University of Applied Sciences and Arts Northwestern Switzerland
School of Applied Psychology

# FRAM in Comparison to another Modelling Method for Complex Socio-technical Systems

Institute Humans in Complex Systems

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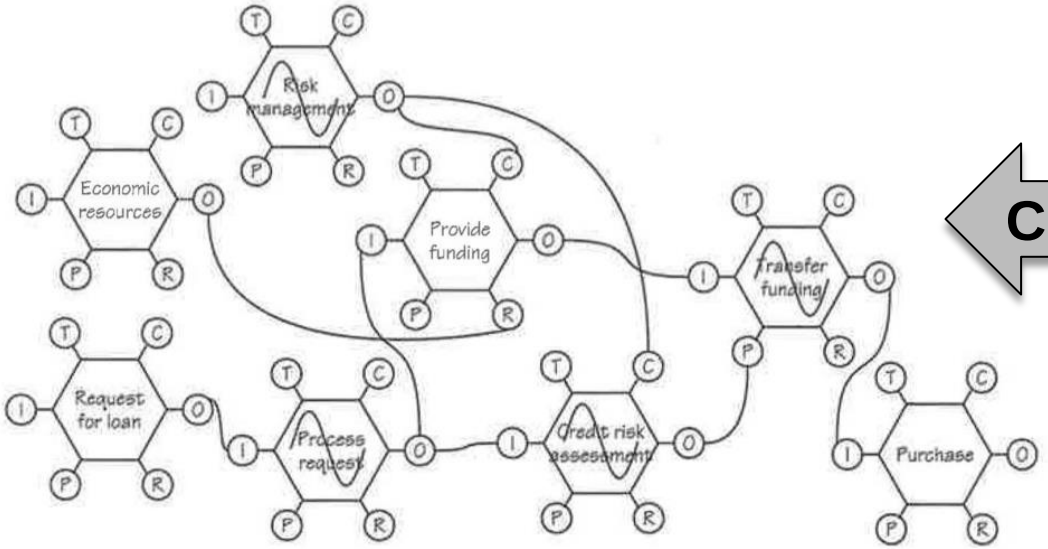
**FRAM**




Hollnagel (2012)

**Comparison**

**Traditional STS: KOMPASS**

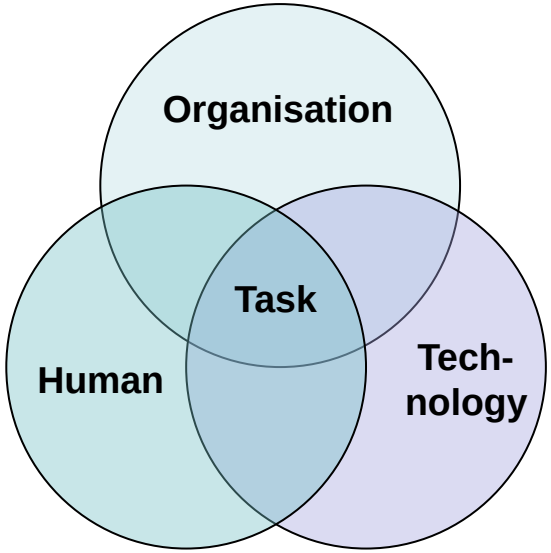



Figure adapted from
Ulich & Strohm (1997)

## Agenda

1) Context of the case study

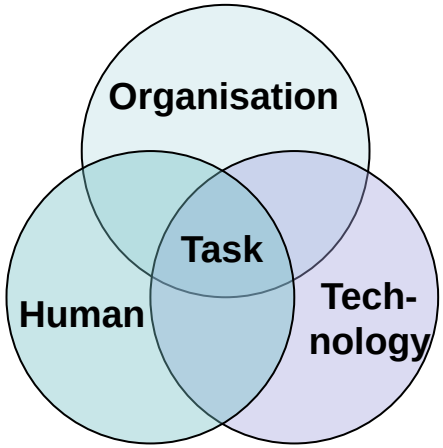
2) KOMPASS method
   - Methodological approach
   - Operationalised criteria

