**Guidance for use in the ATM Context**

The context for the IO MTO method is to find the best practice in allocating functions between different locations, or between man and machine agents given the access to new technology making remote operations possible.

The most relevant change scenarios where the IO MTO method can apply are:

- Consolidation, integration and outsourcing of services and units, e.g.:
  - remote operations and maintenance settings;
  - centralisation of services (e.g. maintenance, AIS);
  - outsourcing of services (e.g. development, maintenance).

- Implementation of international working structures, e.g.:
  - Functional Airspace Blocks (FAB).

- Implementation of future operational concepts and systems, e.g. encompassing:
  - significant changes of roles and responsibilities in operational jobs;
  - more integrated ATM processes characterised by wide information sharing, enhanced CDM (Collaborative Decision Making);
  - significantly increasing automation of tasks or functions.

- Changes in organisational structure of whole companies, authorities or units, e.g.:
  - Corporate privatisation.

- Changes in organisational culture, e.g.:
  - Safety reporting culture.

**Experiences of use in the ATM / safety industry / other industry context, including references / users**

The IO MTO method has proven very successful in the petroleum industry and has been used at more than ten offshore oil platforms in the North Sea.
### ProACT Process Model

<table>
<thead>
<tr>
<th>Applicable to phase and activity of the ProACT Process Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Communication, participation and involvement process</strong></td>
</tr>
<tr>
<td>Participation and involvement are addressed by the IO MTO method.</td>
</tr>
<tr>
<td><strong>Continuous evaluation and adaptation process</strong></td>
</tr>
<tr>
<td>The IO MTO method includes interactive evaluations of the strategy and plans.</td>
</tr>
</tbody>
</table>

**Planning phase**


The IO MTO method analysis function, develops work processes, defines roles and functions allocations and provides solutions.

**Implementation phase**

- Assess & secure acceptance:
  - The assessment of acceptance by staff is part of the IO MTO Method.

### Technical description

**Description of the content / study**

The method is built to handle both the situation of new designs and refurbishment of existing design or organisation. The method is developed for analysing consequences of organisational changes in a distributed organisation with high demands for co-operation between actors placed in physically different locations. The method will give most benefit in projects involving several human or automation actors and multidisciplinary project teams (e.g. engineering, human factors, end user participation). The method covers human factors review and the output is suitable for documentation of the analysis phases for licensing authority reviews.

The method is most suitable for the initial phases of a project where clarification, visualisation and problem identification for design input is of vital interest. The analysis results should be utilised as basis for detailed specification of new work processes.

The method should not be used in projects involving only minor modifications and where all consequences of the proposed modifications are well documented.

**Context and Prerequisites for application**

The method is used by the owner, e.g. IFE with a written consultancy agreement with the requiring organisation.

**Equipment required for application**

- PCs, meeting rooms with projectors and other basic office equipment.

**Required user qualifications**

Even if the method has been sought documented in a self explanatory way, users unfamiliar with the basis for the analysis techniques recommended or without the general knowledge about human factors international standards will need some basic inputs. Depending of the type of installation under analysis, the project management will have to consider different types of competence and qualifications for the analysis team.

**Requirements / constraint concerning conditions for use**

The method shall be used as a tool for guidance of the MTO analysis. The method itself is not an answer book providing final solutions, it is solely a tool for how to structure, approach and perform the analysis of problems.

It is recommended to appoint an analysis team follow the work through the method steps. Analysis team members can either be selected from the organisation in question and/or externally.

The team shall have a facilitator with knowledge of the method and the analyses methods used as support tools for the method. It should be emphasized that the IO-MTO method should be rooted in the organisations general initiatives for ensuring safety, improving efficiency, cutting cost and optimising operation.

It is therefore strongly recommended that process owners and project responsible people are leading and taking part in the practical work.
Measure / Response Types
The following techniques may be considered either separately or in any combinations dependent on the ambitions of the analyses and data collection:

a) Workshops
b) Use of questionnaires
c) Structured interviews
d) Scenario driven interviews, talk through and walkthrough
e) Observations in the work place
f) Use of work process modelling and associated software tools

Collected parameters and data format
Depends upon technique applied. Function analysis produces descriptions of the current situation that includes human (competence, experience etc.), technology (for cooperation between people, for control, for handling deviations etc.), and organisation (work processes, cooperation, decision making processes) need to be collected.

Results obtained and interpretation
The new organisation is created from the output of the function analysis & allocation phase and based on the identified preconditions and constraints. The result will be work process models showing functions, relationships and their associated tasks, decision making processes (who is responsible for what), actors (with requirements for competence and experience), and technology and tools necessary to facilitate the new organisation.

Description of use

Figure / model
Process description

Goals & Requirements (G&R)
This activity runs in parallel with the main phases of the method. Here the organisations visions and goals for the implementation of integrated operations are identified at several levels in the organisation. The purpose is to make goals and visions concrete, uncover internal inconsistencies e.g. between different levels of the organisation, and identify requirements from other stakeholders like government or unions. The other phases of the method are closely tied to the G&R of the project. This implies that the formulation of visions and goals will greatly influence the end result. The strategies for how the visions and goals can be realised guide the analysis towards solutions by providing ideas and concepts necessary to formalise structured solutions. During the analysis, visions will be transformed into more concrete and verifiable goals. All preliminary results should be compared to the visions and goals. If there are discrepancies, one must consider whether some goals should be revised.

Function Analysis & Allocation (FA&A)
An FA&A encompasses an analysis of functions within a defined scenario. The analysis starts firstly by identifying how the existing functions interact with each other. Depending on the strategies to obtain the goals of the project, data i.e. a description of the current situation that includes human (competence, experience etc.), technology (for cooperation between people, for control, for handling deviations etc.), and organisation (work processes, cooperation, decision making processes) need to be collected. Secondly activities and functions are analysed in terms of constraints and preconditions, and thirdly findings are structured into a matrix that forms the basis for the allocation work. As a part of this work, solutions are suggested in the form of tools, technology, facilities, as well as requirements for competence, organisation etc. It is important to involve the users in this phase, but it is also possible to use external resources (from other industries, best practice from other oil companies, other licenses etc.) to generate ideas.

Design of organisation and work processes
This phase will ensure that tasks are assigned to each actor in a systematic way. In this phase the "new" organisation is analysed based on the scenarios selected in the previous phase. The new organisation is created from the output of the function analysis & allocation phase and based on the identified preconditions and constraints. The result will be work process models showing functions, relationships and their associated tasks, decision making processes (who is responsible for what), actors (with requirements for competence and experience), and technology and tools necessary to facilitate the new organisation.

Consequence analysis
The consequences of the proposed work process models are analysed with respect to e.g. requirements for communication, information, decision-making and time for response. It is recommended that this part is handled by a neutral third party investigation.

Evaluation

Strengths and Weaknesses of the tool
The IO-MTO method document states:

This document provides the guidance and technical analysis bases that will help plant operators, suppliers, and supporting third parties
1) plan changes to function allocation between human, machine and/or different physical locations,
2) address obsolescence issues and the need for new capabilities and
3) meet goals of improved availability, reliability, and cost effectiveness while meeting Petroleum Safety Authority documentation requirements.

Proper problem analysis and well founded design choices in early project phases will save time and money for error correction in the later phases of design, implementation and operation. Most documents guiding MTO work are fairly high-level. For example, they may specify that certain analyses should be performed, such as task analysis, but they do not provide a specific methodology to do so. This document provides detailed methods that can be used by project staff.

The guidance has practical descriptions of the activities necessary to carry out as part of the analysis work. Most MTO guidance is made for supporting design review in a central control room with specific focus on design of the human system interface, while this document addresses organisational considerations in a much broader range.

Compared with other standards and guidelines, this method is more specific in the guidance and directed towards support for analysis and major change in organisations. It is designed to handle incremental change as well as major redesign of organisation or work processes. The framework of the method reflects a top down approach for conducting necessary activities to ensure an optimal allocation of functions.

The method will ensure that individual topics may be seen in relation to the overall high level goals of the new design. The method is also important in helping oil companies to meet the Petroleum Safety Authority expectations for analysis and documentation by giving support towards an overall design that meet personnel needs, support efficient human performance, minimise human error, and reduce training burden.
### Alternative methods / tools

- ISO 11064 (partly) and IEC 60964

### Possible combination with other methods / tools

The IO MTO does is in its current version not include change approaches and methods. Change processes need to run in parallel with the method.

### Psychometric / methodological integrity description

<table>
<thead>
<tr>
<th>Objectivity / (or at least) demonstration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Through info and guidance regarding team composition and process. Analysis team members can either be selected from the organisation in question and/or externally. The team shall have a facilitator with knowledge of the method and the analyses methods used as support tools for the method. In addition the data contributors are the staff affected by the potential changes, union representatives are involved, and a third party review of the final results is included.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reliability / (or at least) demonstration</th>
</tr>
</thead>
<tbody>
<tr>
<td>The IO MTO method has been used successfully at 10 Norwegian installations.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Validity / (or at least) demonstration</th>
</tr>
</thead>
<tbody>
<tr>
<td>An analysis of 13 offshore and onshore installations as well as four years of continuous collaboration with an expert group from the oil companies' involved formed the foundation for the development of the IO MTO method.</td>
</tr>
</tbody>
</table>

### Description of methodological integrity and additional Evidence or Value that the tool or study provides

Not Applicable.
**ATTITUDE TOWARD CHANGE SCALE**

**EXECUTIVE SUMMARY**

<table>
<thead>
<tr>
<th>Name of method or tool etc:</th>
<th>Type:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude Toward Change Scale</td>
<td>Questionnaire</td>
</tr>
</tbody>
</table>

**Abstract:**

Attitude toward organisational change is defined as an employee’s positive or negative evaluative judgement of a change implemented by his / her organisation. The **Attitude Toward Change Scale** is a brief questionnaire that assesses individual general cognitions about change, affective reactions to change, and behavioural tendency toward change.

Attitudes toward change in general and toward multiple specific changes are distinct and play an important role in determining whether a person or a group of persons chooses to support or resist a change. Those attitudes are often a better predictor of future behaviour than past behaviour as has been demonstrated by research (Ajzen & Fishbein, 1980, see box ‘Developer and source’). Organisations and managers must not only overcome employee resistance but must be able to generate active employee support for the change (behavioural support).

The concept and rational behind this approach is, that changing the attitudes and beliefs held by employees by creating a positive attitude towards change will in consequence shape the behaviour in a direction towards supporting change. The research also confirms that the more specific a change is, the more specific are the attitudes and orientations of employees towards a change and the more specific should be the questionnaire to be predictive.

**ProACT Process Model**

**Applicable to Phase and Main Activity:**

**References**

**Developer and source**


Contact: Prof. Randall B. Dunham
4110 Grainger Hall / 975 University Avenue
Madison, WI 53706 - USA
mailto: rdunham@bus.wisc.edu

Year of development / publication, updates etc.

## General description

### Purpose of measurement / study

The aim of Dunham et al. (1989) was to develop an instrument to measure attitudes toward change in general.

**Study 1**: Development of an initial version with 52 items, test in one sample and identification of dimensions (by factor analysis). Purification of items based on factor loadings and item statistics. *Result*: 18 items loading on 3 factors (each 6 items): affective, cognitive and behaviour intend.

**Study 2**: Test of the 18 item form in another sample, check of dimensionality, further purification of items (exchange of items). *Result*: 25 items form of general change and a parallel form with 25 items for specific changes to allow checking the influence of specific changes.

**Study 3**: Test of parallel versions in another sample, examination of dimensionality, purification of the instrument and investigation of the distinction between general change and specific change items. *Result*: It was clearly shown that the items for attitude toward change in general and the items for attitude toward a specific change were on separate dimensions and did not correlate high with each other (r = .22). Establishment of a final version of the questionnaire for general change attitude (18 items).

**Study 4**: Correlation between Attitude toward change and various personality constructs: tolerance for ambiguity, dogmatism, growth need strength and locus of control. *Result*: The Growth Need Strength and Locus of control had significant positive correlation with attitude toward change (see also the results from Elias (2009) in box ‘Figure / model’).

The basic assumption for the final scale is: (1) A general, overall construct of attitudinal orientation toward change exists. (2) Individual differences exist in the strength in which this attitudinal orientation is manifested. The questionnaire can be used to measure an individual’s (or a group’s) general attitude toward change which consists of an individual’s cognitions about change, affective reactions to change, and behavioural tendency or intent toward change.

### Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)

Questionnaire.

### Effort required (time, people, equipment, resources); usability and practicability

It takes about 5 minutes to finish the questionnaire. Usability and practicability are given.

### Population – Demographic and or Professional Group for which the method is intended for

Any employee.

### Object of measurement / study (individual, team, profession, department, company)

Individual.

### Language (other than English)

This version of the questionnaire is available in English only.

### Cost information / Copyrights / Agreements needed

No fee and no copyright notification required. The tool (questionnaire, scoring key and Excel spreadsheet) can be obtained from rdunham@bus.wisc.edu. The latest version was made available by Pro Dunham for inclusion in this compendium (see box ‘Description of the content / study’). User should observe the intellectual property rights of the authors in using the questionnaire.
The Attitude Toward Change Scale

ATM specific mapping

Guidance for use in the ATM Context

The Attitude Toward Change Scale focus is on organisational changes, i.e. changes in organisational structures. For pure technical changes, i.e. new technologies, the tool is only recommended in cases with high risk for resistance to change.

The most relevant change scenarios where the Attitude Toward Change Scale can apply are:

- Consolidation, integration and outsourcing of services and units, e.g.:
  - remote operations and maintenance settings;
  - centralisation of services (e.g. maintenance, AIS).
- Implementation of international working structures, e.g.:
  - Functional Airspace Blocks (FAB);
  - Trans-national companies or working arrangements (e.g. EAD Group, Entry Point North).
- Changes in organisational structure of whole companies, authorities or units, e.g.:
  - Corporate privatisation;
  - Civil/military integration of operations.

Experiences of use in the ATM / safety industry / other industry context, including references / users

No information available on the use / application in aviation / ATM. However see for attitude studies in ATM Eurocontrol (2007); see box ‘Alternative Methods’ for source.

ProACT Process Model

Applicable to phase and activity of the ProACT Process Model

Communication, participation and involvement process

Participation and involvement are addressed by the Attitude Toward Change Scale.

Planning phase

Establish structures and resources – Social impact assessment - Risk and opportunities analysis – Feasibility Evaluation – Implementation plan development:

The Attitude Toward Change Scale analysis affective reactions to change and behavioural tendency towards change, including possible impacts and risks.

Implementation phase

Implement supporting structures - Assess & secure acceptance - Implement changes:

The assessment of resistance or support is part of the Attitude Toward Change Scale.

Evaluation phase

Monitor& reinforce C & T process – Process & outcome assessment:

The attitude of staff affected by a change could be easier monitored by using the predictions of the Attitude Toward Change Scale.
### Technical description

#### Description of the content / study

The Attitude Toward Change Scale questionnaire is made up of three subscales: cognitive, affective, and behavioural tendency. Each subscale consists of six items. It has no instruction how to answer the questions on the sheet. Thus, brief additional information should be given.

The answer score is a likert-type scale (5 answer categories) ranging from Strongly agree (1) to Strongly disagree (5).

<table>
<thead>
<tr>
<th>#</th>
<th>Items</th>
<th>Subscale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I look forward to change at work.</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Change usually benefits the organization.</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>I usually resist new ideas.</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>I don't like change.</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Most of my co-workers benefit from change.</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>I am inclined to try new ideas.</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Change frustrates me.</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Change often helps me perform better.</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>I usually support new ideas.</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>Changes tend to stimulate me.</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>Other people think that I support change</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>I often suggest new approaches to things</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>Most changes are irritating.</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>Change usually helps improve unsatisfactory situations at work</td>
<td>2</td>
</tr>
<tr>
<td>15</td>
<td>I intend to do whatever possible to support change</td>
<td>3</td>
</tr>
<tr>
<td>16</td>
<td>I find most change to be pleasing.</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>I usually benefit from change.</td>
<td>2</td>
</tr>
<tr>
<td>18</td>
<td>I usually hesitate to try new ideas.</td>
<td>3</td>
</tr>
</tbody>
</table>


Factor (subscale) 1 = Affective; Factor 2 = Cognitive; Factor 3 = Behaviour intend.

Items with reverse scoring are in **bold** and *italics*.

#### Context and Prerequisites for application

The questionnaire can be used at any time and any place.

#### Equipment required for application

The Attitude toward change scale is a paper-pencil questionnaire. Following material is needed to perform the investigation: an information sheet (e.g. about the aim of the investigation etc.), a questionnaire sheet, an instruction sheet (how to perform the investigation), scoring key (for data analysis) and Excel spreadsheet (for data analysis). Additional material which is required for an investigation via mail: an information sheet (e.g. about the aim of the investigation etc.), envelops (send to subjects) and post-paid and addressed envelops (re-send).

#### Required user qualifications

Good human resources management skills and knowledge and some psychological testing skills are required.

#### Requirements / constraint concerning conditions for use

No specific requirements or constraints.

General remarks:
- To obtain a high response rate the questionnaire should be filled in during an allocated timeslot at work; the questionnaire should be filled in during work hours (not leisure time).
- General information about the tool should be given to the participants. No further instruction and training are needed.
- Dependent on purpose of the measurement general feedback could both be given to the team and/or organisation as an input to decision making on learning and development.
- Confidentiality of results at individual level has to be ensured.

#### Measure / Response Types

A 5-point rating scale ranging from 1 (strongly agree) to 5 (strongly disagree).

#### Collected parameters and data format

The scores of each subscale will be averaged to get a summary score reflecting that scale. This will be processed automatically using the scoring key and the Excel spreadsheet which are attached.
Results obtained and interpretation

Results from Dunham et al (1989):
The authors conclude from their four studies that a general positive orientation (attitude) toward change may not manifest in all circumstances and organisational context: The more specific a change context is (i.e. implementing a specific programme or procedure) the less predictive a general attitude to change will be as was demonstrated in Study 3 (see box ‘Purpose of study’).

Results from Yousef, (2000): Scale statistics for the same 18 item questionnaire but using a 7-point rating scale ranging from 1 (strongly disagree) to 7 (strongly agree).

Cognitive subscale:
Mean = 5.66; SD = 0.945
Significant correlations with affective dimension \( r = 0.28 \), behavioural tendency dimension \( r = 0.28 \), continuance commitment (low perceived alternatives) \( r = -0.15 \) and continuance commitment (high personal sacrifice) \( r = -0.14 \).

Affective subscale:
Mean = 5.14; SD = 0.940
Significant correlations with behavioural tendency dimension \( r = 0.56 \), affective commitment \( r = 0.18 \), satisfaction with working conditions \( r = 0.20 \), pay \( r = 0.15 \), promotion \( r = 0.20 \), supervision \( r = 0.12 \), co-workers \( r = 0.19 \) and security \( r = 0.19 \).

Behavioural tendency subscale:
Mean = 5.45; SD = 0.893
Significant correlations with affective commitment \( r = 0.15 \) and co-workers \( r = 0.12 \).

Results from Elias (2009):
The results concerning general attitude to change is partly a mediating factor between internal work motivation, growth need strength, locus of control and affective commitment (see box ‘Figure / model’ below).

The author concludes that, from a practical implications point of view, managers would do well in selecting employees with a high intrinsic or internal work motive. Especially when it comes to change: high intrinsic motivated people seek situations of change as it allows them to develop (and demonstrate) their skills. Managers will often find that intrinsic motivated people thrive in change situations (and champion change). They should be placed into change situations.

Description of use

Figure / model

From: Elias (2009). The figure shows the coefficients obtained from a structural equation model (SEM) modelling of data with Affective Commitment (one scale from the Meyer & Allen, 1997 three-component model of commitment described in more detail in A-22 and A-24). Affective commitment is the strongest ‘intrinsic’ driver for performance.
## Process description

Address the aim of the change and its transition supporting the organisation's strategy. Obtain the agreement of the works council and business management before starting the investigation. Make sure that this tool is appropriate to investigate the topic you are interested in and ensure you have enough units of the questionnaire and envelopes if you plan to process a postal interrogation. Employees shall be informed of the investigation: its aim, the start and end date and further actions. Ensure anonymity (by using a coded system and voluntarism of the employees) is guaranteed. An information sheet, an informative presentation, or information posters at several places, e.g. notice board, intranet, e-mail can be used. Inform all employees to ensure the investigation is representative. Consider to contact the employees especially if you plan to process a postal interrogation before you start and affirm their commitment for their participation.

Ensure that every employee gets a unit of the questionnaire. If you are processing a postal interrogation you have to indicate the reply due date. The investigation shall be performed under standardised conditions if it is not a postal interrogation; every person has to be exposed to the same conditions (undisturbed setting, material, time etc.). Secure collecting boxes are available within the organisation if the employees got their questionnaires personally and place them in a non-apparent area to ensure anonymity. If the investigation is conducted by an outside consultant or researcher, guarantee anonymity, by preparing a pre-paid envelope together with the questionnaire so that employees can send their completed questionnaires directly back. This can also be used if the employees work at different geographical sites and/or administration of the questionnaire is at another geographical site. After data analysis, inform employees about the results and their interpretation including further actions. Respect the principles of social dialogue.

## Evaluation

### Strengths and Weaknesses of the tool

Using a questionnaire to collect data regarding employees’ attitude toward organisational change might not fully capture the dynamic nature of organisational change. In some instances it might be useful to supplement the results of a screening with the Attitude Towards Change Scale by interviews to fully represent attitudes toward organisational change. No other strength or weaknesses of the tool are known.

### Alternative methods / tools

No alternative methods or tools are known.

**Note:** A specific questionnaire was developed by Eurocontrol to assess the attitude towards change in regard to Continuous Descend Approach (CDA) in European ATM but questions were very specifically addressed to CDA; see Eurocontrol (2007), Attitudes to change in ATM operations – Introduction of CDA trials at Manchester, Bucharest & Stockholm. Final Report, Eurocontrol: EEC (Bretigny) Note No 08/07. [http://www.eurocontrol.int/eec/public/standard_page/DOC_Report_2007_008.html](http://www.eurocontrol.int/eec/public/standard_page/DOC_Report_2007_008.html)

### Possible combination with other methods / tools

Organisational commitment (Meyer, J.P. & Allen, N.H., 1991), Minnesota Satisfaction Questionnaire (Weiss et al., 1967) which has been combined in studies. Combinations with other tools, e.g. SHAPE tools, are possible.

### Psychometric / methodological integrity description

#### Objectivity / (or at least) demonstration

Standardised Questionnaire.

#### Reliability / (or at least) demonstration

According to the authors of the original version (Dunham et al., 1989) the Alpha coefficient for the overall scale is .90 (10% error in measurement). Coefficient alpha reliability estimates for the three subscales: cognitive .80 (20% error in measurement), affective .79 (21% error in measurement) and behavioural tendency .73 (27% error in measurement).

Coefficient alpha in studies with the questionnaire:
- (auto club workers): cognitive .84 (16% error in measurement), affective .81 (19% error in measurement) and behavioural tendency .77 (23% error in measurement).
- (police sample): cognitive .81 (19% error in measurement), affective .79 (21% error in measurement) and behavioural tendency .82 (18% error in measurement).
- Yousef (2000) reported an overall Alpha for the overall score (18 items) of .77. Elias (2009) reports Alpha of .92 for the overall scale.
### Validity / (or at least) demonstration

The construct validity of the instrument can be considered as being sufficiently high given the efforts made in the concept development. The factorial validity is also high for the three sub-scales and the overall scale as reported by Dunham et al. (1989).

### Description of methodological integrity and additional Evidence or Value that the tool or study provides

The instrument has sufficient high reliability and validity to be used as an instrument for orientation purposes that meets some requirements of ISO 10075-3:

<table>
<thead>
<tr>
<th>Objectivity</th>
<th>Is ensured (standardised application and deriving results etc).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability:</td>
<td>Cronbachs Alpha is mostly used to demonstrate reliability and shows that the overall scale and the three sub-scales meet the required value of 0.80.</td>
</tr>
<tr>
<td>Validity:</td>
<td>The scales have good factorial stability demonstrated in more than one study. The conceptual validity can be considered as high. The demonstrated relationship between antecedent factors (p(personality dispositions) and attitude towards change give sufficient evidence for construct validity.</td>
</tr>
<tr>
<td>Sensitivity of measurement:</td>
<td>Ensured (more than 3 steps / item in the answer categories of the BARS).</td>
</tr>
<tr>
<td>Diagnosticity:</td>
<td>The questionnaire has demonstrated in the original study that general attitude to change and specific change attitude are different and that specific attitudes will be better predictors for behaviour.</td>
</tr>
<tr>
<td>Generalisability:</td>
<td>The general attitude to change scale is designed in a way to allow to be applicable to change in general.</td>
</tr>
<tr>
<td>Usability / Acceptance:</td>
<td>There are no known problems with the acceptance of the attitude towards change scale.</td>
</tr>
</tbody>
</table>
**EXECUTIVE SUMMARY**

Last update: 13/08/2010

Name of method or tool etc: Behavioural Support of the Change Scale

**Type:** Questionnaire

**Abstract:**

The Behavioural Support of the Change Scale is a short screening technique which aims to measure behaviour which reflect different 'steps' or levels of support from low support to high support: active resistance – passive resistance – compliance – cooperation – championing. The first measure aims to measure the behaviour on this behaviour continuum. One form of behaviour that people show is called focal behaviour; it expresses their commitment to change to which they feel bound (e.g. to stay with the organisation) and represent a form of compliance.

The degree of commitment to change is expressed in different degrees of compliance and behaviour in support to the change: low levels of commitment will result in forms of resistance (active or passive resistance). High commitment with the change will result in positive supporting behaviour (actively supporting and promoting change with others in the organisation).

The second form of behaviour is called discretionary behaviour and represents behaviour that people might show at their discretion and depending on the type of their commitment which expresses the specific efforts that people will make to make the change a success. Discretionary behaviour represents a form of cooperation with the change. The questionnaire measures both, focal behaviour (compliance respectively resistance) and discretionary behaviour (cooperation and championing).

