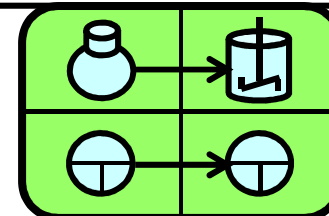


R&D Project Management in the Chemical Industry



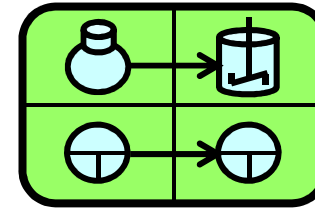
The following collection of PowerPoint® Charts is intended to further clarify and supplement the relevant specialist publications on the subject matters dealt with. This collection in no way is used for any commercial purposes, but as learning material for students.

Selected sources for in-depth studies of the respective subject matters are given in some lists of references.

The chemical-technical target components, formulas, deadlines, data, project structures and action plans shown in project examples P1-P3 are widely with a practical orientation, but yet purely fictitious. They are solely used for a clear illustration of the particular topic and for learning purposes.

The names of all persons with project functions are solely fictional. Matches with the names of other people would be purely coincidental.

R&D Project Management in the Chemical Industry



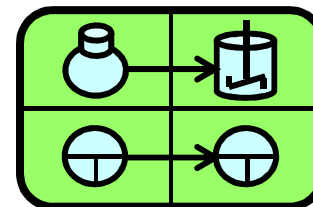
The Subject Matter

- Innovations: Characteristics, Measures for its Promotion, Process Variants.
- Three Examples for Innovation Projects (Chemistry and Technology):
 1. Highly Elastic Clear Coats for the OEM Automotive Sector.
 2. Nitrilase Catalyzed Synthesis of a Chiral Hydroxy-Carboxylic Acid.
 3. New Metal-Organic Frameworks for the Adsorptive Storage of Gases.
- Projects, Target Systems, Project Management in R&D.
- Appropriate Organization and Effective Structure Planning of R&D Projects.
- Project Flow Planning, Milestones, the Stage-Gate®-Process, Network Diagrams.
- Effective Implementation and Control of R&D Projects, Trend Analyses.
- Success Risks: Identification, Classification and Treatment.

Recruitment and Lead of Project Staff: Chemists (m/f/d) – Team Players, Pacemakers and Executives in Projects.

- Project Manager (m/f/d): Tasks, Leadership Functions and Personality Profile.
- The Systematic Evaluation of Individual R&D Projects.
- R&D Strategy: The Planning of a Project Portfolio.

R&D Project Management in the Chemical Industry



Subject Matter →

***Recruitment and Lead of Project Staff:
Chemists (m/f/d) – Team Players,
Pacemakers and Executives in Projects.***

Recruitment and Lead of Project Staff

Megatrends Provide the Appropriate Scope for Options and Actions as "Drivers of Innovations":

Worldwide and long-term development tendencies
in economy and society →

11 Megatrends, as "Drivers of Innovation",
will have a pronounced impact on future recruitment,
personnel lead and personnel development in
companies.

Recruitment and Lead of Project Staff

Megatrends 2030 as "Drivers of Innovations":

01	Digitalization and Global Networking.	WWW, Robotics and A.I., they will control and steer offices, houses, cars, societies, markets, weapons and intelligence agencies in every corner of the world. New, highly efficient and cooperative forms of knowledge acquisition increasingly require orientation and power of judgment.
02	The Progression of Nanotechnology.	Miniaturization of equipment from electrical engineering, electronics, optoelectronics and laser applications. New, "intelligent" materials based on models from nature are used. Incredibly small, molecular "machines" will change our lives.
03	The Progression of Biotechnology.	Biocatalysts and bioconversions enrich and complement the conventional chemical-technical syntheses. Genetic diagnostics, individual medicine, stem cell therapies, tissue engineering and artificial organs will revolutionize the healthcare system.
04	Resolute Expansion of E-Mobility.	The further development of electromobility affects all vehicle types worldwide. High-performance batteries or fuel cells are increasingly being used. Cars are becoming "rolling computers" with new functions via software updates. Development of a charging infrastructure.

Recruitment and Lead of Project Staff

Megatrends 2030 as "Drivers of Innovations":

05	The Growth in Asian Countries.	China, India and Indonesia are expanding their infrastructure, industrial production and domestic demand. They are challenging the US as new gravitational centers in the global economy. The risk of trade wars or economic wars is growing.
06	The Increasing Spread of English.	The progressing of this world language is unstoppable and irreversible. The spread will dominate the effective communication in science, technology, advertising media and in a globalized economy. Innovations are preferably characterized with English terms worldwide.
07	The Demographic Change.	The world population is growing - but the Germans are becoming less and less. Europe is increasingly marginalized, the world is becoming Asian. The population is aging around the world. Society has to fundamentally reinterpret age as well as aging.
08	The Migration and Urbanization.	The south-north migrations will increase. The year 2000 marked the beginning of the urban millennium. The spread of urban life forms is gaining momentum. Numerous megacities and hypercities will dominate the global economy.

Megatrend: Urbanization



"Hypercities" (2021)

Tokyo	37.977.000	<i>Japan</i>
Jakarta	34.540.000	<i>Indonesia</i>
Delhi	29.617.000	<i>India</i>
Mumbai	23.355.000	<i>India</i>
Manila	23.088.000	<i>Philippines</i>
Shanghai	22.120.000	<i>P. R. China</i>
Sao Paulo	22.046.000	<i>Brasil</i>
Seoul	21.794.000	<i>South Korea</i>
Mexico-City	20.996.000	<i>Mexico</i>
Guangzhou	20.902.000	<i>P. R. China</i>
New York	20.100.000	<i>U. S. A.</i>

Megatrend: Urbanization



"Megacities" (2021)

Peking	19.433.000	<i>P. R. China</i>
Cairo	19.372.000	<i>Egypt</i>
Kolkata	17.560.000	<i>India</i>
Moscow	17.125.000	<i>Russia</i>
Bangkok	17.066.000	<i>Thailand</i>
Buenos Aires	16.157.000	<i>Argentina</i>
Shenzhen	15.929.000	<i>P. R. China</i>
Dhaka	15.443.000	<i>Bangladesh</i>
Los Angeles	15.402.000	<i>U. S. A.</i>
Lagos	15.279.000	<i>Nigeria</i>
Istanbul	15.146.000	<i>Turkey</i>

Megatrend: Urbanization

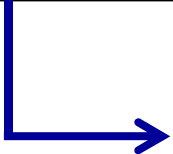


"Megacities" (2021)

London	9.002.000	<i>U. K.</i>
Saint Petersburg	5.384.000	<i>Russia</i>
Madrid	3.335.000	<i>Spain</i>
Kiev	2.967.000	<i>Ukraine</i>
Rome	2.784.000	<i>Italy</i>
Paris	2.142.000	<i>France</i>
Ruhr Area	5.170.000	<i>Germany</i>
Berlin	3.669.000	<i>Germany</i>
Hamburg	1.847.000	<i>Germany</i>

Recruitment and Lead of Project Staff

Megatrends 2030 as "Drivers of Innovations":

09	Climate Change and "Neo-Ecology".	The earth warms up, the sea level rises. Alternative "energy sources" and sustainable technologies for energy use will limit the greenhouse effect. A thorough realignment of ecological values, as well as of entrepreneurial thinking and acting will be necessary.
10	"Gender Shift": Women in Top-Jobs.	Altered role patterns are causing radical change in the economy and society. Additionally, typical "female qualifications" will be in demand in the 21st century - and favor the advancement of women in top positions.
11	"New Work": Changes in the World of Work.	Expansion of the symbiosis between life and work: Time and workplace autonomy and home offices are increasing. In the future, employees will become entrepreneurs in their own right - risks will grow, but so too will freedom.
		One consequence: The project economy is gaining in importance with high dynamics!

Recruitment and Lead of Project Staff

Megatrend "Project Economy" in the World of Work:

In 2020, 15% of the total value creation will be generated worldwide by the "project economy". That is, through cross-company and cross-industry cooperation in temporary, highly flexible networks.

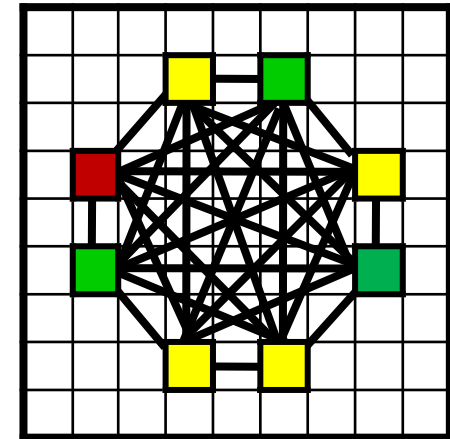
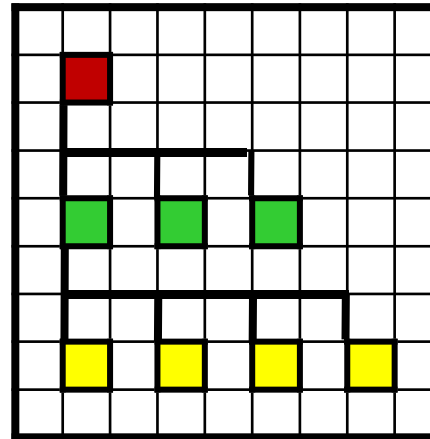
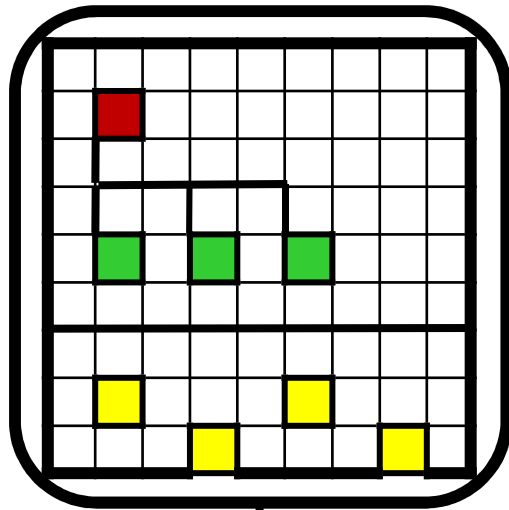
→ (Deutsche Bank Research 2008)

In future, employees will increasingly work together in (part) projects within a limited time frame. When a task has been completed, the teams will be reorganized.

→ (WirtschaftsWoche 2008)

Recruitment and Lead of Project Staff

Innovation Driver "Project Economy" with Incorporation.



Exclusion

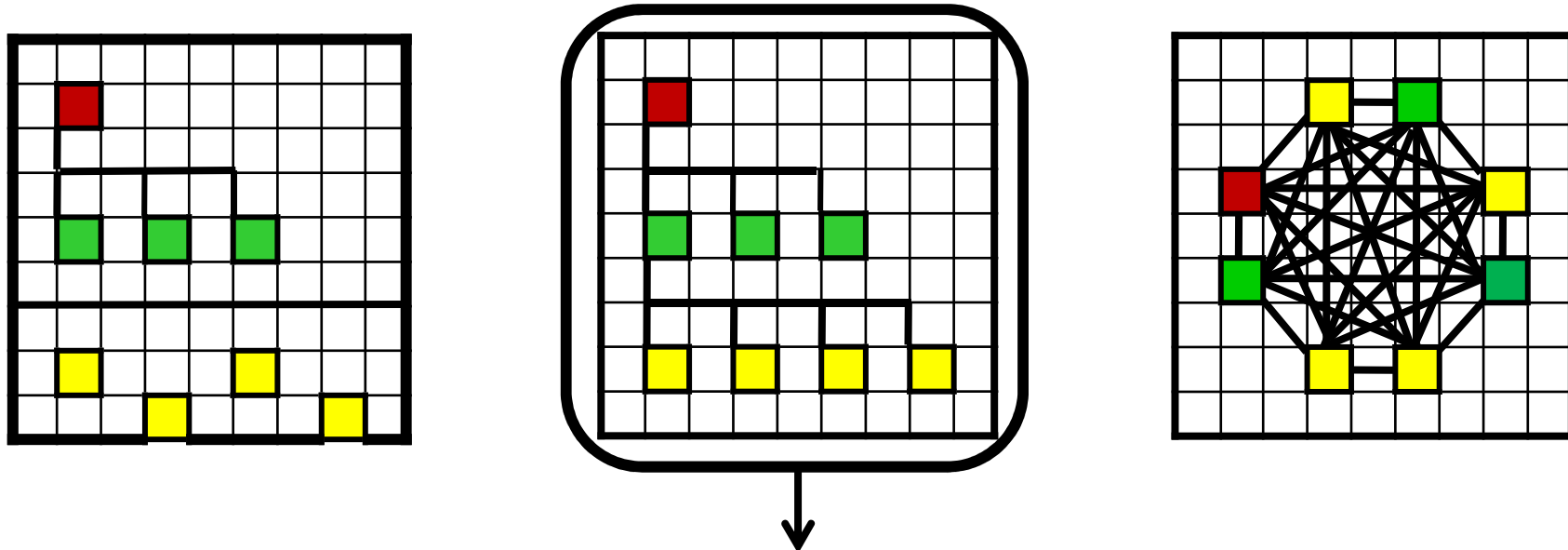


Separate

- "External control", depending on project status and requirements.
- Discontinuous, "filtered" and directed information flows.
- Assignment of individual orders, depending on the purpose.

Recruitment and Lead of Project Staff

Innovation Driver "Project Economy" with Incorporation.



Integration

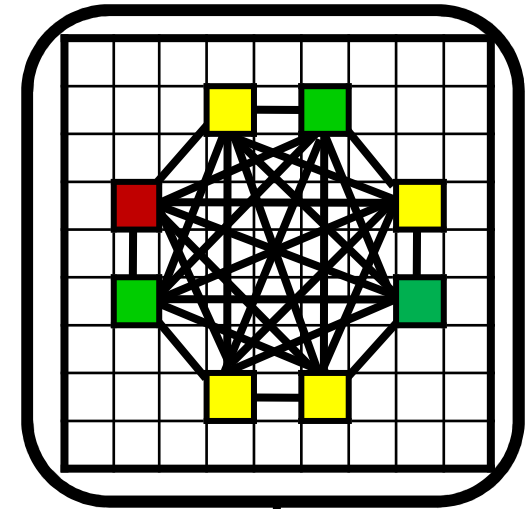
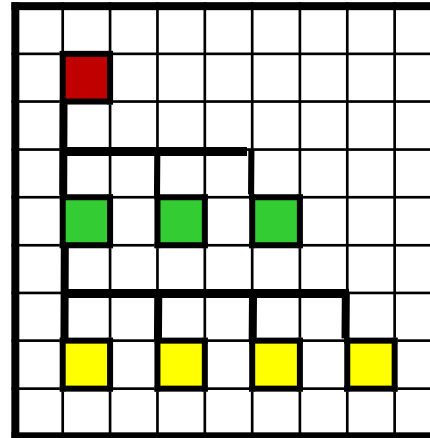
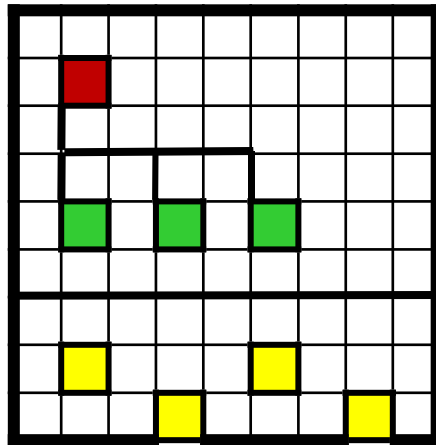


Together

- Continuous control from "above" through the project hierarchy.
- Selected and channeled information flows.
- Intensive and efficient integration into the project process.