3) Comparison of the two analysis methods
   - Collection, selection and application of the comparison criteria

4) Conclusions

## 1) Context of the Case Study

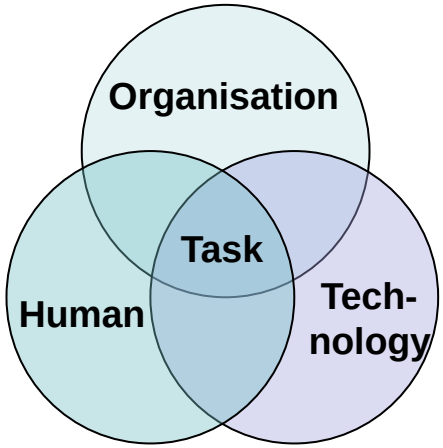
- Goal: Comparison of two analysis methods of socio-technical systems: KOMPASS and FRAM
- Case study in a company providing **aviation maintenance services**
- Time frame of the data collection: February to July 2014




## 2) The KOMPASS Method I

### Methodological Approach

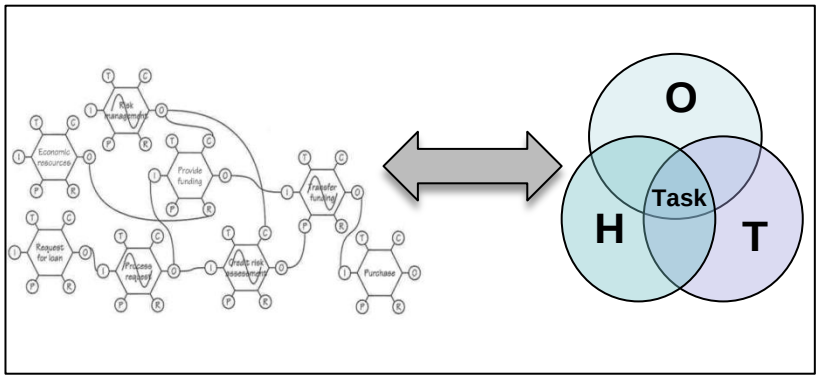
- «Traditional» approach to socio-technical system analysis
- Assessment of job design and task allocation (individual task, work systems and human-machine function allocation)
- Local control of variances and disturbances empower humans with decision latitude in order to be able to compensate for variances and disturbances
- Developed for the manufacturing context
- Not specifically focused on safety, but on normal operations




# 2) The KOMPASS Method II

## Operationalised Criteria

| Criteria Work systems | Criteria Individual work tasks | Criteria Human-machine function allocation |
|---|---|---|
| Task completeness | Task completeness | Process transparency |
| Independence of work systems | Planning and decision-making requirements | Dynamic coupling |
| Fit between regulation requirements and regulation opportunities | Communication requirements | Decision authority |
| Polyvalence of work system members | Opportunities for learning and personal development | Flexibility |
| Autonomy of work groups | Variety | |
| Boundary regulation by superiors | Transparency of work flow | |
| | Influence over working conditions | |
| | Temporal flexibility | |




## 3) Comparison of the Two Analysis Methods I

### Collection of Comparison Criteria (36)

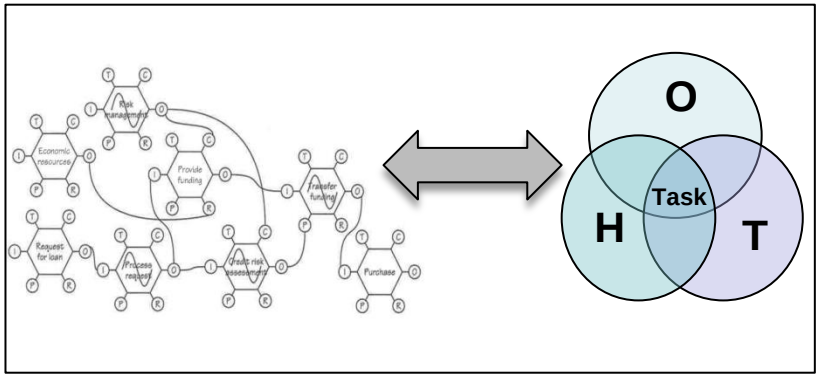
- Literature research
- Definition of additional criteria

