



Safety culture change tools in different life cycles of a nuclear power plant

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NKS-R SC_AIM: Safety Culture Assurance and Improvement Methods in Complex Projects

- NKS-R SC_AIM was carried out during 2016-2017 as a collaboration between the following Nordic organizations:
 - VTT Technical Research Centre of Finland Ltd. (coordinator): Kaupo Viitanen, Nadezhda Gotcheva, Elina Pietikäinen, Mika Kari
 - KTH Royal Institute of Technology / Vattenfall AB: Carl Rollenhagen
 - Lilikoi Consulting (subcontracted by VTT in 2017): Teemu Reiman
- NKS-R SC_AIM was funded by NKS-R, SAFIR2018, VTT and KTH/Vattenfall
- Goals of the project were:
 1. To identify and specify methods to improve and facilitate safety culture in complex projects
 2. To identify and specify methods to assure safety culture in complex projects
- Participating companies: OKG, FKA, Fennovoima and SKB

Introduction: culture of an organization has an effect on what it perceives as hazards

(and what it does not consider as meaningful or dangerous)

- Turner (1978), based on several accident investigations, noted that related to risks “a way of seeing ... is always also a way of not seeing”
 - Attention paid to well-defined problems may distract from ill-defined background issues
 - Cf. Challenger Space Shuttle main motor and solid rocket boosters, Davis Besse and performance indicators, TMI and focus on water level in the pressurizer
- Weick (1998): "organizations are defined by what they ignore – ignorance that is embodied in assumptions – and by the extent to which people in them neglect the same kinds of considerations

=> when developing / changing culture we need to make sure both existing hazards are still considered but that the organization remains open to emergence of new hazards or to changes in the old

Assumptions are the deepest level of culture

- Assumptions such as
 - What is good leadership? How should leaders behave towards their subordinates?
 - What are the appropriate ways to talk to superior? How can one disagree with the superior, on what kinds of issues?
 - How persons gain authority, respect and / or power in the organization? What the organization values in people?
 - Why failures happen, what is the role of people in successes and failures?
 - What is an acceptable evidence of e.g. danger?
 - How safe are we?
- These assumptions are formed, changed and/or maintained by
 - a) behavior of personnel and especially leaders, and
 - b) structures such as organizational structure, management system, tools that are used

During NKS-R/ AIM, a set of twelve principles of safety culture change were developed that summarize the essential good practices of leading safety culture change (Viitanen et al. 2018)

1. Consider the dynamics between classes of system elements
2. Select the boundaries of the system you want to change
3. Select the system elements you want to change
4. Acknowledge that safety culture is not monolithic and internally coherent, and try to benefit from this
5. Make an effort to understand what organizational members actually do and identify leverage points for safety culture change
6. Identify assumptions embedded within safety culture change tools
7. Identify and make use of the indirect effects of safety culture change tools
8. Acknowledge that safety culture cannot be directly changed
9. Consider how power relations influence safety culture change
10. Involve the target group in safety culture change activities
11. All information acquired in safety culture activities may be useful in the future
12. Behavior or structure change may result from safety culture change activities but do not expect rapid change in values and assumptions