---

**ProACT Process Model**

**Applicable to Phase and Main Activity:**

---

**References**

Original version described in:

Prof. John P. Meyer
University of Western Ontario / Department of Psychology
Social Science Centre - UWO
London, Ontario N6A 5C2
CANADA
mailto: meyer@uwo.ca

Year of development / publication, updates etc.

**Behavioural Support of the Change scale**

**Annex A No: A-19**

<table>
<thead>
<tr>
<th>General description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose of measurement / study</strong></td>
</tr>
<tr>
<td>The questionnaire can be used to measure the individual (or group) behavioural consequences of commitment, namely focal behaviour (compliance respectively resistance) and discretionary behaviour (cooperation and championing). Therefore, it can be used to assess employees’ behavioural support for change.</td>
</tr>
<tr>
<td><strong>Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)</strong></td>
</tr>
<tr>
<td>Questionnaire.</td>
</tr>
<tr>
<td><strong>Effort required (time, people, equipment, resources); usability and practicability</strong></td>
</tr>
<tr>
<td>It takes about 4 minutes to complete the questionnaire. Usability and practicability are given.</td>
</tr>
<tr>
<td><strong>Population – Demographic and or Professional Group for which the method is intended for</strong></td>
</tr>
<tr>
<td>Any employee.</td>
</tr>
<tr>
<td><strong>Object of measurement / study (individual, team, profession, department, company)</strong></td>
</tr>
<tr>
<td>Individual.</td>
</tr>
<tr>
<td><strong>Language (other than English)</strong></td>
</tr>
<tr>
<td>English only.</td>
</tr>
<tr>
<td><strong>Cost information / Copyrights / Agreements needed</strong></td>
</tr>
<tr>
<td>Questionnaire and Scoring Key can be obtained from the developer, <a href="mailto:meyer@uwo.ca">mailto:meyer@uwo.ca</a>. Distribution and use is free for scientific purposes.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ATM specific mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Guidance for use in the ATM Context</strong></td>
</tr>
<tr>
<td>The most relevant change scenarios for which the questionnaire applies are:</td>
</tr>
<tr>
<td>o Consolidation, integration and outsourcing of services and units, e.g.</td>
</tr>
<tr>
<td>- Consolidation of control centres</td>
</tr>
<tr>
<td>- Centralisation of services (e.g. maintenance, AIS)</td>
</tr>
<tr>
<td>- Outsourcing of services (e.g. development, maintenance)</td>
</tr>
<tr>
<td>o Changes in organisational structure of whole companies, authorities or units, e.g.:</td>
</tr>
<tr>
<td>- Corporate privatisation</td>
</tr>
<tr>
<td><strong>Experiences of use in the ATM / safety industry / other industry context, including references / users</strong></td>
</tr>
<tr>
<td>There is no information available on the use of this questionnaire in the ATM Industry.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ProACT Process Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applicable to phase and activity of the ProACT Process Model</strong></td>
</tr>
<tr>
<td><strong>Communication, participation and involvement process</strong></td>
</tr>
<tr>
<td>Information obtained helps to select appropriate strategies for communication, participation and involvement.</td>
</tr>
<tr>
<td><strong>Continuous evaluation and adaptation process</strong></td>
</tr>
<tr>
<td>Information obtained is important for updating the continuous evaluation and adaptation process.</td>
</tr>
<tr>
<td><strong>Planning phase</strong></td>
</tr>
<tr>
<td>Project objectives definition - Establish structures and resources – Social impact assessment - Risk and opportunities analysis – Feasibility Evaluation – Implementation plan development:</td>
</tr>
<tr>
<td>The questionnaire assesses potential resistance and level of compliance / cooperation and can provide an indication of people’s support behaviour to organisational change.</td>
</tr>
</tbody>
</table>
### Technical description

#### Description of the content / study

Two types of measures to assess employees' behaviour support for the change do exist:

The **first measure** reflects a *behavioural continuum of resistance and support behaviour* ranging from active resistance to passive resistance, further to compliance, cooperation, and finally championing. **Active resistance** is defined as demonstrating opposition in response to a change by engaging in overt behaviour that is intended to ensure that the change fails. **Passive resistance** is defined as demonstrating opposition in response to a change by engaging in covert or subtle behaviours aimed at preventing the success of the change. **Compliance** is defined as demonstrating minimum, reluctant support. **Cooperation** demonstrates support for a change by showing exerting effort when it comes to the change. **Championing** is by showing extreme enthusiasm to ensure the success of the change and promoting the change to others. Answers are given on a 101-point (0 – 100) behavioural continuum with anchor points from left to right along the continuum for active resistance, passive resistance, compliance, cooperation, to championing. Participants are asked to place a mark on the resulting scale that best represents their reaction to the change.

The **second measure** is a set of multi-item scales that reflect three *forms of discretionary support behaviours*: compliance, cooperation, and championing. Each scale is comprised of several behavioural items that correspond to the conceptualisation given above.

#### Context and Prerequisites for application

The questionnaire can be used at any time and any place but full confidentiality should be ensured.

#### Equipment required for application

Requirements: paper, pencil, statistical software for analyses such as Microsoft Excel, SPSS, or Statistica. Material needed to perform the investigation are an information sheet (e.g. about the aim of the investigation etc.), a questionnaire sheet and an instruction sheet (how to perform the investigation).

Additional material which is required for an investigation via mail: an information sheet (e.g. about the aim of the investigation etc.), envelops (send to subjects) and post-paid and addressed envelops (re-send).

#### Required user qualifications

Good human resources management knowledge and expertise and knowledge about psychological measurement. For this tool a good understanding of the commitment at the workplace concept and research is required.

#### Requirements / constraint concerning conditions for use

No specific requirements or constraints.

General remarks:

- To obtain a high response rate the questionnaire should be filled in during an allocated timeslot at work; the questionnaire should be filled in during work hours (not leisure time).
- General information about the tool should be given to the participants. No further instruction and training are needed.
- Dependent on purpose of the measurement general feedback could both be given to the team and/or organisation, as well as specific feedback could be given to the individual as an intervening input to individual learning and development.
- Confidentiality should be ensured.

#### Measure / Response Types

**First type of measure (behaviour continuum)**: anchor points along the continuum labelled from left to right as active resistance, passive resistance, compliance, cooperation, and championing.

**Second type of measure (discretionary behaviour)**: behavioural items with a 7-point rating scale ranging from 1 (strongly disagree) to 7 (strongly agree).
Behavioural Support of the Change scale

Collected parameters and data format

First type measure: 1 single score is obtained.
Second type measure: Summary scores of each subscale (are averaged to get a summary score reflecting that scale).

Results obtained and interpretation

First type of measure (the change support continuum): Mean / SD from Herscovitch & Meyer, (2002).
Mean: 64.80 (representing a moderate cooperation score; see below for the allocation to level of support).
SD: 17.16.
Corresponding level of support: Scores from 0 to 20 correspond to active resistance, scores from 21 to 40 correspond to passive resistance, scores from 41 to 60 correspond to compliance, scores from 61 to 80 correspond to cooperation, and scores from 81 to 100 correspond to championing.
Cooperation and championing behaviour is more likely to lead to successful change implementation than compliance.

Second type of measure: Mean / SD from Herscovitch & Meyer (2002).
Compliance (3 items) (average score):
Mean = 5.88
SD = 0.99
Significant correlations with Affective commitment to change (r = .32), Normative commitment to change (r = .34), Affective commitment to change (r = .29), Continuance commitment to change (r = .17) and Normative commitment to organisation (r = .20).

Cooperation (8 items) (average score):
Mean = 5.30
SD = 1.02
Significant correlations with Change impact (r = .32), Affective commitment to change (r = .53), Normative commitment to change (r = .51), Affective commitment to organisation (r = .35), Normative commitment to organisation (r = .26), Compliance (r = .65) and Tenure (r = -.18).

Championing (6 items) (average score):
Mean = 5.33
SD = 1.29
Significant correlations with Change impact (r = .32), Affective commitment (r = .57), Normative commitment to change (r = .54), Affective commitment to organisation (r = .37), Normative commitment to organisation (r = .31), Compliance (r = .59), Cooperation (r = .79) and Tenure (r = -.18).

Note: Make sure to have a look at the whole distribution of scores as a high variance or outliers might be of high relevance to managerial decisions.
The Commitment for Change scale with the three subscales Normative, Affective and Continuance Commitment developed by Herscovitch & Meyer (2002) is described in Commitment to & Coping with Change A-24.

Description of use

Figure / model

Figure 1: Model of Workplace Commitment.
**Process description**

Address the aim of the change and its transition supporting the organisation’s strategy. Obtain the agreement of the works council and business management before starting the investigation. Make sure that this tool is appropriate to investigate the topic you are interested in and ensure you have enough units of the questionnaire and envelops if you plan to process a postal interrogation. Employees shall be informed of the investigation; its aim, the start and end date and further actions. Ensure anonymity (by using a coded system and voluntarism of the employees) is guaranteed. An information sheet, an informative presentation, or information posters at several places, e.g. notice board, intranet, e-mail can be used. Inform all employees to ensure the investigation is representative. Consider to contact the employees especially if you plan to process a postal interrogation before you start and affirm their commitment for their participation.

Ensure that every employee gets a unit of the questionnaire. If you are processing a postal interrogation you have to indicate the reply due date. The investigation shall be performed under standardised conditions if it is not a postal interrogation; every person has to be exposed to the same conditions (undisturbed setting, material, time etc.). Secure collecting boxes are available within the organisation if the employees got their questionnaires personally and place them in a non-apparent area to ensure anonymity. If the investigation is conducted by an outside consultant or researcher, guarantee anonymity, by preparing a pre-paid envelope together with the questionnaire so that employees can send their completed questionnaires directly back. This can also be used if the employees work at different geographical sites and/or administration of the questionnaire is at another geographical site. After data analysis, inform employees about the results and their interpretation including further actions. Respect the principles of social dialogue.

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**Evaluation**

**Strengths and Weaknesses of the tool**

**Strength:** The concept of commitment to organisational change and to antecedent conditions and factors for commitment and the consequences of commitment in behaviour are well researched and the concept of behavioural support for change as a consequence of commitment is a new and important area.

**Weaknesses:** There are some problems generally associated with the use of self-report data (e.g., self-serving bias, common method variance). The instrument was developed for research purposes and has not yet been further developed as a standard instrument for application. The Compliance scale is too short and lacks stability (Cronbach Alpha = .49). Analyses using the second type of measure should be interpreted with caution because of this.

**Alternative methods / tools**

No alternative methods or tools are known.

**Possible combination with other methods / tools**

This questionnaire is related to the Openness toward Change Scale questionnaire (Herscovitch & Meyer, 2002); Organizational commitment (Meyer et al., 1993) described in A-24.

**Commitment to change** (Herscovitch & Meyer, 2002) as individual forms of commitment with the 3 sub-scales of normative, affective and continuance commitment. (See A-24).

**Control variables:** change significance (employees’ perceptions of how significant the change was for their organisation) and change impact (employees’ perceptions of the effect of the change on their job performance, organisational climate, and personal life) have been used in combination in studies.

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**Psychometric / methodological integrity description**

**Objectivity / (or at least) demonstration**

Standardised Questionnaire.

**Reliability / (or at least) demonstration**

According to the author following alpha coefficients (internal consistency) of the second type of measure could be obtained (from: Herscovitch & Meyer, 2002):

- compliance .49 (51% error in measurement)
- cooperation .85 (15% error in measurement)
- championing .90 (10% error in measurement)
### Validity / (or at least) demonstration

**Intercorrelation Matrix between ‘Commitment to Change’ Scales and ‘Behaviour Support to the Change’**

<table>
<thead>
<tr>
<th>#</th>
<th>Variable/Scale</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Affective Commitment</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
<td></td>
<td>.94</td>
</tr>
<tr>
<td>2</td>
<td>Continuance Commitment</td>
<td>-.26**</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.71</td>
</tr>
<tr>
<td>3</td>
<td>Normative Commitment</td>
<td>.57**</td>
<td>.24**</td>
<td>--</td>
<td>--</td>
<td></td>
<td></td>
<td>.78</td>
</tr>
<tr>
<td>4</td>
<td>Compliance (Type 2)</td>
<td>.32**</td>
<td>.17</td>
<td>.34**</td>
<td>--</td>
<td></td>
<td></td>
<td>.49</td>
</tr>
<tr>
<td>5</td>
<td>Cooperation (Type 2)</td>
<td>.53**</td>
<td>-.01</td>
<td>.51**</td>
<td>.65**</td>
<td>--</td>
<td></td>
<td>.85</td>
</tr>
<tr>
<td>6</td>
<td>Championing (Type 2)</td>
<td>.57**</td>
<td>-.06</td>
<td>.54**</td>
<td>.59**</td>
<td>.79**</td>
<td>--</td>
<td>.90</td>
</tr>
<tr>
<td>7</td>
<td>Behaviour Continuum (Type 1)</td>
<td>.61**</td>
<td>-.08</td>
<td>.60**</td>
<td>.53**</td>
<td>.60**</td>
<td>.70**</td>
<td>NA</td>
</tr>
</tbody>
</table>

**Compliance:** Significant correlations in addition with Normative commitment to organisation (r = .20).

**Cooperation:** Significant correlations with Change impact (r = .32); Affective commitment to organisation (r = .35), Normative commitment to organisation (r = .26) and Tenure (r = -.18).

**Championing:** Significant correlations with Change impact (r = .32), Affective commitment to organisation (r = 37), Normative commitment to organisation (r = .31) and Tenure (r = -.18).

**Description of methodological integrity and additional Evidence or Value that the tool or study provides**

The methodology has been conceptualised in a systematic way and supported by empirical research that support validity of the concept. Good psychometric results despite of some formal weaknesses stress the robustness of the concept.

The concept behaviour support to the change is less well developed compared to the Commitment to Change concept and lacks follow-up developments and standardisation as a tool to be used in practical application. Despite this and as there is a lack of a similarly developed and linked up tools available in this area can the tool be used to gain indications and orientation in practical circumstances.
EXECUTIVE SUMMARY
Last update: 13/08/2010

Name of method or tool etc: Cynicism About Organisational Change (CAOC)
Type: Questionnaire

Abstract:
The Cynicism About Organisational Change (CAOC) measures three components: pessimism (a pessimistic outlook for successful change), dispositional attribution (a blame placed on those persons considered responsible for lacking the motivation or ability to effect successful change) and the contrary, situational attribution (an attribution of likely failure for a successful change on situational factors, not in the responsibility of persons due to lack of resources, of cooperation etc). The scale was developed based on sound and proven concepts.

The results of various developmental and validation studies show that employee cynicism is more likely to be a learned response to organisational factors than a personality – based predisposition (being a ‘negative attitude person that always will complain’). Cynicism can therefore be influenced by management: the more people think that actually change has occurred in reality, the more they have been participating in past change and the more effective their supervisor were the less is their cynicism about (future) organisational change.

Cynicism about organisational change is the conviction of employees that a change process will not succeed. The reason for this is the belief, that those who are responsible for the process, lack motivation and competence. Cynicism as a result of a learning process that is determined by a small number of previous changes, ineffective leadership and little involvement of affected people in the change process. To reduce cynicism, appropriate steps have to be taken and confirmed in all phases of the process. Therefore, employees should be involved in the whole process. What kind of steps should be taken depends on the organisation and its administrative structure. Besides the well known impacts high scores of cynicism correlate with low organisational commitment and a high amount of work grievances.

ProACT Process Model

Applicable to Phase and Main Activity:

References

Developer and source
mailto: wanous.1@osu.edu

Year of development / publication, updates etc.
Concept development: 1994. Further development was done in 1997 by the same authors. The CAOC was developed in its current version in 2000.
**Cynicism About Organisational Change (CAOC)**

### General description

<table>
<thead>
<tr>
<th>Purpose of measurement / study</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cynicism about organisational change</strong> is 'a loss of faith in the leaders of change and a response to a history of change attempts that are not entirely or clearly successful' as Reichers, Wanous Austin (1997) have summarised their definition.</td>
</tr>
</tbody>
</table>

Wanous et al (2000) define CAOC as a concept with two main elements: (1) a pessimistic outlook for successful change and (2) blame placed on those persons that are considered to be responsible for lacking the motivation and/or ability to effect a successful change. Two basic psychological aspects are involved: (a) expectancy theory – cynicism has a frame of reference in the expectation that successful change is the result of the efforts of those who are responsible for it; and (b) attribution theory – cynicism is a type of disposition to attribute the blame for a failure of change to other persons, their lack of motivation, ability, efforts etc. Cynicism will not result for example if people would attribute the failure to the situation or bad luck.

**Study 1**: Development of the CAOC with 8 items to measure the 2 components (Pessimism about change being successful; Dispositional Attribution (others responsible) for a likely failure (2 motivation items, 2 ability items) and 4 items to measure Situational Attribution about the likely failure of a change. **Result**: 12 item form as given in the box ‘Description of the content / study’). Confirmatory factor analysis for the 2-factor model gave a goodness of fit of .085 which is between mediocre and moderate fit.

**Study 2**: To understand the concept better some relevant antecedents of CAOC were selected and operationalised as measurable constructs to be used in later analysis: Negative Affectivity (assessment of people as being of a ‘bad attitude’ type as described by their managers); Previous change experience (past 6 month experience with change, own role in it etc), Expected future Change (future 6 month expected change), Participation in Decision Making (amount and type of participation in past changes).

**Supervisor Effectiveness** (measured by 15 items. The content is given in the following for interest) (Cronbach Alpha = .88): (1) keeping people informed; (2) personally caring about products being produced; (3) trying to understand each employees point of view; (4) keeping commitments (5) answering questions, (6) caring about employees, (7) acting rationally in a crisis, ((8) communicating the same message regardless of who is listening, (9) having a positive attitude about change, (10) not ignoring conflict, (11) admitting mistakes, (12) not blaming others for mistakes, (13) not singling out people for preferential treatment, (14) providing initial and ongoing training, (15) encouraging participation.

Also other measures of factors that were reasoned to be related to CAOC were conceptualised: Grievances filled in past year (single item), Pay-for-Performance Instrumentality Perception (the belief that the better one performs the higher will be the salary (earning), Motivation to keep on trying (4 items, Cronbach Alpha .87) items are copied here for interest:

1. I personally support attempts to make things better around here.
2. I believe in trying to do everything I can to solve problems around here.
3. I would be willing to serve on a task force to help solve problems around here.
4. I am willing to take on extra duties in order to make improvements around here.

**Results 1**: Hierarchical regression analysis gave that – contrary to what managers thought – Negative Affectivity (‘bad attitude’ personalities) had very little prediction in CAOC. Organisational factors (Amount of past change, participation and supervisor effectiveness) predicted about 12.4% of the variance in CAOC. Overall $R^2 = .142$ was rather small.

**Results 2**: Concurrent relationship between CAOC and other variables showed that CAOC correlates with Motivation to keep on trying ($r = -.40, p<.01$) (those who are more motivated to try are less cynical) and with organisational commitment ($r = .46, p<.01$) showing that those that are more committed to the organisation are less cynical about change.

**Overall appreciation of results and impacts for management actions from the findings:**

1. Management can influence cynicism by addressing two components (a) pessimism and (b) dispositional attribution.
2. **Pessimism** can be influenced by sharing and publishing all successful change, as small as it may be (small wins)
3. **Dispositional attribution** is influenced by (a) giving full and unbiased information on all facts that have an impact so people will find it hard to blame persons and ignore the situational impacts.
4. **Actions** that managers can take are: the more people are involved in the change, the more situational attributions they will make and the less cynical they will be. This is a strong supporting fact for increased participation. The more people will understand management actions and see the reasons for them, the more they will see things from both sides: management and their own. Lastly, past failures need to be fully explained and acknowledged and not ignored. The latter will lead to more cynicism about the way changes are managed.
Cynicism About Organisational Change (CAOC)  

**Annex A No: A-20**

| Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.) |
| Questionnaire. |

| Effort required (time, people, equipment, resources); usability and practicability |
| It takes about five minutes to fill in the questionnaire. Practicability and usability are given. |

| Population – Demographic and or Professional Group for which the method is intended for |
| Any employee. |

| Object of measurement / study (individual, team, profession, department, company) |
| Individual. |

| Language (other than English) |
| English only. |

| Cost information / Copyrights / Agreements needed |
| The questionnaire is available in the article from the authors (Wanous et al., 2000) (see box ‘Description of the content / study’). Users should respect the intellectual property of the questionnaire and make proper reference to the authors. The same applies to the questionnaire used by FAA (Thompson et al., 1999) described separately in the box ‘Alternative methods’. |

**ATM specific mapping**

**Guidance for use in the ATM Context**

The most relevant change scenarios for which cynicism about Organisational Change can apply are:

- Consolidation, integration and outsourcing of services and units, e.g.
  - Consolidation of control centres
  - Centralisation of services (e.g. maintenance, AIS)
  - Outsourcing of services (e.g. development, maintenance)
- Implementation of international working structures, e.g.
  - Functional Airspace Blocks (FAB’s)
- Changes in working conditions
  - New organisational or social structures and/or processes

**Experiences of use in the ATM / safety industry / other industry context, including references / users**

No information is available for the use of the CAOC in ATM.

**ProACT Process Model**

**Applicable to phase and activity of the ProACT Process Model**

**Communication, participation and involvement process**

The prime use of the questionnaire is in this process. The questionnaire assesses factors that affect employee satisfaction on communication and involvement in the change and will give further supporting evidence for providing full information, increase participation in the change process and see things from different perspectives (i.e. management, influence of the market, clearly experiencing external, European change drivers and so forth.

**Continuous evaluation and adaptation process**

Information obtained from the questionnaire can be used to evaluate / assess employee responses to change.

**Planning phase**

Social impact assessment– Feasibility Evaluation:

The questionnaire can be used for testing the feasibility in the preparing stages of the change

**Implementation phase**

Implement supporting structures - Assess & secure acceptance:

The questionnaire results show how employees respond to ongoing change and how they attribute (potential) failure of the change.

**Evaluation phase**

Monitor& reinforce C & T process – Process & outcome assessment:

Monitoring of cynicism about change reflects decreasing or increasing problems in the past change/transition process and the past change experience impacts on future changes.
Cynicism About Organisational Change (CAOC)

Technical description

<table>
<thead>
<tr>
<th>Item #</th>
<th>Item</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Most of the programs that are supposed to solve problems around here will not do much good</td>
<td>Pessimism</td>
</tr>
<tr>
<td>2</td>
<td>Attempts to make things better around here will not produce good results</td>
<td>Pessimism</td>
</tr>
<tr>
<td>3</td>
<td>Suggestions on how to solve problems will not produce much real change</td>
<td>Pessimism</td>
</tr>
<tr>
<td>4</td>
<td>Plans for future improvement will not amount to much</td>
<td>Pessimism</td>
</tr>
<tr>
<td>5</td>
<td>The people responsible for solving problems around here do not try hard enough to solve them</td>
<td>Dispositional Attribution</td>
</tr>
<tr>
<td>6</td>
<td>The people responsible for making things better around here do not care enough about their jobs</td>
<td>Dispositional Attribution</td>
</tr>
<tr>
<td>7</td>
<td>The people responsible for making improvements do not know enough about what they are doing</td>
<td>Dispositional Attribution</td>
</tr>
<tr>
<td>8</td>
<td>The people responsible for making changes around here do not have the skills needed to do their jobs</td>
<td>Dispositional Attribution</td>
</tr>
<tr>
<td>9</td>
<td>The people responsible for fixing problems around here cannot really be blamed if things do not improve</td>
<td>Situational Attribution</td>
</tr>
<tr>
<td>10</td>
<td>The people responsible for solving problems around here are overloaded with too many job responsibilities</td>
<td>Situational Attribution</td>
</tr>
<tr>
<td>11</td>
<td>The people responsible for fixing problems around here do not have the resources they need to get the job done</td>
<td>Situational Attribution</td>
</tr>
<tr>
<td>12</td>
<td>The people responsible for making changes around here do not get the cooperation they need from others</td>
<td>Situational Attribution</td>
</tr>
</tbody>
</table>


Context and Prerequisites for application

The questionnaire can be used at any time and place.

Equipment required for application

Requirements: paper, pencil, statistical software for analyses such as Microsoft Excel, SPSS, or Statistica. Material needed to perform the investigation are an information sheet (e.g. about the aim of the investigation etc.), a questionnaire sheet and an instruction sheet (how to perform the investigation). Additional material which is required for an investigation via mail: an information sheet (e.g. about the aim of the investigation etc.), envelops (send to subjects) and post-paid and addressed envelops (re-send).

Required user qualifications

A good background in human resources management, organisational / occupational psychology is required to advise and plan appropriate actions. Some psychological testing skills and basic HF knowledge are also required.
Cynicism About Organisational Change (CAOC)  
Annex A No: A-20

### Requirements / constraint concerning conditions for use

The CAOC is clearly a psychological instrument and requires appropriate background knowledge to use results correctly. If this knowledge is not available there is a risk of wrong interpretation.

**General remarks:**
- To obtain a high response rate the questionnaire should be filled in during an allocated timeslot at work; the questionnaire should be filled in during work hours (not leisure time).
- General information about the tool should be given to the participants. No further instruction and training are needed.
- Due to the high stake and sensitivity of the information that is gathered it is pertinent to have the application of the CAOC being demanded and confirmed by senior management.
- The feedback is given to management together with appropriate background information on the basic concepts, implications and antecedent and other conditions to ensure appropriate understanding of the results and to take appropriate actions.
- There is no need for specific feedback given to the individuals.
- Full confidentiality is to be ensured.

### Measure / Response Types

The items are formed as statements. Answers will be given on a 5-point rating scale from 1 (strongly disagree) to 5 (strongly agree).

### Collected parameters and data format

The scores of each subscale are averaged to get a summary score reflecting that scale. The overall measure for cynicism is based on the 8 items from the pessimism and dispositional attribution subscale.

### Results obtained and interpretation

Subtest scores for pessimism and dispositional attribution can be derived. The overall test score is ‘Cynicism about organisational change’ (CAOC). The higher the score the more cynical the person.