### Selection of Comparison Criteria (9)

- Clustering the collected criteria into 4 themes: Description, use of the method, analysis and background
- Focus on similarities, differences and application of methods

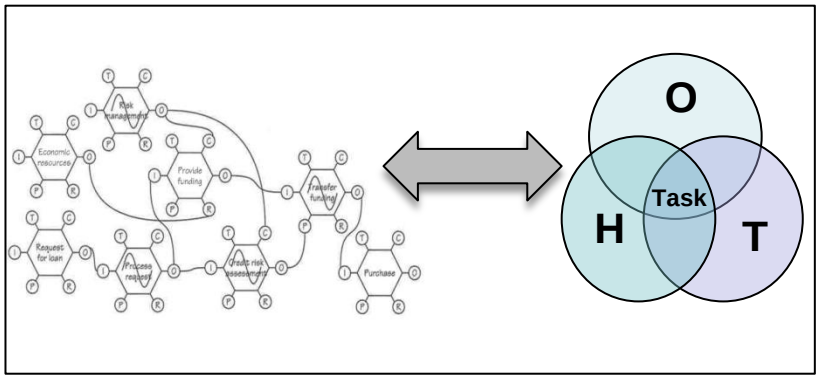
### Description of Similarities and Differences by Means of the Comparison Criteria

- Original description of methods
- Own experience when applying the methods



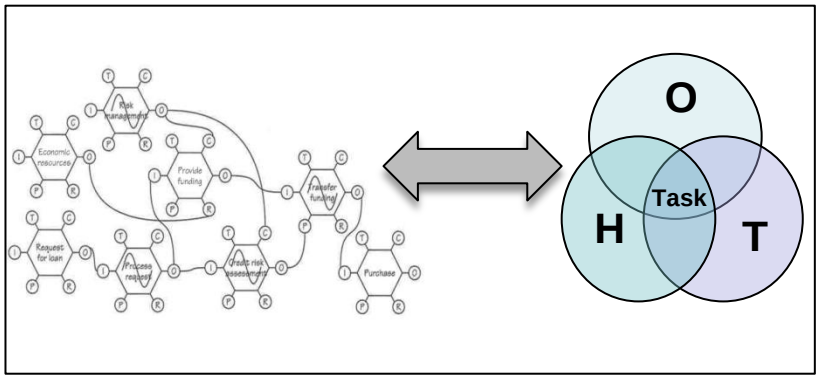

# 3) Comparison of the Two Analysis Methods II

| Criteria | KOMPASS | FRAM |
|---|---|---|
| **Description** | | |
| **Scopes of the method (Frei, 1981)** | • Job design and task allocation<br>• Normative | • 4 principles: Equivalence of failures and successes, approximate adjustments, emergence, resonance<br>• Descriptive |
| **Structure of the method (Dunckel, 1999)** | • Guidelines for the interviews and workplace observations<br>• Operationalised criteria | • Instructions for the various steps<br>• Guiding questions |