Recruitment and Lead of Project Staff

Innovation Driver "Project Economy" with Incorporation.



Inclusion

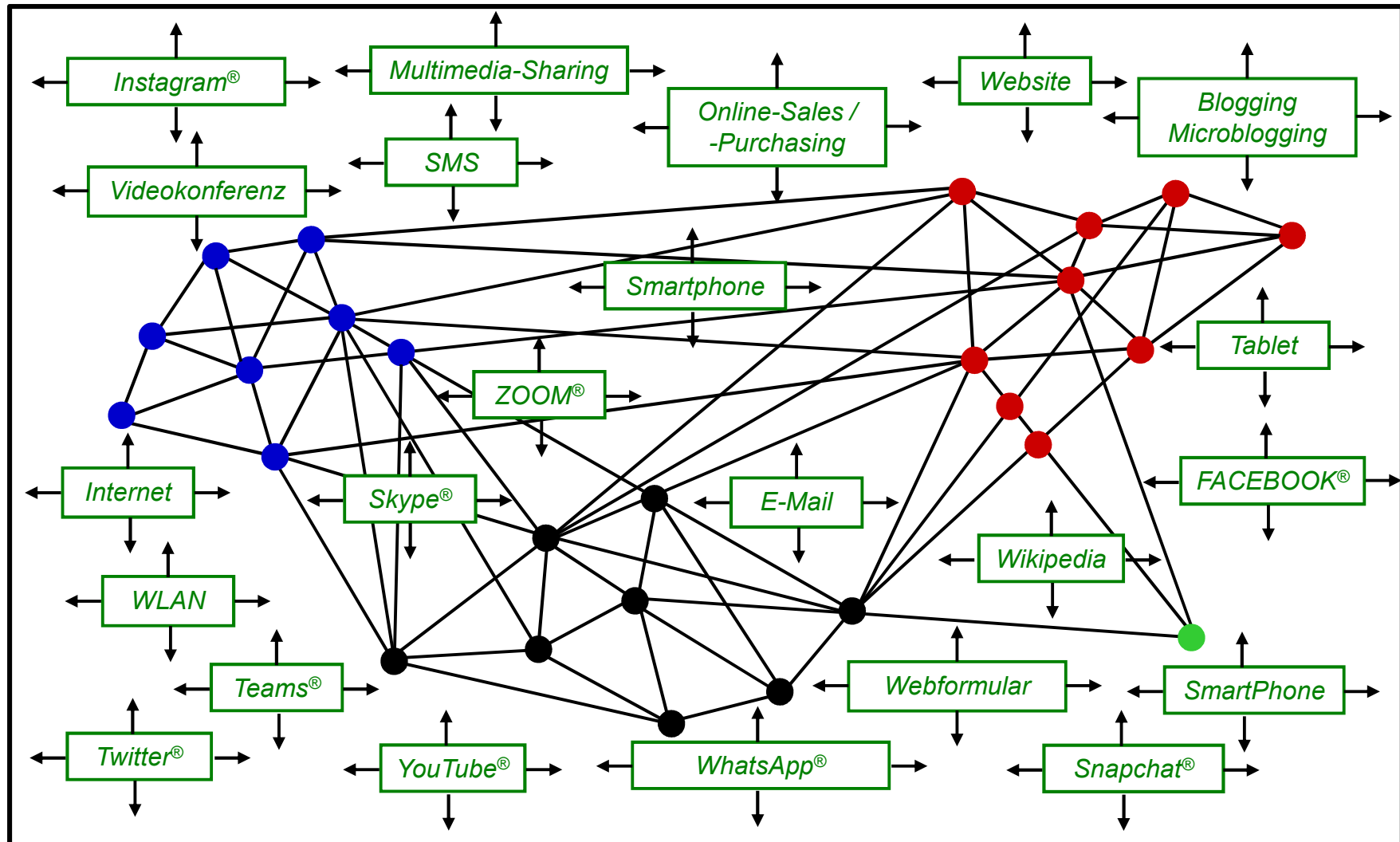


Together and for Each Other

- Continuous self-control in a fully structured team.
- Continuous, comprehensive and transparent information flows.
- Intensive and targeted integration into the project process.

Recruitment and Lead of Project Staff

High Effectiveness Through Compact Interconnectedness.



Recruitment and Lead of Project Staff

Changes in the World of Work, Chemical Industry 2020. **Causes** and Indicators of the Trend:

Further "Waves of Globalization"

- Realignment of international trade and customs agreements.
- Continued cross-border migration.
- Further expansion of global environmental protection measures.

Demographic Changes

- Aging and decrease of the working population.
- Top skills shortage.
- Extension of working life.

→ **Consequences for the recruitment of personnel!**

Recruitment and Lead of Project Staff

Changes in the World of Work, Chemical Industry 2020. **Causes** and Indicators of the Trend:

New Technologies

- Dominance of network technologies and system technologies.
- Increase in robotics, automation and artificial intelligence.
- Progressive digitization of numerous operation sequences.

Structural Change in the Economy

- Knowledge-based service society.
- Increase in the qualification level.
- Flexibility of working hours and place of work.

→ Consequences for the recruitment of personnel!

Recruitment and Lead of Project Staff

Employed Persons: Categories, Relation to Project Work.

Highly Qualified Specialists

- Excellent specialist knowledge and skills (vocational training, study).
- "Fast and long-term learners", also in different subject areas.
- High professional flexibility.
- Practical Experiences with trans-disciplinary teamwork.
- Result and performance orientation.

**Strong Project
Relatedness**

20%

Tendency:



Recruitment and Lead of Project Staff

Employed Persons: Categories, Relation to Project Work.

"Common" Employees

- *One* basic pattern of employment throughout all their working life.
- Careful and reliable execution of all tasks to be done.
- In principle, routine work is dominating.
- Perception of the continuous cuts of previous social guarantees.
- Noticeable "dismissal pressure".

**Weak Project
Relatedness**

50%

Tendency:



Recruitment and Lead of Project Staff

Employed Persons: Categories, Relation to Project Work.

Low-Skilled People

- Temporarily or periodically recurring economic inactivity.
- Low qualifications, positions on the edge of the labor market.
- Inner resignation regarding future employment opportunities.
- Occasionally precarious employment.
- Dependencies on official orders and regulations.

**Hardly Project
Relatedness**

10%

Tendency:



Recruitment and Lead of Project Staff

Employed Persons: Categories, Relation to Project Work.

Leasing Workers and Temporary Workers

- Periodic employment through work contracts or service contracts.
- Sometimes, precarious employment relationships with little "freedom of choice".
- The remuneration for simple services are in some cases close to the statutory minimum wage.
- Piecework and unpaid overtime are not uncommon.

**Few Project
Relatedness**

10%

Tendency:



Recruitment and Lead of Project Staff

Employed Persons: Categories, Relation to Project Work.

Freelancers and Small Entrepreneurs

- Transdisciplinary professional activities and experiences.
- Hobbies often serve as the basis for their respective "vocations".
- Passionate, customer-oriented problem solvers and service providers.
- Self-determined planning of phases of intensive work and free time.

**Strong Project
Relatedness**

10%

Tendency:



Recruitment and Lead of Project Staff

Chemical Industry 2020 →

Requirements to Scientists (m/f/d) with Effectiveness:

Courage for Responsibility

Lifelong Learning

- Ability to free self-employment.
- Willingness to a discontinuous employment biography.
- Openness for additional, "different" expertise.
- Adaptability to new, flexible forms of organization.
- **Professionalism in project work. ←**

Willingness to Cooperation

Transdisciplinary Fitness

Recruitment and Lead of Project Staff

The Recruitment of Capable and Motivated Team Players: One Powerful Key to Project Success!

Not searched, because not available in own company:

"Universal Geniuses" who can do everything!

"Universal Geniuses" exist mainly in the job descriptions of HR departments, but very rarely in reality!

The effectiveness of "**strengths**" and "**weaknesses**" of the team players are significantly dependent on the specific situations in the project, its environment, and the nature of the tasks to be solved in each case.

Recruitment and Lead of Project Staff

The Recruitment of Capable and Motivated Team Players: One Powerful Key to the Project Success!

Not necessary for the achievement of the target system:



Pure Specialists

"The expert knows more and more about less and less,
until he finally knows **everything about nothing**."



Pure Generalists

"The generalist knows less and less about more and more,
until he finally knows **nothing about everything**."

Recruitment and Lead of Project Staff:
Chemists (m/f/d) – Team Players, Pacemakers and Executives

The careful selection of capable and motivated team players: "Central Key" to the project success!

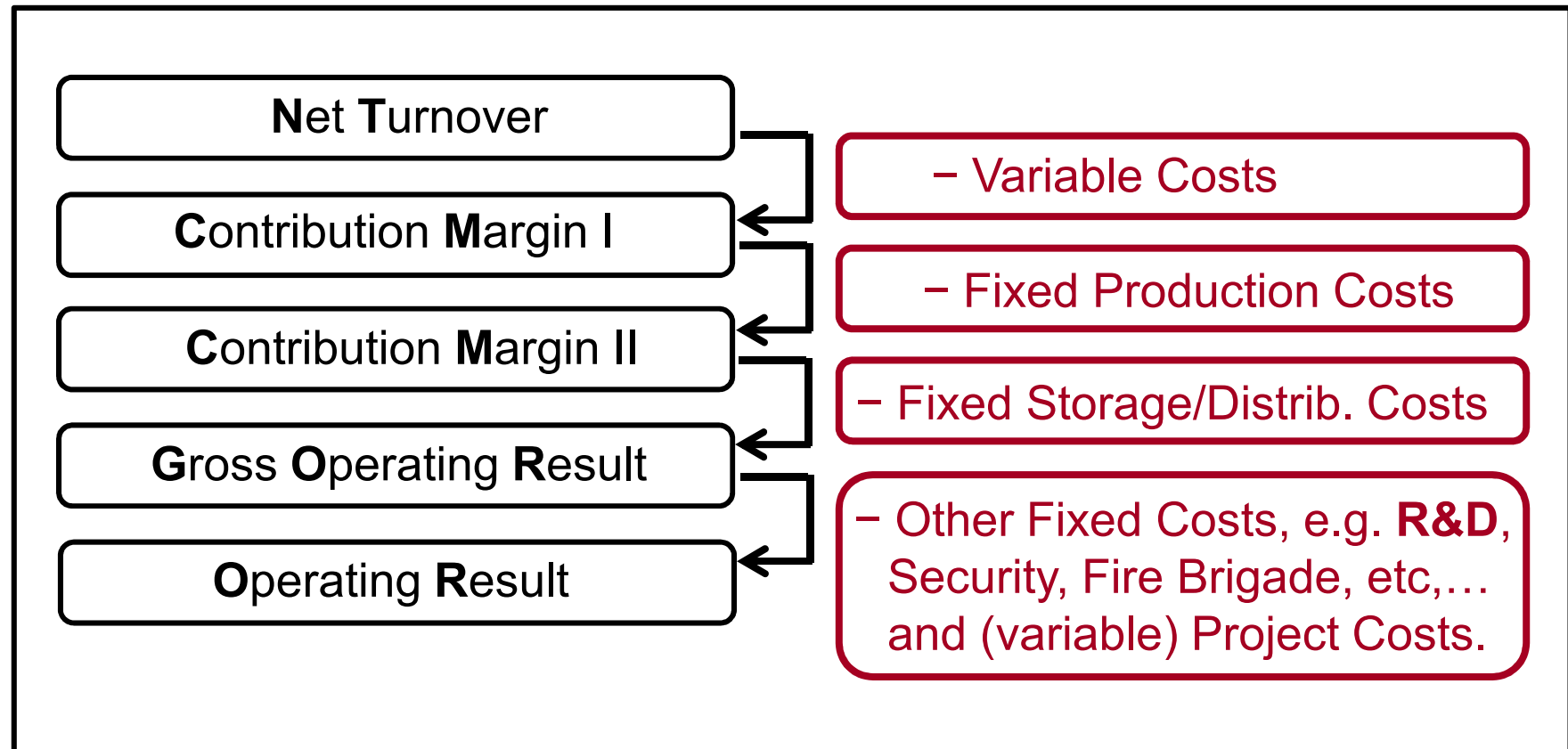
Searched!

People who will contribute to project success through their work results!



- High level of (chemical and technical) expertise.
- Convincing personality.

The project financing for companies usually takes place from the funds of the gross operating result:



**Necessary for the inclusion of a chemist in the team:
Medium-term increase in OR through more NT, CM I, CM II or GOR.**

Recruitment and Lead of Project Staff:
Chemists (m/f/d) – Team Players, Pacemakers and Executives

Professional Competence of Chemists (m/f/d)!

Professional *Skills*, not "only" Technical *Knowledge*!



Professional skillfulness is the ability to goal-oriented and effectively applicate one's own technical knowledge in the practical solution of tasks within a complex problem, therefore an **"Intrinsic Expertise of Action"**.

Recruitment and Lead of Project Staff:
Chemists (m/f/d) – Team Players, Pacemakers and Executives

Selection Criterion (Chemical) Skills, "Hardskills":

- Above-average work **results** as a scientist and laboratory manager.
- Ability to quickly and professionally solve demanding chemical tasks, manual (!) skills.
- Solid specialist knowledge through degrees (bachelor/master/diploma/doctorate) and by in-company training.
- Sound knowledge in the items safety, health and environmental protection.
- Ability to apply one's own knowledge and to assure the required goal-oriented knowledge transfer.