In this presentation we focus on principle 6

Table 1 Continued

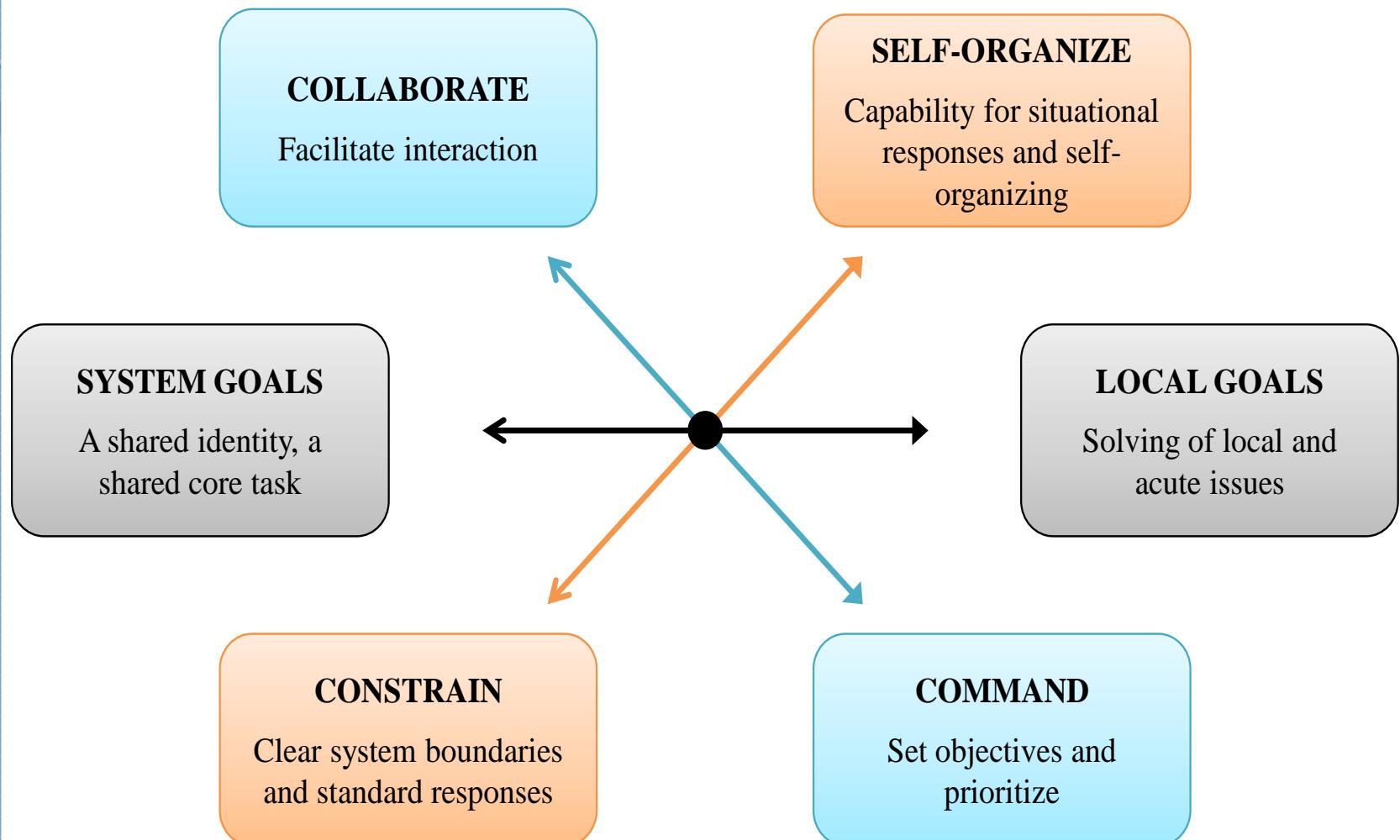
	Assumptions	Examples of assessment questions
<u>Principle 5:</u> Make an effort to understand what organizational members actually do and identify leverage points for safety culture change	Shared values and assumptions develop in the context of what organizational members do and in the relation to the activities of others	What is the core task and success criterion for each organizational group? What problems do the employees face in their daily work and how have they learned to solve them? What working practices are utilized in daily work? What solutions or good practices are taken for granted?
<u>Principle 6:</u> Identify the assumptions embedded within safety culture change tools	Safety culture change tools embed assumptions on how they are to be used	Who has developed and disseminated the tool? What was the context where the tool was originally developed and what was its purpose? Is the original context and purpose generalizable to other organizations as such, and if not, how should it be modified? What are the mechanisms of action underlying the tool, i.e., how does the tool produce its effect? What prerequisites (organizational or user) does the tool require to function as intended? What possible side effects can the tool have? How does the implementation approach influence the tool's functionality?
<u>Principle 7:</u> Identify and make use of the indirect effects of safety culture change tools	Sociotechnical systems react and adapt to the effects of safety culture change tools	What were the direct effects of the tools (on behaviour or on structures)? What indirect effects did the tool have? On which class of system element (behaviour, structures or values and assumptions)? How did the organisation respond to the implementation of the tools?
<u>Principle 8:</u> Acknowledge that safety culture cannot be directly changed	Indirect effects of safety culture tools are the only methodical way to change safety culture	How were the values and assumptions influenced in response to the change caused by the implementation of the tools? What measures or indicators were used to assess the state of values and assumptions after implementing the change initiative? Were they valid and reliable? Did the change influence safety positively or negatively (or not at all)?

