

 **SBB CFF FFS****FRAM as a method to evaluate the effects of standardization****Manuela Vieli, Toni Wäfler**

改善

Kai = Change Zen = Good

Swiss Federal Railways and Kaizen

The Swiss Federal Railways (SBB) are facing rising costs and competition pressure.

Kaizen

- Japanese business philosophy
- Increasing productivity by decreasing unnecessary workarounds, idle times or overproduction
- Three pillars
 - Leadership
 - targeted improvement
 - *Standardization = the reduction or elimination of variability*

(SBB, 2016)



Aim and research questions

What are the consequences of standardization in the process of wheelset exchange?

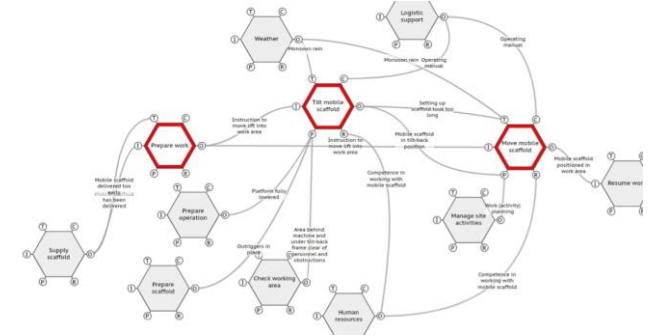
What are the functions of the wheelset exchange?

How do the functions interact with each other?

Which functions are actually (pre-standardization) subject to variability?

What happens when the actual context variability is restricted or eliminated?

What happens when the actual adaptive performance variability in functions is restricted or eliminated?



Method (1/3)

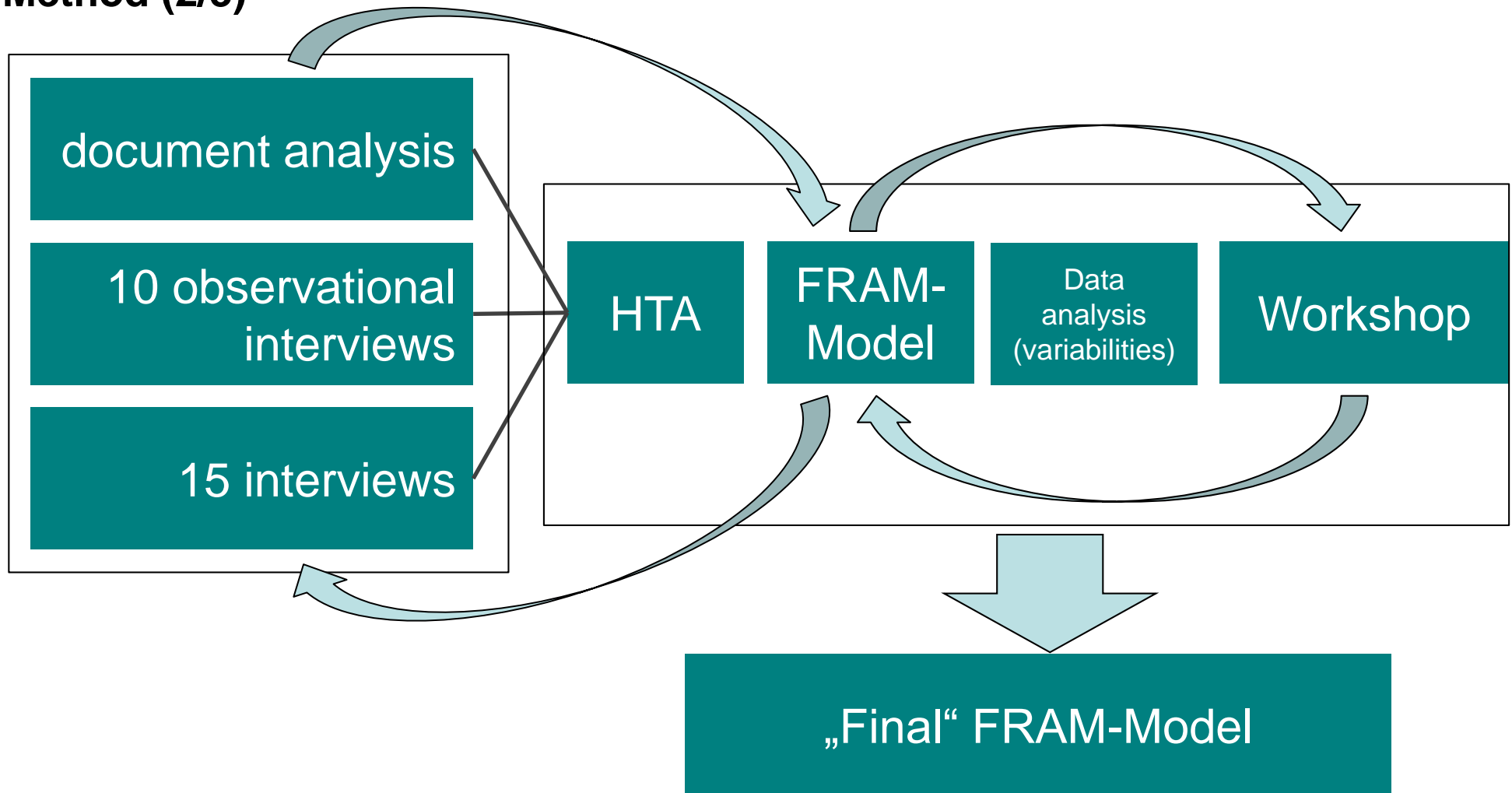
Functional resonance analysis method (Hollnagel, 2012; Hollnagel, Hounsgaard & Colligan, 2014)