Recruitment and Lead of Project Staff:
Chemists (m/f/d) – Team Players, Pacemakers and Executives

Selection Criterion (Chemical) Skills, "Hardskills". **Example**

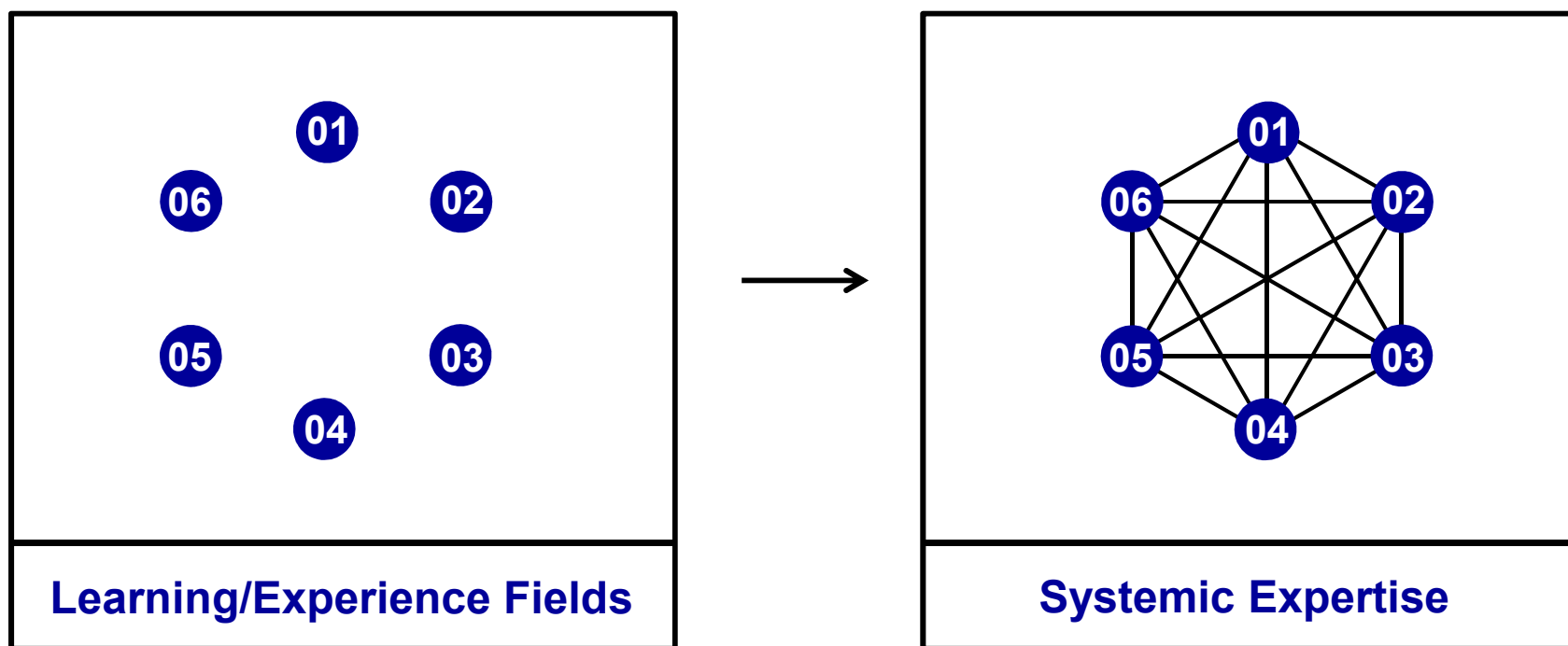
"Crossover Study" of Business Chemistry.
Essential Learning Subjects within Chemistry Studies:

01	Mathematics
02	Inorganic Chemistry
03	Organic Chemistry and Biochemistry
04	Physical Chemistry and Physics
05	Analytical Chemistry
06	Macromolecular Chemistry

(Degrees)
Bachelor (B. Sc.)
Master (M. Sc.)
Doctorate (PhD)

Recruitment and Lead of Project Staff:
Chemists (m/f/d) – Team Players, Pacemakers and Executives

From Learning Subjects to Chemical Knowledge and Skills. Elaboration and Saving of "Cognitive Networks":



Chemical skills: Successful use of systemic expertise for concrete problem solutions.

(K₆ – Graph) $\begin{bmatrix} 6 \\ 2 \end{bmatrix}$ (15 Edges)

Recruitment and Lead of Project Staff:
Chemists (m/f/d) – Team Players, Pacemakers and Executives

Selection Criterion (Business) Skills, "Hardskills". **Example**

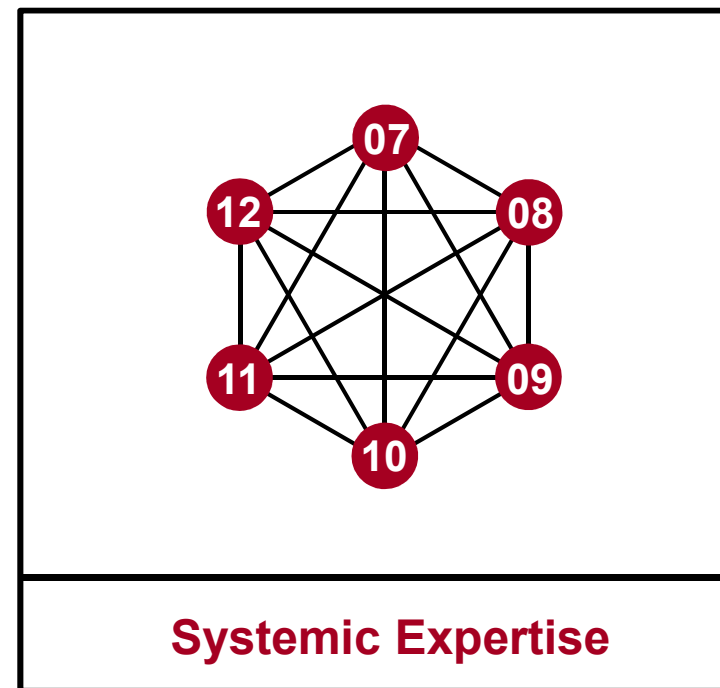
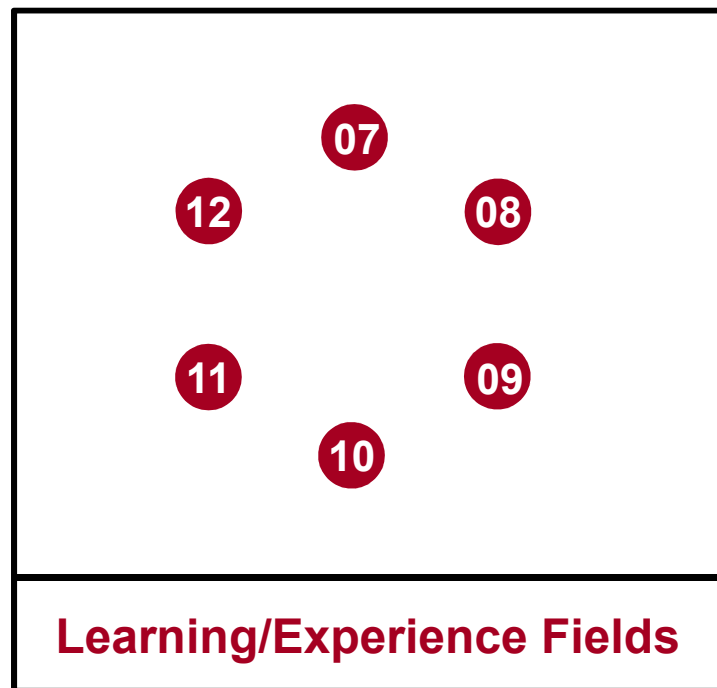
"Crossover Study" of Business Chemistry
Essential Learning Subjects within Business Studies:

07	Corporate Strategy
08	Controlling and Cost Account
09	Accounting and Balance Sheets
10	(Project) Management
11	Production, Marketing und Sales
12	Organization and Leadership

(Degrees)
Bachelor (B. A.)
Master (M. B. A.)
Doctorate (PhD)

Recruitment and Lead of Project Staff:
Chemists (m/f/d) – Team Players, Pacemakers and Executives

**From Learning Subjects to Technical Knowledge and Skills.
Elaboration and Saving of "Cognitive Networks":**

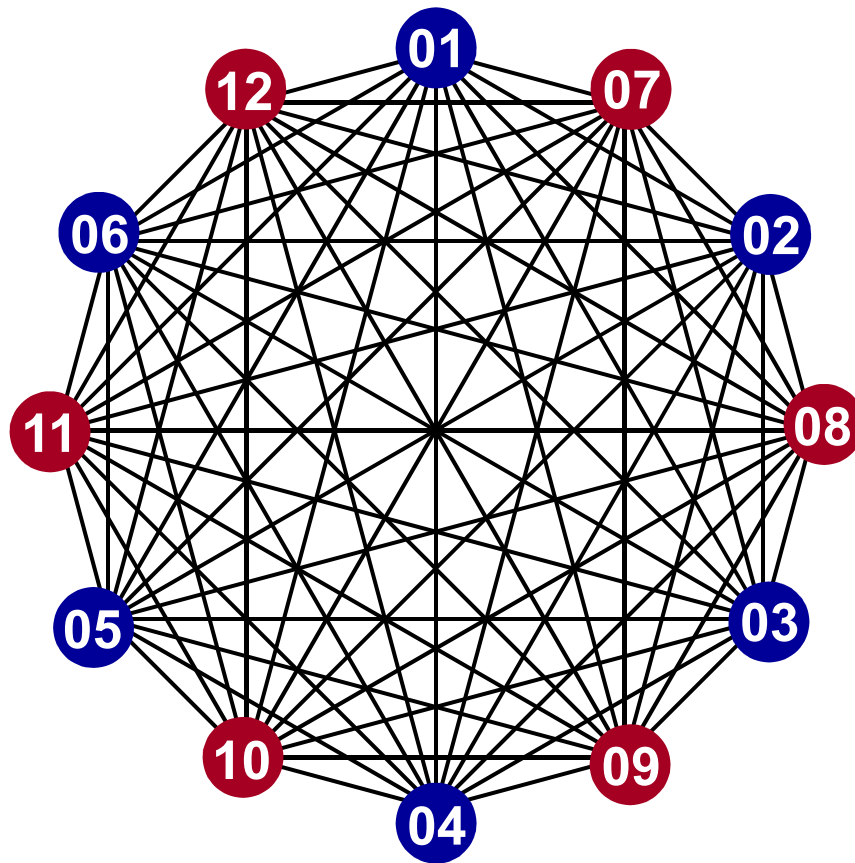


Business skills: Successful use of
systemic expertise for concrete
problem solutions.

(K₆ – Graph) $\begin{bmatrix} 6 \\ 2 \end{bmatrix}$ (15 Edges)

Recruitment and Lead of Project Staff:
Chemists (m/f/d) – Team Players, Pacemakers and Executives

"Crossover Study" of Business Chemistry
Elaboration and Saving of "Cognitive Networks":



(K_{12} -Graph) $\begin{bmatrix} 12 \\ 2 \end{bmatrix}$ (66 Edges)

$$\frac{n(n-1)}{2}$$

The systemic specialist
knowledge *exponentially*
grows with the number
of learning and experi-
ence fields!

Recruitment and Lead of Project Staff:
Chemists (m/f/d) – Team Players, Pacemakers and Executives

Selection Criterion "Internalized Entrepreneurship":

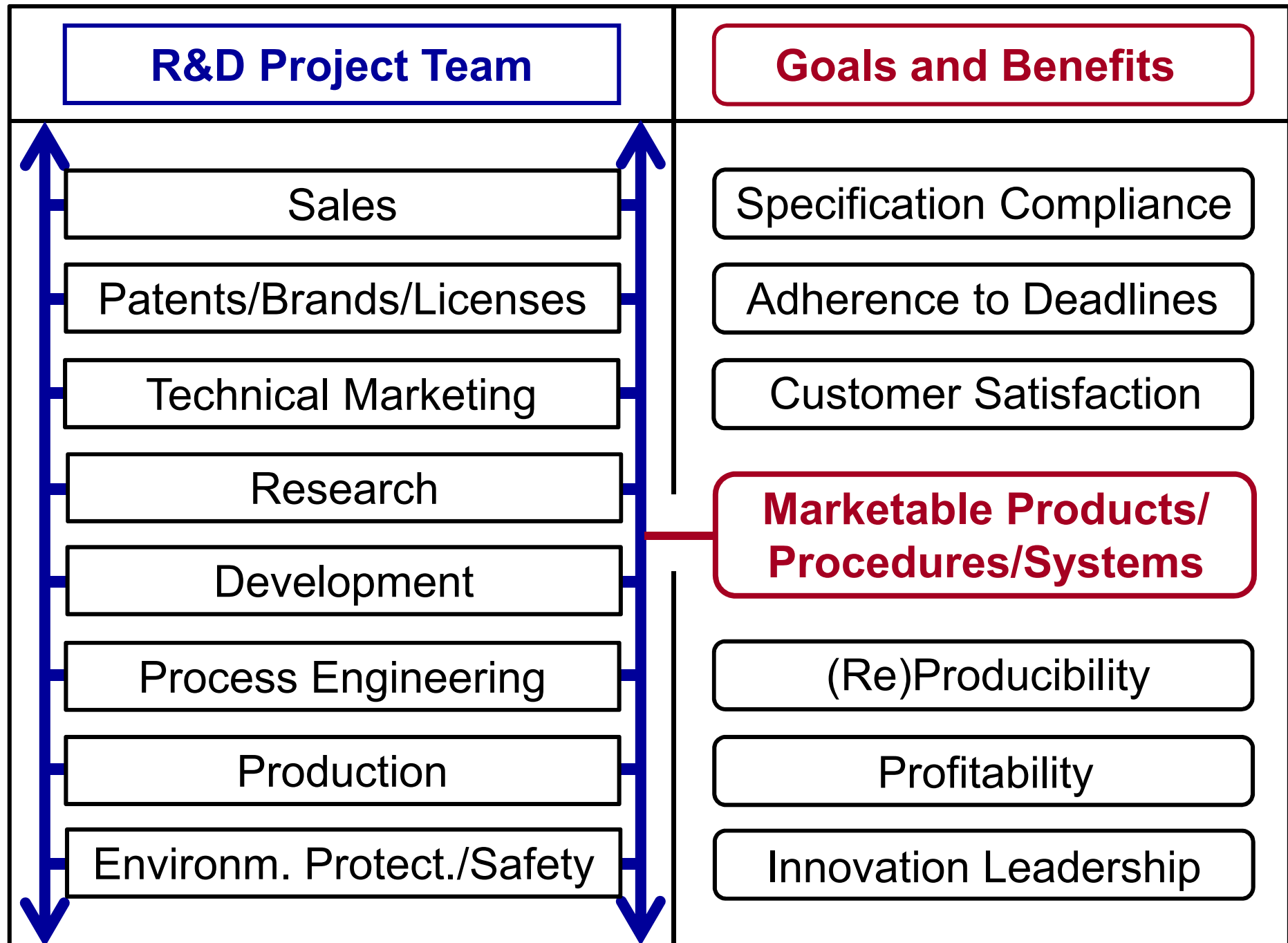
- Strong single-mindedness and result orientation.
- A recognizable will to self-responsible action.
- Constant orientation to the project strategy.
- Analytical way of thinking, perspicacity for the essential.
- Talent for a target-oriented work organization.
- Innovation orientation, willingness to changes.
- Creativity and mental flexibility.
- Absolute determination to performance.

Recruitment and Lead of Project Staff:
Chemists (m/f/d) – Team Players, Pacemakers and Executives

Selection Criterion

"Ability to Result-Oriented Social Interaction":

- Strong communication skills and empathy.
- Ability to effectively influence and effectuate.
- Understanding of organizational forms and appropriate use of internal and external networks.
- Recognizable will to constructive cooperation.
- Conflict ability, diplomatic skill.
- Customer orientation.
- Intercultural openness.



Recruitment and Lead of Project Staff:
Chemists (m/f/d) – Team Players, Pacemakers and Executives

Differences: Group Work – Team Work.