**Overall CAOC (data from Wanous et al. 2000):**

- Mean = 2.91; SD = .70
Description of use

**Process description**

Address the aim of the change and its transition supporting the organisation’s strategy. Obtain the agreement of the works council and business management before starting the investigation. Make sure that this tool is appropriate to investigate the topic you are interested in and ensure you have enough units of the questionnaire and envelopes if you plan to process a postal interrogation. Employees shall be informed of the investigation; its aim, the start and end date and further actions. Ensure anonymity (by using a coded system and voluntarism of the employees) is guaranteed. An information sheet, an informative presentation, or information posters at several places, e.g. notice board, intranet, e-mail can be used. Inform all employees to ensure the investigation is representative. Consider to contact the employees especially if you plan to process a postal interrogation before you start and affirm their commitment for their participation.

Ensure that every employee gets a unit of the questionnaire. If you are processing a postal interrogation you have to indicate the reply due date. The investigation shall be performed under standardised conditions if it is not a postal interrogation; every person has to be exposed to the same conditions (undisturbed setting, material, time etc.). Secure collecting boxes are available within the organisation if the employees got their questionnaires personally and place them in a non-apparent area to ensure anonymity. If the investigation is conducted by an outside consultant or researcher, guarantee anonymity, by preparing a pre-paid envelope together with the questionnaire so that employees can send their completed questionnaires directly back. This can also be used if the employees work at different geographical sites and/or administration of the questionnaire is at another geographical site. After data analysis, inform employees about the results and their interpretation including further actions. Respect the principles of social dialogue.
Cynicism About Organisational Change (CAOC)

Evaluation

Strengths and Weaknesses of the tool

**Strength:** According to the individual focus of this research (compared to an organisational perspective) the focus of this tool is on the individual employees who are confronted with the impact of an organisational change. The individual perspective is indispensable for the realisation of successful change.

The CAOC was developed based on well established psychological constructs and research and has shown sufficient evidence for validity and reliability.

**Weakness:** The CAOC is clearly a psychological instrument and requires appropriate background knowledge to use results correctly.

Alternative methods / tools

The ‘Behavioural support of change’ scale might be an alternative especially in organisations with team oriented / flat hierarchy in the organisational structure. More behaviour oriented instruments are anyhow an alternative.

As the results have shown is CAOC moderately correlated with motivation to keep on trying to make change (a form of commitment) and Organisational commitment. Both (Commitment to Organisational Change and Commitment to Organisation) are alternative measures.

Thompson et al (1999) developed a different questionnaire aiming to measure ‘Cynicism about change’ scale as a self reported degree of cynicism regarding the efficacy of changes being made and the perceived cynicism among their co-workers.

The items are given below (Cronbach Alpha):

<table>
<thead>
<tr>
<th>#</th>
<th>Scale: Cynicism about Change (Alpha = .85)</th>
<th>#</th>
<th>Scale: Co-worker Cynicism (Alpha .63)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>When changes are made in this organization, the employees usually lose out in the end. (R)</td>
<td>1</td>
<td>“We've always done it that way” and “we tried that before and it didn't work” are typical responses from my co-workers to new ideas or suggestions. (R)</td>
</tr>
<tr>
<td>2</td>
<td>Most changes lead to improvements in the way we work.</td>
<td>2</td>
<td>My co-workers readily adjust to technological changes.</td>
</tr>
<tr>
<td>3</td>
<td>It's really not possible to change things around here. (R)</td>
<td>3</td>
<td>Changes in [this division] are met with apprehension and suspicion. (R)</td>
</tr>
<tr>
<td>4</td>
<td>Changes here always seem to create more problems than they solve. (R)</td>
<td>4</td>
<td>Good ideas are implemented quickly by my co-workers.</td>
</tr>
<tr>
<td>5</td>
<td>I think that changes in this organization tend to work well.</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>My co-workers are encouraged to develop and try new ways of doing things.</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

Answers are on 7-point Likert scale (1 = strongly disagree – 7 = strongly agree); reversed scoring are indicated with (r) in brackets.


All instruments are in the appendix of the study which is available from FAA on website: [http://www.faa.gov/library/reports/medical/oamtechreports/1990s/media/AM99-27.pdf](http://www.faa.gov/library/reports/medical/oamtechreports/1990s/media/AM99-27.pdf)

Possible combination with other methods / tools

Combinations with Commitment to Organisational Change and with Commitment to the Organisation and with organisational variables like: Participation, leadership and supervisor effectiveness can reveal important antecedent conditions for CAOC.
### Psychometric / methodological integrity description

<table>
<thead>
<tr>
<th>Objectivity / (or at least) demonstration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standardised Questionnaire.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reliability / (or at least) demonstration</th>
</tr>
</thead>
<tbody>
<tr>
<td>According to the authors the internal consistency reliability (Coefficient Alpha) is acceptable. The Cronbach’s Alpha for the overall scale (CAOC – Pessimism &amp; Dispositional Attribution combined) is .86.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Validity / (or at least) demonstration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conceptual validity is high; the CAOC is based on sound and validated psychological constructs. Factorial validity is also supported by evidence. According to the authors discriminative validity is given as groups formed on the basis of the CAOC show differences in motivation to keep on trying to make a change and organisational commitment. CAOC is significantly (and as expected, in all cases negatively) correlated to the number of previous changes ($r = -.16$), with the employees’ willingness to support changes ($r = -.40$), with organisational commitment ($r = -.46$) and grievance filing ($r = .13$).</td>
</tr>
</tbody>
</table>

### Description of methodological integrity and additional Evidence or Value that the tool or study provides

The CAOC questionnaire was based on systematic concept development in combination with other personal and contextual (organisational) factors important during change. There are some good psychometric results from regression analysis that support the conceptual validity of the CAOC.

The CAOC has sufficient high reliability and validity to be used as a an instrument that meets the requirements of ISO 10075-3 for orienting purpose and can thus provide information on the direction of management activity based on this information:

<table>
<thead>
<tr>
<th>Objectivity:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is ensured (standardised application and deriving results etc).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reliability:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cronbachs Alpha reaches the value of 0.80.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Validity:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evidence is based on a big sample but in one study only. The scale shows sufficient discriminative validity and shows factorial validity in one study.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sensitivity of measurement:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensured (more than 3 steps / item in the answer categories of the BARS).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diagnosticity:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not known. However from the results reported in the original study it can be assumed that the instrument is capable of detecting (existing) differences between different change contexts (which are characterised by different organisational settings, i.e. participation, past change management, supervisor effectiveness during change etc) or groups of persons that were exposed to different change contexts.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Generalisability:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not known.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Usability / Acceptance:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The questionnaire can be applied easily but requires, due to its nature specific qualification to be interpreted and used correctly. There are no known problems with the acceptance of the instrument.</td>
</tr>
</tbody>
</table>

The Cynicism of change instrument used in the Thompson et al. (1999) is sufficiently reliable and has demonstrated factorial validity (2 factors); Cynicism of change was strongly correlated with willingness to change ($r = .47$, $p < .001$) and acceptance of change ($r = .60$, $p < .001$). Formal validity coefficients are not known.
## EXECUTIVE SUMMARY

**Name of method or tool etc:** Integrated Task Analysis (ITA)

**Type:** Observation, Evaluation tool and Interview guide

**Abstract:**

The Integrated Task Analysis (ITA) is a task analysis method that covers different approaches addressing the **behavioural** and the **cognitive** aspects of the ATCO's tasks in order to compare different positions and service provisions. ITA can be used in early phases and as a system evaluation process (before / after or previous / new system comparison) or for process outcome evaluation.

The ITA is adjustable and adaptable for specific purposes and is applied within the real-time working environment of ATC, concurrently ensuring minimal interference with normal working procedures. Within the framework of developing the ITA a new concept, "the cognitive profile" (cognitive aspects include memory, decision-making, evaluation, attention and action control), was established and investigated. This allows making comparisons from the cognitive point of view between the different types of Air Traffic Services provision.

Furthermore, the ITA accounts for different ATC services and for controllers from different geographical areas. The ITA can be used in early (scoping and planning phase) and late stages (evaluation) within a change process. Therefore it is a useful method to explore a successful transition towards new procedures from a human (behavioural and cognitive) perspective. Options to check the impact of critical situations are included in the set of task analysis tools that form part of the ITA toolset.

### ProACT Process Model

**Applicable to Phase and Main Activity:**

![ProACT Process Model Diagram](image)

### References

**Developer and source**

Original version and development: Kallus, K.W., Dittmann, A. & van Damme, D. (Eurocontrol)  

Websites with documentation:

- [http://www.eurocontrol.int/humanfactors/gallery/content/public/docs/DELIVERABLES/HF24___(HUM.ET1.ST01.1000-REP-05)Released.pdf](http://www.eurocontrol.int/humanfactors/gallery/content/public/docs/DELIVERABLES/HF24___(HUM.ET1.ST01.1000-REP-05)Released.pdf)

Contact: wolfgang.kallus@uni-graz.at or info@begleitforschung.de

**Year of development / publication, updates etc.**

### General description

#### Purpose of measurement / study
ITA can be used to address behavioural and the cognitive aspects of the ATCO's tasks in order to compare different positions, equipment and procedures.

#### Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)
Observation and Evaluation tool including a Questionnaire and Interview Guide

#### Effort required (time, people, equipment, resources); usability and practicability
There are several resources required:
- Subject matters experts (Air Traffic Controllers)
- Trained analysts (familiar with interview techniques and behaviour observations and a fair background in ATC or an education in task analysis)
- ITA methods documents (interview guide, observation grids and questionnaires; and data processing scales)

Analysts need a basic training which means that a training of observers/ interviewers is necessary (for each position at least 4h for data collection and 8h for data analysis should be calculated). For support the “Institut für Begleitforschung” (Institute for Evaluation Research) can be contacted (http://www.begleitforschung.de). Experts have to be educated in how to conduct ITA observation (detailed presentation of the different methods and procedures for application). For on-the-job observations an experienced observer, who is familiar with ATC phraseology and procedures is recommended.

The Observation and Evaluation tool is easy to use and takes about 5 hours for each position:
- Cognitive interview (about 60-90 minutes)
- Observation at the working position (60-90 minutes)
- Post-observational interview and the flight progress reconstruction interview (45-75 minutes)
- Stress and strain questionnaires (about 20 minutes)

The data processing of interviews and observations is time consuming. At least six trials are necessary to draw reasonable conclusions.

#### Population – Demographic and or Professional Group for which the method is intended for
Air Traffic Controllers (en-route sector, arrival/departure sector, aerodrome control).

#### Object of measurement / study (individual, team, profession, department, company)
Air Traffic Controller Working position.

#### Language (other than English)
English and German.

#### Cost information / Copyrights / Agreements needed
ITA is available free of charge from EUROCONTROL (see web-links in box ‘Developer and source’). A training of observers is necessary.

### ATM specific mapping

#### Guidance for use in the ATM Context
The most relevant change scenarios for which ITA applies are:
- Implementation of future operational concepts and systems, e.g. encompassing:
  - significant changes of roles and responsibilities in operational jobs
  - more integrated ATM processes characterised by wide information sharing, enhanced CDM (Collaborative decision making)
  - new technologies (e.g. Data link, 4D trajectory based planning and control, support tools for separation delegated to flight crew, conflict resolution and collision avoidance automation support).
- Changes in organisational culture, e.g.:
  - Safety reporting culture
  - Innovation and change readiness

#### Experiences of use in the ATM / safety industry / other industry context, including references / users
An ITA validation project used the tool in 15 different Units of European Civil Aviation Conference (ECAC) Member States. Additional data is available from the “Vienna Change & Transition study” (Kallus, Hoffmann et al., 2008).
### ProACT Process Model

**Applicable to phase and activity of the ProACT Process Model**

**Scoping phase**
Risk and opportunities identification – Feasibility evaluation:
The tool could support the risk and opportunities identification by analysing the current situation; projecting future needs and as such contributes to the feasibility evaluation.

**Planning phase**
Project objectives definition – Risk & opportunities analysis - Feasibility Evaluation:
The tool can be used to enhance the definition of objectives due to cognitive indicators, to analyse potential risks and constraints and contributes to their recognition for the feasibility evaluation.

**Implementation phase**
Implement training:
The results obtained contribute to a better implementation of required training.

**Evaluation phase**
Process & outcome assessment:
A post-observational interview and stress and strain questionnaires support the process & outcome assessment.

### Technical description

**Description of the content / study**
The task analysis is conducted by applying a standardised set of methods comprising of:
- a cognitive interview and flight process reconstruction interview;
- a set of behavioural observations (task units, call survey, information flow sheet);
- a post observational interview (flight progress reconstruction)
- a method of flight strip reconstruction interviews and
- several complementary questionnaires on strain and stress: Synba-GA (addresses the stress imposed by working conditions), Rest-Q (addresses the strain level resulting from stress and compensating recovery activities) and TQQ (addresses aspects of team quality).

**Context and Prerequisites for application**
Analysts need to be familiar with interview techniques, behaviour observations and task analysis and need to have a basic knowledge of ATC.

**Equipment required for application**
Paper and Pencil. A Note-Book based version available. ITA documentation including interview guide, observation grids questionnaires, data processing scales and Interview recording equipment (analysis is based on transcripts of interviews) is required.

**Required user qualifications**
Trained analysts are required. At least one qualified psychologist is needed to adopt the systems, to instruct the controllers and to instruct the task analysis team. Training required for analysts is for each position at least 4h for data collection and 8-16h for data analysis.

**Requirements / constraint concerning conditions for use**
No specific requirements or constraints however, general information about aim should be provided to the participants. No specific training for participating/observed ATCO’s is needed.

**Measure / Response Types**
Mostly frequency based data, additional rating scales, and qualitative questions.

**Collected parameters and data format**
Profiles to compare different work settings, workstations with different equipment, furthermore profiles for stress and strain. Cognitive profiles (cognitive interview data and data of flight progress reconstruction; top-down/bottom-up rating or top-down/bottom-up scale) are compared to behavioural profiles based on the task observations. Data can be integrated by a cluster analysis (clustering of subjects according to particular characteristics; e.g. ATCO’s are clustered according to their rated cognitive working style).

Data from organisational interviews get categorised and summarised in an Excel spreadsheet. Data from the flight progress reconstruction interviews and the cognitive interviews have to be transcribed and assessed using qualitative content analysis. Data from the rating scales for the post-observational interview, the frequency counts from the behavioural observations and the ratings of the stress and strain questionnaires have to be analysed using statistical software.
Results obtained and interpretation

ITA identified and described four basic sub-processes of the job ((1) updating mental picture/maintaining situational awareness, (2) checking, (3) searching conflicts and (4) issuing instructions), one control process (switching attention) and five task processes ((1) taking over position/building up mental picture, (2) monitoring, (3) managing routine traffic, (4) managing requests/assisting pilots, (5) solving conflicts).

Reference material is available on the cognitive processes of ATCO's and their working style. Results from a cluster analysis of Controllers with respect to their cognitive working style shows that the major differences and similarities between controllers are explained by the kind of ATC service they provide.

Description of use

<table>
<thead>
<tr>
<th>Figure / model</th>
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</thead>
</table>

Figure 1: Overview of task and sub-processes

ITA creates a baseline reference for the cognitive task processes of ATCOs, outlines common aspects and differences in cognitive task processes between different services and different regions within the ECAC area. The results contribute to:

- the development of new Air Traffic Control systems;
- the selection and recruitment processes for ATCOs;
- basic training, rating training and instructor training.
### Process description

Two to four observers visit the ATC units for two or three days. Before starting the observational days, an organisational interview with the leader of the unit or a representative of the unit will be conducted by one of the observers to gather information about the unit such as sectorisation, rostering and shift system, equipment and so on.

The participating controllers are given detailed instructions which take about 60 minutes on the day of the first interviews. Possible upcoming questions about the purpose and the procedure of the interrogation/study will be answered including the assurance of the confidentiality of the study. In the mean time the different parts of the ITA are integrated into the working procedures of the unit. The behavioural observations will be processed in periods of moderate to high traffic density. The interviews have to be scheduled so as to allow the controllers sufficient break within their working cycles. Usually, one additional controller on duty is needed to fill in the time which is spent on the interviews.

This procedure has to be adjusted if an online interrogation will be used. If assistance in this endeavour will be needed, the “Institut für Begleitforschung” (Institute for Evaluation Research) can be contacted (http://www.begleitforschung.de).

### Evaluation

#### Strengths and Weaknesses of the tool

**Advantages:**
- Easy to use
- Adjustable and adaptable for specific purposes
- Reference material is available on the cognitive processes of ATCO's and working style
- Results allow before/after or previous/new system comparison
- Already specifically adopted for the ATM environment.
- ITA is a combination of classical task analysis methods and cognitive task analysis methods.

**Disadvantages:**
- The data processing is time consuming.
- Analysts need a basic training.
- No computerised tools available for the data collection and processing.

#### Alternative methods / tools


#### Possible combination with other methods / tools

Well to be combined with task-load/work-load analysis, can well be combined with psycho physiological strain assessment methods and questionnaire surveys (macro-micro-analysis).

### Psychometric / methodological integrity description

**Objectivity / (or at least) demonstration**

According to the authors high inter-rater relativities for well trained observers. Standard procedure/ standardised set of methods adapted to the situation of the unit at hand.

**Reliability / (or at least) demonstration**

According to the authors reliability is sufficiently high only for observers that are well trained in the ITA methodology. For 26 double-observations with pairs of experienced observers, the reliability of the observations (consistency of observations for pairs of observers for two parts of the observation (first and second part) were sufficiently high and around .80.

**Validity / (or at least) demonstration**

According to the authors a broad range of validity measures are documented. No formal validity coefficients are reported.

**Description of methodological integrity and additional Evidence or Value that the tool or study provides**

The ITA method has been developed in a systematic way and based on recent psychological theory and findings. The result is a systematic and well documented psychological task analysis methodology for the cognitive and behavioural aspects in ATC tasks.

The methodology has shown sufficient high reliability (inter – rater and consistency of ratings) and for nearly all categories of observation.
### Organisational Commitment Questionnaire (OCQ)

**EXECUTIVE SUMMARY**

<table>
<thead>
<tr>
<th>Name of method or tool etc:</th>
<th>Type:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisational Commitment Questionnaire (OCQ)</td>
<td>Questionnaire</td>
</tr>
</tbody>
</table>

**Abstract:**

Organisational commitment is the employee’s psychological attachment to an organisation and shows the tendency of a person of maintaining membership in an organisation. The OCQ measures three types of organisational commitment: Affective, Normative and Continuance Commitment. The **affective** commitment is developed through the emotional attachment to the organisation. It is even higher the more employees identify with the aims of the organisation and therefore desire to remain within the organisation. The **continuance** commitment is determined by the employee’s investments within the organisation that would be lost, if they quit. The individual commits to the organisation because he or she “has to”. **Normative commitment** means that the employees commit to and remain with an organisation because of feelings of obligation. The employee shows sense of duty, and “ought to” stay in the organisation. In sum: the OCQ describes the relationship of a person to the organisation and their reasons for staying.

**Important Note:** The **Commitment to Change** questionnaire (Herscovitch & Meyer, 2002) also measures three types of individual **commitment to change:** Affective, Normative and Continuance Commitment which all are positively related to support to change and is described in A-24. The scales are all based on the same general **Three Component Model (TCM)** developed by Meyer & Allen (1991) and subsequently extended in its application to organisations and recently to organisational change. This explains the similarity between the approach and the forms.

### ProACT Process Model

**Applicable to Phase and Main Activity:**

![ProACT Process Model Diagram](image)

### References

**Developer and source**


Contact: mailto:meyer@uwo.ca or mailto:ecomm@uwo.ca (administering person: Heather Bennett)


**Year of development / publication, updates etc.**

**Organisational Commitment Questionnaire (OCQ)**

### General description

#### Purpose of measurement / study

The questionnaire measures three forms of employee commitment to an organisation: desire-based (affective commitment), obligation-based (normative commitment) and cost-based (continuance commitment). The OCQ contains three separate scales that measure these three forms. The scores from the OCQ can be used to identify the 'commitment profile' of employees in an organisation.

Although it is common sense that committed people work harder and are more likely 'to go the extra mile' to achieve organisational objectives. However, research showed consistently that there is a need to differentiate between the three forms of commitment to understand better differences in performance, turnover intention (= the intention to stay or quit an organisation) and the like.

Those who want (affective c.) outperform others in the organisation; those who think they are obliged to stay (normative c.) work also hard but less then the former. Finally, those who stay because they want to avoid losing something (continuance c.) hardly do more than what is necessary to retain their position.

#### Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)

Questionnaire.

#### Effort required (time, people, equipment, resources); usability and practicability

It takes about ten minutes to fill in the questionnaire. The data analysis can be performed manually via Excel or SPSS / STATISTICA. Usability and practicability are given.

#### Population – Demographic and or Professional Group for which the method is intended for

Any employee.

#### Object of measurement / study (individual, team, profession, department, company)

Individual.

#### Language (other than English)

English and German.

### Cost information / Copyrights / Agreements needed

The Organisational Commitment Questionnaire can be found at [http://www.employeecommitment.com](http://www.employeecommitment.com). The costs are as follows:

- Academic Version - TCM Employee Commitment Survey – free of charge (manual and both test versions)
- Commitment Scales Commercial Version from 1 to 100 Subjects - $300.00 CAD
- Commitment Scales Commercial Version from 1 to 300 Subjects - $700.00 CAD
- Commitment Scales Commercial Version from 1 to 500 Subjects - $1,000.00 CAD
- Commitment Scales Commercial Version from 1-1000 Subjects - $1,500.00 CAD
- Commitment Scales Commercial Version from 1-4000 Subjects - $5,000.00 CAD
### ATM specific mapping

**Guidance for use in the ATM Context**
As the questionnaire results provide information about the commitment to the organisation of individual staff in general, it can be applied to any ATM change scenario and also outside of the scope of a change situation.

**Experiences of use in the ATM / safety industry / other industry context, including references / users**
No information is available for the use of the OCQ in ATM.

### ProACT Process Model

**Applicable to phase and activity of the ProACT Process Model**

<table>
<thead>
<tr>
<th>Communication, participation and involvement process</th>
</tr>
</thead>
<tbody>
<tr>
<td>The questionnaire measures relevant personal aspects of commitment that drive performance and investing efforts to reach organisational goals. The results could be used to identify communication and participation strategies that help to foster antecedent conditions for organisational commitment. It will also help to identify highly committed employees that can take the role of championing change and built cooperation in working teams (involvement and participation).</td>
</tr>
</tbody>
</table>

**Scoping phase**
Change need analysis - Feasibility evaluation:
The questionnaire helps to evaluate the scope and need for change and the feasibility of a change process and the expected support and efforts that can be expected from employees.

**Planning phase**
Establish structures and resources - Social impact assessment - Risk & opportunities analysis:
The questionnaire provides information about required resources, perceived impacts and objections by staff as regards their organisational commitment.

**Implementation phase**
Implement supporting structures- Assess & secure acceptance:
The questionnaire results contribute to a better implementation of required support and indicate the level of acceptance. Developing or revising a supportive scheme that helps to foster feelings of organisational commitment.

**Evaluation phase**
Monitor & reinforce C & T processes:
The questionnaire results indicate the level of commitment and can be used to enhance the change process.

### Technical description

**Description of the content / study**
Organisational commitment is the employee's psychological attachment to an organisation; it measures the tendency of a person of maintaining membership in an organisation. Organisational Commitment is a multidimensional model that describes (individually) different forms of commitment to the same organisation. Conditions at the workplace, in the profession and other contextual factors will be reflected in it and in subsequent behaviour of employees.

The results from various studies (see Meyer et al, 1993) indicate:
(a) The three-component-model of commitment can be generalised and applies in different settings and towards different objects or target situations.
(b) Affective, continuance and normative commitment scales developed for differential applications were reliable.
(c) Evidence exists for the differential validity of the three components to the antecedents' conditions and to consequences of commitment.
(d) That the three components contribute independently to the prediction (criterion / predictive validity) of important organisational outcome variables (turnover, performance, corporate feeling (=citizenship).

The Meyer et al (1993) study it was shown inter alias that the form of commitment might change over time and is not necessarily a given personal factor that remains stable: Enthusiasm (high affective commitment) to an organisation or a self imposed feeling of obligation to stay with the organisation and he working environment in the outset of a career (or probably also a change process) might be replaced by a feeling of a sober cost-based commitment after time.

Managers could consider this as a need to invest in nurturing and supporting affective and normative commitment in their organisation.

### Context and Prerequisites for application
The questionnaire) can be used at any time and any place.
Organisational Commitment Questionnaire (OCQ)  

**Equipment required for application**

Requirements: paper, pencil, statistical software for analyses. Material needed to perform the investigation are an information sheet (e.g. about the aim of the investigation etc.), a questionnaire sheet and an instruction sheet (how to perform the investigation). Additional material which is required for an investigation via mail: an information sheet (e.g. about the aim of the investigation etc.), envelops (send to subjects) and post-paid and addressed envelops (re-send).

**Required user qualifications**

Human resources management knowledge and expertise and a good knowledge and understanding of the concepts and background of the three-component model are required to correctly interpret conclude from the results achieved. Some skills and knowledge in psychological testing is required to administer and analyse the questionnaire.

**Requirements / constraint concerning conditions for use**

No specific requirements or constraints.

General remarks:
- To obtain a high response rate the questionnaire should be filled in during an allocated timeslot at work or during working hours and not during leisure time.
- General information about the questionnaire should be given to the participants. No further instruction and training are needed.
- Dependent on purpose of the measurement general feedback could both be given to the team and/or organisation (management).
- Specific feedback could be derived from the results as an intervening input to develop communication and involvement strategies and activities and for organisation learning and development.
- Confidentiality on individual level is to be ensured.

**Measure / Response Types**

Answers are given on a 7-point intensity scale ranging from 1 (“I don’t agree at all”) to 7 (“I completely agree”).

**Collected parameters and data format**

18 items overall (6 per component) results in 3 scores. The scores of each subscale will be averaged to get a summary score reflecting that scale.

**Results obtained and interpretation**

The result consists on average scores for each scale.