Extract of Table I, from Viitanen et al. 2018 (NKS-405)

Tools for developing safety and safety culture

- Safety is an emergent property of the system
 - It is ability to succeed under varying conditions
- The organization requires adaptive capacity in addition to standard operating procedures
 - It needs to be able to respond to both expected and unexpected disruptions.
- Management of a complex safety-critical organization is an inherently contradictory activity.
 - It requires balancing between various tensions, competing demands and irresolvable dichotomies that can never be completely solved
- This means that different, even opposing tools are needed for managing safety.
- CHALLENGE: often these tools are used without explicit understanding of their conflicting background assumptions
 - To be able to proactively manage the development activities of an organization, a model is needed to guide the selection and use of the development tools and methods.

Model of adaptive safety management with six contradicting goals (Reiman et al. 2015, Reiman & Viitanen 2019)



Checking the assumptions embedded in selected safety culture tools

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T. Reiman and K. Viitanen

A checklist was created to assist in evaluating whether a given safety management tool supports or hinders the fulfilment of the principles of adaptive safety management and under what condition

(Reiman and Viitanen 2019)

The use of the checklist was illustrated with four methods:

- auditing
- training
- Human performance tools
- reporting systems

System goals principle refers to shared core tasks of the organization as well as its identity, and how the company sees itself. They are the shared guiding principles according to which decisions should be made, thus steering general adaptive capacity.

Is the tool in line with company strategy, company objectives and top management expectations?

Does the tool help communicate or internalize the organizations shared core task?

Local goals principle refers to the need to pay attention to acute and local issues in the organization. This includes solving specific problems related to subsystems and their functioning. Often solving the local issues does not immediately contribute to system goals, but without solving the local issues, time and resources cannot adequately be devoted to the system goals either.

Does the tool help employees in their daily problems and operational difficulties?

Does the tool help employees to solve acute safety issues?

Collaborate principle refers to facilitating interaction and connections between members of the organization. Connections and interaction between employees at all levels, both horizontally and vertically, are needed in order to guarantee organizational cohesiveness, communication and enough structure for the system to act in a coherent manner and to organize in a decentralized manner when needed. By creating connections between the various actors in the organization, the system also gains situational adaptive capacity due to the possibility of sharing task related information or helping others in their tasks.

Does the tool help employees participate in decision-making processes or design of their own work or the tools they use in their work?

Does the tool create opportunities for discussion between managers and employees?

Does the tool create or serve as an arena of interaction between organizational members?