Criteria	Group – Characteristics	"Ideal Team" – Characteristics
<i>Interests</i>	The members pursue their own interests in each case.	Everybody is pulling in one direction.
<i>Goals</i>	Different individual targets are pursued.	Everyone is strictly pursuing the same target system.
<i>Priorities</i>	Belonging to the group is a secondary priority.	Belonging to the team has the highest priority.

Recruitment and Lead of Project Staff:
Chemists (m/f/d) – Team Players, Pacemakers and Executives

Differences: Group Work – Team Work.

Criteria	Group – Characteristics	"Ideal Team" – Characteristics
Organization	Organization is loose and non-binding.	Organization is lean and binding.
Motivation	Goal comes from the outside ("I have to...").	Motivation comes from inside ("I want...").
Competition	Individual competition against each other.	Common, external facing competition.

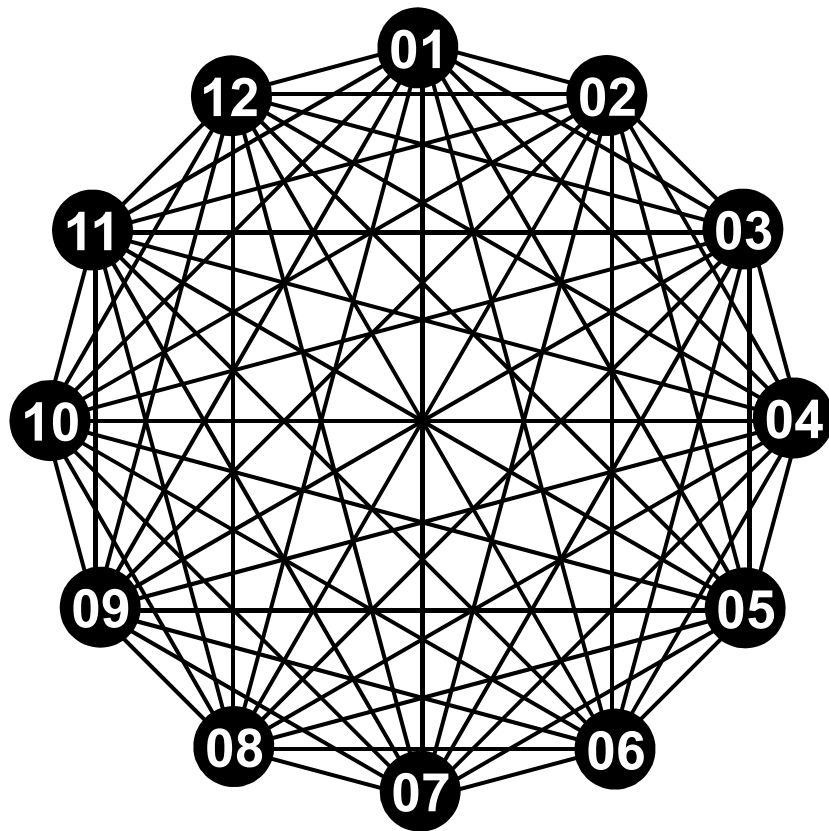
Chemists (m/f/d) Team Players, Pacemakers and Executives

Checklist for the own "Experiences with Teamwork".

Positive						Negative
						
Very trusting attitude.						Without any confidence.
Much coordination/communication.						No coordination/communication.
Strong willingness to cooperate.						No willingness to cooperate.
Conflicts are openly resolved.						Conflicts are covered up and not openly resolved.
Decisions are made together.						Decisions are only made by one side.
Agreements are complied with.						A lot is promised, but nothing is kept.
Problems of the other team member are seen and understood.						Problems of the other team members are not of any interest.
Open information exchange.						Many information is held back, often they are used for manipulation.
There is a clear and noticable willingness to compromise						Everyone insists on his point of view.

Chemists (m/f/d) Team Players, Initiators and Executives

**Danger of "Information Flooding" and "Action Paralysis"
at Key-Actions in Full-Structure Teams K_n with $n > 8$!**



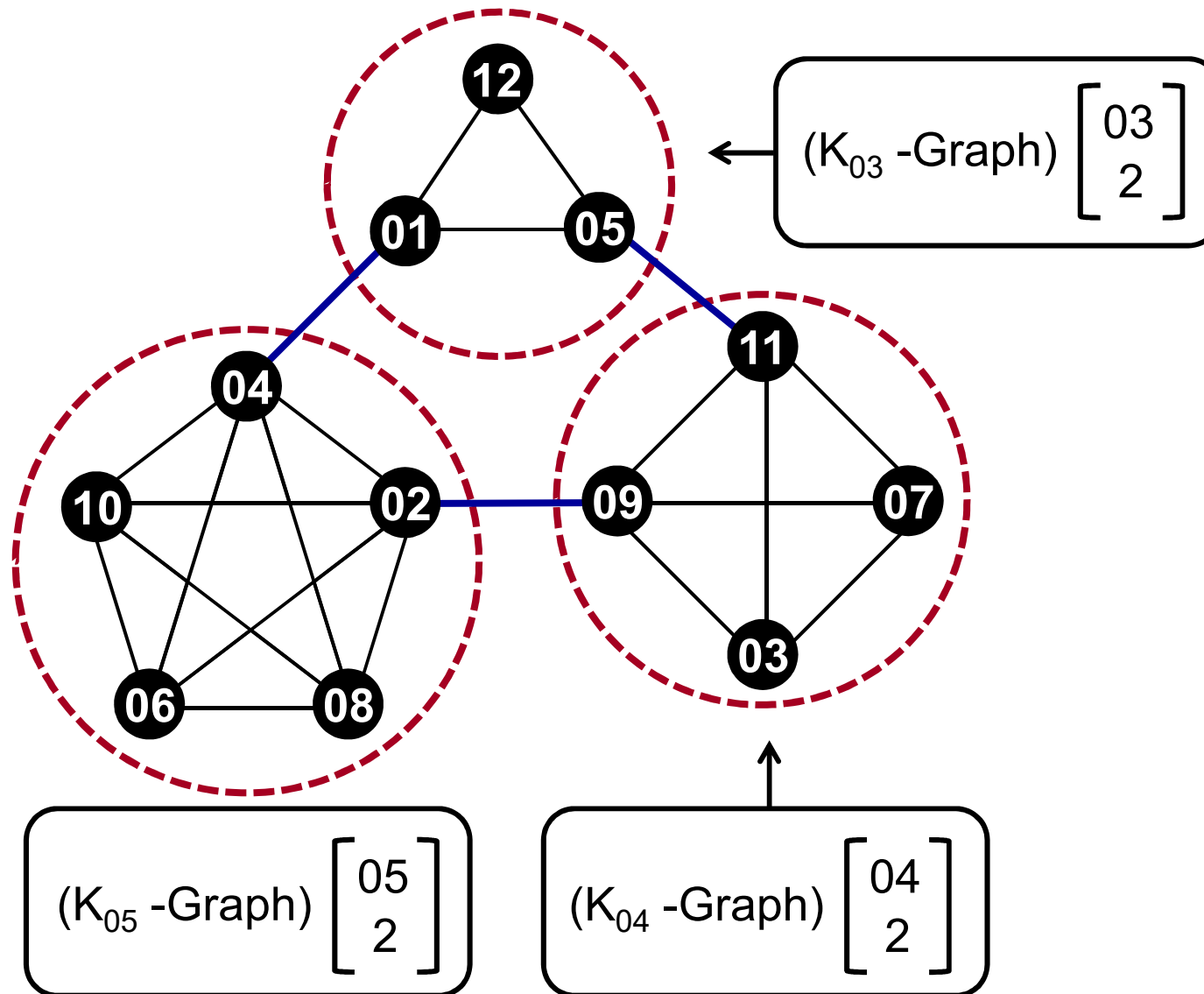
$$(K_{12}\text{-Graph}) \rightarrow \begin{bmatrix} 12 \\ 2 \end{bmatrix}$$

(66 Edges!)

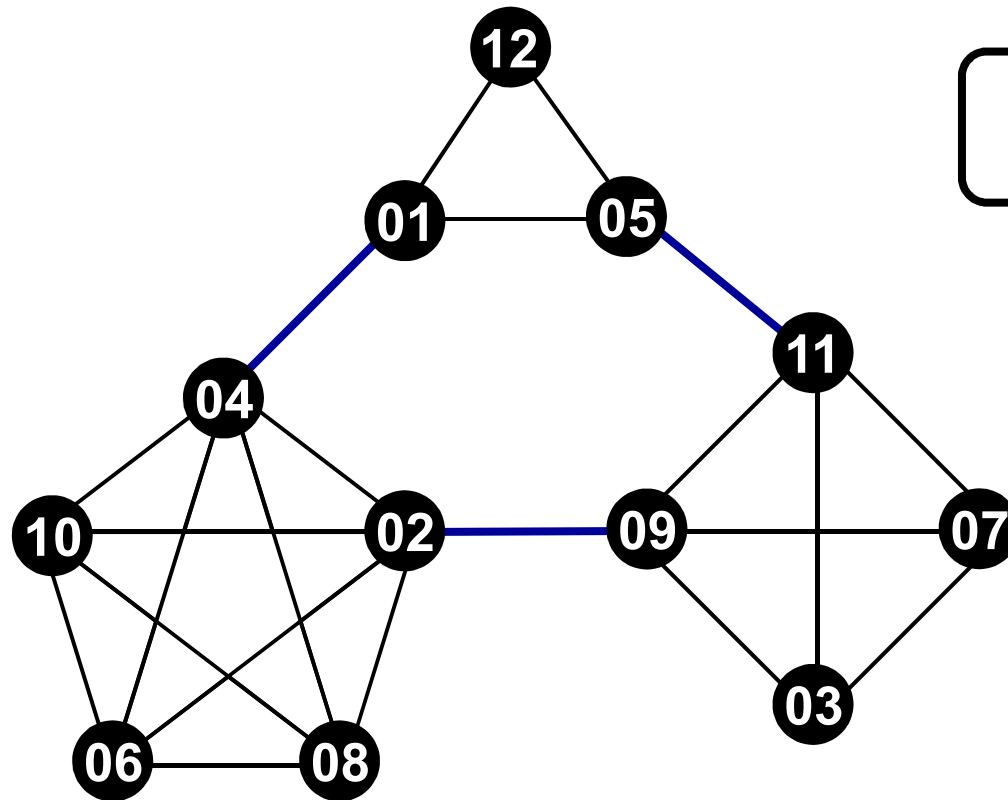
A **Simplex** with n vertices.
The number of all edges:

$$\frac{n(n-1)}{2}$$

Provision According to the **Principle of Subsidiarity ...**
 With Smaller, **Networked** Full Structures (Effective Cliques):



Provision According to the **Principle of Subsidiarity ...**
With Smaller, **Networked** Full Structures (Effective Cliques):



(22 Edges!)

Number of Edges : $10 + 6 + 3 + 3 = 22 = 66/3$ (!)

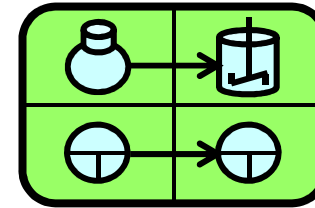
Recruitment and Lead of Project Staff:
Chemists (m/f/d) – Team Players, Pacemakers and Executives

R&D Project: An effective and "fairly" practised result orientation is essential for the overall success (Achievement of the target system)!

"First and foremost, it depends on the **people** and their daily interaction in the team, but not on meticulously elaborated and adhered network plans."

"Not head numbers, but head contents, basic attitudes and thought patterns are relevant for success in research and development projects."

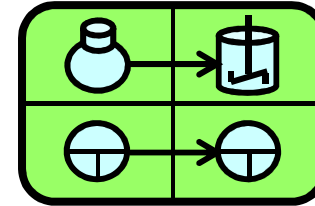
R&D Project Management in the Chemical Industry



The Subject Matter

- Innovations: Characteristics, Measures for its Promotion, Process Variants.
- Three Examples for Innovation Projects (Chemistry and Technology):
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R&D Project Management in the Chemical Industry



Subject Matter



***Project Manager (m/f/d):
Tasks, Leadership Functions
and Personality Profile.***

Project Manager (m/f/d): Tasks and Leadership Functions

The Functions from the Point of View of the Steering Group ("Technical Steering Committee"):

- Contractors (Technical Steering Committee).
- Contact persons (Technical Steering Committee).
- Managers of innovation processes.
- Target- and result-oriented pioneers.
- "Entrepreneurs within the own companies".

Project Manager (m/f/d): Tasks and Leadership Functions

Effectiveness as the Key to this Leadership Function!

Project Manager (m/f/d)	
Efficiency	Effectiveness
To do things right.	To do the right things.
To solve given problems.	To create intelligent alternatives.
To use the funds economically.	To optimize the use of funds.
To fulfill obligations (To perform enjoined activities).	To achieve results (To achieve project targets).
To reduce costs.	To increase the operating profit.
To reduce (redundant) staff.	To mobilize motivation and skills for achieving goal relevant results.

Project Manager (m/f/d): Tasks and Leadership Functions

Expectations of the Steering Committee:

Wanted for the project management →

Experienced, "resilient" and consequently result-oriented scientists who lead themselves!

- Target- and result-oriented planners/organizers.
- Executives with self-discipline and "coolness" ...
- Effective "pace makers"/"pulse generators".
- "Thrust powers" and "motors" in their R&D projects.
- Self understanding: "Entrepreneurs in Action".

Project Manager (m/f/d): Tasks and Leadership Functions

Different Leadership Styles During the Project Flow.

Leadership Style	Designation
R	Result-/Performance-oriented leadership.
H	Human-socially-oriented leadership.
P	Problem- and fact-oriented leadership.
S	Systematic leadership.
T	Tactic characterized leadership.

According to W. Fuchs,
Institut für methodisches Management, Hamburg 1980

Project Manager (m/f/d): Tasks and Leadership Functions

Different Leadership Styles During the Project Flow.

Leadership Style	Characteristics for the project participants:
R	Decides quickly and prevails energetically. Does not be afraid of conflicts. Sets short, ambitious deadlines. Demands a great deal from himself and from the other project participants.
H	Makes every endeavor for balances conflicts. Connects the human side with the project work. Has a lot of empathy. Trusts the team members and takes care of them.
P	Argues rational-consistent in discussions. Checks all reasonable alternatives. Does not ease off until the problem has been solved. Takes into account long-term considerations.
S	Ensures a programmed, exact project flow. Is conscientious, has principles and adheres to the rules. Does not participate in "experiments" or risky actions.
T	Strives to successfully balance the interests between the parties. Proposes acceptable compromise solutions. Negotiates clever and diplomatically.

Ideal Leadership: Situational applications of *all* styles.

Actual Leadership: A preferred main style, two "minor styles".

Project Manager (m/f/d): Tasks and Leadership Functions

Indispensable: To Clarify One's Own Framework of Action!

Framework of Action for the Project Manager (m/f/d):

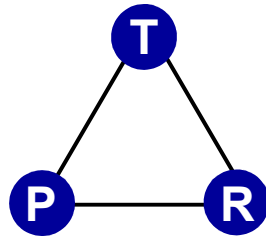
Tasks (T)

Power (P)

Responsibility (R)

Project Manager (m/f/d): Tasks and Leadership Functions

Indispensable: To Clarify One's Own Framework of Action!



