A Context-Sensitive Functional Model of Teamwork Processes

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Introduction

Teamwork involves two or more people (within or across organizations) interacting dynamically, adaptively and interdependently toward a shared objective/goal/mission (Salas et al., 1992)

Key distinctions:

- **teamwork and taskwork**

- **intra-team and inter-team collaboration**

Inter-team collaboration can take place within a single agency, as in joint operations involving the army, navy and air force. Multi-agency teamwork occurs when a number of organizations collaborate to deal with a particular situation (e.g., coalition operations).

Introduction

A great deal of research on team functioning has been devoted to:

1) identifying the relevant cognitive and social processes

2) measuring their impact on team effectiveness

Challenge

There are a multitude of individual attitudes, behaviors, decisions, and actions that may contribute to successful outcomes for the entire organization (MacMillan et al., 2005, p. 253)

- This complexity creates a major challenge for understanding and measuring organizational performance.

- A strong framework to organize and synthesize knowledge is needed to guide measurement and analysis.

Building blocks of collaboration

Synthesis based on the research literature: 18 distinct features of collaboration

|	
Adaptability	**Monitoring progress toward goals**
Conflict management	**Mutual monitoring & support**
Communication	**Planning & synchronization**
Division of labor	**Resource sharing**
Goal specification	**Shared knowledge, representations & intentions**
Group cohesion & team identity	**Systems interoperability**
Group motivation & commitment	**Systems monitoring**
Leadership	**Training & education**
Mission analysis	**Trust**

Functional classification of team processes
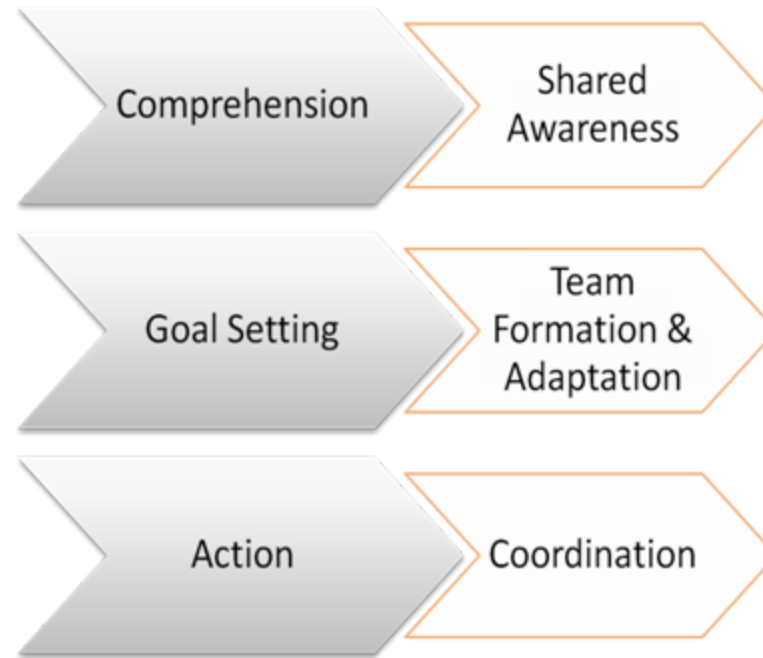
Figure 1: Aspects of behaviour associated with team functions