Only work as done

Sample: 17 male mechanics

Subject of investigation: Process of wheelset exchange

Method (2/3)

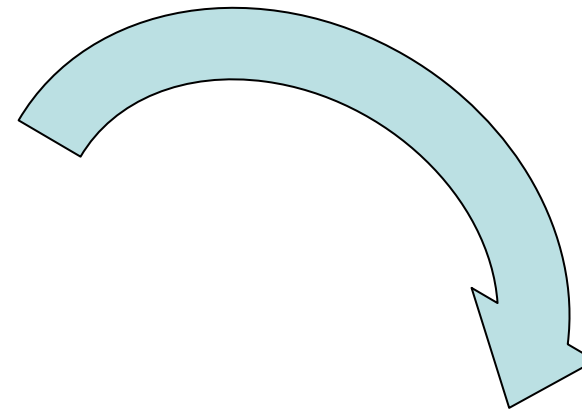


Method (3/3)

Variability – how strong and why?

time-value x precision-value = Evaluation

Time	Value	Precision	Value
on time	1	acceptable	2
omission	3	precise	1
too early/ too late	2	imprecise	3



Limit value	Evaluation
1-2	Low
3-4	Medium
5-9	High

(Tomczynski, 2014; Steiner, 2015; Vieli, 2016)

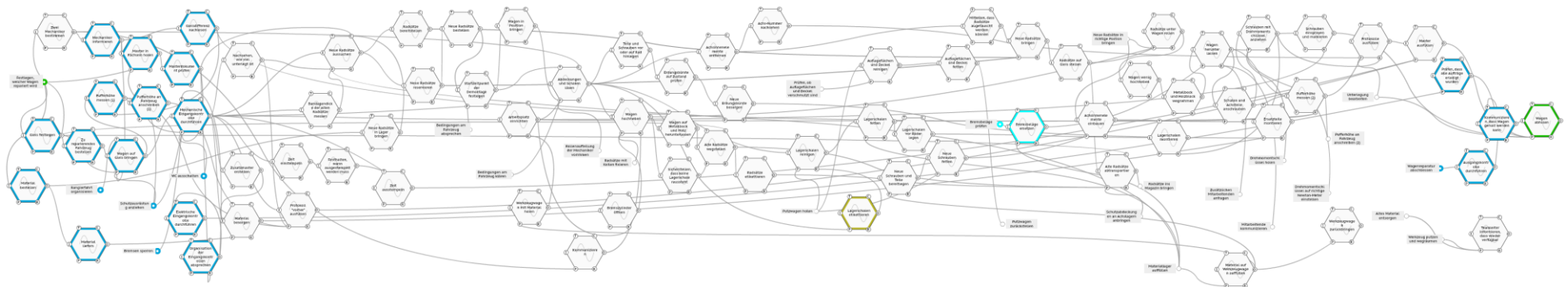
Results

102 functions in total, 77 of which are foreground functions.

There are key functions that appear to have a high impact on the overall process.

75 out of the 77 foreground functions display variabilities. The variabilities were classified as low, medium and high.

Main causes of context variability in this study are time pressure and resources. The main factor of adaptive performance variability is experience.



(Vieli, 2016)

Recommendations

Standardization is ...