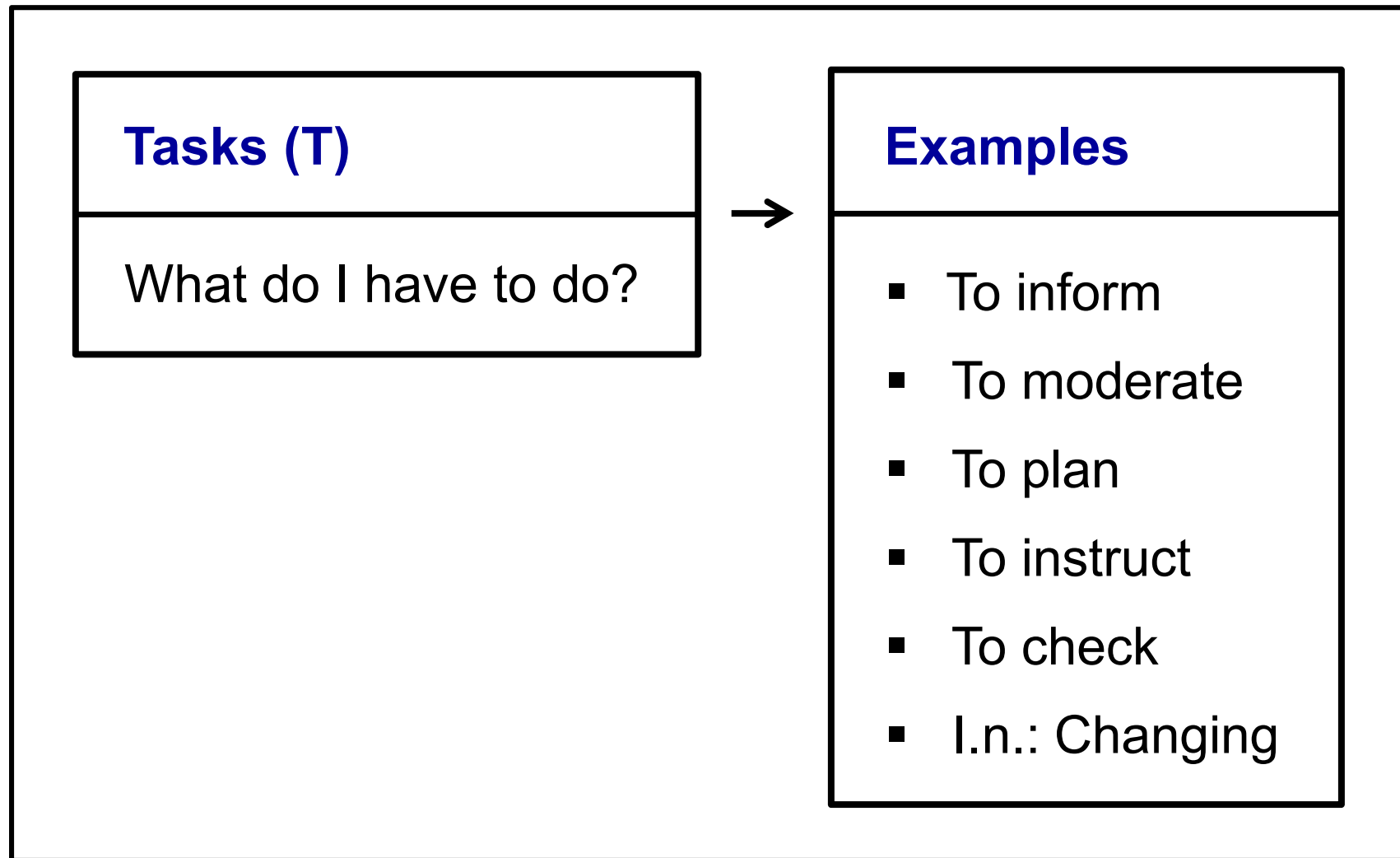
$$(K_3) \begin{bmatrix} 3 \\ 2 \end{bmatrix}$$

"Project Management Triad"

T	Tasks	Project Management. Project Steering.
P	Power	Budget-Use, Authority.
R	Responsibility	Project Progress, Target Achievement.

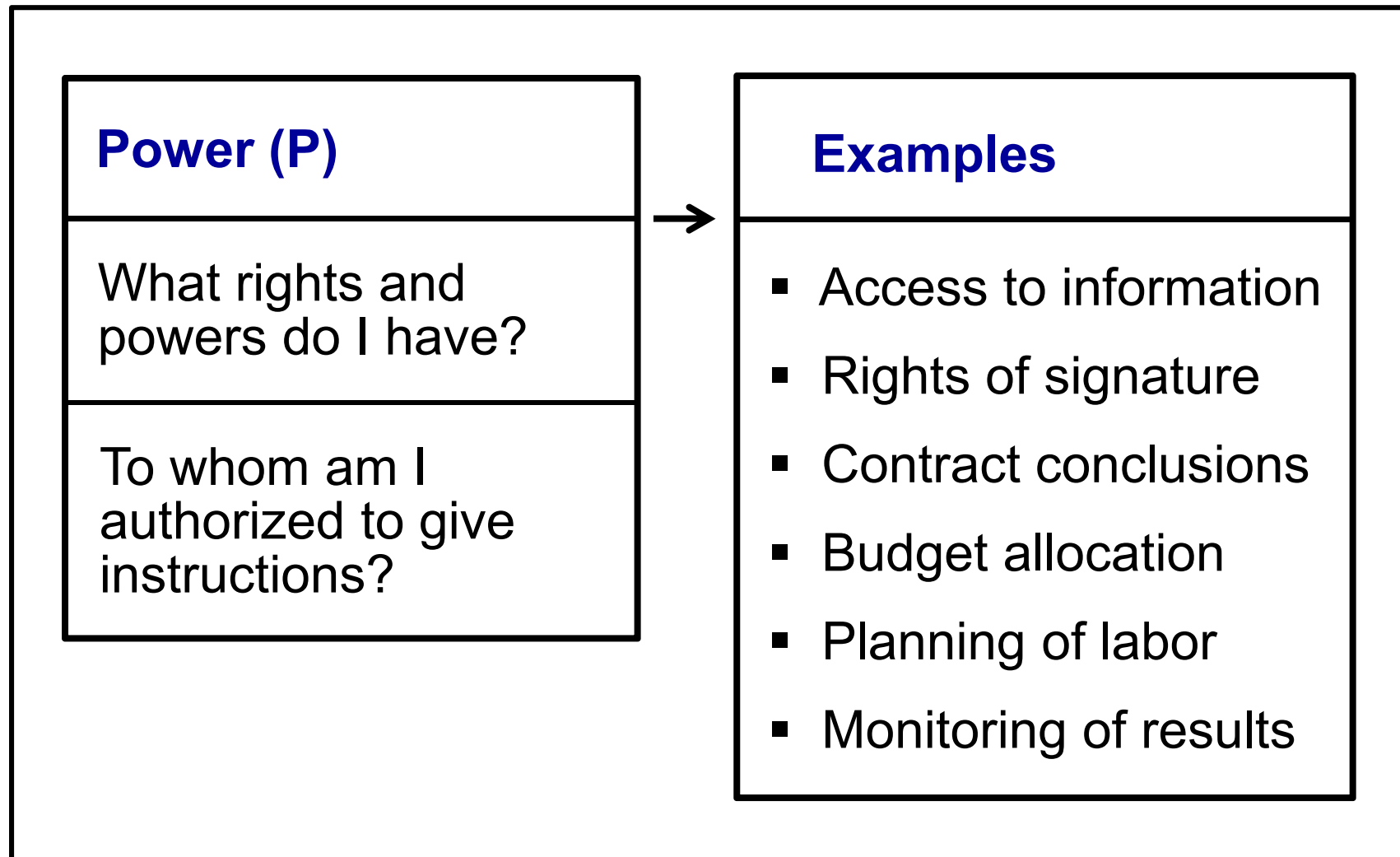
Project Manager (m/f/d): Tasks and Leadership Functions

The Framework for Action to be Clarified in Advance:



Project Manager (m/f/d): Tasks and Leadership Functions

The Framework for Action to be Clarified in Advance:



Project Manager (m/f/d): Tasks and Leadership Functions

The Framework for Action to be Clarified in Advance:

Responsibility (R)

What obligations do I have against third parties?

What do I have to guarantee for?



Examples

- Achievement of goals
- Calling in of funds
- Deadline compliance
- Personnel selection
- Team spirit within team
- T. S. C.-Information

Project Manager (m/f/d): Tasks and Leadership Functions

Integration of the "Right" Promoters!

- **Promoter of Expertise** (Technical Skills).
- **Promoter of Power** (General Support).
- **Promoter of Process** (Effective Project Management).

Promoter of Expertise	Expert (m/f/d) in scientific and technical realization.
Promoter of Power	Member of the company management.
Promoter of Process	Coach, Advisor, Colleague (m/f/d).

Project Manager (m/f/d): Tasks and Leadership Functions

Their Duties Require Skill and Experience in Various Management Activities!

- In advance: Clarifying the own framework of action.
- Ensuring a clear and achievable target system.
- Planning and organizing the project goal-oriented.
- Initiating problem-solving operations.
- Controlling and evaluating the results.
- Making project-relevant decisions.
- Controlling of an effective project implementation.

Project Manager (m/f/d): Tasks and Leadership Functions

Their Duties Require Skill and Experience in Various Management Activities!

- Ensuring verifiable progress during the project flow.
- "Coaching" and judging individual team members.
- Maintaining the "inner motivation" in the project team.
- Moderating of project-relevant meetings.
- Ensuring an effective communication flow.
- Addressing regularly the steering committee.
- Report on the project status (Status Reports, QBs.)

Project Manager (m/f/d): Tasks and Leadership Functions

Industrial "Multitaskplayers":

Chemist

Politician

Scapegoat

Consultant

Strategist

Diagnostician

Moderator

Project Manager

Communicator

Mediator

Manager

Teacher

Diplomat

Team Leader

Pastor

Project Manager (m/f/d):
Tasks, Leadership Functions and Personality Profile.

**Function Oriented Personality Profile:
Three Components are Important for the Success!**

→	1. Expert Knowledge/-Skills
→	2. Methodological Knowledge
→	3. Social Skills/-Competency

Project Manager (m/f/d):

Tasks, Leadership Functions and Personality Profile.

Requirements for the Specialist Knowledge/-Skills: →

- Chemistry, natural sciences, (process) technology.
- Project management: Basics of theory and practice, project experience, at least as a team member.
- Business administration: Basic knowledge on profit and loss account, determination of net present value and tools of cost control.
- IT: Application of project-specific software / "Apps".

Project Manager (m/f/d):

Tasks, Leadership Functions and Personality Profile.

Requirements for the Methodological Knowledge: →

- Experience with research- /development projects.
- Mastery of planning methods.
- Knowledge of control-/settlement techniques.
- Basic experiences with moderation techniques.
- Ability to systematically analyze problems.
- Experiences with "problem-solving tools".

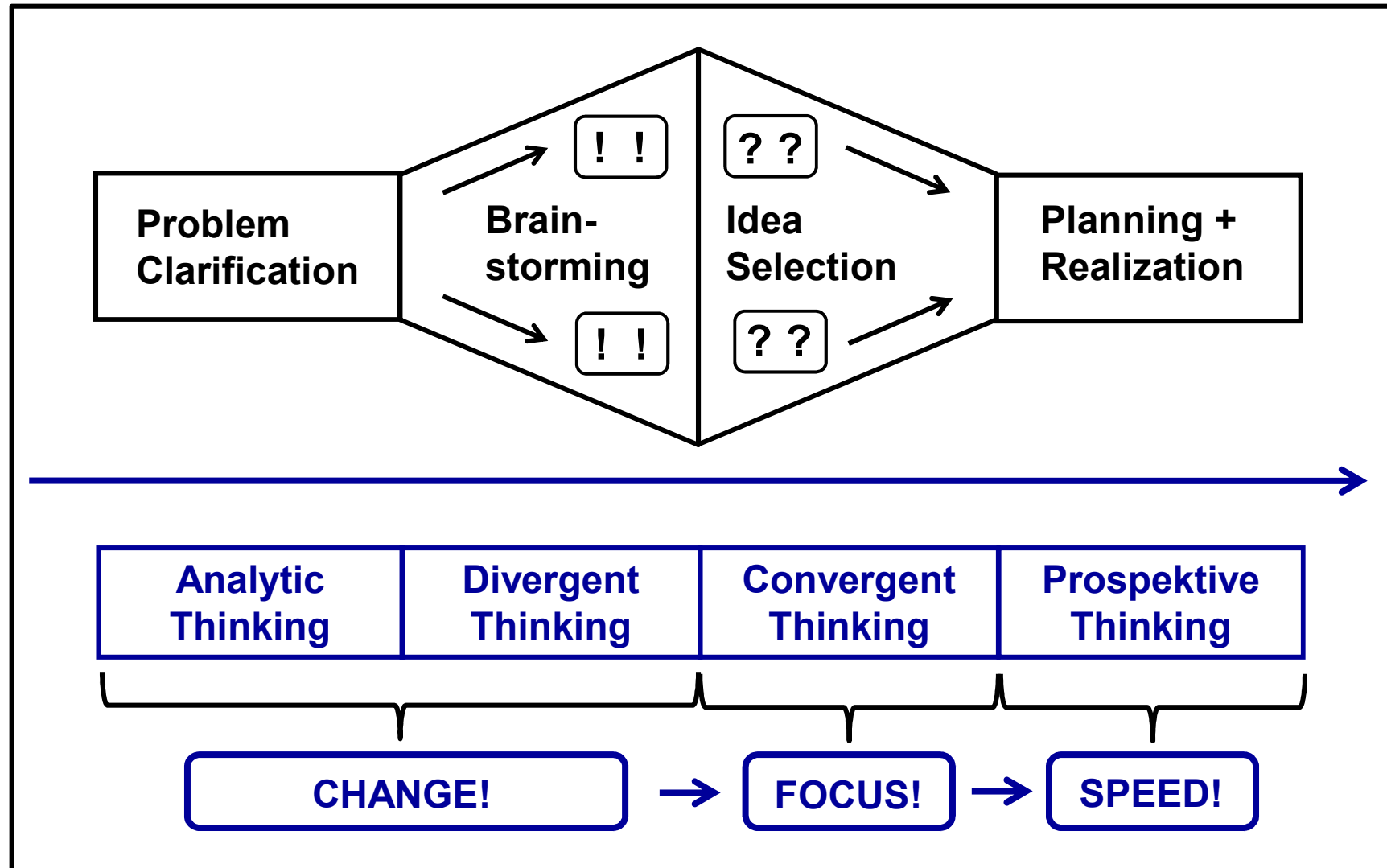
Project Manager (m/f/d):
Tasks, Leadership Functions and Personality Profile.