**Description of use**

**Figure / model**

*Figure 1: Workplace commitment model*

Process description

Address the aim of the change and its transition supporting the organisation’s strategy. Obtain the agreement of the works council and business management before starting the investigation. Make sure that this tool is appropriate to investigate the topic you are interested in and ensure you have enough units of the questionnaire and envelops if you plan to process a postal interrogation. Employees shall be informed of the investigation; its aim, the start and end date and further actions. Ensure anonymity (by using a coded system and voluntarism of the employees) is guaranteed. An information sheet, an informative presentation, or information posters at several places, e.g. notice board, intranet, e-mail can be used. Inform all employees to ensure the investigation is representative. Consider to contact the employees especially if you plan to process a postal interrogation before you start and affirm their commitment for their participation.

Ensure that every employee gets a unit of the questionnaire. If you are processing a postal interrogation you have to indicate the reply due date. The investigation shall be performed under standardised conditions if it is not a postal interrogation; every person has to be exposed to the same conditions (undisturbed setting, material, time etc.). Secure collecting boxes are available within the organisation if the employees got their questionnaires personally and place them in a non-apparent area to ensure anonymity. If the investigation is conducted by an outside consultant or researcher, guarantee anonymity, by preparing a pre-paid envelope together with the questionnaire so that employees can send their completed questionnaires directly back. This can also be used if the employees work at different geographical sites and/or administration of the questionnaire is at another geographical site. After data analysis, inform employees about the results and their interpretation including further actions. Respect the principles of social dialogue.

Evaluation

Strengths and Weaknesses of the tool

Strength: The Organisational Commitment Questionnaire can be quickly filled in and is well validated. No other strength and weaknesses of the tool are known. The OCQ is based on well defined and validated concept that has proven its merits as measuring three different aspects of commitment to organisations (and other targets, i.e. profession) in independent studies. The instrument is a reliable and valid measure. The available information on validity and statistics from various studies are helpful to understand and use the results.

Weakness: Specific weaknesses of or this scale are not known.

Alternative methods / tools

Other commitment scales developed by the same author like the Behavioural Support of the Change scale (see A-19), the Commitment to change questionnaire (see A-24) and the Coping with change questionnaire (see also A-24).

Possible combination with other methods / tools

Assessment of the construct “organisational identification” that measure the degree to which an employee experiences a ‘sense of oneness’ with their organisation which has been used in studies. Combination with other tools, e.g. SHAPE tools is possible.

Psychometric / methodological integrity description

Objectivity / (or at least) demonstration

Standardised Questionnaire.

Reliability / (or at least) demonstration

Meyer et al (1993) findings: Cronbach’s Alpha (internal consistency) for organisational commitment was used in all studies to demonstrate reliability (time = time of measurement at the beginning or end of training course for nurses).

<table>
<thead>
<tr>
<th>Scale/Dimension</th>
<th>Study Time 1</th>
<th>Study Time 2</th>
<th>Registered Nurses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affective C.</td>
<td>.87</td>
<td>.85</td>
<td>.82</td>
</tr>
<tr>
<td>Continuance C.</td>
<td>.79</td>
<td>.83</td>
<td>.74</td>
</tr>
<tr>
<td>Normative C.</td>
<td>.73</td>
<td>.77</td>
<td>.83</td>
</tr>
</tbody>
</table>

From: Schmidt, K.H., Hollmann, S. & Sodenkamp, D. (1998): Cronbach’s Alpha for the three subscales ranged from .76 to .79. Sufficiently high retest reliability after 12 months. The split- half coefficients for the subscales differ from .91 to .94. High values could be the result of an accurate splitting of the test.
Organisational Commitment Questionnaire (OCQ)  

Validitiy / (or at least) demonstration

Large body of empirical studies, content/construct/criterion-related validity can be considered as given. Factorial stability: Confirmatory Factor Analysis (CFA) revealed the 3 factor solution as the best fit. Correlations between factors were: Affective Commitment – Normative Commitment = .40; Affective C. – Continuance C. = -.23; Continuance C. – Normative C. = .23.

Correlation between Commitment to organisation and some (selected) variables in a professional sample (registered nurses) (significant correlations on < .05 level in bold)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Affective Commitment</th>
<th>Continuance Commitment</th>
<th>Normative Commitment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job Satisfaction</td>
<td>.49</td>
<td>-.22</td>
<td>.37</td>
</tr>
<tr>
<td>Intention to leave occupation</td>
<td>-.37</td>
<td>.00</td>
<td>-.30</td>
</tr>
<tr>
<td>Intention to leave organisation</td>
<td>-.45</td>
<td>-.34</td>
<td>-.34</td>
</tr>
<tr>
<td>Supervisor rating - Performance</td>
<td>.16</td>
<td>-.12</td>
<td>.06</td>
</tr>
</tbody>
</table>

From: Meyer et al. (1993).

Description of methodological integrity and additional Evidence or Value that the tool or study provides

The questionnaire has a sufficient high reliability and validity to be used (with some reservations) as a measurement instrument that meets the requirements of ISO 10075-3:

Objectivity: Is ensured (standardised application and deriving results etc).

Reliability: Cronbachs Alpha is mostly used to demonstrate reliability and shows that some subscales in the Commitment to Change questionnaire fail to reach the required value of 0.80 for tools that are applied in cases in which practical decisions are derived from the results.

Validity: Factorial validity: The scales demonstrated factorial stability and fit. The conceptual validity of the of the three-component model as the basis for the commitment to organisation scales can be considered as high. The three component show significant an substantial correlations with a number of relevant consequence variables. The requirements of ISO 10075-3 regarding validity are therefore met.

Sensitivity of measurement: Ensured (more than 3 steps / item in the answer categories of the BARS).

Diagnosticity: The questionnaire has shown to measure individual differences in the components.

Generalisability: The generalisability of the three-component concept and model has been demonstrated in several studies.

Usability / Acceptance: The questionnaires can be applied by human resources management professionals. There are no known problems with the acceptance of the questionnaire.
EXECUTIVE SUMMARY

Name of method or tool etc:
Openness toward Change Scale

Type:
Questionnaire

Abstract:
The Openness toward Change Scale questionnaire can be used to gather information about the employees’ change readiness. It inquires into the individual appraisal of a change and examines employee openness to change in two areas: change acceptance and positive view of changes. Then questionnaire has been used in a study together with other work context variables (i.e. level of information, participation) and variables representing individual differences (i.e. resilience, perceived control) as competing other explanatory factors that can explain employee reactions to change: turnover intention or actual turnover (leaving the company), job satisfaction and work related feelings of irritation.

The results showed that lower levels of change acceptance are associated with lower job satisfaction, more work irritation, and stronger intentions to quit. Personal resilience (a composite of self-esteem, optimism, and perceived control) is related to higher levels of change acceptance. One important finding is that the three context-specific variables (information received about the changes, self-efficacy for coping with the changes, and participation in the change decision process) predict higher levels of employee openness to the changes. If the participants believe in the outcome of the change and provide information on a focal shift from “resistance” to “resolution”. The more employees accept the change - improved by high amount of information and involvement in the process - the more they are satisfied with their job and think less about quitting.

ProACT Process Model

Applicable to Phase and Main Activity:

References

Developer and source

Latest developments / modifications:
Professor Connie R Wanberg
University of Minnesota / Industrial Relations Ctr
321 19th Ave S
Minneapolis, MN 55455
Office Phone: +1 612-624-4804
Contact: wanbe001@umn.edu or cwanberg@csom.umn.edu


Year of development / publication, updates etc.

### General description

<table>
<thead>
<tr>
<th><strong>Purpose of measurement / study</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The questionnaire was developed for research purposes. It can be used to assess if employees are willing to accept change and if this upcoming change is viewed positively or negatively.</td>
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</table>

<table>
<thead>
<tr>
<th><strong>Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)</strong></th>
</tr>
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<tbody>
<tr>
<td>Questionnaire.</td>
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<table>
<thead>
<tr>
<th><strong>Effort required (time, people, equipment, resources); usability and practicability</strong></th>
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</thead>
<tbody>
<tr>
<td>It takes about five minutes to fill in the questionnaire. Usability and practicability are given.</td>
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</table>

<table>
<thead>
<tr>
<th><strong>Population – Demographic and or Professional Group for which the method is intended for</strong></th>
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<tr>
<td>Any employee.</td>
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<tr>
<th><strong>Cost information / Copyrights / Agreements needed</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>There is no copyright notification required. The questionnaire can be obtained from the author. Contact: <a href="mailto:wanbe001@umn.edu">wanbe001@umn.edu</a> or <a href="mailto:cwanberg@csom.umn.edu">cwanberg@csom.umn.edu</a></td>
</tr>
</tbody>
</table>

### ATM specific mapping

#### Guidance for use in the ATM Context

The most relevant change scenarios for which the questionnaire applies are:

- Consolidation, integration and outsourcing or services and units, e.g.:
  - consolidation of control centres.

- Implementation of international working structures, e.g.:
  - Functional Airspace Blocks (FAB);
  - Trans-national companies or working arrangements (e.g. EAD Group, Entry Point North).

- Changes in working conditions, e.g.:
  - new organisational or social structures and/or processes.

- Changes in organisational structure of whole companies, authorities or units, e.g.:
  - corporate privatisation;
  - civil/military integration of operations

- Changes in organisational culture, e.g.:
  - safety reporting culture;
  - innovation and change readiness.

#### Experiences of use in the ATM / safety industry / other industry context, including references / users

No information is available for the use of the Openness toward Change Scale in ATM.
Applicable to phase and activity of the ProACT Process Model

Communication, participation and involvement process
Research has shown that the manner in which organisational change is communicated has powerful effects on followers' receptiveness to change. The results from the questionnaire can give indications about the need for more communication and information to employees and on the choice of the 'correct' communication strategy towards a more inclusive, dialogic communication with employees to increase directly or indirectly openness to the change.

Scoping phase
Risk & opportunities identification - Feasibility evaluation:
The questionnaire helps to determine how the change is seen by the employees and provides information for the feasibility of a change process.

Planning phase
Social impact assessment - Risk & opportunities analysis Feasibility evaluation:
The questionnaire provides information about perceived impacts and objections by staff and provides information on overcoming obstacles to change.

Implementation Phase
Assess and secure acceptance:
During implementation keeping a momentum of positive views on the change and remaining open to accept impacts of change are important. Information on the openness towards change can help to shape communication activities (information, participation) and increasing personal resilience by addressing personal qualities that help to ‘cushion’ and counter change related impacts.

Technical description

Description of the content / study
The Openness toward Change Scale Questionnaire from Wanberg & Banas is a modified version of the Openness toward Organisational Change Scale developed by Miller et al. (1994).

Openness to change is conceptualised by Miller etc al. (1994) involving (a) willingness to support the change and (b) positive affect about the potential consequences of the change (i.e. feeling, that the change will be beneficial in some way). Openness to change is a necessary, initial condition for successful planned change.

The Exploratory factor analyses supports a two-factor structure for the questionnaire. Factor 1 is about change acceptance. Factor 2 is about positive views of changes. A score for each factor is computed.

The following table gives the items of the questionnaire and the subscale; items in **bold** and *italics* are to be inverted:

<table>
<thead>
<tr>
<th>Change Acceptance subscale:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I would consider myself to be open to the changes.</td>
</tr>
<tr>
<td>2. I am somewhat resistant to the changes.</td>
</tr>
<tr>
<td>3. I am quite reluctant to accommodate and incorporate these changes into my work.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Positive views on Change subscale:</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. I think that the implementation of the changes will have a positive effect on how I accomplish my work.</td>
</tr>
<tr>
<td>5. Overall, the proposed changes are for the better.</td>
</tr>
<tr>
<td>6. The changes will be for the worse in terms of the way that I have to get my work done.</td>
</tr>
<tr>
<td>7. I think that the changes will have a negative effect on the clients we serve.</td>
</tr>
</tbody>
</table>

Context and Prerequisites for application
The questionnaire can be used at any time and any place. The questionnaire needs possibly be re-phrased in accordance with the change situation that participants will face or face.

Equipment required for application
Requirements: paper, pencil.

Required user qualifications
A human resources manager with knowledge and experience in work and organisational psychology and familiarity of conduction questionnaire surveys and using simpler statistical methods is also appropriate.
Requirements / constraint concerning conditions for use

No specific requirements or constraints.

General remarks:
- To obtain a high response rate the questionnaire should be filled in during an allocated timeslot at work; the questionnaire should be filled in during work hours (not leisure time).
- General information about the tool should be given to the participants. No further instruction and training are needed.
- Dependent on purpose of the measurement general feedback could be given to the team and/or organisation.
- Confidentiality of individual results.

Measure / Response Types

The items are formed as statements. The answers are given on a 7-point rating scale ranged from 1 (strongly disagree) to 7 (strongly agree). The first three items belong to the first scale named change acceptance from these items two and three have to be inverted. The second subscale consists of the last four items of the tool and items six and seven have to be inverted.

Collected parameters and data format

On the basis of this factor-analytic work, the decision was made to report two scale scores: (a) change acceptance and (b) positive view of the changes.

Results obtained and interpretation

Acceptance subscale (3 items, average score):
Mean = 15.40
SD = 3.01

Positive view subscale (4 items, average score):
Mean = 18.41
SD = 4.28

Selected Correlations (significant correlations < .05 in bold)

<table>
<thead>
<tr>
<th>Scales</th>
<th>Change Acceptance</th>
<th>Positive Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive Change</td>
<td>.56</td>
<td></td>
</tr>
<tr>
<td>Personal Resilience</td>
<td>.21</td>
<td>.11</td>
</tr>
<tr>
<td>Information</td>
<td>.21</td>
<td>.24</td>
</tr>
<tr>
<td>Participation</td>
<td>.09</td>
<td>.26</td>
</tr>
<tr>
<td>Job Satisfaction</td>
<td>.33</td>
<td>.24</td>
</tr>
<tr>
<td>Work irritation</td>
<td>-.29</td>
<td>.26</td>
</tr>
<tr>
<td>Intention to quit</td>
<td>-.31</td>
<td>-.27</td>
</tr>
</tbody>
</table>

Regression Analysis results sig. < .05 in bold; figures in brackets additional contribution of openness to change over and above other personal and context variables:

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Job satisfaction</th>
<th>Work irritation</th>
<th>Intention to quit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change Acceptance</td>
<td>.31 (.27)</td>
<td>-.24 (-.19)</td>
<td>-.25 (-.19)</td>
</tr>
<tr>
<td>Positive Change</td>
<td>.08 (.10)</td>
<td>-.15 (-.18)</td>
<td>-.16(-.19)</td>
</tr>
</tbody>
</table>

## Description of use

### Figure / model

<table>
<thead>
<tr>
<th>Individual Difference Variables:</th>
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</thead>
<tbody>
<tr>
<td>• Self Esteem</td>
</tr>
<tr>
<td>• Optimism</td>
</tr>
<tr>
<td>• Perceived control etc</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Context Variables:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Information</td>
</tr>
<tr>
<td>• Participation</td>
</tr>
<tr>
<td>• Change self-efficacy</td>
</tr>
<tr>
<td>• Social / Managerial support</td>
</tr>
<tr>
<td>• Personal impact</td>
</tr>
</tbody>
</table>

### Figure 1: Openness towards change scale overview


### Process description

Address the aim of the change and its transition supporting the organisation’s strategy. Obtain the agreement of the works council and business management before starting the investigation. Make sure that this tool is appropriate to investigate the topic you are interested in and ensure you have enough units of the questionnaire and envelops if you plan to process a postal interrogation. Employees shall be informed of the investigation; its aim, the start and end date and further actions. Ensure anonymity (by using a coded system and voluntarism of the employees) is guaranteed. An information sheet, an informative presentation, or information posters at several places, e.g. notice board, intranet, e-mail can be used. Inform all employees to ensure the investigation is representative. Consider to contact the employees especially if you plan to process a postal interrogation before you start and affirm their commitment for their participation.

Ensure that every employee gets a unit of the questionnaire. If you are processing a postal interrogation you have to indicate the reply due date. The investigation shall be performed under standardised conditions if it is not a postal interrogation; every person has to be exposed to the same conditions (undisturbed setting, material, time etc.). Secure collecting boxes are available within the organisation if the employees got their questionnaires personally and place them in a non-apparent area to ensure anonymity. If the investigation is conducted by an outside consultant or researcher, guarantee anonymity, by preparing a pre-paid envelope together with the questionnaire so that employees can send their completed questionnaires directly back. This can also be used if the employees work at different geographical sites and/or administration of the questionnaire is at another geographical site. After data analysis, inform employees about the results and their interpretation including further actions. Respect the principles of social dialogue.

### Evaluation

#### Strengths and Weaknesses of the tool

**Weaknesses:** The empirical base (sample size) is limited but the participants belonged to organisations that differed in size very much. No other strength and weaknesses of the tool are known.

#### Alternative methods / tools

Tools that measures employees’ openness towards future organisational changes, like the Attitude toward change scale.

#### Possible combination with other methods / tools

Combination with other tools that measure other personal variables: Coping with change questionnaire; Commitment to organisational change; Cynicism about organisational change; Resilience.

Combination with contextual measures: Participation and Communication scales measuring the effectiveness of communication and participation efforts.
### Openness toward Change Scale

#### Psychometric / methodological integrity description

<table>
<thead>
<tr>
<th>Objectivity / (or at least) demonstration</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Standardised Questionnaire.</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Reliability / (or at least) demonstration</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>According to the author, the coefficient alpha reliability estimates for the two subscales: change acceptance .76 (24% error in measurement) and positive view .85 (15% error in measurement).</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Validity / (or at least) demonstration</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Factorial validity for the 2-factor solution in accordance with the concept is given as reported by the authors.</td>
<td></td>
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</tbody>
</table>

#### Description of methodological integrity and additional Evidence or Value that the tool or study provides

The questionnaire was based on systematic concept development in combination with other personal and contextual factors during change. There are some good psychometric results from regression analysis that support the conceptual validity of the scales that support the robustness of the concept. Some weaknesses exist as regards formal criteria (reliability) of one subscale.

The Openness to change scale has sufficient high reliability and validity to be used as an instrument that meets the requirements of ISO 10075-3 for **orienting purpose** and can thus provide information on the direction of an activity based on this information:

- **Objectivity**: Is ensured (standardised application and deriving results etc).
- **Reliability**: Cronbach’s Alpha reaches the value of 0.70 for tools that are applied in cases in which a direction is sought.
- **Validity**: Evidence is based on small sample and on one study only. The scale shows sufficient discriminative validity (it predicts at least additional variance in some criteria over and above concurrent other context and personal variables) and shows factorial validity in one study.
- **Sensitivity of measurement**: Ensured (more than 3 steps / item in the answer categories of the BARS).
- **Diagnosticity**: Not known. However from the results reported in the original study it can be assumed that the instrument is capable of detecting (existing) differences between different change contexts or groups of persons exposed to different change context correctly.
- **Generalisability**: Not known.
- **Usability / Acceptance**: The questionnaire can be applied easily and without specific qualification. There are no known problems with the acceptance of the questionnaire.
Commitment to & Coping with Change

EXECUTIVE SUMMARY

Name of method or tool etc: Commitment to & Coping with Change

Type: Questionnaire

Abstract:

Commitment to Change (CttC) and Coping with Change (CwC) were identified as two important antecedent factors that are related to intentions of people regarding leaving or staying with their organisation going through change (organisational turnover intention). CttC and CwC are individual, psychological factors that influence their change efforts in terms of motivation, efforts and abilities employed. Commitment is therefore one of the important factors for the support that people give to change initiatives.

Commitment to change is a kind of (inner) force that connects employees to the goals in change and binds them to a course of action that is deemed necessary for the successful implementation of changes. Coping with Change is a conscious psychological and physical effort (behaviour) that people show to improve their capabilities to deal with the uncertainty, the anger, stress and conflict at work or home that is often associated with organisational changes. Employees that are confident that they will cope with change are likely better equipped to contribute to the change process.

The Commitment to Change questionnaire (Herscovitch & Meyer, 2002) measures three types of individual commitment to change: Affective, Normative and Continuance Commitment which all are positively related to support to change. The Coping with Change questionnaire (Judge et al., 1999) measures the reactance of employees (in this case managers) to change in terms of expressing confidence in their own capabilities to handle changes and to resolve upcoming problems.

Organisational turnover intentions are correlated with both, a reduced commitment to change and a reduced ability to cope with a change. A potential outcome is employee turnover, e.g. the employee to leave the company or department. Organisational turnover intentions should therefore be measured and monitored throughout the organisational change process to detect such intention.

Results of a study demonstrate the importance of both commitment and coping with change: Coping mediates the relationships between affective commitment (valuing change positively) to turnover intentions whilst normative (feeling a sense of duty to go with the change) commitment and continuance commitment (believing that there is not much choice) are directly related to turnover: high normative c. is positively and high continuance c. is negatively correlated.

ProACT Process Model

Applicable to Phase and Main Activity:
Commitment to & Coping with Change

References

Developer and source


Research findings and application of the Commitment to Change Scale:

Latest developments / study (summary of findings and own study on then relationship):

George B. Cunningham.
Dept. of Health and Kinesiology,
Texas A&M University,
TAMU 4243
College Station, TX 77843-4243 - USA
Phone: + 1(979) 458-8006
Fax: + 1 (979) 847-8987
Contact: gbcunningham@hlkn.tamu.edu

Year of development / publication, updates etc.

General description

Purpose of measurement / study

The purpose of the Cunningham (2006) study was on the ‘micro’ level that is on people-oriented issues pertaining to change. The study examined the effects of the various forms of commitment to change on employee coping with change and organisational turnover intentions. The data was collected from 299 employees of 10 organisations undergoing significant organisational change.

The basic outcome of the three forms of commitment to change (see also the copied structural equation model in box ‘Figure / Model’ further down) in their relation to ‘Turnover Intention’ (as the independent variable):

- **Affective** commitment to change fully mediated the relationship between affective commitment to change and organisational turnover intentions. People with an affective commitment believe in the value of the change and view it as an effective organisational strategy; furthermore, employees with such a commitment are unlikely to leave the organisation because of the change efforts taking place. However, results from the structural equation model (see Figure 1 from Cunningham (2006) in box ‘Figure / Model’) show coping behaviourerves as an intervening variable in the negative relationship between affective commitment and turnover intentions. Specifically, employees who see the value in the change process are also more likely to engage in problem-focused coping behaviour (Herscovitch & Meyer, 2002; Judge et al., 1999). In the current study, the coping behaviour resulted in low turnover intentions.

- **Continuance** commitment to change was related to organisational turnover intentions both directly and through coping with change. The negative relationship between continuance commitment to change and coping with change may indicate that the stress associated with pressures of continuance commitment contributes to feelings of tension and strain in the change process. Consequently, as feelings of tension and stress mount, employee coping behaviour is thought to decrease (Herscovitch & Meyer, 2002) whilst the intentions to leave the organisation increase.

- **Normative** commitment to change held a significant, negative association with organisational turnover intentions. These findings suggest that as employees feel a sense of duty and obligation to support the change process, they will also be unlikely to leave the organisation because of such initiatives.

The Questionnaire used in the study allows evaluating how employees cope with change and can help to select adequate strategies to support employees to keep or increase their commitment to change. It can also be used to measure employees’ (individuals’ or groups’) intentions to quit or to remain in an organisation during a change process.
### Commitment to & Coping with Change

<table>
<thead>
<tr>
<th>Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)</th>
</tr>
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<tbody>
<tr>
<td>Questionnaires.</td>
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<tr>
<td>It takes about two minutes to finish each questionnaire.</td>
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<table>
<thead>
<tr>
<th>Cost information / Copyrights / Agreements needed</th>
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</thead>
<tbody>
<tr>
<td>The commitment to change and coping with change questionnaire items are given in the box 'Validity' together with the factor loadings from the original studies.</td>
</tr>
</tbody>
</table>

**Note:** The Coping with Change Scale is copyrighted by Timothy A. Judge and Vladimir Pucik and users should ask for permission (email: timothy.judge@cba.ufl.edu). The Commitment to Change Scales were developed by Herscovitch & Meyer. The current version is called TCM – Three Component Model of commitment and dis a copyrighted product available for download free of charge for research purposes. For commercial use the cost in 2009 is about $52.

The original version described here and a revised version and the application manual is available on the following webpage: [http://www.flintbox.com/technology.asp?page=689](http://www.flintbox.com/technology.asp?page=689)

### ATM specific mapping

**Guidance for use in the ATM Context**

The most relevant change scenarios for which the questionnaire applies are:

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  - consolidation of control centres.

- Implementation of international working structures, e.g.:
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- Changes in organisational structure of whole companies, authorities or units, e.g.:
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- Changes in organisational culture, e.g.:
  - safety reporting culture;
  - innovation and change readiness.

### Experiences of use in the ATM / safety industry / other industry context, including references / users

No information is available for the use of the Commitment to & Coping with Change questionnaires in ATM.

### ProACT Process Model

**Applicable to phase and activity of the ProACT Process Model**

- **Communication, participation and involvement process**
  The questionnaires measure aspects that are relevant for identifying important issues for personal communication, involvement and participation of staff to increase compliance and support and reward change supporting behaviour of staff.