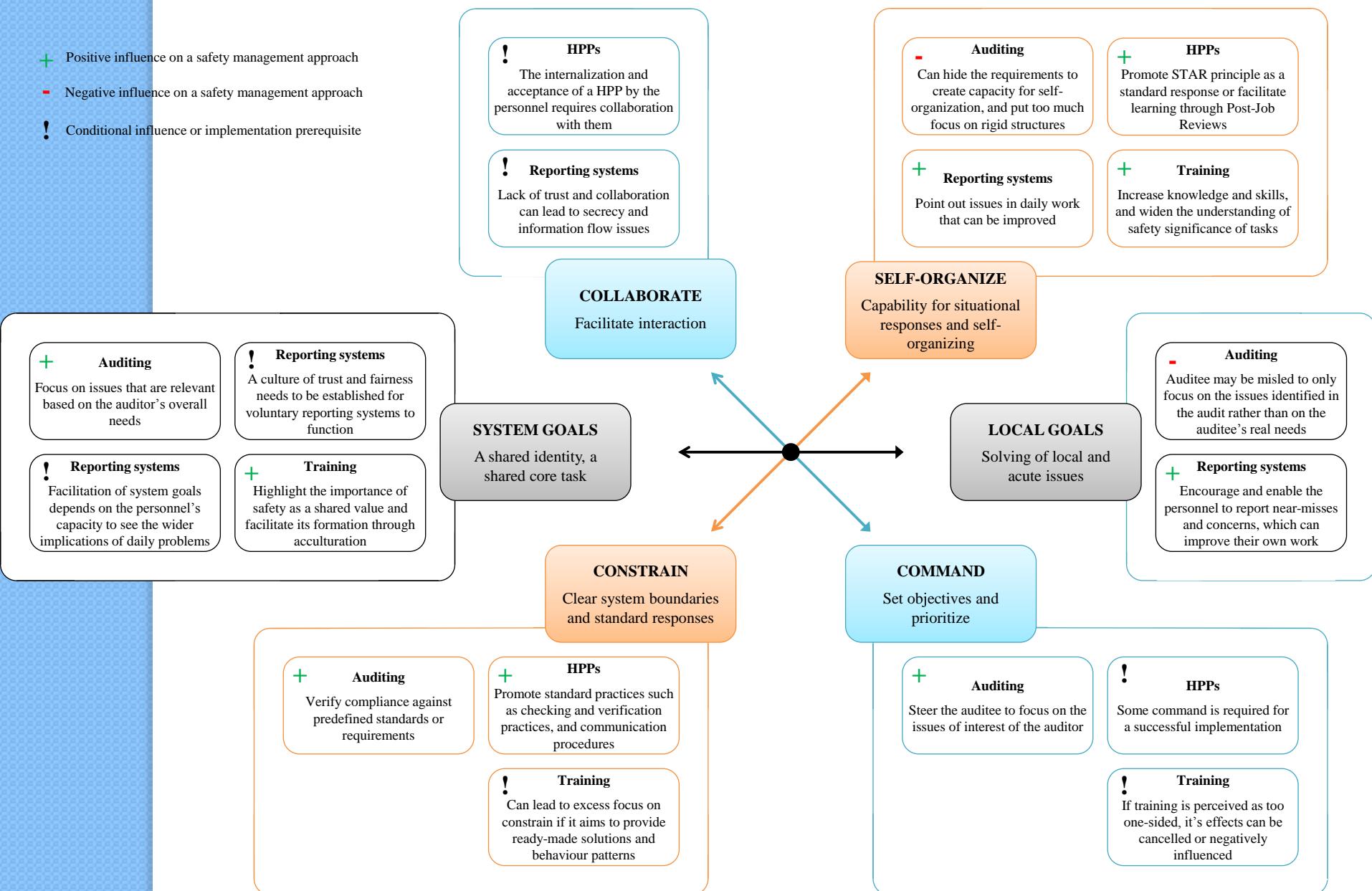
Command principle refers to setting objectives and prioritizing. Leaders need to select areas where they will focus their effort and to emphasize some connections and some persons over others, depending on their potential contribution to organizational goals. Generally this means that not everyone's wishes can be fulfilled and not everything can be a priority at the same time. In this role, the manager decides what is important and what is not important for the organization.

Does the tool help top management prioritize safety initiatives?