General Problem Solving Technique/–Tools:



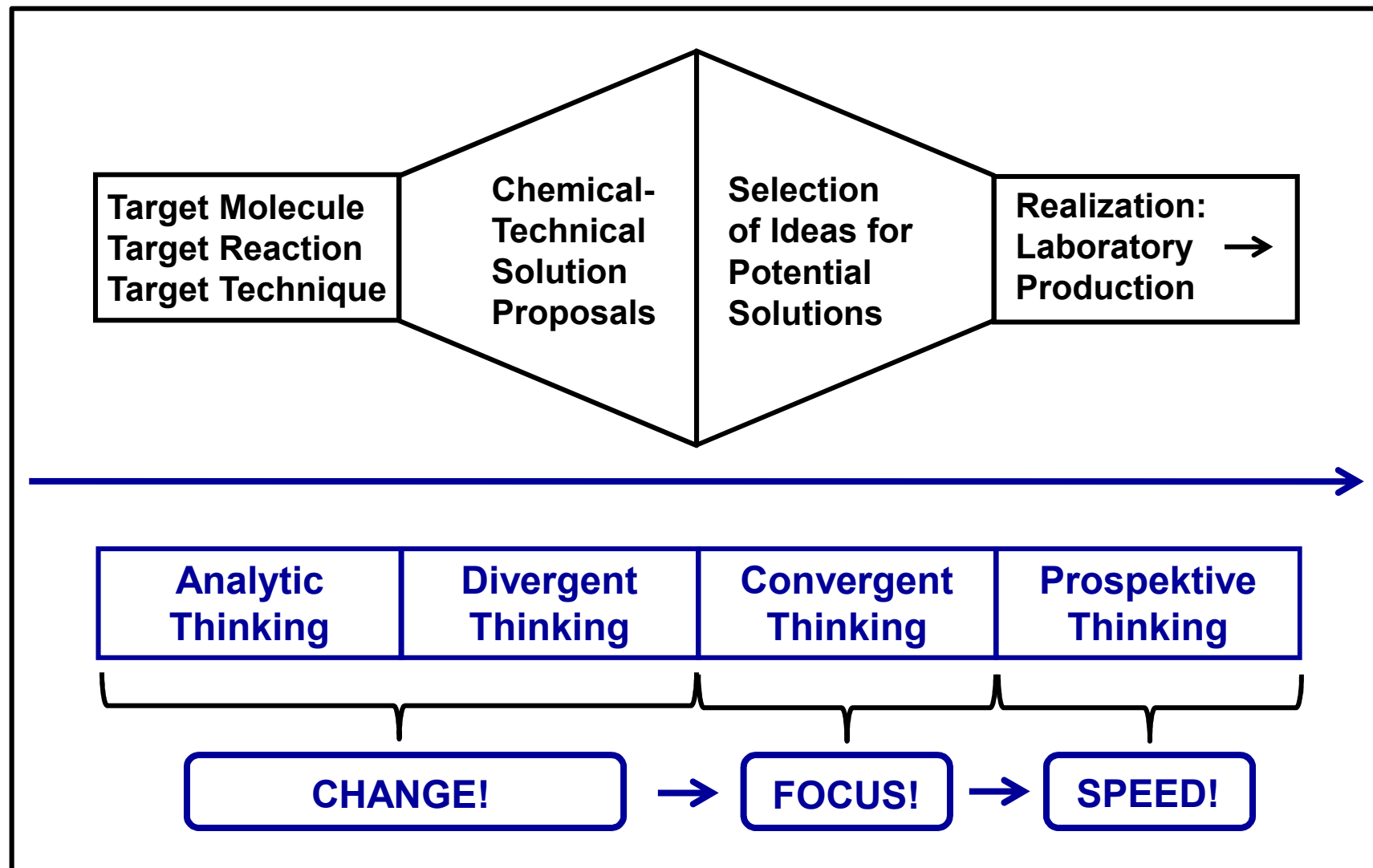
Project Manager (m/f/d): Tasks and Leadership Functions

General Problem Solving Technique and –Tools:



Project Manager (m/f/d): Tasks and Leadership Functions

General Problem Solving Technique and –Tools:



Project Manager (m/f/d): Tasks and Leadership Functions

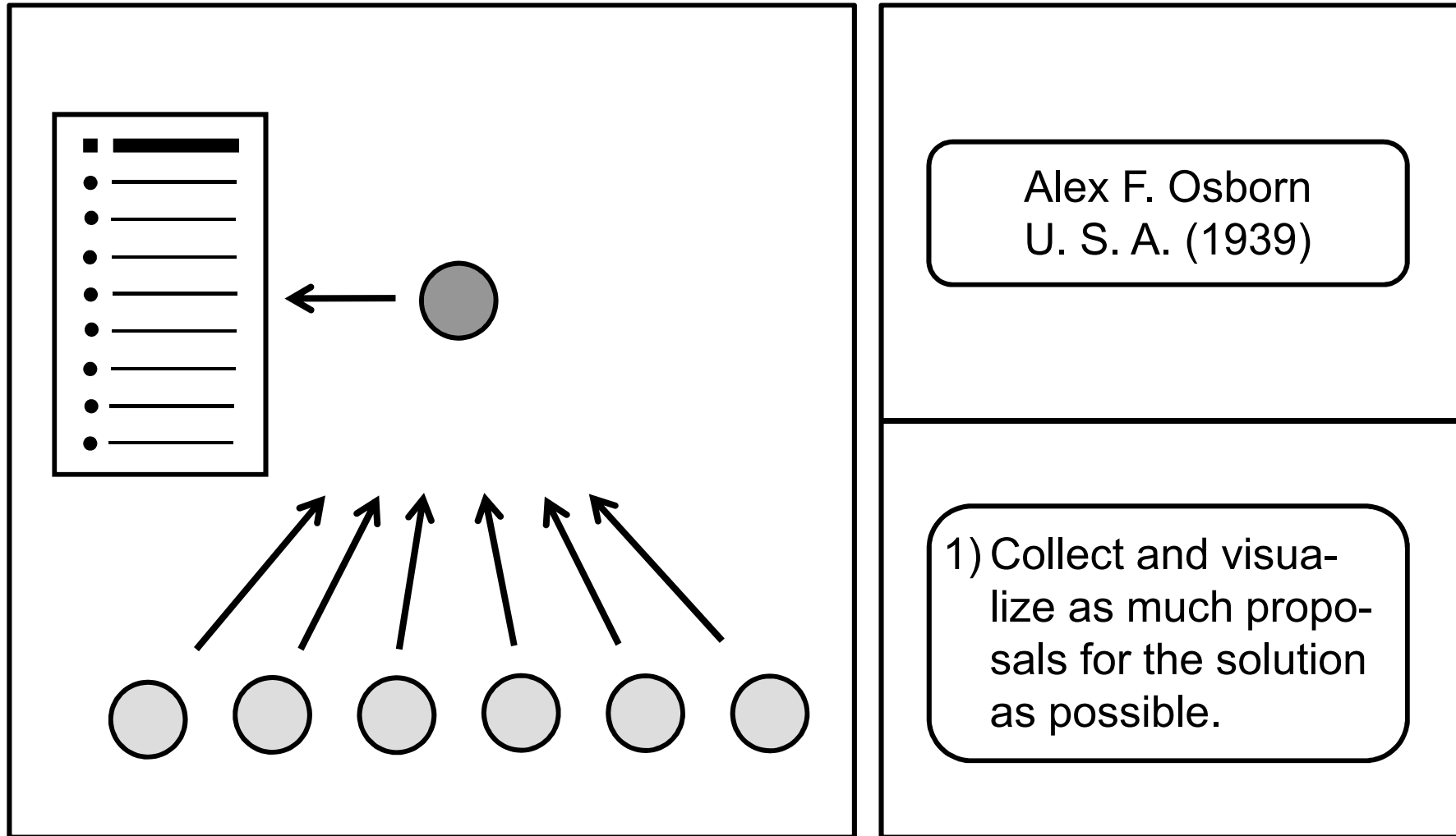
Tool for Problem-Solving: "Brainstorming":

Procedure →

- 5-7 Participants of different disciplines and functions, as well as the moderator (m/f/d); Time required: Approximately 30 min.
- Clarification and explanation of the exact problem.
Jointly writing down of the problem definition (Flipchart).
- Joint and open announcement of as many ideas as possible by every participant.
- Documentation of *each* idea *without* rating (flipchart).
- Structuring of the total input (clusters) and evaluation of the best target oriented ideas by each team member.

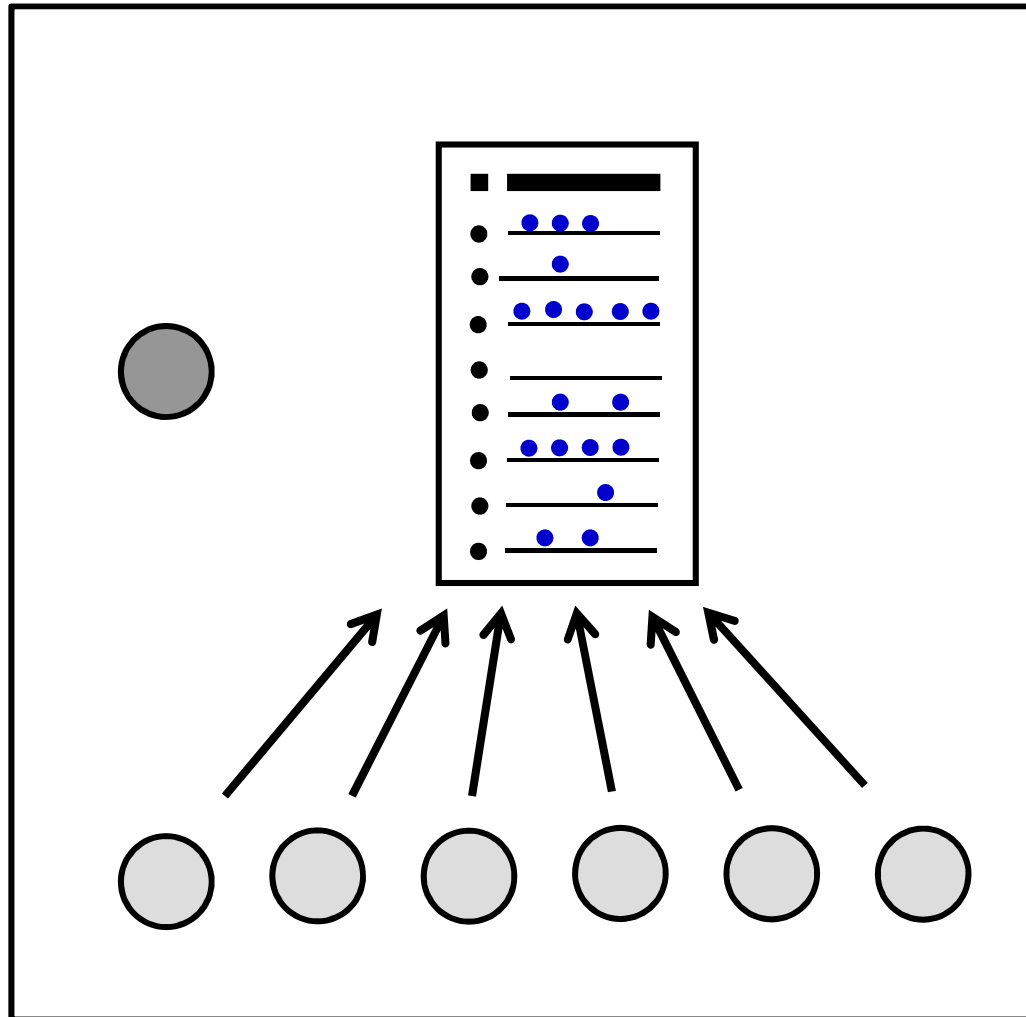
Project Manager (m/f/d): Tasks and Leadership Functions

Tool for Problem-Solving: "Brainstorming":



Project Manager (m/f/d): Tasks and Leadership Functions

Tool for Problem-Solving: "Brainstorming":



Alex F. Osborn
U. S. A. (1939)

2) Evaluating of all
single proposals
for solution towards
their quality.

Project Manager (m/f/d): Tasks and Leadership Functions

Tool for Problem-Solving: "Brainstorming":



Advantages:

- High spontaneity.
- Strong, reciprocal excitation effect.
- The moderator can promote the solution process.
- Comfortable for the participants.



Disadvantages:

- A competent moderator (m/f/d) is required.
- No real *cooperation*, rather only *participation*.
- The removing from the core issue (problem) may occur.
- Thorough contemplation is hardly possible.
- The problem should not be too complex.

Project Manager (m/f/d): Tasks and Leadership Functions

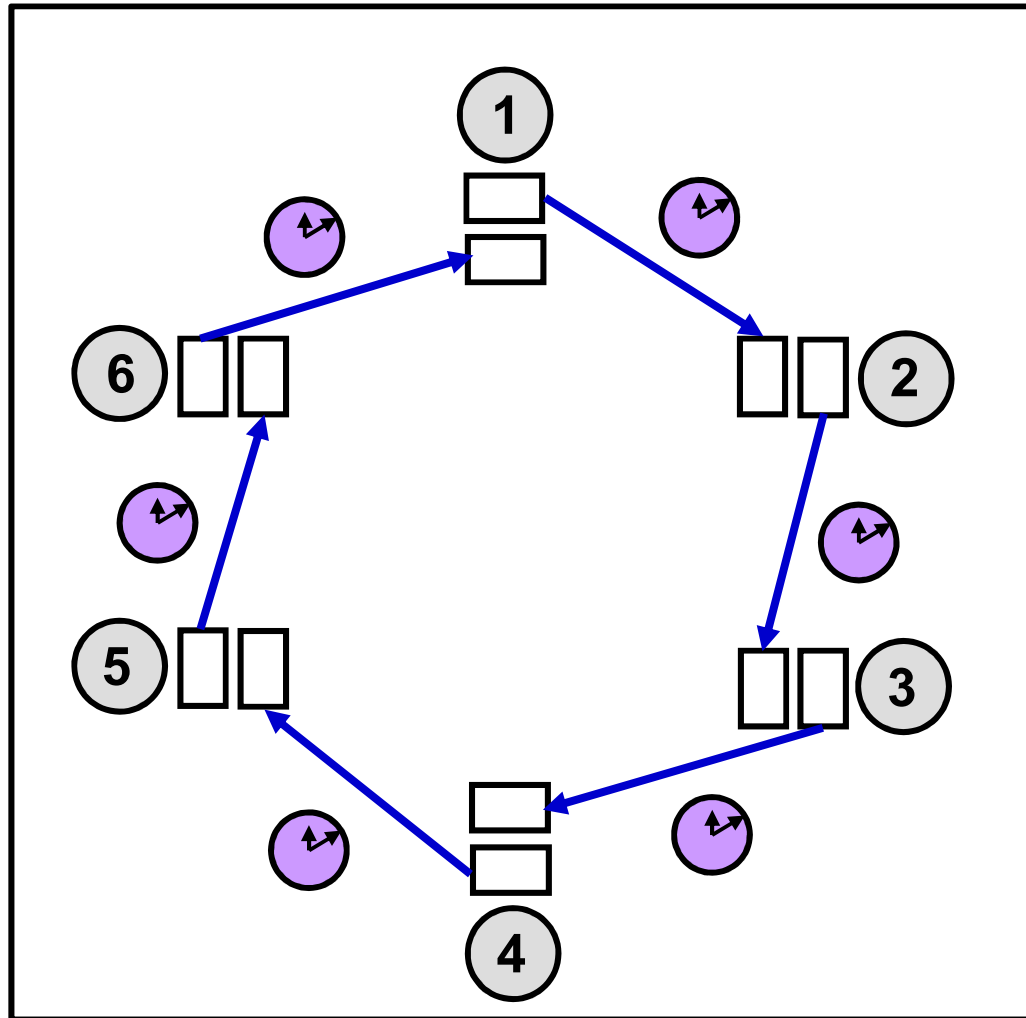
Tool for Problem-Solving: "Brainwriting":

Procedure →

- 5-7 Participants of different disciplines and functions inclusive the moderator (m/f/d); Time required: Approximately 30 min.
- Determination and explanation of the exact problem. Problem definition, jointly writing down of the problem definition (Flipchart).
- Each participant writes down his suggestions for solutions on cards (one idea - one card).
- After an agreed period of time, each stack of cards will be forwarded to the neighbors on the left for viewing.
- All cards will be collected and doublings will be put away.
- First structuring (cluster formation) and evaluation.