- **Continuous evaluation and adaptation process**
  The questionnaires provide information about the personal commitment of staff for change and their perceived capacity to dealing with change (coping).
Commitment to & Coping with Change

<table>
<thead>
<tr>
<th>Scoping phase</th>
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<tbody>
<tr>
<td>Feasibility evaluation:</td>
</tr>
<tr>
<td>The questionnaires help to take decisions about the feasibility of a change process in terms of the 'psychological' preparedness to change.</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Planning phase</th>
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<tbody>
<tr>
<td>Social impact assessment - Risk &amp; opportunities analysis - Feasibility evaluation:</td>
</tr>
<tr>
<td>The questionnaires provide information about perceived impacts and objections by staff and their commitment and coping behaviour.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Implementation phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assess &amp; secure acceptance:</td>
</tr>
<tr>
<td>The questionnaires indicate the level of acceptance in terms of commitment and coping during the implementation phase when change impacts are becoming very concrete and change difficulties impact most.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Evaluation phase</th>
</tr>
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<tbody>
<tr>
<td>Monitor &amp; reinforce C &amp; T process – Process &amp; outcome assessment:</td>
</tr>
<tr>
<td>The questionnaire results indicate the level of commitment and can be used to enhance the change process.</td>
</tr>
</tbody>
</table>

### Technical description

**Description of the content / study**

**The Commitment to organisational change questionnaire (Herscovitch & Meyer, 2002):**

The authors define commitment as 'a force (mind set) that binds an individual to a course of action to one or more targets'. This force can take 3 different forms: **desire** (affective c.), **perceived cost** (continuance c.) or **obligation** (normative c.) and all 3 forms bind people to an action deemed necessary to achieve a successful change implementation. The focus of the behaviour in situations of change is **compliance** (non-compliance resembles change resistance). The main results of the study are as follows:

- **Study 1** showed that indeed the 3 forms of commitment are measurable constructs that can be distinguished from each other (see box 'Validity' giving the exploratory factor analysis results).
- **Study 2** confirmed the finding of 3 different forms of commitment in a different sample and using a confirmatory factor analysis approach. All 3 scales correlated significantly with **compliance**. Commitment to change also contributed significantly to **behavioural support** that people gave to the change compared to commitment to the organisation for which they worked.
- **Study 3**: Again supported the 3 forms of commitment as different. The finding from Study 2 was again supported: commitment to change predicted more (and independent) variance in the dependent variable 'behavioural support' then did commitment to the organisation.

The study showed that commitment does lead to compliance with specific behaviour to support change, i.e. seek the cooperation with others and 'go the extra mile' in their efforts. Whether compliance is sufficient to achieve successful change depends on how clearly the requirements for change are spelled out (importance of communication), how closely the behaviour can be monitored and supported (importance of involvement and participation) and how effectively the right behaviour can be rewarded.

**The Coping with organisational change questionnaire (Judge et al., 1999):**

The authors conceptualised the coping concept based on a well defined concept validation process. They reviewed personality literature to discover variables that could relate to coping with change as dispositions (personality traits). The choice was for those traits for which well validated measures existed, that had demonstrated evidence for construct validity and had been used successfully in research and finally had some evidence for a theoretical relationship with coping with change. This lead to the choice of 7 traits or dispositions: (1) locus of control (2) generalised self-efficacy, (3) self-esteem, (4) positive affectivity, (5) openness to experience, (6) tolerance for ambiguity and (7) risk aversion.

The **independent variable** **Coping with Change** was measured with a scale (developed by Judge and Pucik) that measures coping considering both reactance to change and leading change. The 12 items load as expected on one factor (see further details in the respective boxes in this description.)

**Results:** Judge et al. (1999) showed that indeed all 7 traits were correlated with coping with change (considered as the independent variable). They also identified two general personality characteristics from this list of variables that showed to be independent factors in factor studies and that reliably predicted coping with change measured with the coping with change questionnaire: positive self-concept (and risk tolerance). A positive self-concept consists of an internal locus of control, high generalised self-efficacy, high self-esteem, and positive affectivity. Risk tolerance, on the other hand, is comprised of openness to experience, tolerance for ambiguity, and a low level of risk aversion. Not only were these personality characteristics reliably related to coping with change, but the elements of positive self-concept have also been shown to relate to organisational commitment (Judge et al., 1999), to job satisfaction (Judge et al., 1999), and to job performance (cf. Barrick, Mount, & Judge, 2001).

These positive outcomes and the need to cope with a continually changing environment demonstrate that coping in the sense as conceptualised is a key concept and managers may do well to consider such characteristics not only but also when making staffing decisions by attracting persons to the organisation who can effectively cope with change. Also managers should look at these aspects during situations of change.
Commitment to & Coping with Change

Context and Prerequisites for application

Both questionnaires can be used at any time and any place. As both measures concerns sensitive aspects related to personality it is important to ensure full confidentiality and anonymity to deliver valid results.

Equipment required for application

Requirements: paper, pencil.

Required user qualifications

A psychologist or Human Resources specialist knowledgeable in work related personality and behaviour matters is preferred to interpret results obtained correctly and provide accurate advice to management on possible implications and follow up actions.

Requirements / constraint concerning conditions for use

No specific requirements or constraints.

General remarks:
- To obtain a high response rate the questionnaire should be filled in during an allocated timeslot at work; the questionnaire should be filled in during work hours (not leisure time).
- General information about the tool should be given to the participants. No further instruction and training are needed.
- Dependent on purpose of the measurement general feedback could both be given to the team and/or organisation, as well as specific feedback could be given to the individual as an intervening input to individual learning and development.
- Full anonymity and confidentiality as regards individual responses is to be ensured.

Measure / Response Types

Coping with change:
Items are measured using a 7-point Likert-type scale from 1 ("strongly disagree") to 7 ("strongly agree").

Commitment to change:
Items are measured using a 7-point Likert-type scale from 1 ("strongly disagree") to 7 ("strongly agree").

Organisational turnover intentions:
In the Cunningham (2006) study three items were used to measure organisational turnover intentions (e.g., "I plan on voluntarily leaving the department within the next year as a result of these changes") on a 7-point Likert-type scale from 1 ("strongly disagree") to 7 ("strongly agree").

Collected parameters and data format

The item-scores are be averaged to get a summary score.

Results obtained and interpretation

Results of the Cunningham (2006) study:
As expected, affective and continuance commitment to change both held significant, bivariate correlations with the coping behaviour. Finally, all forms of commitment and coping with change were significantly related to organisational turnover intentions in the expected directions:

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Descriptive statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Item</strong></td>
<td><strong>M</strong></td>
</tr>
<tr>
<td>1. Affective commitment</td>
<td>5.20</td>
</tr>
<tr>
<td>2. Continuance commitment</td>
<td>4.05</td>
</tr>
<tr>
<td>3. Normative commitment</td>
<td>4.56</td>
</tr>
<tr>
<td>4. Coping with change</td>
<td>4.34</td>
</tr>
<tr>
<td>5. Turnover intentions</td>
<td>2.14</td>
</tr>
</tbody>
</table>

r ≥|.21|, p <.05.
Commitment to & Coping with Change

Description of use

**Figure / model**

![Diagram](image)

**Process description**

Address the aim of the change and its transition supporting the organisation’s strategy. Obtain the agreement of the works council and business management before starting the investigation. Make sure that this tool is appropriate to investigate the topic you are interested in and ensure you have enough units of the questionnaire and envelopes if you plan to process a postal interrogation. Employees shall be informed of the investigation; its aim, the start and end date and further actions. Ensure anonymity (by using a coded system and voluntarism of the employees) is guaranteed. An information sheet, an informative presentation, or information posters at several places, e.g., notice board, intranet, e-mail can be used. Inform all employees to ensure the investigation is representative. Consider to contact the employees especially if you plan to process a postal interrogation before you start and affirm their commitment for their participation.

Ensure that every employee gets a unit of the questionnaire. If you are processing a postal interrogation you have to indicate the reply due date. The investigation shall be performed under standardised conditions if it is not a postal interrogation; everyone has to be exposed to the same conditions (undisturbed setting, material, time etc.). Secure collecting boxes are available within the organisation if the employees got their questionnaires personally and place them in a non-apparent area to ensure anonymity. If the investigation is conducted by an outside consultant or researcher, guarantee anonymity, by preparing a pre-paid envelope together with the questionnaire so that employees can send their completed questionnaires directly back. This can also be used if the employees work at different geographical sites and/or administration of the questionnaire is at another geographical site. After data analysis, inform employees about the results and their interpretation including further actions. Respect the principles of social dialogue.

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**Figure 1.** Illustrative summary of partially mediated model. $\chi^2(316) = 710.65, \ p < .001, \ \text{RMSEA} = .07; \ \text{CFI} = .95, \ \text{NFI} = .92. \ *p < .05, \ **p < .001.$

*From:* Cunningham (2006). See box ‘General description’ for a detailed description of the findings that support the relationships.
Commitment to & Coping with Change

Evaluation

Strengths and Weaknesses of the tool

Strength and Weaknesses of both Coping with Change and Commitment to Change questionnaires:
The Commitment to Change questionnaire is based on well defined and validated concept that has proven its merits as measuring three different aspects of commitment in independent studies. The instrument is a reliable and valid measure. The available information on validity and statistics from various studies are helpful to understand and use the results. Specific weaknesses of or this scale are not known.

The Coping with Change questionnaire has been developed to measure coping as an independent variable and has been used in research only. Basic psychometric statistics are available that allow to select items as was done by Cunningham (2006). The weakness of the instrument is that it was not developed with the same scrutiny as the concepts that support coping (the 7 personality dispositions as locus of control etc) as described in the box ‘Description of the content / study’.

Alternative methods / tools

Michigan Organisational Assessment Questionnaire ; Allen and Meyer’s Continuance Commitment Scale.

Possible combination with other methods / tools

Organisational Identification, Organisational Commitment, Job Satisfaction, Job Performance have been used in combination with Commitment to Change and Coping with Change in several studies. Job satisfaction and Job performance correlates positively with Coping with change. Affective and Normative Commitment to Change is positively correlated to important change behaviour that helps to ensure success: compliance, cooperating with others and championing change.

Psychometric / methodological integrity description

Objectivity / (or at least) demonstration

Standardised Questionnaires.

Reliability / (or at least) demonstration

Cronbach’s Alpha (internal consistency) was used in all studies to demonstrate reliability. The table summarises the findings for the Commitment to Change and Coping with Change scales and for the dependent variable ‘Organisational Turnover Intention’ (3 items only) in different studies.

<table>
<thead>
<tr>
<th>Scale/Dimension</th>
<th>Herscovitch et al.</th>
<th>Cunningham 2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affective C.</td>
<td>.94</td>
<td>.93</td>
</tr>
<tr>
<td>Continuance C.</td>
<td>.71</td>
<td>.89</td>
</tr>
<tr>
<td>Normative C.</td>
<td>.78</td>
<td>.74</td>
</tr>
<tr>
<td>Coping with Change</td>
<td>--</td>
<td>.63</td>
</tr>
<tr>
<td>Turnover Intentions</td>
<td>--</td>
<td>.96</td>
</tr>
</tbody>
</table>

That the reliability for some scales is under the cut-off limits 0.80 as required by ISO 100075-3 presents a possible limitation to the use of those scales for practical decisions and interventions. For affective commitment and organisational turnover intentions the reliability of the measure is high.
## Validity / (or at least) demonstration

### Items and Factor Loadings for Coping With Change Scale

<table>
<thead>
<tr>
<th>Item</th>
<th>Loading</th>
<th>t value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. When dramatic changes happen in this company, I feel I handle them with ease.</td>
<td>.51</td>
<td>10.81</td>
</tr>
<tr>
<td>2. I have been a leader of transformation efforts within this company.</td>
<td>.46</td>
<td>9.53</td>
</tr>
<tr>
<td>3. The rapid changes that have been occurring in this company are sometimes beyond the abilities of those within the company to manage.</td>
<td>.27</td>
<td>5.35</td>
</tr>
<tr>
<td>4. Rapid change is something to adapt to, but not to embrace.</td>
<td>.52</td>
<td>10.84</td>
</tr>
<tr>
<td>5. When changes happen in this company, I react by trying to manage the change rather than complain about it.</td>
<td>.38</td>
<td>7.82</td>
</tr>
<tr>
<td>6. The changes occurring in this company cause me stress.</td>
<td>.43</td>
<td>8.85</td>
</tr>
<tr>
<td>7. I see the rapid changes that are occurring in this company as opening up new career opportunities for me.</td>
<td>.59</td>
<td>12.61</td>
</tr>
<tr>
<td>8. Deep changes ultimately better the company.</td>
<td>.58</td>
<td>12.32</td>
</tr>
<tr>
<td>9. Environmental turbulence presents opportunities to make overdue changes in this company.</td>
<td>.35</td>
<td>7.04</td>
</tr>
<tr>
<td>10. When changes are announced, I try to react in a problem-solving, rather than an emotional, mode.</td>
<td>.38</td>
<td>7.83</td>
</tr>
<tr>
<td>11. I often find myself leading change efforts in this company.</td>
<td>.57</td>
<td>12.43</td>
</tr>
<tr>
<td>12. I think I cope with change better than most of those with whom I work.</td>
<td>.51</td>
<td>10.71</td>
</tr>
</tbody>
</table>

*Note.* Items 3, 4, and 6 are reverse scored. The Coping With Change Scale is copyrighted by Timothy A. Judge and Vladimir Pucik and may not be used without permission. All factor loadings are significant at the .001 level.

The items and factor loadings for the Commitment to Change scales from the original publication (Herscovitch & Meyer, 2002) are given below and show factorial validity of the scales. The three different types of commitment as concepts for developing the items could be replicated in the three factor solution.

### Factor Analysis of Commitment to Change Items (Study 1)

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor I</th>
<th>Factor II</th>
<th>Factor III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affective commitment items</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. I believe in the value of this change.</td>
<td>-.01</td>
<td>.91</td>
<td>.22</td>
</tr>
<tr>
<td>2. This change is a good strategy for this organization.</td>
<td>.02</td>
<td>.93</td>
<td>.25</td>
</tr>
<tr>
<td>3. I think that management is making a mistake by introducing this change. (R)</td>
<td>-.13</td>
<td>.83</td>
<td>.12</td>
</tr>
<tr>
<td>4. This change serves an important purpose.</td>
<td>-.09</td>
<td>.91</td>
<td>.23</td>
</tr>
<tr>
<td>5. Things would be better without this change. (R)</td>
<td>-.11</td>
<td>.81</td>
<td>.23</td>
</tr>
<tr>
<td>6. This change is not necessary. (R)</td>
<td>-.04</td>
<td>.78</td>
<td>.33</td>
</tr>
<tr>
<td>Continuance commitment items</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. I have no choice but to go along with this change.</td>
<td>.87</td>
<td>-.03</td>
<td>.36</td>
</tr>
<tr>
<td>2. I feel pressure to go along with this change.</td>
<td>.76</td>
<td>-.05</td>
<td>.32</td>
</tr>
<tr>
<td>3. I have too much at stake to resist this change.</td>
<td>.93</td>
<td>-.03</td>
<td>.32</td>
</tr>
<tr>
<td>4. It would be too costly for me to resist this change.</td>
<td>.87</td>
<td>-.05</td>
<td>.28</td>
</tr>
<tr>
<td>5. It would be risky to speak out against this change.</td>
<td>.82</td>
<td>-.06</td>
<td>.31</td>
</tr>
<tr>
<td>6. Resisting this change is not a viable option for me.</td>
<td>.89</td>
<td>.03</td>
<td>.36</td>
</tr>
<tr>
<td>Normative commitment items</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. I feel a sense of duty to work toward this change.</td>
<td>.28</td>
<td>.22</td>
<td>.82</td>
</tr>
<tr>
<td>2. I do not think it would be right of me to oppose this change.</td>
<td>.47</td>
<td>.31</td>
<td>.69</td>
</tr>
<tr>
<td>3. I would not feel badly about opposing this change. (R)</td>
<td>.24</td>
<td>.23</td>
<td>.65</td>
</tr>
<tr>
<td>4. It would be irresponsible of me to resist this change.</td>
<td>.38</td>
<td>.15</td>
<td>.58</td>
</tr>
<tr>
<td>5. I would feel guilty about opposing this change.</td>
<td>.32</td>
<td>.12</td>
<td>.76</td>
</tr>
<tr>
<td>6. I do not feel any obligation to support this change. (R)</td>
<td>.19</td>
<td>.21</td>
<td>.79</td>
</tr>
</tbody>
</table>

*Note.* Oblimin rotation was performed. Each item's highest loading is presented in boldface. Eigenvalues and percentage of variance accounted for by Factors 1, 2, and 3 were 6.05 (31.80%), 4.91 (25.91%), and 2.15 (9.97%), respectively. R = reverse scored.

Description of methodological integrity and additional Evidence or Value that the tool or study provides

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>The questionnaires have a sufficient high reliability and validity to be used as a measurement instrument that meets some requirements of ISO 10075-3:</td>
<td></td>
</tr>
<tr>
<td><strong>Subjectivity:</strong></td>
<td>Is ensured (standardised application and deriving results etc).</td>
</tr>
<tr>
<td><strong>Reliability:</strong></td>
<td>Cronbachs Alpha is mostly used to demonstrate reliability and shows that some subscales in the Commitment to Change questionnaire fail to reach the required value of 0.80 for tools that are applied in cases in which practical decisions are derived from the results.</td>
</tr>
<tr>
<td><strong>Validity:</strong></td>
<td>The scales of the commitment to change have good factorial stability in more than one study. The conceptual validity of the commitment to change scales can be considered as high. The coping with change scale is less well developed as a measurement instrument and lacks the level of scrutiny in development. However, the demonstrated relationship between antecedent factors (dispositions) and coping indirectly give evidence of construct validity. Factorial validity was demonstrated. The requirements of ISO 10075-3 regarding validity are met.</td>
</tr>
<tr>
<td><strong>Sensitivity of measurement:</strong></td>
<td>Ensured (more than 3 steps / item in the answer categories of the BARS).</td>
</tr>
<tr>
<td><strong>Diagnosticity:</strong></td>
<td>The commitment to change questionnaire was demonstrated in then study from Herscovitch &amp; Meyer that the scales related in a differential way to behaviour and in the expected direction.</td>
</tr>
<tr>
<td><strong>Generalisability:</strong></td>
<td>Provided that full anonymity is ensured the scales should deliver valid results.</td>
</tr>
<tr>
<td><strong>Usability / Acceptance:</strong></td>
<td>The questionnaires are recommended to be applied by qualified practitioners. There are no known problems with the acceptance of the instruments.</td>
</tr>
</tbody>
</table>
Profile Analysis of Job Satisfaction (PAJS)

EXECUTIVE SUMMARY

<table>
<thead>
<tr>
<th>Name of method or tool etc:</th>
<th>Profile Analysis of Job Satisfaction (PAJS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type:</td>
<td>Questionnaire</td>
</tr>
</tbody>
</table>

Abstract:
The Profile Analysis of Job Satisfaction (PAJS) is a multidimensional questionnaire which measures 11 different aspects related to job satisfaction (communication and information; leadership; job content, salary etc.). It can be used for diagnosis of sources for job satisfaction and dissatisfaction as well as for potential analysis of the risk potentials for situations of critical levels of job satisfaction in an organisation.

The assessment of job satisfaction should be considered during organisational changes that have an impact on the measured factors. It is further recommended to monitor changes in the individuals’ job satisfaction during the implementation of a change process.

ProACT Process Model

Applicable to Phase and Main Activity:

Table: ProACT Process Model

References


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Contact: paul.jimenez@uni-graz.at

Year of development / publication, updates etc.

2008
### Profile Analysis of Job Satisfaction (PAJS)

#### General description

**Purpose of measurement / study**

The PAJS development is based on a model of job satisfaction in which employees compare their current, actual situation at their workplace with their level of expectation in different aspects that contribute to job satisfaction.

The PAJS measures these aspects in a multi-dimensional manner by capturing satisfaction, expectation and importance of the following 11 (psychologically relevant) aspects that contribute to overall job satisfaction:

1. Information and communication,
2. Work challenge,
3. Relations to immediate colleagues,
4. Relations to immediate supervisors,
5. Organisation and leadership,
6. Possibilities for advancement and career,
7. Working conditions,
8. Room for decision making,
9. Salary,
10. Working time and leave,
11. General framework conditions.

The questionnaire can be used to measure sources for job satisfaction and/or dissatisfaction in a job as well as to analyse risk potentials in an organisation.

**Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)**

Questionnaire (standardised)

**Effort required (time, people, equipment, resources); usability and practicability**

A long and a short version are available (10 minutes or more for data collection). In general, low effort is required and usability and practicability are given.

**Population – Demographic and or Professional Group for which the method is intended for**

Any employee

**Object of measurement / study (individual, team, profession, department, company)**

Individual

**Language (other than English)**

The original version is in German. English, Bosnian, Croatian and Spanish version are also available.

**Cost information / Copyrights / Agreements needed**

Acquisition and application costs are estimated low. The instrument can be applied free of charge for scientific purposes. For use in scientific projects contact the author.

For use in commercial cases an online version is available and can be acquired from Schuhfried GmbH at: [http://www.schuhfried.at/de/produkte/wiener-testsyste-m-wts.html](http://www.schuhfried.at/de/produkte/wiener-testsyste-m-wts.html)

and from the Company rt-research-team at [http://www.research-team.at/](http://www.research-team.at/)
ATM specific mapping

**Guidance for use in the ATM Context**

The most relevant change scenarios where PAJS applies are:

- Consolidation, integration and outsourcing of services and units, e.g.:
  - consolidation of control centres;
  - centralisation of services (e.g. maintenance, AIS);
- Implementation of future operational concepts and systems, e.g. encompassing:
  - significant changes of roles and responsibilities in operational jobs;
  - more integrated ATM processes characterised by wide information sharing, enhanced CDM (Collaborative Decision Making);
  - significantly increasing automation of tasks or functions;
  - new technologies (e.g. Data link, 4D trajectory based planning and control, support tools for separation delegated to flight crew, conflict resolution and collision avoidance automation support).
- Harmonisation and mobility of staff, e.g.:
  - transfer of operational staff to other states or in multinational working arrangements;
- Changes in working conditions, e.g.:
  - new shift/rostering cycles and working hours (e.g. to flexibly adapt to variations in traffic amount);
  - new organisational or social structures and/or processes.
- Changes in organisational structure of whole companies, authorities or units, e.g.:
  - Civil/military integration of operations.
- Certification and regulatory implementation activities, e.g.:
  - implementation of harmonised safety management standards;
  - implementation of harmonised competence regulations;
- Changes in organisational culture, e.g.:
  - Innovation and change readiness.

**Experiences of use in the ATM / safety industry / other industry context, including references / users**

Data for ATCOs e.g. special norms for IT, are available and can be asked from the author.

**ProACT Process Model**

**Applicable to phase and activity of the ProACT Process Model**

**Communication, participation and involvement process**

The questionnaire results can provide an input to developing and providing appropriate communication and information to staff.

**Continuous evaluation and adaptation process**

The questionnaire results provide input to adapt the change process to the needs of staff and addressing relevant aspects job satisfaction that are impacted by the change.

**Scoping phase**

Risk & opportunities identification:
The questionnaire results provide a diagnosis of problems in work relationships within and between teams and working groups. The questionnaire helps to identify groups which lower their involvement and helps to identify critical variables (e.g. satisfaction with personal development, decision latitude) for their commitment to the organization. A measure of job satisfaction before the changes are implemented can be done and being used as a baseline against which job satisfaction can be evaluated (monitored).

**Planning phase**

Social impact assessment - Risk & opportunities analysis - Feasibility evaluation:
The questionnaire results provide information on how the staff estimates the social environment, organisational processes, leadership aspects and job content. The questionnaire provides information about possible risks for lack of ‘buy-in’, internal withdrawal, i.e. lowering the personal engagement of people in the change that could lead to decreasing quality of work and services etc.
Implementation phase
Implement supporting structures - Assess & secure acceptance:
The questionnaire results provide information on perceived impacts of a change on individual job satisfaction. The questionnaire assesses the critical combination of sources for positive engagement in the change (e.g. positive job demands and other aspects in the change that increase job satisfaction).

Evaluation phase
Monitor & reinforce C & T process – Process & outcome assessment:
The questionnaire, if used in a test - re-test design, can provide in information on changes in job satisfaction of staff over time, i.e. before, during and after the implementation of a change. The questionnaire can give indications on the quality of the change process and the acceptance of the changes during the process stages in general.

Technical description

Description of the content / study
The PAJS is a multidimensional questionnaire based on a cybernetic model of job satisfaction. It is a self administered, standardised questionnaire consists of 53 items that measure 11 different aspects (scales):
Information & Communication; Challenge of Work; Relationship to Colleagues; Relationship to Supervisors; Organisation & Leadership; Job Advancement & Career Possibilities; Working Conditions; Room for Decision Making; Salary, Working time & Leave; General (Job) Framework.

Each aspect is assessed by three to six items. The scales can be used for diagnosis of job satisfaction and dissatisfaction as well as for potential analysis of risk potentials at an organisation, like satisfaction with the:
- Organisational characteristics (assessing processes and structures within an organisation)
- Social environment at the workplace (assessing aspects of relationships at work, i.e. between or within teams or working groups).
- Direct work related satisfaction characteristics (aspects of duties, working hours and working conditions).

Context and Prerequisites for application
The questionnaire can be used at any time and any place. General advice to obtain a high response rate: the questionnaire is filled in during an allocated timeslot at work; the questionnaire is filled in during work hours (not leisure time). Appropriately qualified persons are required for the application of the tool.

Equipment required for application
Requirements: paper, pencil, statistical software for analyses such as Microsoft Excel, SPSS, or Statistica. An online version is provided by Schuhfried GmbH within the “Wiener Testsystem”, a special online version can be used from rt-research-team.

Required user qualifications
A qualified organisational or work psychologist or human factors specialist is preferred to make appropriate use of the results. Good human resources management knowledge especially on work environment, working conditions and culture is required for making suggestions for changes in the job environment based on questionnaire results.

Requirements / constraint concerning conditions for use
No specific requirements or constraints.
General remarks:
- To obtain a high response rate the questionnaire should be filled in during an allocated timeslot at work; the questionnaire should be filled in during work hours (not leisure time).
- General information about the tool should be given to the participants. No further instruction and training are needed.
- Dependent on purpose of the measurement general feedback could both be given to the team and/or organisation, as well as specific feedback could be given to the individual as an intervening input to individual learning and development.
- Ensure Confidentiality.

Measure / Response Types
There is a direct rating of satisfaction on a bipolar 5-point-scale ranging from 1 (very satisfied) to 5 (dissatisfied). Sample item of the subscale “payment”: “I am ... with my payment compared to my colleagues.” followed by the scale “very satisfied” to “dissatisfied”.

Furthermore, there are optional (and additional) statements which can be included in the survey which assess the future estimation of the development for all of the facets of job satisfaction. Answer possibilities range from “very positive” (1) to “very negative” (5) on a 5-point rating scale.
### Collected parameters and data format

Profile of job satisfaction according to the 11 factors measured and one overall score.