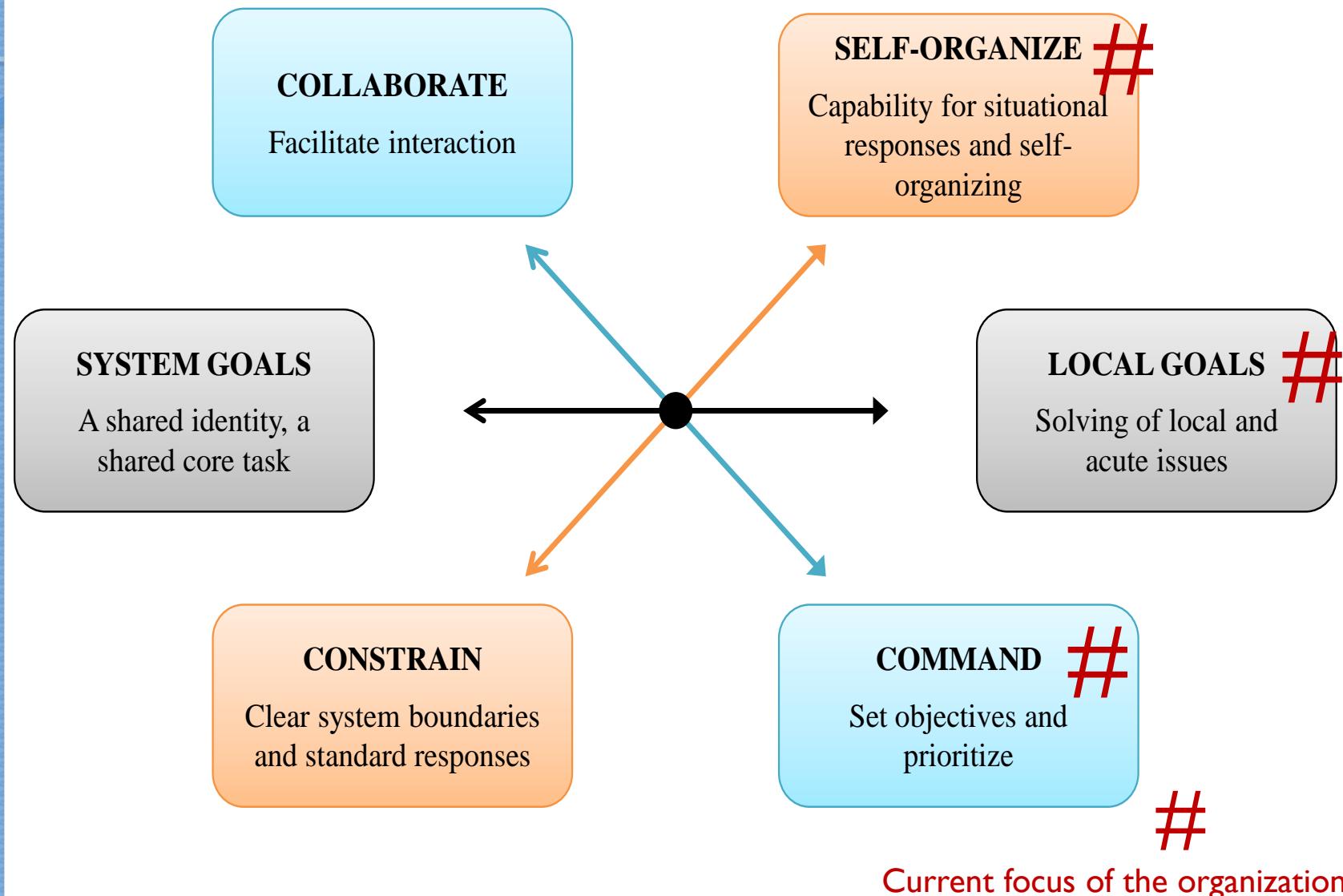
Does the tool give decision-making authority to selected safety professionals or management representatives?

Examples of how the selected tools can contribute to the conflicting approaches (Viitanen et al. 2018)