Project Manager (m/f/d): Tasks and Leadership Functions

Tool for Problem-Solving: "Brainwriting":

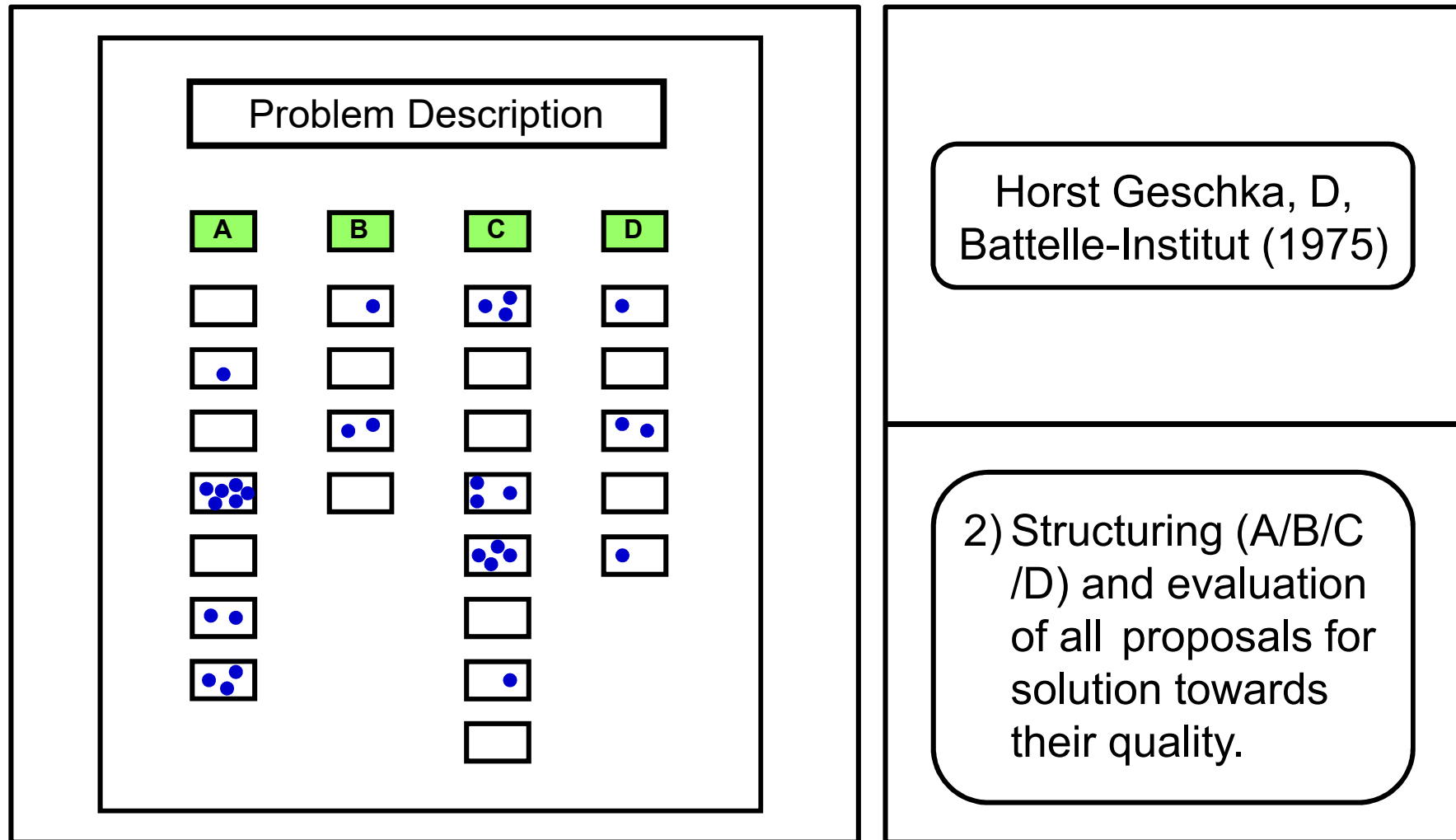


Horst Geschka, D,
Battelle-Institut (1975)

1) Writing down of
problem solutions
and forward them.

Project Manager (m/f/d): Tasks and Leadership Functions

Tool for Problem-Solving: "Brainwriting":



Project Manager (m/f/d): Tasks and Leadership Functions

Tool for Problem-Solving: "Brainwriting":



Advantages:

- Self-determined, undisturbed thinking.
- Parallel work saves time.
- A fast structuring (clustering) of collected solutions is possible.
- No experienced moderator (m/f/d) is needed.
- Option to a virtual variant by e-mail (@).
- No "killer phrases" during brainstorming.



Disadvantages:

- Few spontaneity.
- Double proposals inevitably occur.
- The moderator (m/f/d) can not stimulate.

Project Manager (m/f/d): Tasks and Leadership Functions

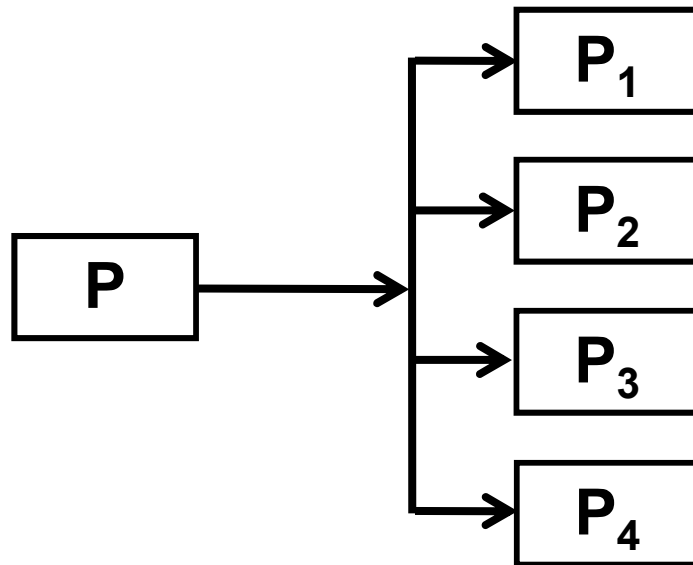
Tool for Problem-Solving: "Morphologic Tableau":

Procedure →

- 5-7 participants of different disciplines and functions, as well as the moderator; Time required:> 60 min.
- Clarification of the exact problem: Commonly agreed, written fixed definition (flipchart).
- Division of the problem into problem elements.
- Tabulation of the individual problem elements.
- Searching of partial solutions and their entries in the assigned tableau cells.
- Joint identification and evaluation of possible overall solutions ("roadmaps").

Project Manager (m/f/d): Tasks and Leadership Functions

Tool for Problem-Solving: "Morphologic Tableau": ("Zwicky Box" as a Multidimensional Matrix).



1) Disassembling the overall problem into individual "problem elements" P_n .

Fritz Zwicky
14.02.1898-
08.02.1974

Astronomer and
Physicist at
Caltech, Pasadena,
U.S.A.

Researcher at the
observatories
Mount Palomar,
Mount Wilson.

Project Manager (m/f/d): Tasks and Leadership Functions

Tool for Problem-Solving: "Morphologic Tableau": ("Zwicky Box" as a Multidimensional Matrix).

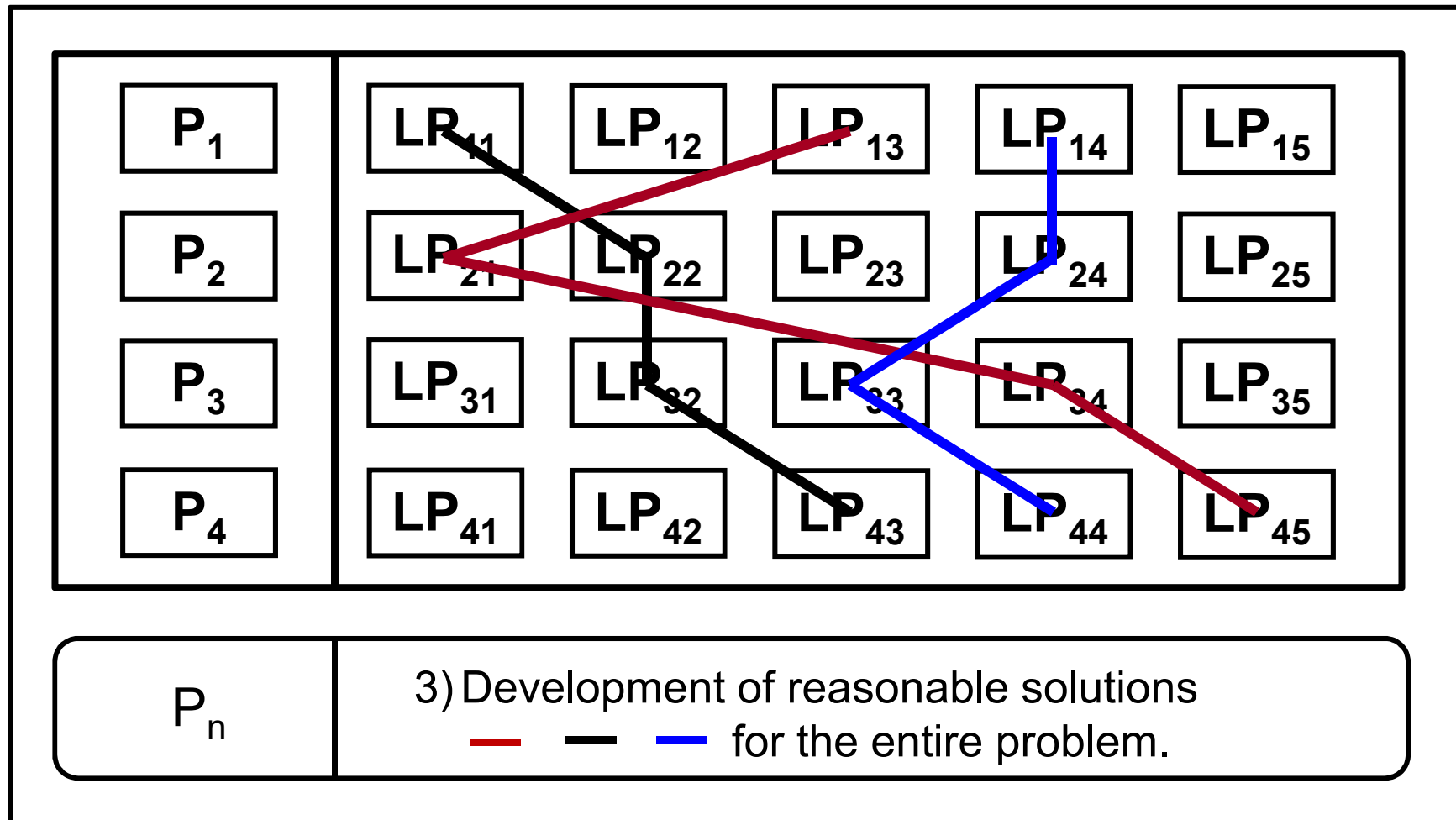
P_1	LP_{11}	LP_{12}	LP_{13}	LP_{14}	LP_{15}
P_2	LP_{21}	LP_{22}	LP_{23}	LP_{24}	SP_{25}
P_3	LP_{31}	LP_{32}	LP_{33}	LP_{34}	LP_{35}
P_4	LP_{41}	LP_{42}	LP_{43}	LP_{44}	LP_{45}

P_n

2) Working out and writing down of suggested solutions LP_{nm} for the individual problem elements.

Project Manager (m/f/d): Tasks and Leadership Functions

Tool for Problem-Solving: "Morphologic Tableau": ("Zwicky Box" as a Multidimensional Matrix).



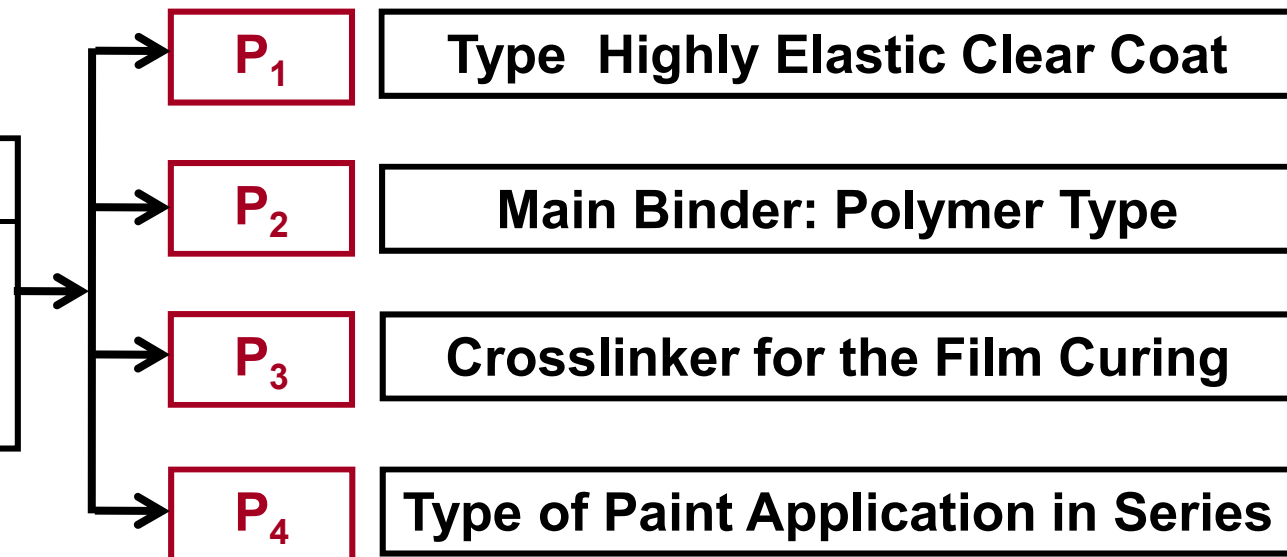
Project Manager (m/f/d): Tasks and Leadership Functions

Tool for Problem-Solving: "Morphologic Tableau": ("Zwicky Box" as a Multidimensional Matrix).