Functional classification of team processes
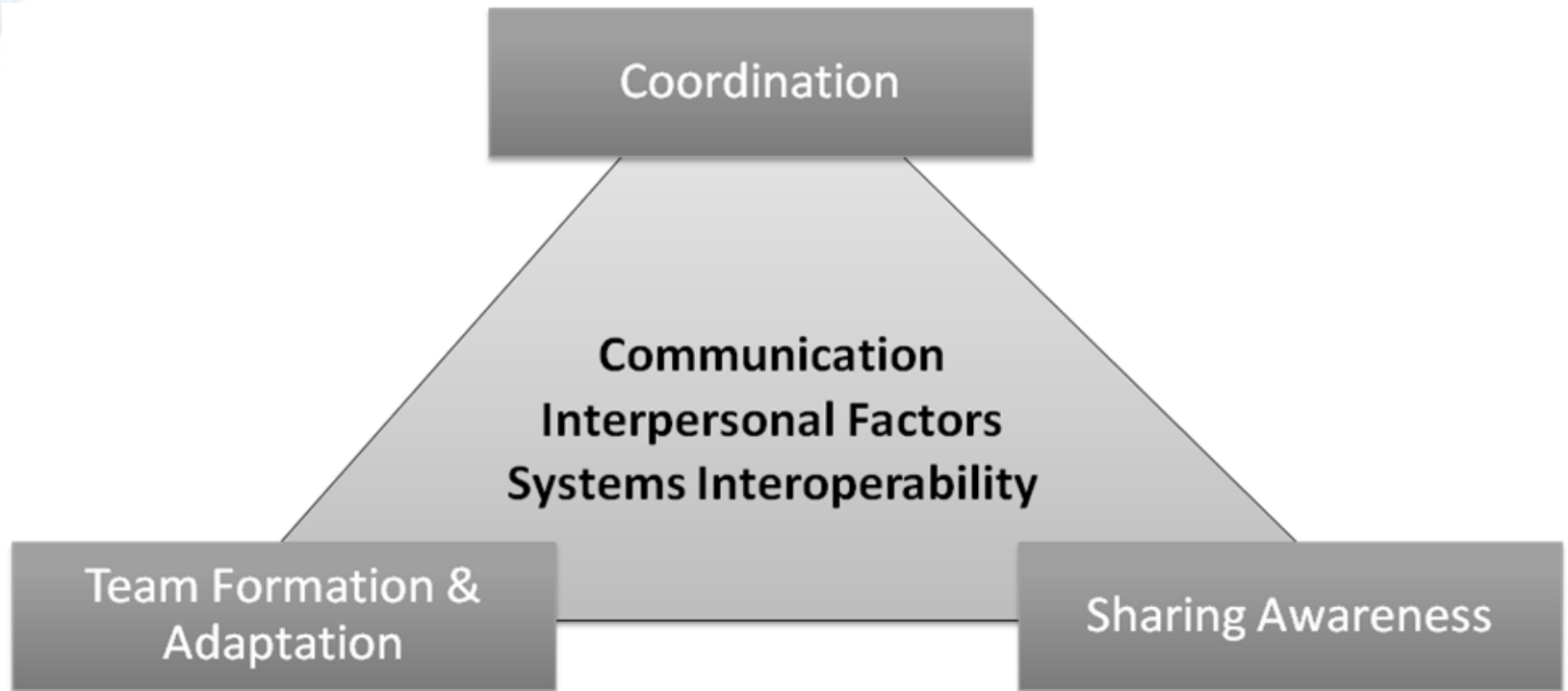
Figure 2: Functions of collaborative interaction and teamwork requirements

Process-function mapping

Table 1: Functional classification of the building blocks of collaboration

Team formation & adaptation	Coordinating	Sharing awareness	Teamwork requirements
Adaptability	Leadership	Shared knowledge, representations & intentions	Communication
Division of labour	Planning & synchronization	Systems monitoring	Group cohesion & team identity
Goal specification	Conflict management	Monitoring progress toward goals	Group motivation & commitment
Mission analysis	Resource sharing		Systems interoperability
Mutual monitoring & support			Trust
Training & education			

Contextual factors

The collaboration context can have a profound impact on teamwork requirements and mediate the relationship between team processes and team effectiveness

For example:

The teamwork requirements of an effective explosive ordnance disposal team are not the same as those on a combat information center or weapons fire team (Driskell, Salas, & Hogan, 1987).

Purpose of the model

A general limitation of existing teamwork models is that they fail to *account for the variable effects of teamwork processes depending on the context*:

> [Group research, in general] not only fails to study the interactions between group and embedding context but takes great pains to strip away "irrelevant" contextual factors. […] What is most successfully stripped away is the researcher's attention to context
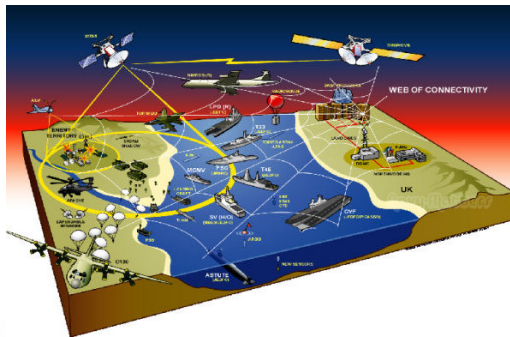
(Arrow et al., 2000)

Model overview

- Assessment of teamwork processes to indicate the level of collaborative activity achieved

- Degree of collaboration can be a powerful predictive factor of team / multiteam effectiveness by considering the key factors of collaboration in combination

- Each building block's intrinsic importance (weight) in predicting the outcome is expected to change in various contexts (i.e., according to task type, time pressure, team structure, etc.)