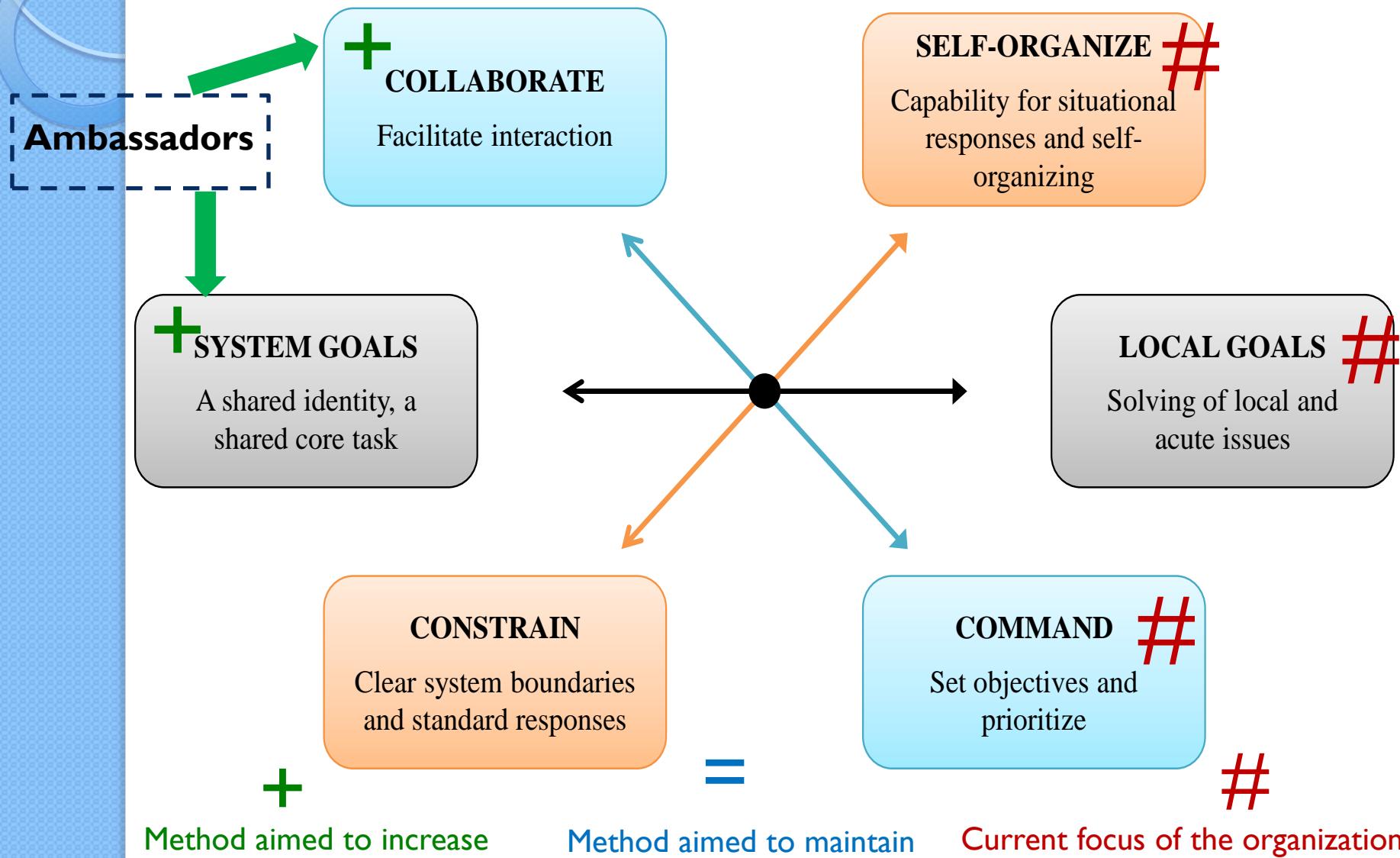
- + Positive influence on a safety management approach
- Negative influence on a safety management approach
- ! Conditional influence or implementation prerequisite