### Results obtained and interpretation

Low scores represent high job satisfaction. Data for ATCOs are available. Large system of job-related norms can be obtained from the author.

### Description of use

#### Figure / model

No Figure/model is available

#### Process description

Address the aim of the change and its transition supporting the organisation’s strategy. Obtain the agreement of the works council and business management before starting the investigation. Make sure that this tool is appropriate to investigate the topic you are interested in and ensure you have enough units of the questionnaire and envelopes if you plan to process a postal interrogation.

Employees shall be informed of the investigation; its aim, the start and end date and further actions. Ensure anonymity (by using a coded system and voluntarism of the employees) is guaranteed. An information sheet, an informative presentation, or information posters at several places, e.g. notice board, intranet, e-mail can be used. Inform all employees to ensure the investigation is representative. Consider to contact the employees especially if you plan to process a postal interrogation before you start and affirm their commitment for their participation.

Ensure that every employee gets a unit of the questionnaire. If you are processing a postal interrogation you have to indicate the reply due date. The investigation shall be performed under standardised conditions if it is not a postal interrogation; every person has to be exposed to the same conditions (undisturbed setting, material, time etc.). Secure collecting boxes are available within the organisation if the employees got their questionnaires personally and place them in a non-apparent area to ensure anonymity.

If the investigation is conducted by an outside consultant or researcher, guarantee anonymity, by preparing a pre-paid envelope together with the questionnaire so that employees can send their completed questionnaires directly back. This can also be used if the employees work at different geographical sites and/or administration of the questionnaire is at another geographical site. After data analysis, inform employees about the results and their interpretation including further actions. Respect the principles of social dialogue.

### Evaluation

#### Strengths and Weaknesses of the tool

The PAJS is easy to use. Moreover, norms and practical relevant information are available. No other strength and weaknesses of the tool are known.

#### Alternative methods / tools

Other work-satisfaction scales.

#### Possible combination with other methods / tools

The PAJS can be combined with other measures either as a full version or by using selected scales. The combination with a tool measuring Strain and Recovery is recommended.

### Psychometric / methodological integrity description

#### Objectivity / (or at least) demonstration

Standardised Questionnaire.

#### Reliability / (or at least) demonstration

Internal consistency (Cronbachs Alpha) of the scales (German version) show good – to high reliability coefficients ranging from 0.82 to 0.91. The overall score reaches an Alpha of above .85 (15% error in measurement).

The stability of the results (test – re-test) was assessed in several studies with a time lag between measures of up to 10 weeks. Test – Re-test coefficients show a moderate to high stability with values between $r = 0.64$ to $r = 0.87$ depending on the scale used.
**Profile Analysis of Job Satisfaction (PAJS)**

### Validity / (or at least) demonstration

Several studies provide evidence on different aspects of validity: Convergent validity is demonstrated against other (related) indicators like burnout, intention for job change or absences from work.

People with higher scores on scales measuring burnout or on scales that measure intention to change their job or have a high absences from work (> 9 days) show lower levels of job satisfaction especially in the following scales of the PAJS: Job advancement / Career possibilities; Relationship to Colleagues; Relationship to Supervisors; Job Challenge; Room for Decision Making; Working time & Leave.

Further studies show evidence for differential validity of the PAJS, especially for applications in situations of change and transition compared with other measurement methods. The results of these studies can be obtained from the author.

### Description of methodological integrity and additional Evidence or Value that the tool or study provides

The questionnaire is based on a systematic concept development. Good psychometric results from various studies support the value of the instrument.

The PAJS has sufficient high reliability and validity to be used as an instrument that meets the requirements of ISO 10075-3 for measurement purpose and can thus provides accurate and reliable information for making decisions based on this information:

<table>
<thead>
<tr>
<th>Objectivity:</th>
<th>Is ensured (standardised application and deriving results etc).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability:</td>
<td>Cronbach's Alpha reaches the value of &gt; 0.80.</td>
</tr>
<tr>
<td>Validity:</td>
<td>Evidence is based on various samples. The scale shows convergent and discriminative validity.</td>
</tr>
<tr>
<td>Sensitivity of measurement:</td>
<td>Ensured (more than 3 steps / item in the answer categories of the BARS).</td>
</tr>
<tr>
<td>Diagnosticity:</td>
<td>From the results reported it can be assumed that the instrument is capable of detecting (existing) differences between different work environments and job contexts or groups of persons that were exposed to different job contexts.</td>
</tr>
<tr>
<td>Generalisability:</td>
<td>Not known.</td>
</tr>
<tr>
<td>Usability / Acceptance:</td>
<td>The questionnaire can be applied easily but requires, due to its nature specific qualification to be interpreted and used correctly. There are no known problems with the acceptance of the instrument.</td>
</tr>
</tbody>
</table>
The Swedish Organisational Change Manager (OCM) model intends to promote improvements and change initiatives and increasing their probability of success. During the development an ‘Integrative Group Process’ (IGP) was employed that used expert knowledge from an expert network covering the complexity of change areas to identify, test and validate a usable model of change.

The IGP process identified 11 generic (= applicable to changes in general) factors that are critical for success / failure of a change. They were tested and showed of being important for successful improvements (change) in an organisation also in practice. The model predicted 80% of all successful changes and 75% of unsuccessful initiatives. It can therefore be used to diagnose weaknesses in an existing improvement or change process and change contexts; it can help to measure the organisation’s overall potential for successful improvement and to prioritise potential initiatives (changes) that are still under consideration by management in regard to their probability of success or risks for failure. The OCM model groups the 11 critical success factors into four main change context phases that are the basics in a change process: 1) Environment for New Ideas; 2) Planning Phase; 3) Do, Execute Project; 4) Study and Act.

The model is based on Bayesian statistics (= on (subjective) probabilities for success / failure under the given circumstances of a change at hand). The model aims to address a problem and bias in change projects, namely that managers tend to overestimate the prospects of organisational change and need support in creating successful change contexts. The OCM model helps to get inputs on these context factors to increase change success.
### General description

#### Purpose of measurement / study

The OCM model can be used to diagnose weaknesses or shortcomings in improvement projects. The model aims to address a problem and bias in change projects, namely that managers tend to overestimate the prospects of organisational change and need support in creating successful change contexts.

The OCM model helps to get inputs on these factors to increase change success. It measures organisations overall potential for successful improvement and to prioritize potential initiatives under consideration.

#### Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)

Change process model (Integrative Group Process); instrument for gathering information on context factors for change success (questionnaire style).

#### Effort required (time, people, equipment, resources); usability and practicability

It takes about 8 minutes to finish the questionnaire. Usability and practicability are given.

#### Population – Demographic and or Professional Group for which the method is intended for

Any employee knowledgeable about the change context in an organisation.

#### Object of measurement / study (individual, team, profession, department, company)

Team, department and organisation/company level.

#### Language (other than English)

Original: Swedish. A complete English version is not yet available; for a translation see box ‘Description of the content / study’.

#### Cost information / Copyrights / Agreements needed

There is no fee but a copyright notification should be sent to the author.

### ATM specific mapping

#### Guidance for use in the ATM Context

The most relevant change scenarios for which the OCM applies are:

- Consolidation, integration and outsourcing of services and units, e.g.:
  - consolidation of control centres;
  - centralisation of services (e.g. maintenance, AIS);
- Implementation of future operational concepts and systems, e.g. encompassing:
  - significant changes of roles and responsibilities in operational jobs;
  - more integrated ATM processes characterised by wide information sharing, enhanced CDM (Collaborative Decision Making);
- Harmonisation and mobility of staff, e.g.:
  - transfer of operational staff to other states or in multinational working arrangements;
- Changes in working conditions, e.g.:
  - new organisational or social structures and/or processes.
- Changes in organisational structure of whole companies, authorities or units, e.g.:
  - Corporate privatisation;
  - Civil/military integration of operations.
- Changes in organisational culture, e.g.:
  - Innovation and change readiness.

#### Experiences of use in the ATM / safety industry / other industry context, including references / users

The Swedish Organisational Change Manager (OCM) model was successfully used in the Swedish Health Care Sector. The model can be adapted to use in other context areas, i.e. ATM as it is based on expert judgement from a variety of knowledge fields (Total Quality Management, behaviour science, health care, social dialogue with union background, other industry outside health care, change agents from the healthcare sector and outside).

These factors and items are therefore somewhat independent from the healthcare environment.
### ProACT Process Model

**Applicable to phase and activity of the ProACT Process Model**

The OCM model is a generic model and addresses context factors critical for change success. The model and assessment / checklist instrument can be used throughout the entire change process. The following are examples and rational for use which could be done in the form of a staff and management survey by management and or a regular check at regular intervals during the change process:

**Communication, participation and involvement process**

As a number of items related directly or indirectly to communication, involvement and leadership etc., the OCM can be used by the project team to test whether sufficient care is taken of the communication, participation and involvement of affected staff and where there is a need for improving the process. This could be done in the future.

**Continuous evaluation and adaptation process**

The OCM can provide inputs to a problem analysis and surfacing problems in the change process.

**Scoping phase**

Change need analysis – Communication plan development - Risk & opportunities identification - Feasibility evaluation:
The OCM model can provide inputs to the scoping of the current organisational culture and values, to check whether preparing staff for the change and ensuring their involvement are sufficient.

**Planning phase**

Project objectives definition – Establish structure and resources - Social impact assessment - Feasibility evaluation – Implementation plan development:
The OCM can surface / uncover whether required resources and means are available for the change project team.

**Implementation phase**

Implement supporting structures – Implement Training – Assess & Secure acceptance – Implement changes:
The OCM can identify whether the implementation is running as it should, what critical success factors are upcoming during the implementation phase as missing or incomplete and if improvements to the change process are successful.

**Evaluation phase**

Monitor & reinforce C & T process – Process & outcome assessment:
The OCM model can provide feedback in hindsight after the change on organisational learning, whether change outcome is as expected or has not been achieved.

### Technical description

**Description of the content / study**

The final version of the OCM model consists of four main headings (Environment for New Ideas; Planning Phase; Do, Execute Project; Study and Act). For each of these main headings different factors are assessed resulting in the 11 factors of the model. In total the model consists of 44 statements (items) (11 factors x 4 items) as presented below. Participants are asked to tick as many boxes as required to describe the current context for change.

**ENVIRONMENT FOR NEW IDEAS**

1. **Culture and Environment**
   - We discuss our core organisational values.
   - Constructive criticism from peers as well as differences of opinion is always respected.
   - We have an organisational culture that encourages risk taking and experimenting. We do not punish individuals for errors – we try to learn from them.
   - People who think differently are encouraged and seen as assets.

2. **Participation among Workers**
   - Staff are prepared to make personal sacrifices to make the improvement initiatives successful. For example, work on a Saturday.
   - Staff uses their possibilities for knowledge input in the improvement process.
   - Staff affected by the change is allowed to participate in the development of the aim (goals and objectives), measures, and the implementation of new ideas; it makes sense.
   - All information within the organisation is easily accessible and opportunities exist to discuss organisational priorities as well as any concerns staff may have.
### 3. Shared Platform
- We have a past history and experience with creating successful change.
- We have a somewhat uniform process for solving problems that is applied.
- We possess needed improvement skills and knowledge.
- We have a shared set of organisational aims and visions.

### 4. Leadership for Improvement
- Leaders have the ability to remove barriers and obtain needed support for an improvement project.
- Top management takes personal interest in the improvement project, seeks out updates regularly and gives feedback.
- Key leaders are committed and play an active role in the improvement work.
- Formal leaders are not afraid to let others lead the change work.

### 5. Tension for Change (do we feel, is it obvious)
- Staff is dissatisfied with the way things are being done because they do not work.
- Customers are dissatisfied with the current system.
- We are being outperformed by others.
- Budgets are continually being cut and fewer people are being asked to do more with less.

### PLANNING PHASE

### 6. Resources
- Adequate time is allocated for the task.
- We have access to attractive and stimulating meeting locations to conduct the improvement meetings.
- We have access to individuals from the key areas affected by the improvement project.
- There is enough money or budgetary resources allocated for the task.

### 7. Problem Analysis
- We have tried to identify persons affected by the problem and its solution.
- Staff has experienced problems with the proposed area of change in their daily work.
- We have investigated the problem enough to uncover any hidden agendas.
- There are 'objective' data supporting the customer importance of the problem that is perceived as credible data by staff.

### 8. Project Team
- The project team continuously communicates with affected staff and management.
- The project team consists of members that can represent and drive the improvement work in all parts of the affected system.
- The project team has access to needed improvement experts and educational materials.
- The project team has reassured colleagues and top management that they have understood the task.

### DO EXECUTE PROJECT

### 9. Project Initiating
- There is a clear start point and a calculated endpoint for the project.
- There is a clearly communicated project plan covering issues like roles, information strategies, and expected increased value by the improvement.
- The project has high but realistic aims developed in dialogue with top management.
- Top management or other key leaders have made it perfectly clear that the status quo is not an actionable alternative.

### STUDY AND ACT

### 10. Feedback
- Feedback surrounding the project is for learning not for judgment.
- We have the ability to show practical outcomes resulting from the improvement project.
- A key leader communicates the project’s essence and findings to the rest of the organisation.
- We have clear outcome criteria indicating if the change is an improvement.

### 11. Reflection and Learning
- The project is fun and projects a picture of the future worth working for.
- Leadership is prepared to support staffs’ personal learning in the project through practical training.
- There is flexibility in how the solutions may be implemented in different working units of the organisation.
- Those affected by the project have time for reflection and learning about the project.
## Context and Prerequisites for application

Generally, the questionnaire can be used in a variety of circumstances and contexts of change. However, participants should have sufficient understanding of the terms used. A clear description as regards the change project must be given to participants as the relevant framework for their replies.

## Equipment required for application

Requirements: paper, pencil.

## Required user qualifications

A human resources manager with familiarity questionnaire surveys is appropriate.

## Requirements / constraint concerning conditions for use

**General:**
- A high response rate is important to have covering all areas and job categories affected by the change.
- The results shall reflect subjective likelihood and not wishful thinking. Individual and open replies are to be ensured.
- General information about the tool should be given to the participants. No further instruction and training are needed.
- The outcome shall lead to reflection and conclusion what needs to be changed in the course of actions. Feedback should be given on what conclusions on the outcome have been drawn and what measures management will take to improve the process.
- Confidentiality is to be ensured.

## Measure / Response Types

The items are normally dichotic and participants are asked to tick the boxes for those statements to which they agree. A non response on a statement corresponds then with disagreement. In the study by Olsson (see 'Description of content / study: Phase 3, 3rd test) the response scale was a 7-point rating scale. If a rating scale should be used it is advisable to use a 6-point rating scale instead to avoid a middle category.

## Collected parameters and data format

Each factor comprises of four indicators each representing levels of a positive impact on the change. The more impact factors are fulfilled, the higher the likelihood of change success. High model scores indicate a good supporting context and climate for change therefore high likelihood and chance for change success.

## Results obtained and interpretation

Empirical tests of the OCM concluded that the model predicts success and failure of change to a high extent. High model scores indicate a climate in favour for successful change. The scores correlate also with staff satisfaction of staff and customers.

## Description of use

### Figure / model

No Figure/Model is available.

### Process description

**Description of the original development study:**

The Swedish Organisational Change Manager (OCM) model developed intends to use promote improvements and change initiatives and increasing their probability of success. The model was established through a process called IGP (Integrative Group Process). The purpose of IGP is to obtain knowledge from a group of experts in such a way that the model developed can predict reality as accurately as possible. This was done in three phases of development described below:

**Phase 1 (Pre-work):**

(a) Choosing an appropriate statistical model that fits the complexity and dynamics of change; the Baye’s theorem which is in simple terms a mathematical method for the likelihood of revising a prior opinion (prior odds - which are subjective) when being confronted with new evidences on the phenomenon at hand.

(b) establishing a panel of experts; the panel has to represent the change area from diverse perspectives;

(c) interviewing the experts to getting inputs for a 'straw model' by asking questions on critical knowledge they would like to have before making predictions about the outcome (success / failure) of a change project, how that could be measured, what type of answers to the items they would like to get would make them pessimistic about the outcome and what optimistic etc. From the raw material a non-duplicated list of factors/indicators was extracted and categorised; the 'straw model' had 22 different factors with each 3 – 9 indicators (items) each.
Phase 2 – Expert Meetings:
In a 2-day meeting the expert panel worked on 5 objectives:

1. A Definition of a successful change which was:
   "At the end of the project, the changes made have positive and prolonged effects regarding social/human aspects
   and/or objectively measured improvements. The new solution is a part of the daily work and meets future
   demands."

2. Based on the 'straw model' to identify those factors / indicators most important for predicting / understanding a
   successful change initiative (outcome: 11 factors/ each with 4 indicators).

3. Estimating the prior odds (subjective estimated likelihood ratio) on all 11 factors / indicators in view of the
   objective.

4. Experts agreeing on the final prior odds for the 11 factors at three levels: low – medium – high for both, presumed
   successful and unsuccessful change projects. This delivered a table of prior odds for all 11 factors based on expert
   judgement as 'normative' data which gives the expert model that could be tested against reality.

5. Testing the models validity and reliability in a theoretical model check exercise using 72 theoretical combinations
   of the factors / indicators as the 'profiles' each describing a change project and rated as regards their probability
   for success/failure by the experts. The outcome was that the two model fit very well (R² = .73 = 88% fit).

Phase 3 – Empirical Test of the OCM model:
Three tests were performed with participants from outside the expert panel:

1. Testing whether practitioners interpret the indicators in a similar way as the experts. This information was used to
   revise the linguistics of the model.

2. Ten teams with each three people (from healthcare centres) assessed the model first individually and secondly as
   a group. The inputs were also used to revise the linguistics of the indicators.

3. The third test was a test of the predictive power of the model: (a) the positive predictive value (PPV) (predicting
   successful initiatives correctly) and (b) the negative predictive value (NPV) (predicting unsuccessful initiatives
   correctly) using a big sample of practitioners from healthcare sector. The outcome was that the model correctly
   predicts 80% of the PPV and 75% of the NPV.

Evaluation

Strengths and Weaknesses of the tool
The OCM is especially useful for managers and project teams looking to increase the success of change projects. It
focuses on the improvement of actual work performance.

The predictive accuracy might be limited because the validation evidence is still limited. Further research is required to
gain better knowledge about to what extent the model can be generalised. No other strength and weaknesses of the
tool are known.

Alternative methods / tools
No alternative methods or tools are known.

Possible combination with other methods / tools
Combinations with other models, e.g. Hourglass model are possible.

Psychometric / methodological integrity description

Objectivity / (or at least) demonstration
Standardised Questionnaire.

Reliability / (or at least) demonstration

Inner reliability (see also 'Process description' for details):
Experts where given a set of 72 hypothetical profiles building on the model developed. They were asked to rate the
 chances of success for each one in percent (0 – 100%). The rated percentage score from each profile was plotted
against the expert model prediction of the same profile.

This test proofs whether the model can accurately predict the views of the experts who developed it. The correlation
between the model and the experts gave an R² = .72 (about 80% coverage between both models) which can be seen
as a good model fit.
### Validity / (or at least) demonstration

**Predictive validity:**
According to the authors the OCM correctly predicted 80% of the successful and 75% of the unsuccessful improvement initiatives. Thus, the validity of this tool in terms of predicting change success is sufficient.

**Validity:**
The OCM has only been validated in hospitals. A high correlation between the OCM score and (hospital) patient satisfaction surveys (0.74), outpatient satisfaction surveys (0.72), and a moderate correlation with work satisfaction surveys of the personnel (0.41) were found.

### Description of methodological integrity and additional Evidence or Value that the tool or study provides

The OCM is based on systematic scientific development using expert knowledge from a broad knowledge and expertise area in change. The Bayesian statistical model is used to assess the subjective likelihood ratio for success. The type of reliability tested is inner reliability in the sense of replicating the expert model. The model fit is very good (more than 80% fit).

The weakness of the design was, that the same experts that identified and rated the impacts of the factors / indicators were used to rate random profiles of the same indicators in terms of likelihood (in %) of success.

The predictive validity of the model using practitioners was tested using data from real change environment and using the OCM as the predictor for success / failure. The correct prediction of successes (80%) and of failures (75%) shows that the model has good predictive validity. There is no further data available from psychometric studies of the OCM.

In summary it can be concluded that the OCM is not a standard psychometric instrument but a model. ISO 10075 criteria do not apply in this case.
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EXECUTIVE SUMMARY

<table>
<thead>
<tr>
<th>Name of method or tool etc:</th>
<th>Type:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team Quality Questionnaire (TQQ)</td>
<td>Questionnaire</td>
</tr>
</tbody>
</table>

Abstract:

The Team Quality Questionnaire (TQQ) is used to assess team quality independent from the occupational field in which the team operates. The TQQ consists of five factors of team quality: social-emotional (e.g. support within team), team atmosphere (e.g. work satisfaction), leadership quality (e.g. management quality), performance (e.g. continuous improvements) and flow of communication (e.g. exchange of experience). The five factors are measured with 20 items. An overall score for team quality is estimated. The TQQ reflects changes in team quality over a period of time; the questionnaire was developed as an evaluation instrument. It proved especially useful for team leaders in action research setting, survey-feedback approaches, benchmarking studies and action research.

Alternatively a Team Effectiveness Audit Tool (TEAT) is proposed. The questionnaire measures six team effectiveness factors: Team synergy, Performance objectives, skills, Use of resources, Innovation and Quality. The questionnaire has proved useful in providing a context for improvements in effectiveness of working teams in organisations. The questionnaire was developed based on EFQM (European Federation for Quality Management) principles. The results can be used by the teams themselves to address areas for improvement.

ProACT Process Model

References

Developer and source

TQQ:
Contact: wolfgang.kallus@uni-graz.at or info@begleitforschung.de (Jens Brandt).
Institut für Begleitforschung und psychologisches Qualitätsmanagement
Wendelweg 10
D-97084 Würzburg, Germany
Phone: +49 (0)931 - 78 41 686
Website: http://www.begleitforschung.de

TEAT:
Down Lisburn H&SS Trust
Lagan Valley Hospital, Lisburn/ Northern Ireland (UK)

Year of development / publication, updates etc.

TQQ: 1988, but continuous development to the final version of 2006.
Team Quality Questionnaire (TQQ)  

General description

**Purpose of measurement / study**
Both, the TQQ and TEAT can be used to assess team quality / team effectiveness independent from the occupational field.

**Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)**
Questionnaire

**Effort required (time, people, equipment, resources); usability and practicability**
It takes about 10 minutes to finish the questionnaire. Usability and practicability are given. The data analysis can be performed manually via Excel or SPSS or STATISTICA etc.

**Population – Demographic and or Professional Group for which the method is intended for**
The TQQ was designed for different populations. The data from different small samples of ATCOs are available; otherwise any employee (team member) can be questioned. The TEAT was developed for use in a service (clinic) environment. The items are context free and the instrument can be used for other populations independent from occupational background.

**Object of measurement / study (individual, team, profession, department, company)**
TQQ: Individual / Team / Department. TEAT: All team members in a working team.

**Language (other than English)**
TQQ: German and English. TEAT: English.

**Cost information / Copyrights / Agreements needed**
TQQ: A small fee is asked for the questionnaire licence. For details, please contact the authors: wolfgang.kallus@uni-graz.at or info@begleitforschung.de (Jens Brandt)
TEAT: The questionnaire is printed in Bateman, Wilson & Bingham (2001). See list of items further down.

ATM specific mapping

**Guidance for use in the ATM Context**
Both, the TQQ as well as the TEAT are recommended to be used in change process that impact on already formed teams. This includes regrouping and reorganising the work environment of teams or rearranging working teams. The most relevant change scenarios where both apply are:

- Consolidation, integration and outsourcing of services and units, e. g.:
  - consolidation of control centres;
  - remote operations and maintenance settings.

- Implementation of international working structures, e.g.:
  - Functional Airspace Blocks (FAB);

- Implementation of future operational concepts and systems, e.g. encompassing:
  - significant changes of roles and responsibilities in operational jobs;
  - significantly increasing automation of tasks or functions;
  - more integrated ATM processes characterised by wide information sharing, enhanced CDM (Collaborative Decision Making);
  - new technologies (e.g. Data link, 4D trajectory based planning and control, support tools for separation delegated to flight crew, conflict resolution and collision avoidance automation support).

- Harmonisation and mobility of staff, e.g.:
  - transfer of operational staff to other states or in multinational working arrangements;

- Changes in working conditions, e. g.:
  - new shift/rostering cycles and working hours (e.g. to flexibly adapt to variations in traffic amount);
  - new organisational or social structures and/or processes;

- Certification and regulatory implementation activities, e.g.:
  - implementation of harmonised safety management standards;

- Changes in organisational structure of whole companies, authorities or units, e.g.:
  - Civil/military integration of operations.
Experiences of use in the ATM / safety industry / other industry context, including references / users

**TQQ:** First experiences of TQQ are mentioned in the EUROCONTROL deliverable: “Integrated Task and Job Analysis of Air Traffic Controllers - Phase 3: Baseline Reference of Air Traffic Controller Tasks and Cognitive Processes in the ECAC Area”. More information is available on: http://www.eurocontrol.int/humanfactors/public/standard_page/ATCO_Task_Analysis.html

The TQQ has also been used by Austrocontrol in the Vienna Change and Transition study.

**TEAT:** No known use of the questionnaire in the ATM environment yet.

### ProACT Process Model

<table>
<thead>
<tr>
<th>Applicable to phase and activity of the ProACT Process Model</th>
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The TQQ and TEAT questionnaires can be used in different stages of an organisational change process as can be seen in the overview.

#### Communication, participation and involvement process

To verify if the communication lines are working, the team(s) are correctly informed and the participation process is appropriately accepted by team(s) and staff. The TEAT assesses team members perception of having clear performance objectives to be achieved during the change, have adequate skills and are aware of the standards that shall be applied.

#### Continuous evaluation and adaptation process

Providing valuable information about the perception of the change process in a team; including effective skill and resources usage and synergies.

### Scoping phase

- Communication plan development - Risk & opportunities identification:
- Providing information on the expected communication from management to a team and help to identify the acceptance level of the change process by a team. Areas for improvement of team effectiveness can be assessed using the TEAT.