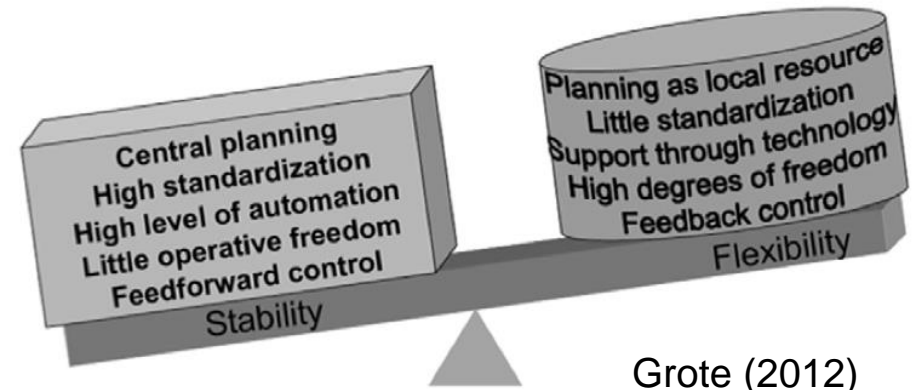
... an advantage for small, independent functions as e.g. the specific use of a tool like a torque wrench.

... a disadvantage for functions that are conditional on the context, like for example the function „to assign two mechanics for carrying out the wheelset exchange”.

→ goal, process and action rules (Hale & Swuste, 1998)

Flexible sequences have a positive impact on a successful wheelset exchange. An important aspect of standardization is the balance between standardization and flexibility (Grote, 2012).

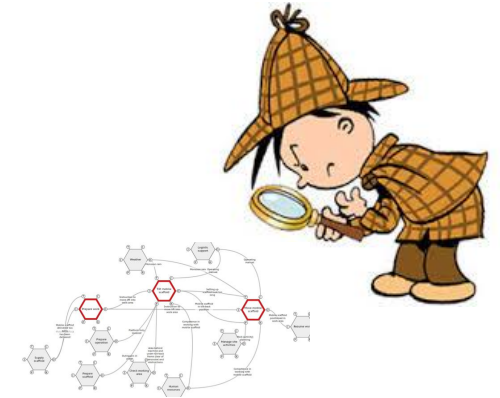
The consideration of the causes of variability is important. Performance variability shouldn't be restricted, as long as the context variability is still the same.



Method reflection (1/2)

Experiences with FRAM itself:

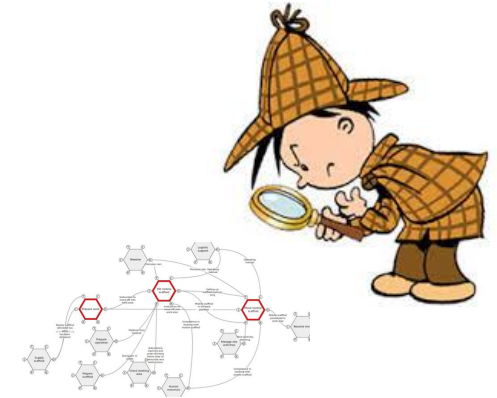
- Visualization becomes confusing
- Logical structure helps to investigate on the effects of standardization.
- The terms „too late” and „too early” for the characteristic „time” are negatively connoted. For this study it would have been more appropriate if, in addition, there were also terms like „later” and „earlier”.
- Later use of the model (e.g. training)



Method reflection (2/2)

Experiences with the FRAM Model Visualizer:

- Why not select two characteristics? e.g. too early AND too late
- FRAM Model Visualizer combines equal outputs and inputs. Some functions occur twice, e.g. the measurement of the buffer, but aren't actually the exact same function. Solution -> Number in brackets.



Questions?



References

- Grote, G. (2012). Safety management in different high-risk domains – All the same? *Safety Science*, 50 (10), 1983-1992.
- Hale, A., & Swuste, P. (1998). Safety rules: procedural freedom or action constraint? *Safety Science*, 29 (3), 163-177.
- Hollnagel, E. (2012). FRAM, the functional resonance analysis method : modelling complex socio-technical systems. Farnham, Surrey UK: Ashgate
- Hollnagel, E., Hounsgaard, J. & Colligan, L. (2014). FRAM – the Functional Resonance Analysis Method – a handbook for the practical use of the method. Centre for Quality, in the Southern Region of Denmark. Retrieved from http://functionalresonance.com/onewebmedia/FRAM_handbook_web-2.pdf
- SBB (2016). Kaizen Operating. SBB Intranet. Retrieved from <http://intranet.sbb.ch/de/themen/sbb-auf-einen-klick/personenverkehr/qualitaetkaizen/kaizen-operating/Seiten/Default.aspx>
- Steiner S. (2015). Resources and dependencies in the departure of suburban trains. Unpublished work, University of Applied Sciences Northwestern Switzerland
- Tomczynski, A. (2014). Application of resilience engineering concepts to the management of airworthiness. Unpublished work, Cranfield University.
- Vieli, M. (2016). Effect of standardization on the partial process of wheelset exchange in the repair center in Zurich-Altstetten of Swiss Federal Railways. Unpublished work, University of Applied Sciences Northwestern Switzerland.