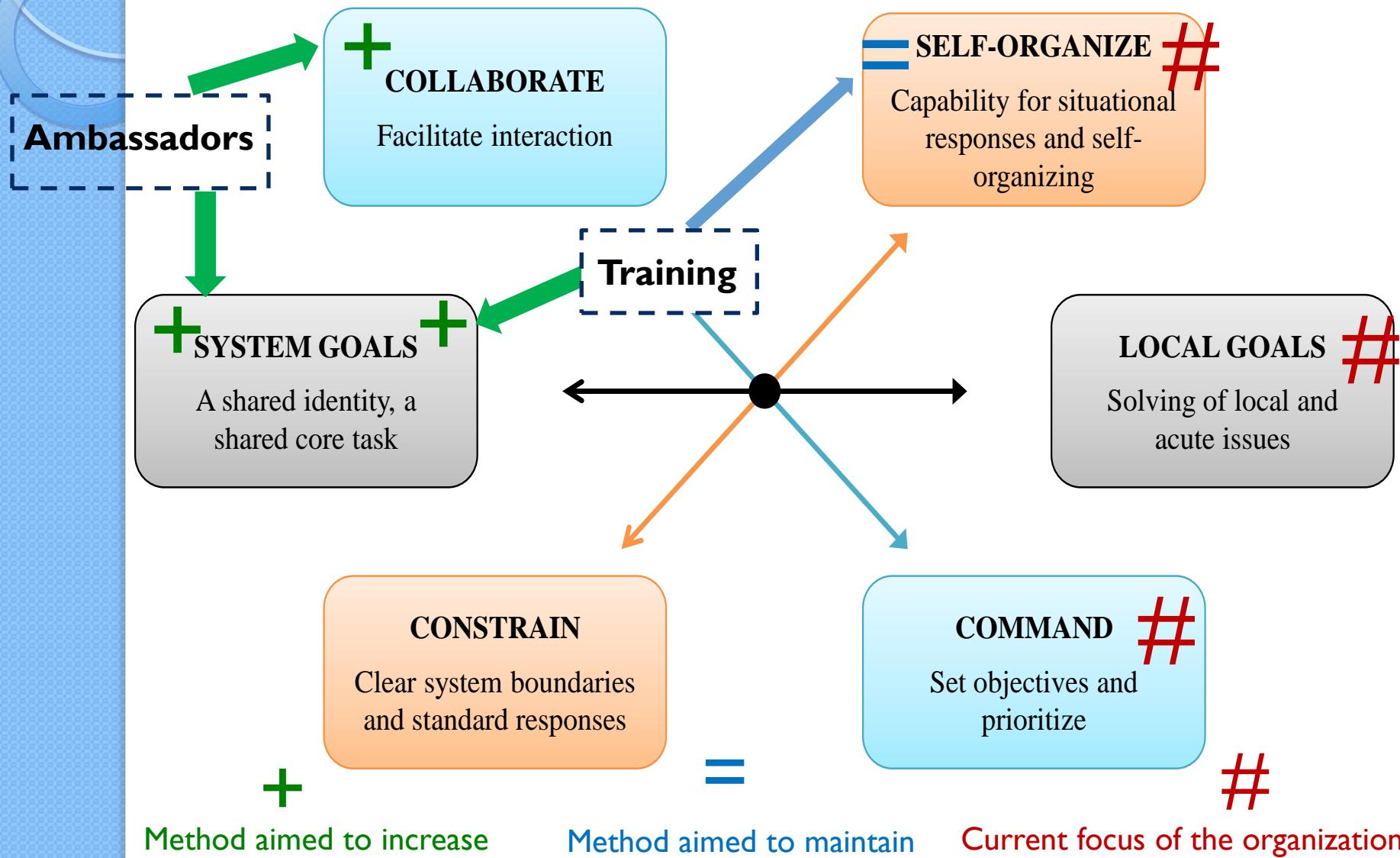
Simplified illustration of the selection of safety culture ambassadors & safety training methods in a case organization – *not reported previously*