### Planning phase

- Establish structure and resources - Social impact assessment - Risk & opportunities analysis - Feasibility evaluation:
- Providing information on critical items for teams contributing to the problem analysis and the feasibility evaluation.

### Implementation phase

- Implement supporting structures - Assess & Secure acceptance:
- Strengthen the support from teams and their effectiveness and to secure team acceptance of the change.

### Evaluation phase

- Monitor & reinforce C & T process – Process & outcome assessment:
- Providing information on exchange of experiences, sharing of knowledge and rewarding team innovations (finding solutions and solving problems in TEAT) in the team and the level of information in the team.

### Technical description

**Description of the content / study**

The **Team Quality Questionnaire (TQQ)** is used for the assessment of team quality independent from the occupational field. The TQQ consists of the following five factors of team quality:

1. **Social-emotional area:** Support within the team, dealing with conflicts, co-operating without conflicts, communication quality, integration of new team members.
2. **Team atmosphere:** Team atmosphere, work satisfaction, reduced stress and identification with the team.
3. **Leadership quality:** Management quality, communication quality, participation, qualification in the team and self-control of the team members.
4. **Performance:** Continuous improvement process, active realisation of plans and constructive task management.
5. **Flow of communication:** Exchange of experience and level of information in the team.

The five factors are measured with 20 subscales. An overall score for team quality is estimated. Especially in action research settings this feedback proved very useful for team leaders.

The **Team Effectiveness Audit Tool (TEAT)** is used to address all organisational priorities including team processes and individual team members’ needs. The TEAT is an audit tool to be used by teams to self-analyse their team productivity and quality in respect to those aspects that an organisation needs to hold up and needs to monitor during situations of change in particular. The six core themes of effectiveness the TEAT questionnaire addresses are:

1. **Team synergy:** Sense of purpose that is shared among team members;
2. **Performance objectives:** The team has clear performance objectives that are monitored on ongoing basis;
3. **Skills:** Team members are adequately trained and have the competence they need to do their work and their skills are adequately used;
4. **Use of resources:** Adequate use of all available resources (people, finances, equipment etc) is made and employed to optimal potential;
5. **Innovation:** The team looks constantly to improve way of working or solving problems;
6. **Quality:** The team has high customer awareness and observes the standards that apply.
Context and Prerequisites for application

The TQQ and the TEAT are paper-pencil questionnaires and can be used at any time and any place. General advice to obtain a high response rate: the questionnaire is filled in during an allocated timeslot at work; the questionnaire is filled in during work hours (not leisure time).

The TEAT is a self-administered tool for teams.

Equipment required for application

Requirements: paper, pencil, statistical software for analyses such as Microsoft Excel, SPSS, or Statistica.

Required user qualifications

A human resources manager with familiarity of supervising questionnaire surveys and using simpler statistical methods is also appropriate.

The TEAT can be used during team workshops and there is no need for special expertise in interpreting the outcome. The results of the questionnaire will be discussed by the teams directly to improve and address difficult problems. Some team facilitation should be foreseen.

Requirements / constraint concerning conditions for use

No specific requirements or constraints.

General remarks:
- To obtain a high response rate the questionnaire should be filled in during an allocated timeslot at work; the questionnaire should be filled in during work hours (not leisure time).
- General information about the tool should be given to the participants. No further instruction and training are needed.
- Dependent on purpose of the measurement general feedback could both be given to the team and/or organisation, as well as specific feedback could be given to the individual as an intervening input to individual learning and development.
- Confidentiality is to be ensured.

Measure / Response Types

TQQ: The items assess frequencies of states and events within a defined timeframe (“Within the last four weeks”). The 7-point rating scale ranges from 0 (never) to 6 (always).

TEAT: Items

Collected parameters and data format

TQQ: Overall score for team quality and subtest values. Five factors can be measured based on the 20subscales of the questionnaire. The scores of each subscale will be averaged to get a summary score reflecting the dimension of a factor.

TEAT: The original version of the questionnaire consists of 44 items and is presented below:

Introduction:
The Team Effectiveness questionnaire is designed to help teams measure their effectiveness. It examines six areas of team working by making a series of statements, which are rated by those who are completing the questionnaire. The rating mechanism helps provide indicators of effectiveness in each area.

The questionnaire can be used for team building activities by helping team members examine the way in which they currently function and identify areas where strengthening should occur. It can also be used as a means of assessing organizational effectiveness through establishing standards of performance and then benchmarking work based teams throughout the organisation or other organisations.

Marking system:
The questionnaire consists of 6 areas of questions. Each contains a number of statements, which require a response. A response should be given by ticking the relevant box using the following scoring system:

(1) strongly disagree,
(2) disagree
(3) undecided
(4) agree
(5) strongly agree.
### Team Synergy

1. The membership of the team can be readily identified
2. There is a common sense of purpose for the team
3. Members are clear about their roles within the team
4. There is effective communication within the team
5. Individuals feel valued as members of the team
6. The team is highly valued by other parts of the organisation
7. Individuals feel proud to be a member of the team
8. Morale within the team is high
9. There is effective and appropriate leadership within the team
10. All individuals perform to the best of their ability within the team

### Performance Objectives

11. There are clear financial targets established for the teams activities
12. There are targets for levels of work activity for the team
13. There are regular reports on how the team is meeting its targets
14. The team is involved in agreeing how work activity targets are set
15. The team is aware of the business objectives of the organisation and is committed to achieving them.
16. The team meets its financial and work activity objectives

### Skills

17. All members of the team are adequately trained and are competent to do the professional aspects of the job.
18. All members of the team are adequately trained in the administrative systems and procedures relating to their work
19. There is a formal system in place to identify staff development and training needs
20. Staff training and development needs are systematically identified
21. Resources are identified and made available for staff training
22. Team members are competent to perform a range of jobs within the team
23. There is willingness to be flexible and perform other roles and jobs within the team
24. Training is highly valued within the team

### Use of Resources

25. Members of the team feel they are fully utilized
26. We ensure that we make the maximum practical use of our buildings and equipment
27. The team keeps wastage to a minimum
28. The team has the resources it needs to do the job and meet the targets it has been set
29. We ensure that all the necessary systems for monitoring and controlling the use of resources are in place
30. The team does not feel inhibited by systems and controls

### Innovation

31. Members of the team are encouraged to try new work methods or introduce new services
32. The team is involved from the outset in new developments relating to their services or products
33. Innovation is rewarded within the team
34. Problems relating to services or products are quickly identified
35. Once identified the team is quick to address the problem
36. Problem solving is seen as an opportunity for learning and growth

### Quality

37. Members of the team have a high level of customer awareness
38. We have clearly defined who our clients/customers are
39. There are clearly defined standards for working practices within the team
40. Standards are monitored on a regular basis
41. Feedback on the monitoring of standards is given to the team on a regular basis
42. There are measurable standards for outcomes which are monitored
43. The team meets the organizational standards for dealing with complaints
44. Complaints are regularly reviewed and lessons learned are applied in a systematic way

### Results obtained and Interpretation

An overall score for team quality is provided. The scores of each subscale will be averaged to get a summary score reflecting each of the five factors.
### Description of use

**Figure / model**

The [Team Quality Questionnaire (TQQ)](#) is used for the assessment of team quality. An overview of some of the factors and their relationships are provided in the figure below.

#### Level of Team quality:

![Graph showing the relationship between various factors of team quality.](image)

The [TEAT](#) is a tool and is based on basic organisational needs that are to be followed by effective teams. The idea is that teams are able to learn and improve their effectiveness and deliver effective solutions based on own insight and giving teams the power to ‘harness individual team members’ energy and skills (to) empower the group dynamic’ ([Bateman et al., 2002](#)) if they were aware of the need of the organisation.

#### Process description

No process descriptions or underlying model exists for the FQQ and TEAT questionnaire.

### Evaluation

#### Strengths and Weaknesses of the tool

The feedback is well usable for team leaders and managers, especially in action research settings. The Team Quality Questionnaire is sensitive concerning changes. It has been developed throughout practical needs.

#### Alternative methods / tools

A couple of alternative tools concerning team quality are available.

#### Possible combination with other methods / tools

Combination with other tools, e.g. OCM Model and/or SHAPE tools, are possible.

### Psychometric / methodological integrity description

#### Objectivity / (or at least) demonstration

Standardised Questionnaire.

#### Reliability / (or at least) demonstration

**FQQ:** The internal consistencies (Cronbach’s Alpha) for the five factors varies between from .83 to .90 (17% to 10% error in measurement), which indicates a very good precision of measurement compared to other questionnaires:

- Social-emotional area: .87 (13% error in measurement)
- Team climate: .86 (14% error in measurement)
- Leadership quality: .83 (17% error in measurement)
- Performance: .90 (10% error in measurement)
- Flow of information: .97 (13% error in measurement)

**TEAT:** The inter-item reliability (correlation between items and overall score is reported to be very high: (N=400 representing 37 different teams) and ranged between 0.97 – 0.98; overall Cronbach’s Alpha was 0.98. No internal consistencies are reported for the six separate scales.
**Validity / (or at least) demonstration**

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FQQ:</strong></td>
<td>According to the authors construct and criterion validity (team performance) have been established.</td>
</tr>
<tr>
<td><strong>TEAT:</strong></td>
<td>Several factors analysis (Catell’s Principal Components analysis) revealed consistently four factors with Eigenvalues &gt; 1.0:</td>
</tr>
<tr>
<td>Factor 1:</td>
<td>(56% variance): Effectiveness of team outputs;</td>
</tr>
<tr>
<td>Factor 2:</td>
<td>(10% variance): Team identity / Team synergy;</td>
</tr>
<tr>
<td>Factor 3:</td>
<td>(3.6% variance): Clarity of performance objectives;</td>
</tr>
<tr>
<td>Factor 4:</td>
<td>(2.4% variance): Team role clarity.</td>
</tr>
</tbody>
</table>

There is statistical evidence that the TEAT applied in two occasions (1 year) showed improvements in 8 out of 11 teams over all six domains whilst in the three other teams there was no improvement or a decline.

**Description of methodological integrity and additional Evidence or Value that the tool or study provides**

Both, the FQQ and the TEAT are questionnaires with sufficient reliability but insufficient validity evidence and therefore are recommended to be used for the purpose of orientation (but not as a precise measure according to ISO 10075-3):

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectivity:</strong></td>
<td>Is ensured (standardised application and deriving results etc).</td>
</tr>
<tr>
<td><strong>Reliability:</strong></td>
<td>Cronbachs Alpha internal consistency reliability was used and is sufficient in both cases and in all subscales of the FQQ. There is no such information on subscale level for the TEAT.</td>
</tr>
<tr>
<td><strong>Validity:</strong></td>
<td>Some evidence on validity is available (factorial) for sufficient to accept the tools as a measure for orientation purpose.</td>
</tr>
<tr>
<td><strong>Sensitivity of measurement:</strong></td>
<td>Ensured (more than 3 steps / item in the answer categories). TEAT: The use of a 5 – steps answer scale allows a middle category ‘undecided’. This should be avoided.</td>
</tr>
<tr>
<td><strong>Diagnostics:</strong></td>
<td>There is limited evidence for the fact that the results obtained in the TEAT indicate that most teams could improve their effectiveness over time; it is not clear whether this can be attributed to learning from the questionnaire results.</td>
</tr>
<tr>
<td><strong>Generalisability:</strong></td>
<td>Provided that full anonymity is ensured the scales should deliver valid results.</td>
</tr>
<tr>
<td><strong>Usability / Acceptance:</strong></td>
<td>The questionnaires can be applied by the teams themselves without specific expertise. There are no known problems with the acceptance of the instruments.</td>
</tr>
</tbody>
</table>
Belbin® Team Role Self-Perception Inventory (SPI)

EXECUTIVE SUMMARY

Last update: 14/08/2010

Name of method or tool etc: Belbin® Team Role Self-Perception Inventory (SPI)

Type: Questionnaire

Abstract:

The Belbin® Team Role Self-Perception Inventory was developed based on nine years of worldwide research on managers’ behaviour. The research for studying teams and managers’ behaviour in teams was based on a business game, a computerised simulation, done during a one-week management course. Managers were placed in teams of varying composition to take part in the exercise. Participants’ core personality traits, intellectual styles and their behaviour were assessed during the simulation using objective methods (standardised questionnaires and behaviour observation rating scales). As the research progressed, first eight and later nine different clusters of behaviour were identified, called “Team Roles”.

Team Roles are defined by Belbin (1981) as “a pattern of behaviour characteristic of the way in which one team member interacts with another so as to facilitate the progress of the team as a whole”. The composition of a team in terms of the team roles was predictive of how the teams performed in the subsequent management courses. Five principles for building effective teams were derived from the research:

1. Each member contributes to achieving the objectives by performing both a functional (technical, expert) role and a team role.
2. An optimal balance of both functional and team roles is required, depending on the teams’ task.
3. Team effectiveness depends on the extent to which team members correctly recognise and adjust to the relative strength of other within the team.
4. Personality and mental abilities fit members for some team roles and limit their ability to play other roles.
5. A team can deploy its technical resources to best advantage only when it has the range and balance of team roles to ensure efficient team work.

The current online version of the SPI identifies the nine different team roles which ideally should be represented in each team. The roles are: (1) Plant, (2) Resource Investigator, (3) Co-ordinator, (4) Shaper, (5) Monitor – Evaluator, (6) Teamworker, (7) Implementer, (8) Completer – Finisher (9) Specialist.

The distribution of roles in the team makes it possible to predict how decisions within the team are made and if the team keeps good company. The team role self-perceptions allow also to derive options for team development. During a change process the results show options for rearrangement of already formed teams or for forming new teams.
### References

**Developer and source**


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Website: www.belbin.com

**Year of development / publication, updates etc.**

1981 (original research study).  
It is to be noted that the SPI as an instrument to measure an individual’s team role was developed without recourse to the original research study.

### General description

#### Purpose of measurement / study

The Belbin® Team Role Self-Perception Inventory (SPI) allows identifying nine different types/roles of team members and helps to improve self-knowledge and understanding among individuals and comparing teams. It is mainly focused on behaviour of team members and as such can contribute to individual and team performance.

#### Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)

Questionnaire

Although various forms of questionnaires exist that are based or said to be based on the Belbin team role classification there is no sanctioned (that is, recognised and allowed to be used by Belbin® company) self-scoring method available for completing the Belbin Self-Perception Inventory (SPI). The company provides online testing with a downloaded SPI form and gathering up to six Observer Assessments.

#### Effort required (time, people, equipment, resources); usability and practicability

It takes about 10 to 15 minutes to finish the 4 pages questionnaire online.  
Usability and practicability are given. An online data analysis and expert report is sent to participant. The data is analysed using a specific software, e-interplace®. The website info states: “The strength of the (…) software rests in its emphasis on construct validity: using multiple sources of evidence to draw a conclusion. The system's outputs are designed to take account of the degree of consensus on observed behaviour.”

#### Population – Demographic and or Professional Group for which the method is intended for

The tool was originally designed for managers responsible for teams, but can be used by any team member. Observer Assessments can be gained from other co-workers or managers (360°).

#### Object of measurement / study (individual, team, profession, department, company)

Individuals and Teams.

#### Language (other than English)

The online version is available in English only. A German language questionnaire version of eight team roles (the role of the Specialist is not included) based on the Belbin team role classification is available from:  
Andreas Patrzek, 83673 Bichl, Kreutweg 4  
www.patrzek.de  
Email: mail@fragekompetenz.de

The questionnaire version includes a simple recording sheet, a short description of the theoretical background of the Belbin team role classification etc.
### ATM specific mapping

#### Guidance for use in the ATM Context

The Belbin® Team Role Self-Perception Inventory can be used in change processes that affect existing teams and for newly formed teams to get an impression on how team members cooperate together. The results describe the individual’s self-perceived role in a team. The most relevant change scenarios for which the Belbin® Team Role Self-Perception Inventory (SPI) applies are all scenarios that require technical/functional teams or expert and management teams tasked to work out solutions agree and decide on a best way forward and which require a well balanced team composition. This could be the case in:

- Consolidation, integration and outsourcing of services and units, e.g.:
  - consolidation of control centres;

- Implementation of international working structures, e.g.:
  - Functional Airspace Blocks (FAB);

- Implementation of future operational concepts and systems, e.g. encompassing:
  - significant changes of roles and responsibilities in operational jobs;
  - significantly increasing automation of tasks or functions;
  - more integrated ATM processes characterised by wide information sharing, enhanced CDM (Collaborative Decision Making);
  - new technologies (e.g. Data link, 4D trajectory based planning and control, support tools for separation delegated to flight crew, conflict resolution and collision avoidance automation support).

- Harmonisation and mobility of staff, e.g.:
  - transfer of operational staff to other states or in multinational working arrangements;

- Changes in working conditions, e.g.:
  - new shift/rostering cycles and working hours (e.g. to flexibly adapt to variations in traffic amount);
  - new organisational or social structures and/or processes;

- Certification and regulatory implementation activities, e.g.:
  - implementation of harmonised safety management standards;

- Changes in organisational structure of whole companies, authorities or units, e.g.:
  - Corporate privatisation;
  - Civil/military integration of operations.

#### Experiences of use in the ATM / safety industry / other industry context, including references / users

The questionnaire has not yet been used in the ATM context. No further information on the potential for the use of the SPI in the ATM context is currently available.

### ProACT Process Model

#### Applicable to phase and activity of the ProACT Process Model

With increasing importance of working in teams to resolve complex issues which are typical for situations of change questions of how to compose a team of persons and achieve a ‘best fit’ solution for effective work and team performance and achieving best possible results are of high interest. The composition of teams must allow for complementary (opposite or complementing the roles of others) and supplementary roles (people of same or similar role and style).

The following are only some examples that aim to trigger the understanding of the contributions that team roles can make in the course of a change project to achievements critical for the overall success of a change project.

**Scoping phase**

**Risk & opportunities identification:**

The SPI results provide information that helps to compose teams. For this phase the functional role of a conscientious and complete analysis of the situation and an objective and cool calculation of risks and of existing opportunities could be key.
### Planning phase

**Establish structure and resources - Social impact assessment - Risk & opportunities analysis:**

The SPI results provide information that helps to compose teams. Many different aspects, including objective analysis of the situation and of ‘soft’ factors are key but also developing feasible, practical and ‘workable’ plans that are followed. The roles of good communication and of involving others, of co-ordination and bringing others in the organisation on board and into the plan is also a key role to have in a leading team during this phase.

### Implementation phase

**Implement supporting structures - Assess & Secure acceptance:**

The SPI results provide information that helps to compose teams. ‘Soft’ factors are key in this phase and respective roles to involve others and communicate.

### Evaluation phase

**Monitor & reinforce C & T process:**

The SPI provides information on exchange of experiences from different angles to gather lessons learned for the future and having a balanced outcome evaluation.

### Technical description

#### Description of the content / study

The original study on team work roles has been explained in short in the Summary box which provided the nine team roles as a classification scheme.

The SPI form developed by Belbin (1981) to be filled in by an individual is accompanied normally by independent observer assessments (between 1 – 6 other observers that know the person well) of the individual in what they see is the perceived team role they play. The data from these assessments compliments the self-perception on team roles and gives additional information on the strength (and weaknesses) of the person as a team member.

The SPI questionnaire form for individual use is composed of seven sections with the following heading statements:

I. What I believe I can contribute to a team…
II. If I have a possible shortcoming in team work, it could be that …
III. When involved in a project with other people…
IV. My characteristic approach to group work is that…
V. I gain satisfaction in a job because…
VI. If I am suddenly given a difficult task with limited time and unfamiliar people…
VII. With reference to the problems I experience when working in groups…

These heading statements are complemented by 10 sub-statements (items) to be rated by distributing points i.e. by sorting the items according to the rank-order (highest ranking statement receives 10 points, second highest 9 points…). The scores are collated as per individual and the person is assigned to a behavioural type according to the preferred responses. This leads to a primary and a secondary role that the individual prefers to have (and is most probably successful) in a team. This gives the (individual) self-perception team role profile.

#### Context and Prerequisites for application

The online questionnaire can be used at any time and any place which has access to the Internet. Other versions of offline (printed) questionnaires could be distributed during team sessions.

#### Equipment required for application

Requirements: for paper and pencil versions no further equipment. The questionnaires can be ordered via the website from Belbin Associates online.

#### Required user qualifications

The online version is analysed by the specific software e-interplace®. This software uses the multiple sources of evidence (from the individual, from observers and from a rich database of comparative (norm) data) to draw a conclusion. The degree of consensus on observed behaviour is what the system puts most emphasis on.

The output provided in a file sent to the individual that has taken the SPI provides a detailed and comprehensive description of all main findings in the context of team work and in view of the observers and from the database (norm) data. The use of this information needs good background knowledge on human factors and teamwork and human resources management.

For the offline (paper) versions a human resources manager with familiarity and in-depth knowledge of the Belbin team role concept and the research findings and good understanding of the limits of the methodology is required. Good background knowledge on human factors and teamwork and human resources management is required to apply the findings in team building and facilitation.
Belbin® Team Role Self-Perception Inventory (SPI)  

**Requirements / constraint concerning conditions for use**

**General remarks:**

- The questionnaire requires an investment. The purpose and the expected benefits must be clear and must be justified in a rational way before deciding to employ the approach.
- The SPI taps on complex and sensitive issues (roles are linked to personality and behaviour styles). A sensible approach in data handling and using the results – especially strength and weaknesses – must be followed.
- General information about the questionnaire should be provided to the participants and the purpose of using it must be explained and agreed by all members.
- Specific feedback should be given to the individual: what roles are their primary and secondary roles in which they will most probably have success and which they should focus on.
- Specific team feedback should also be given to existing teams as to their current composition, the strength and weaknesses available in the team, how best to use available team strength etc. is probably the most important output with direct impact on team performance and achievements.
- Confidentiality has to be established in the Team and is dependent.

**Measure / Response Types**

The scale used for the rating of the answer statements can be described as a ‘restricted (and thus forced) choice’ scale. Ten statements in each of the seven sections of the questionnaire are to be rank-ordered according to agreement with the statement; the highest order statement receives a 10, the second highest a 9 and so forth (ipsative measurement).

**Collected parameters and data format**

Rank-order scale (ipsative answers of preference for the descriptive statements); numeric. An ipsative scale measures are ‘forced choice’ – the person has to take a decision to which alternative in the answers it agrees more. In the case of the SPI a rank order of the answers has to be produced. The ranks (as measurement values) for the different alternatives that are to be ranked are thus not independent. This does not allow applying standard statistical measures (i.e. those based on covariance) and factor analysis. The forced choice measure over nine different alternatives puts higher cognitive demand on people which could lower the reliability further.

**Results obtained and interpretation**

The individual questionnaire results are compiled according to the preferred answers that correspond to the nine different team roles as defined by Belbin (1981). Each team role has its own characteristics and behaviours, strength and weaknesses associated with it as explained in the table below:

<table>
<thead>
<tr>
<th>Team Role</th>
<th>Contribution / Strength</th>
<th>Allowable Weakness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant</td>
<td>Creative, imaginative, unorthodox. Solves difficult problems</td>
<td>Ignores incidentals, too pre-occupied to communicate effectively</td>
</tr>
<tr>
<td>Resources</td>
<td>Extrovert, enthusiastic, communicative. Explores opportunities. Develops contacts</td>
<td>Over-optimistic, loses interest once initial enthusiasm has passed</td>
</tr>
<tr>
<td>Investigator</td>
<td>Mature, confident, a good chairperson. Clarifies goals, promotes decision-making, delegates well.</td>
<td>Can be seen as manipulative, offloads personal work</td>
</tr>
<tr>
<td>Co-ordinator</td>
<td>Challenging, dynamic, thrives on pressure. The drive and courage to overcome obstacles.</td>
<td>Prone to provocation, offends peoples feelings</td>
</tr>
<tr>
<td>Shaper</td>
<td>Sober, strategic and discerning. Sees all options. Judges accurately.</td>
<td>Lacks drive and ability to inspire others</td>
</tr>
<tr>
<td>Monitor Evaluator</td>
<td>Co-operative, mild perceptive and diplomatic. Listens, builds averts friction.</td>
<td>Indecisive in crunch situations</td>
</tr>
<tr>
<td>Teamworker</td>
<td>Disciplined, reliable, conservative and efficient. Turns ideas into practical actions.</td>
<td>Somewhat inflexible, slow to respond to new possibilities</td>
</tr>
<tr>
<td>Implementer</td>
<td>Painstaking, conscientious, anxious. Searches out errors and omissions. Delivers on time.</td>
<td>Inclined to worry unduly, reluctant to delegate</td>
</tr>
<tr>
<td>Completer</td>
<td>Single minded, self starting, dedicated. Provides knowledge and skills in rare supply.</td>
<td>Contributes on only a narrow front, dwells on technicalities</td>
</tr>
</tbody>
</table>

A Team or Group report is established, describing the profile of and allocating the different roles to each of the team members. The Team Report can be provided for a group of minimum 3 and maximum 15 people. The individual team role description and a team role analysis and reporting is available online.

For an example, please click on this link:

http://www.belbin.com/content/page/1982/Belbin_e-interplace_Sample_team+group_report.pdf
### Description of use

<table>
<thead>
<tr>
<th>Figure / model</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is no model or a figure that represents the theoretical basis or concept of team work roles as established in the Belbin Team Role Self Perception Inventory (SPI).</td>
</tr>
</tbody>
</table>

Team roles are described as a cluster (rather than a singular) or set of related characteristics of a person. In factor analytical terms they are second order factors (in accordance with Cattell et al. (1970) in regard to the 16PF personality research and findings: people, who fulfil similar functions or roles, tend to share similar personality and ability characteristics.

And it is these observations that were made during the nine year research study that are the basis for the SPI. This is the reasoning also behind the validation study of the nine team roles reported below (Dulewicz, 1995).

### Process description

| Make sure that the SPI is the appropriate tool and that the information that it delivers is relevant to the problem in the change process at hand. |

Team members must be informed and should be fully involved and support the application. They should be informed in a way that ensures that they have control of the process and that the results obtained on their team roles will give them choice as to what role they can fulfil in the team. The outcome should be made available to all team members.