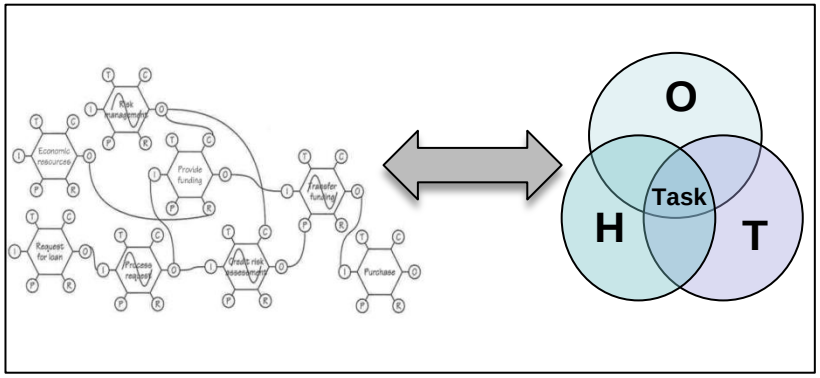

## 3) Comparison of the Two Analysis Methods III

| Criteria | KOMPASS | FRAM |
|---|---|---|
| **Use of the method** | | |
| **User of the method (Dunckel, 1999)** | People trained in applying the method | People trained in applying the method |
| **Domain of use (Dunckel, 1999)** | Manufacturing context | Any socio-technical system |
| **Required resources (Dunckel, 1999)** | Laborious | Laborious |
| **Stop rule** | • As soon as there are enough arguments<br>• No formal criterion | • Until there is no unexplained (or unexplainable) variability of functions |



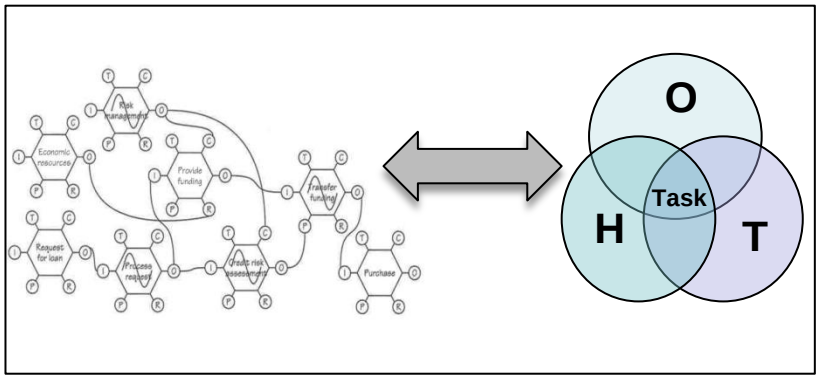

## 3) Comparison of the Two Analysis Methods IV

| Criteria | KOMPASS | FRAM |
|---|---|---|
| **Analysis** | | |
| **Focus of the analysis (Dunckel, 1999)** | • Work as done<br>• Normal operations | • Work as done<br>• Normal operations |
| **Type of the results (Frei, 1981)** | • Normative assessment of task and organisation design<br>• Nominal-actual comparison | • Description of functions, aspects, variabilities and functional resonances<br>• Chart (hexagons) |




## 3) Comparison of the Two Analysis Methods V

| Criteria | KOMPASS | FRAM |
|---|---|---|
| **Background** | | |
| **Theoretical foundation (Frei, 1981)** | • Socio-technical system approach (Emery, 1959)<br>• Action regulation theory (Hacker, 1973) | • Event-structures (Alport, 1954)<br>• Cybernetics (Wiener, 1948)<br>• Resilience Engineering (Hollnagel, 2006)<br>• Safety II (Hollnagel, 2013) |




## 4) Conclusions

### Both Methods

- focus on normal operations
- consider variability as useful in many situations

### KOMPASS

- provides normative guidelines for “good” system design based on psychological theory
- limited field of application

### FRAM

- reflects phenomena of complex system behaviour (emergence, resonance)
- more powerful as the «traditional» STS analysis method to consider complexity

# Thank you for your attention!

## Discussion

- What experiences in finding the system boundary have you made when applying FRAM?
- Is there any empirical advice you would like to share with us how to identify the functional resonances?

# Thank you!

## References

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