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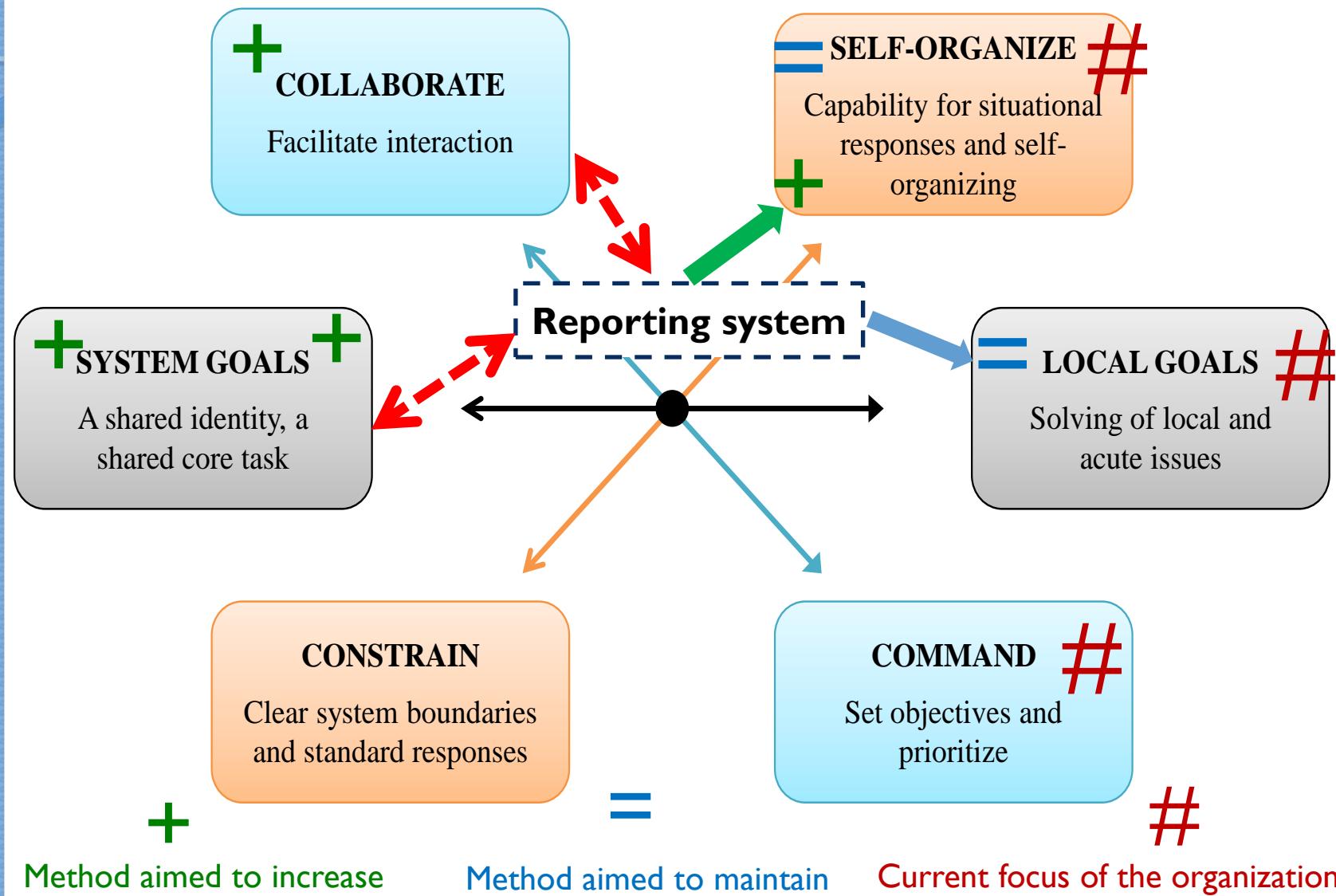


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The study also gave implications of preconditions for reporting systems, implying all development methods need to be considered together



Conclusions

- Selection of development tools should not be random but based on analysis of current organizational conditions and pros and cons of various methods
 - Principles and the management model provide assistance for selecting and using culture change tools
 - However, empirical testing is needed for more methods
- Principle 6 highlights that all methods include assumptions
 - Guidance is needed for selection and use of these tools to avoid unintended consequences and e.g. loss of openness to new risks when “old” risks are emphasized
- Future tool development would benefit from consideration of the conditions under which the methods should be used
 - E.g. all principles manifest differently during different life-cycles of the nuclear power plant => it is important to consider what tools are applicable e.g. during construction or decommissioning

References

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