An information sheet, an informative presentation and consultation session in which all questions can be asked should be arranged. The commitment for the participation of the team should be affirmed.

After data analysis, inform the team members about the results and their interpretation including the discussions on further performance of the Team.

### Evaluation

<table>
<thead>
<tr>
<th>Strengths and Weaknesses of the tool</th>
</tr>
</thead>
</table>

**Strength:** High face validity, easy to understand and valuable input to individuals and to teams that help better understanding and achieving success in the work. Testing via internet delivers quick results. Outcome and descriptions of roles – strength and weaknesses and how the role of the individual sits with their roles and abilities and in general (norm sample) is done in a professional and well balanced manner and will be perceived as helpful. The tool has a wide reputation in practical applications.

**Weaknesses:** Team roles are not fixed personality aspects only but people can and do behave differently in different situations and can adapt to a role that they find themselves in. This aspect should be stressed in interpreting results. There is still a debate on the psychometric quality and the validity of the SPI.

<table>
<thead>
<tr>
<th>Alternative methods / tools</th>
</tr>
</thead>
</table>

Different team quality questionnaires, like the **Team Quality Questionnaire (TQQ)**.

<table>
<thead>
<tr>
<th>Possible combination with other methods / tools</th>
</tr>
</thead>
</table>

Possible to combine with most methods and tools. Could be combined with the **Hourglass model**.

<table>
<thead>
<tr>
<th>Psychometric / methodological integrity description</th>
</tr>
</thead>
</table>

**Objectivity / (or at least) demonstration**

Standardised Questionnaire.
Belbin® Team Role Self-Perception Inventory (SPI)

<table>
<thead>
<tr>
<th>Reliability / (or at least) demonstration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investigations of the psychometric properties of the SPI are rare and Belbin (1993) declined that the standard psychometric procedures are a correct approach to the SPI. Team roles are not fundamental personality traits but clusters of related person characteristics.</td>
</tr>
<tr>
<td>Internal consistency is expected to be lower than in a psychometric (one-dimensional) construct. The ipsative scale (forced choice) lets expect that reliability is indeed lower than usual.</td>
</tr>
<tr>
<td><strong>Reliability:</strong> The Cronbach’s Alpha was below .65 (more than 35% error in measurement) for six of the eight subscales (Furnham et al. 1993), the lowest being .35 for the team role “Plant”. The sample consisted of N = 102 (50% male). The ipsative scale of preference was in this analysis transformed into a rating scale with 9 = totally agree – 1 = disagree which is not in line with the original concept of the scale. In a more recent study and based on a German version of the SPI (in German, University Kiel) internal consistency (Cronbach) and split-half reliability were between .35 - .60 and thus lower than allowed for a psychometric instrument.</td>
</tr>
<tr>
<td><strong>Validity:</strong> Furnham etc al (1993) found low discriminate validity for the different team roles and the convergent validity (factor analysis) with other personality measures. Low discriminate validity evidence and convergent validity analysed using different statistical measures were found in the German version (University Kiel).</td>
</tr>
<tr>
<td>In summary: there is little psychometric evidence in terms of internal consistency or other measures of reliability available from scientific literature in support to the psychometric properties of the scale. The scale should only be used for information and orientation purposes.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Validity / (or at least) demonstration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Validity is proven in a couple of studies, especially in intervention studies with respect to content and construct (according to the author).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description of methodological integrity and additional Evidence or Value that the tool or study provides</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Belbin SPI is based on long and systematic development of the concept and rational of team work and team roles. The emphasis in this approach is on providing insight and understanding of those roles and team performance. However, psychometric evidence that is required for a psychometric instrument of this calibre and for the purposes to which the SPI is employed show serious shortcomings.</td>
</tr>
<tr>
<td>In summary: High face validity (as in many typological approaches) contrasts to weak psychometric data.</td>
</tr>
<tr>
<td>The SPI instrument has not sufficiently high reliability and validity to be used as a measurement instrument that meets the requirements of ISO 10075-3:</td>
</tr>
<tr>
<td><strong>Objectivity:</strong> Is ensured (standardised application and deriving results etc).</td>
</tr>
<tr>
<td><strong>Reliability:</strong> Cronbachs Alpha is mostly used to demonstrate reliability and shows that only one scale reaches the .70 level of reliability; all other scales show lower or very low internal consistency.</td>
</tr>
<tr>
<td><strong>Validity:</strong> The outcomes of various studies show that the SPI has low discriminate an convergent validity.</td>
</tr>
<tr>
<td><strong>Sensitivity of measurement:</strong> Ensured, the answer mode requires high cognitive skills.</td>
</tr>
<tr>
<td><strong>Diagnosticity:</strong> Not enough evidence available.</td>
</tr>
<tr>
<td><strong>Generalisability:</strong> Not known.</td>
</tr>
<tr>
<td><strong>Usability / Acceptance:</strong> The SPI can be easily applied and there are no known problems with the acceptance of the questionnaire and the approach. The instrument can help to understand and support team processes better and can help to improve team work and cooperation between team members. The instrument also helps increasing the sensitivity for intra-team processes.</td>
</tr>
<tr>
<td>Individual SPI results are prone to ‘self assessment –bias which increases the common variance part (halo effect). The role assessments as seen by other colleagues and supervisors will help to become sensitive to this type of bias.</td>
</tr>
</tbody>
</table>
### EXECUTIVE SUMMARY

<table>
<thead>
<tr>
<th>Name of method or tool etc:</th>
<th>Type:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatigue- Monotony- Saturation- Stress Questionnaire (BMS)</td>
<td>Questionnaire</td>
</tr>
</tbody>
</table>

**Abstract:**

The Fatigue- Monotony- Saturation- Stress Questionnaire (BMS) measures subjective experienced short-term effects of work related strain in terms of three different psychic effects: stress, fatigue, psychic saturation at work. These effects are deficiencies that are detrimental to health, performance, motivation and development. These short-term effects are known to lead in the longer-term to severe health problems i.e. psychosomatic disorders, decreasing performance (quality and quantity) and to absences from work due to sickness.

Two versions of the BMS exist; version BMS II of the questionnaire is for application in industrial and service business settings in which control, monitoring and operational steering and management activities (cognitive tasks) are the focus of work. BMS II is appropriate for the work environment in ATM. Several studies show a negative correlation between occupational stressors and attitudes to change, indicating that with increasing stress commitment to work and tasks decreases and acceptance to organisational change increases. The questionnaire can be used to identify different forms of critical psychological strain states and the perception of changes in working conditions that are experienced as stress, saturation, fatigue, and monotony during change. The BMS II consists of four scales with ten items each for the four factors: psychic fatigue, monotony, psychic saturation and stress. High fatigue, monotony and stress or a combination of these effects can have detrimental impacts on health and safety in the day-to-day work of personnel with increased risk for human error or safety risks.

Since 2009 the predictive model based on BMS is part of REBA a software for the ergonomic analysis, evaluation and design of task contents in consideration of health and safety.

### References

- **Developer and source:**

- **Background and theoretical concept information:**
  Contact: richter@psychologie.tu-dresden.de

- **Year of development / publication, updates etc.**
  1984; 2009 (PC-based version combined with Job Diagnostic Survey (TBS); Hacker et al., (1995); 2010 (ongoing) revision of BMS handbook and integration of findings from recent studies.
# General description

## Purpose of measurement / study

Fatigue, monotony, saturation and stress can negatively influence performance, work experience and output. The questionnaire measures stress, fatigue, psychological saturation and fatigue induced psychological strain at the workplace as the effects of undue work load or difficult, tense or awkward workplace or working conditions.

The predictive (regression) model developed and validated for the BMS is the model in a software instrument called ergoInstrument REBA (recent version 9.0) which enables a PC based ergonomic analysis, evaluation and design of task / job contents and working conditions in regard to health and safety at work (available at Technical University Dresden, Germany; see University website). The BMS instrument itself is not included in the REBA but is available as a standalone instrument.

## Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.)

Questionnaire; two parallel forms (A and B) as per version (BMS I and BMS II) are available and are to be used in repeated measurement design (for example measuring stress, fatigue etc before or at the start and towards the end or after shifts / normal working hours).

## Effort required (time, people, equipment, resources); usability and practicability

Usability and practicability of the instrument are given. It takes about 5 minutes to complete the questionnaire and 5 minutes to analyse individual results.

However, correct interpretation of the questionnaire results can only be done in the frame of a work and task analysis done in parallel. If the analysis leads to the conclusion that the working conditions have a detrimental effect in terms of felt stress, fatigue etc. appropriate conditional measures for the redesign or change in the working conditions and or tasks will be derived. These pre-conditions for the use and correct application of BMS results are to be taken into account when planning to use the instrument.

## Population – Demographic and or Professional Group for which the method is intended for

Any employee

## Object of measurement / study (individual, team, profession, department, company)

Individual

## Language (other than English)

English, German, Dutch, Hungarian and Finnish language

## Cost information / Copyrights / Agreements needed

The BMS handbook is under revision and will be published in Hogrefe Verlag, Germany. The handbook will provide an overview of recent validation findings from various studies done since 1984, the last edition of the handbook. The BMS scales will not change. For acquisition and use of the BMS contact the author Prof. Peter Richter at Technical University Dresden for further information: richter@psychologie.tu-dresden.de

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# ATM specific mapping

## Guidance for use in the ATM Context

Most studies undertaken in the ATM context with ATCOs and other operational staff clearly indicate high psychic and physic load of OPS staff. Health and safety risks are higher in the ATCO compared to the pilot profession.

The questionnaire can be used to identify the effects of stress, fatigue, monotony and psychological saturation in terms of perceived (subjective) states of staff as a result of difficult, stretched or awkward working conditions which could have resulted from a change in the work environment leading to working conditions. The BMS II Version is especially useful for ATM operational staff (ATCOs, Engineers, and Supervisors).

The most relevant change scenarios in which changes of working conditions, workplace re-design, reorganisation of the workflow, revised task allocation, new or additional tasks could occur and in which thus a task and job analysis is to be done are:

- Implementation of future operational concepts and systems, e.g. encompassing:
  - significant changes of roles and responsibilities in operational jobs;
  - more integrated ATM processes characterised by wide information sharing, enhanced CDM (Collaborative decision making);
  - significantly increasing automation of tasks or functions;
  - new technologies (e.g. Data link, 4D trajectory based planning and control, support tools for separation delegated to flight crew, conflict resolution and collision avoidance automation support).
Fatigue- Monotony- Saturation- Stress Questionnaire (BMS)  

<table>
<thead>
<tr>
<th>Changes in working conditions, e. g.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• new shift/rostering cycles and working hours (e.g. to flexibly adapt to variations in traffic amount);</td>
</tr>
<tr>
<td>• new organisational or social structures and/or processes.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Changes in organisational structure of whole companies, authorities or units, e.g.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Civil/military integration of operations.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Changes in organisational culture, e.g.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Safety reporting culture.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Experiences of use in the ATM / safety industry / other industry context, including references / users</th>
</tr>
</thead>
<tbody>
<tr>
<td>The questionnaire has been used in different industries and work environment. BMS I is used for work environment dominated by repetitive tasks and of operating equipment inducing fatigue, psychological saturation and monotony) whilst version BMS II is for application in industrial and service business settings in which control, monitoring and operational steering and management activities (cognitive tasks) are the focus of work. BMS II is the appropriate version to be used in the ATM work environment.</td>
</tr>
<tr>
<td>The BMS has been applied in various settings and has a long track record in development and use. However, there is little if all experience with application of the BMS in the ATM context.</td>
</tr>
<tr>
<td>The BMS was developed based on a generic model of workload and strain as laid down in DIN EN ISO 10075.</td>
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<table>
<thead>
<tr>
<th>ProACT Process Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Note:</strong> According to the authors a correct interpretation of the questionnaire results can only be done in the frame of a work and task analysis done in parallel. If the analysis leads to the conclusion that the working conditions have a detrimental effect in terms of felt stress, fatigue etc. appropriate conditional measures for the redesign or change in the working conditions and or tasks will be derived. These pre-conditions for the use and correct application of BMS results are to be taken into account when planning to use the instrument.</td>
</tr>
<tr>
<td>The following list of possible applications provides some rational and examples:</td>
</tr>
</tbody>
</table>

**Scoping phase**  
Risk and opportunities identification:  
The questionnaire helps to understand the current states of staff and the effect of stress and fatigue in current working conditions. This data can be used as baseline data for later comparison after changes to the working conditions or the work place or work process have been implemented. It will also help to identify health risks in the current work place and deriving appropriate recommendations and proposals for changes.  

**Planning phase**  
Risk & opportunities analysis:  
In cases in which a prototype of the work place is available and simulations can be performed on a planned to be implemented working position / configuration data can be gathered using the BMS II (before / after shifts/ simulator sessions) measuring perceived stress, psychological fatigue, monotony and psychological saturation which could be attributed to the changes. This will provide input to further adapting the working conditions and limiting future stress, fatigue etc. levels.  

**Implementation phase**  
Assess & Secure acceptance:  
During implementation of the final version of the working conditions change or workplace re-configurations applying the BMS II version before / after shifts will help to address acceptance issues related to workload and stress etc due to the changes and compare the findings with baseline data (scoping phase) in a more objective and standardised way. Positive outcomes and or addressing negative findings during implementation will help to foster acceptance.  

**Evaluation phase**  
Monitor & reinforce C & T process – Process & outcome assessment:  
The questionnaire helps to identify areas for improvement after the implementation of the changes, especially on working hours, work processes, scheduling of breaks and relief measures etc. The outcome will be compared to earlier measures (baseline data and data gathered during the implementation phase) to verify or falsify whether the changes have lead to positive results.
### Technical description

#### Description of the content / study

The development and validation of the BMS was done based on well established findings and empirical evidence about work related psychic strain and the impact in terms of individually experienced physiological and psychic outcome. The development of the scales to measure the four different responses to work strain (fatigue, monotony, saturation and stress) was done through controlled experiments and filed studies and employing appropriate psychometric means and approaches in analysing the results and deriving scale values and norms (T-norms).

Fatigue, monotony, saturation and stress can have negative influence on work performance, relationships between team members and work output (quantitative and qualitative). The questionnaire measures individual’s critical psychological state caused by work load and provides information on the prediction of burn-out of staff.

The questionnaire exists in two different versions. The first version (BMS I) can be applied for all kind of operating and manufacturing activities. The second version (BMSA II) was developed for monitoring and controlling activities and has an additional stress subscale. As parallel scales exist, retests can be processed and results compared.

#### Context and Prerequisites for application

The questionnaire should be applied at same times and under same conditions. The standard configuration is to apply parallel version (alternating) before and after the shifts or simulator sessions. The variation in presenting parallel forms of the instrument will help to avoid group responses if used in groups.

The instructions need to be strictly followed at all times to ensure objectivity in application, analysis and interpretation of results. The user has to bear in mind the specific nature of the measured effects as changing over time (dynamic) phenomena. In order to compare results the time for application of the forms is pertinent.

#### Equipment required for application

Requirements: paper, pencil.

#### Required user qualifications

The questionnaire is for professional use by (industrial) psychologists with good background knowledge and expertise in work and organisational psychology, diagnostics and mental workload and stress. Especially the interpretation of results and drawing appropriate conclusions is to be done by psychological experts. Trained assistant staff having good understanding of psychological testing are to be used for gathering the data. Correct interpretation and deriving appropriate conclusions from the findings is a task for industrial psychologists or special trained human factors experts.

#### Requirements / constraint concerning conditions for use

The questionnaire measures individual (person related) responses to working conditions. Individual differences in the responses are to be expected.

The instrument should best be used in a group testing setting with more than six employees who best represent the entire range of the workforce or apply the test to all employees and in a repeated measure design. Suggestions for changes based on the outcome of the questionnaire require sufficient sample size and spread.

**General:**

- To obtain complete data sets the questionnaire should be filled in during an allocated timeslot before and after work.
- Testing conditions (i.e. introduction, short instruction etc) are to be maintained.
- Sufficient and detailed enough information about the questionnaire, its use and purpose etc must be provided to the participants and all questions regarding use of results, purpose of the study or measurement must be answered correctly and openly (to be done by professional staff).
- General support and emphasis should be given to the team to maintain motivation to respond correctly and conscientiously to the questionnaires at all times and over the entire measurement period.
- Sharing of the outcome with the participants and the entire workforce affected from the change is crucial and needs to be done in a well prepared, open and professional way.
Measure / Response Types

Alternative response format (agree / disagree) to items that reflect different degrees of experienced strain in terms of fatigue, monotony etc.

Collected parameters and data format

Scores for each subscale are possible. Item scores are converted to norm-values (T-Scores) and averaged for each of the four subtests.

Results obtained and interpretation

The results are divided into the following three levels (according to T-values):

**Level A:** Feeling well. Felt impacts are very small. No changes in working conditions necessary.

**Level B:** Moderate impact. Individual’s condition is affected. Performance impacts, physiological and psychic destabilisation has set in. The work situation should be further assessed and counter measures should be derived, especially when impairment of performance and physiological destabilisation has set in.

**Level C:** Strong impact on individual’s condition. Changes in working conditions and/or organisational structures are necessary.

Based on the T-scores the three levels are assigned as follows:

- **Fatigue:** level A: ≥50.0; level B: 49.9-46.0; level C: <46.0.
- **Monotony:** level A: ≥50.0; level B: 49.9-48.0; level C: <48.0.
- **Saturation:** level A: ≥50.0; level B: 49.9-48.0; level C: <48.0.
- **Stress:** level A: ≥52.0; level B: 51.0-50.0; level C: <50.0.

Description of use

**Figure / model**

![Simplified Model of Load – Strain – Stress (ISO 10075)](attachmentURL)
Fatigue, monotony, saturation and stress can negatively influence performance, work experience and output. The questionnaire measures stress, fatigue, psychological saturation and fatigue induced psychological strain at the workplace as the effects of undue work load or difficult, tense or awkward workplace or working conditions.

The BMS should be used only after complete and timely information of management and staff concerned. The information should cover purpose and aim of the use. The minimum sample size for group-statistic purposes is 6. Controlled parameters should include: age, gender, qualification.

**Evaluation**

**Strengths and Weaknesses of the tool**

The scales have been developed demand specific and based on a well established theoretical and scientific (empirical) basis. The questionnaire is appropriate to be used for repeated measures and does not only present negative statements but also positive ones. The authors advise users to not interpret the results without a job analysis. No other strengths and weaknesses of the tool are known.

**Alternative methods / tools**

No comparable alternative methods or tools are known.

**Possible combination with other methods / tools**

The tool shall be applied in conjunction with a job and task analysis of the job and tasks that are subject to change or have been changed based on the outcome of these results to derive correct conclusions.

- The software tool ergoInstrument REBA 9.0 allows the combined analysis of (projected or existing) jobs and tasks and surfacing all relevant psychological factors as specified in ISO 10075 and other norms (DIN) and standards. The results can be used to derive proposals for the design / re-design of the job. (Source: Richter, P., Debitz, U. & Pohlandt, A. (2009), Evaluation of the quality of job design with the action-oriented software tool REBA – recent developments and applications. In: C.M. Schlick (Ed.), Methods and Tools of Industrial Engineering and Ergonomics for Engineering Design, Production, and Service – Tradition, Trends and Visions. Berlin: Springer.)
- Website: [http://www.infomediaverlag.com/psyche-reba.htm](http://www.infomediaverlag.com/psyche-reba.htm)
- The Integrated Task Analysis (ITA) approach provides a frame and approach specifically for the ATCO job analysis (in this Compendium).
- The instrument can be combined with other questionnaires that measure (mental) workload, trust etc in automation, i.e. the SHAPE toolkit (in this Compendium).
- The Fleishman Job Analysis Survey (FJAS) can provide information on ability and skill demand of the workplace and or task at hand (in this Compendium).

**Psychometric / methodological integrity description**

**Objectivity / (or at least) demonstration**

The BMS is a standardised questionnaire. Objectivity in application is ensured through strict and detailed instructions. Objectivity in analysing the scales is high; rules exist for establishing metric data and scale values. The objectivity in interpretation is facilitated through available norm values and average (mean) values. Recommendations are given how to interpret different levels of work related strain.

**Reliability / (or at least) demonstration**

According to the author reliability is given for both forms and versions. **Parallel test reliability** was used as this was the best compromise to establish reliability for measuring the time dynamic phenomena. The (1984) handbook gives for the BMS II as per scale the following parallel – test reliabilities ($r_{tt}$)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Parallel – Test Reliability ($r_{tt}$)</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychic fatigue</td>
<td>.88</td>
<td>88</td>
</tr>
<tr>
<td>Monotony</td>
<td>.77</td>
<td>89</td>
</tr>
<tr>
<td>Psychic saturation</td>
<td>.83</td>
<td>89</td>
</tr>
<tr>
<td>Stress</td>
<td>.78</td>
<td>90</td>
</tr>
</tbody>
</table>

The differences between the two measures at start of work – end of work for all four scales (individually corrected for the level at the start) were reliable with

- Fatigue = .90
- Monotony = .84
- Saturation = .89
- Stress = .74

For a sample of N=30.
Validity / (or at least) demonstration

BMS II results of tests (through controlled experiments and in field studies) of the criterion – related validity ($r_{tc}$) (criterion corrected validity coefficients) for performance in different criteria are given and show significant and sufficiently high correlations between BMS scales and features of task structures.

Experimental results (with a standardised test) and in situations that aimed to induce; fatigue, monotony and saturation. All coefficients significant at $p < 0.01$.

<table>
<thead>
<tr>
<th>Study</th>
<th>Task / Work structure</th>
<th>Performance Measure</th>
<th>Fatigue ($r_{tc}$)</th>
<th>Monotony ($r_{tc}$)</th>
<th>Saturation ($r_{tc}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment</td>
<td>Moderate difficulty</td>
<td># correct solutions</td>
<td>.34</td>
<td>.48</td>
<td>.56</td>
</tr>
<tr>
<td></td>
<td>High difficulty</td>
<td># correct solutions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Saturation inducing task</td>
<td>% of failures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field study</td>
<td>Moderate difficulty</td>
<td>Performance (Time)</td>
<td>.49</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>High difficulty</td>
<td>Time to correct errors</td>
<td>.78</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following table gives the criterion – related validity ($r_{tc}$) (uncorrected validity coefficients) for different performance criteria (shift work) in experimental conditions and in field study.

All coefficients $> /= .40$ were significant at $p < 0.01$; others were significant at $p< 0.05$.

<table>
<thead>
<tr>
<th>Study</th>
<th>Task / Work structure</th>
<th>Performance Measure</th>
<th>Fatigue ($r_{tc}$)</th>
<th>Monotony ($r_{tc}$)</th>
<th>Saturation ($r_{tc}$)</th>
<th>Stress ($r_{tc}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment</td>
<td>Monitoring and Control</td>
<td>Failures</td>
<td>-.33</td>
<td>-.27</td>
<td>-.40</td>
<td>-.43</td>
</tr>
<tr>
<td></td>
<td>Choice Reaction Time (4)</td>
<td>Mean reaction time</td>
<td>-.46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Choice Reaction Time (9)</td>
<td>Mean Reaction Time</td>
<td>-.29</td>
<td></td>
<td>.56</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CRT (4)</td>
<td>% Failures</td>
<td>-.35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CRT (9)</td>
<td>% Failure</td>
<td>-.28</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field study</td>
<td>Operational control (complex monitoring and operational control of processes)</td>
<td>% of different task / shift (multiple correlation) - operational handling - control - stand-by time</td>
<td>.30</td>
<td>.42</td>
<td>.58</td>
<td>.51</td>
</tr>
</tbody>
</table>

Further studies demonstrated high validity evidence of the BMS with external activation parameters (heart periodic, eye blink) under different task conditions and scales of the BMS (all sig.).

Summary: Significant correlations exist between BMS and performance data and respective features of the tasks. Situations in which man-machine functions are distributed in a way that does not allow sufficient prediction and control of the processes lead to loss of goal-directedness and emotional disturbance and uncertainty in regard to task demand.

This seems to be especially relevant in situation of changes of tasks in an operational (monitoring, control, steering) environment.
The BMS has been developed following a systematic, empirically supported and well founded concept and is based on a generic model of workload and strain as laid down in DIN EN ISO 10075.

The BMS has shown good – very good psychometric results in all respect. The empirical evidence available and the widespread use of the questionnaire in practice stress the robustness and relevance of the underlying concept and the instrument itself.

The BMS instrument has sufficiently high reliability and (criterion related) validity to be used as a measurement instrument that meets the requirements of ISO 10075-3:

<table>
<thead>
<tr>
<th>Objectivity:</th>
<th>Is ensured (standardised application and deriving results etc).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability:</td>
<td>All forms reach a sufficient high level of reliability.</td>
</tr>
<tr>
<td>Validity:</td>
<td>The instrument is valid in all respects (concurrent, factorial, conceptual and criterion related) and measures the aspects correctly that it aims to measure. The scales reflect demand / strain depending changes in measures of wellness and mood with high selectivity.</td>
</tr>
<tr>
<td>Sensitivity:</td>
<td>Is ensured.</td>
</tr>
<tr>
<td>Diagnosticity:</td>
<td>Is ensured.</td>
</tr>
<tr>
<td>Generalisability:</td>
<td>Development of the instrument is based on a generic and widely accepted model and empirical research. The instrument can be applied in different industrial settings and working contexts in various professions.</td>
</tr>
<tr>
<td>Usability / Acceptance:</td>
<td>The BMS can be easily applied and there are no known problems with the acceptance of the questionnaire and the approach.</td>
</tr>
</tbody>
</table>

The questionnaire has been used in different industries and work environment. BMS I is used for work environment dominated by repetitive tasks and of operating equipment inducing fatigue, psychological saturation and monotony) whilst version BMS II is for application in industrial and service business settings in which control, monitoring and operational steering and management activities (cognitive tasks) are the focus of work.

BMS II is the appropriate version to be used in the ATM work environment.

The BMS can be used as an instrument for accurate measurement of the aspects measured with high sensitivity and diagnosticity.