Model overview

COLLABORATION INCREASES **CAPABILITY**
(as an integrative variable)   (not just effectiveness)

TEAMWORK REQUIREMENTS DEPEND ON **CONTEXT**

AGILE TEAMS ADAPT THEIR COLLABORATION
PROCESS TO **CHANGING REQUIREMENTS**

Formal representation

Team capacity is predicted by the (weighted) degree of collaborative interaction (DC)

Mutually reinforcing perspective on team factors:

$$DC = F_1 \cdot F_2 \cdot F_3 \cdot F_4 \cdot F_5 \dots \cdot F_{18}$$

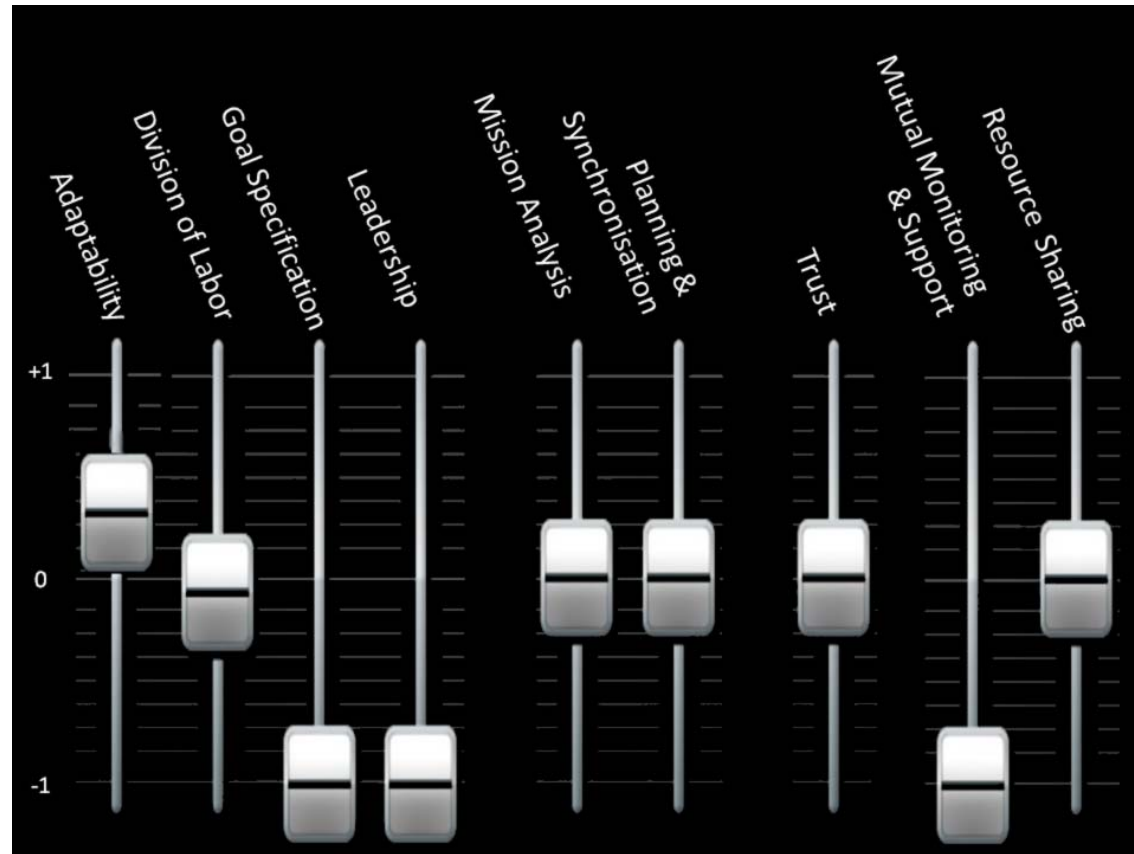**Simplified model using functional classification:**

$$DC = F_1 \cdot F_2 \cdot F_3 \cdot F_4$$

Model with context-dependent weights:

Predicted capacity$_{(Context\ x)}$ = (F1 · w1) (F2 · w2) (F3 · w3) (F4 · w4)

Context-dependent weights

Figure 3: The equalizer as an analogy of the relative weights of the building blocks

Model calibration method

3 complementary approaches:

- Multiagent simulations

- Laboratory experiments with microworlds

- Evaluation of field operations / exercises

Applications:

- Identifies critical teamwork processes according to context

- Better collaboration and adaptation = greater agility

Implications for C2 team agility

Six dimensions of agility (Alberts & Hayes, 2003):

Robustness: ability to maintain effectiveness across contexts

Resilience: ability to recover / adjust to damage or perturbations

Responsiveness: ability to react to a change in the environment

Flexibility: ability to employ multiple ways to succeed

Innovation: ability to do new things or do old things in new ways

Adaptation: ability to change work processes and organization

Implications for C2 team agility

Agile C2 requires teams and multiteam systems to adapt their collaborative processes as a function of contextual changes.

A better capability to figure out the requirements of the situation would support adaptive C2.

Limits: Change is difficult to anticipate or even to detect once it has occurred (change blindness).

- Requires good monitoring and sensemaking.

Conclusion

Model proposes a predictor of team effectiveness that may prove more useful than individual factors taken separately.

Rather than considering team processes individually, it is their combination that best determines the global outcome.

Contributions:

- Integration of conflicting results in team research

- Metric for assessing teamwork effectiveness
  as a function of contextual requirements

- Tool to identify context-based collaboration priorities for
   team design and adaption