Example P1

Overall Problem

Clear Coat with
90% Gloss Re-
tention (AMTEC)



Project Manager (m/f/d): Tasks and Leadership Functions

Tool for Problem-Solving: "Morphologic Tableau": ("Zwicky Box" as a Multidimensional Matrix).

Example P1

P₁

UV-curing Coat

Dendrimer-System

HBC-System

ORMOCER-System

P₂

OH-Polyacrylate

OH-Polyurethane

Unsat. Polyacrylate

OH-Polyester

P₃

UV-Reactive Diluent

Oligoisocyanate

Melamin Resin

Silica-Sol

P₄

Turbo Bells

Dipping Process

Pneumatic Pistol

Casting Process

Project Manager (m/f/d): Tasks and Leadership Functions

Tool for Problem-Solving: "Morphologic Tableau": ("Zwicky Box" as a Multidimensional Matrix).

Example P1

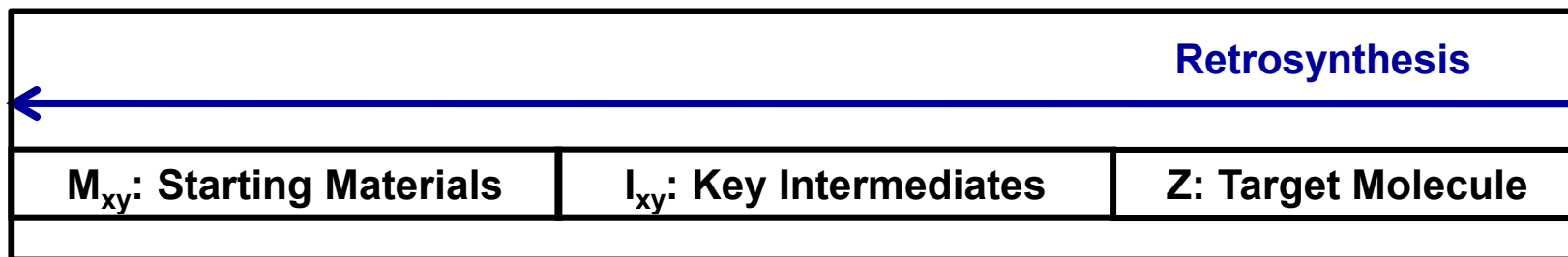
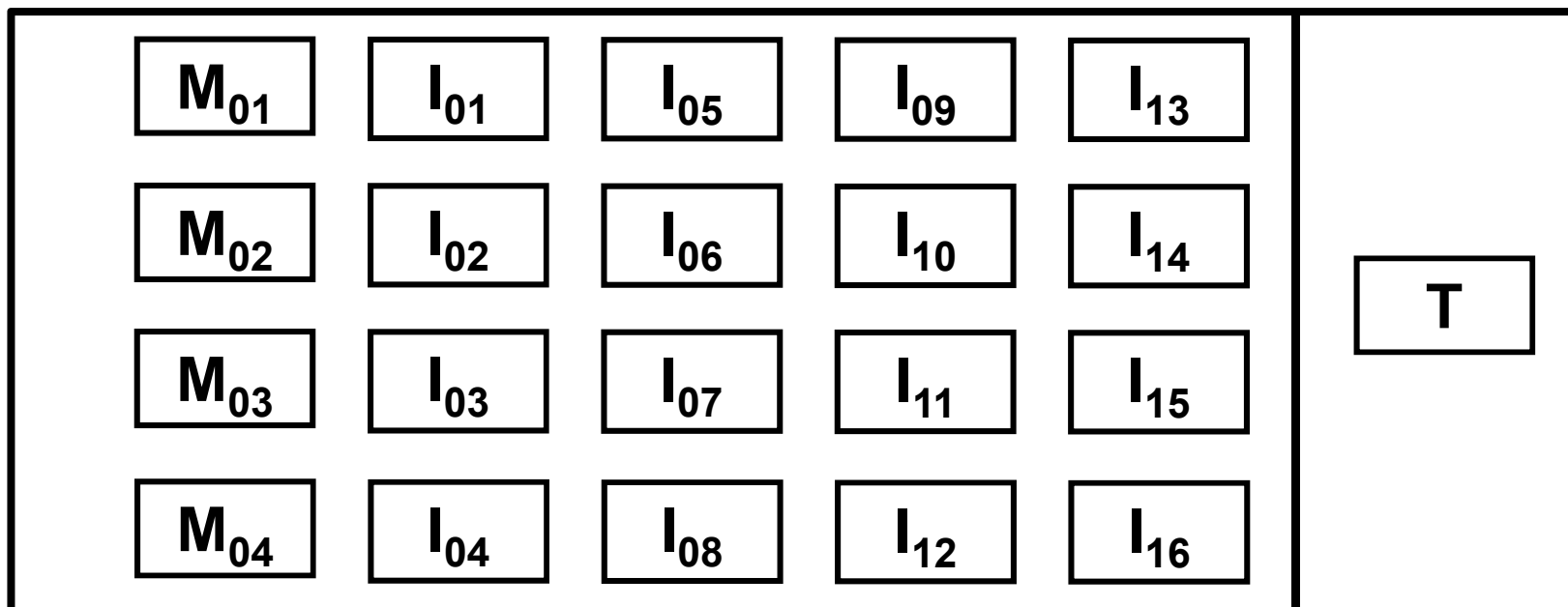
Approach: —

P ₁	UV-curing Coat	Dendrimer-System	HBC System	ORMOCER-System
P ₂	OH-Polyacrylate	OH-Polyurethane	Unsat. Polyacrylate	OH-Polyester
P ₃	UV-Reactive Diluent	Oligoisocyanate	Melamin Resin	Silica-Sol
P ₄	Turbo Bells	Dipping Process	Pneumatic Pistol	Casting Process

Project Manager (m/f/d): Tasks and Leadership Functions

Synthesis Planning: Target Molecule "T", ("Morphologic Tableau"):

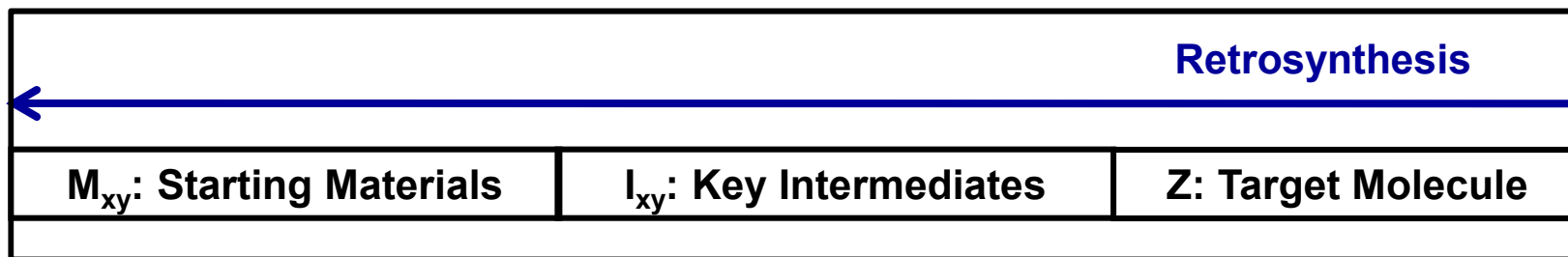
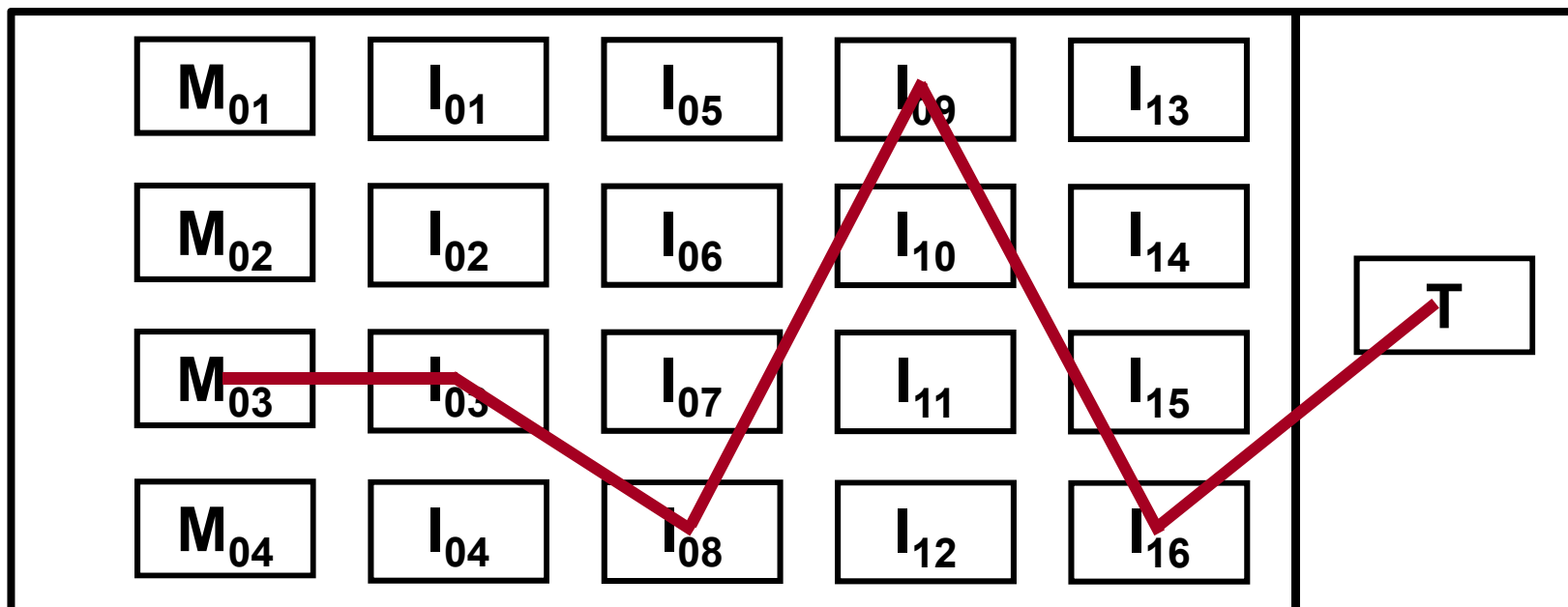
Example



Project Manager (m/f/d): Tasks and Leadership Functions

**Synthesis Planning: Target Molecule "T",
Starting from M_{03} via I_{03} , I_{08} , I_{09} , I_{16} :**

Example



Project Manager (m/f/d): Tasks and Leadership Functions

Tool for Problem-Solving: "Morphologic Tableau":



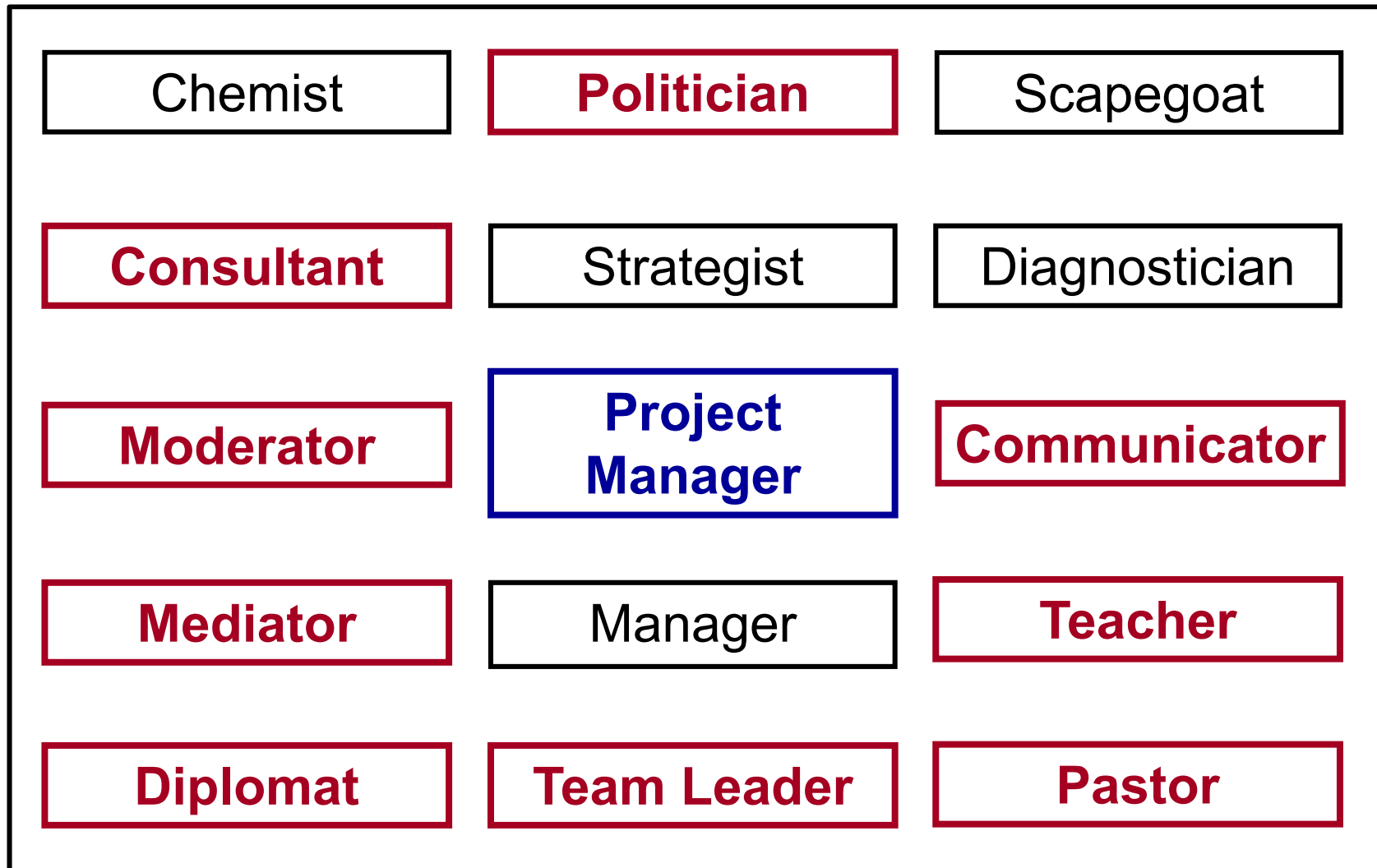
- Multilayered, complex problems can be solved.
- Heuristic, swift procedure.
- Low organizational effort.
- Suitable for rather smaller research teams.



- Problem element development can become complicated.
- There exists no general problem-solving algorithm.
- The true time requirement is difficult to plan.
- No sufficient clarity in case of several overall solutions.
- Variety of solutions makes the selection difficult.

Project Manager (m/f/d): Tasks and Leadership Functions

Numerous **"Communicative"** Functions:



Project Manager (m/f/d): Tasks and Leadership Functions

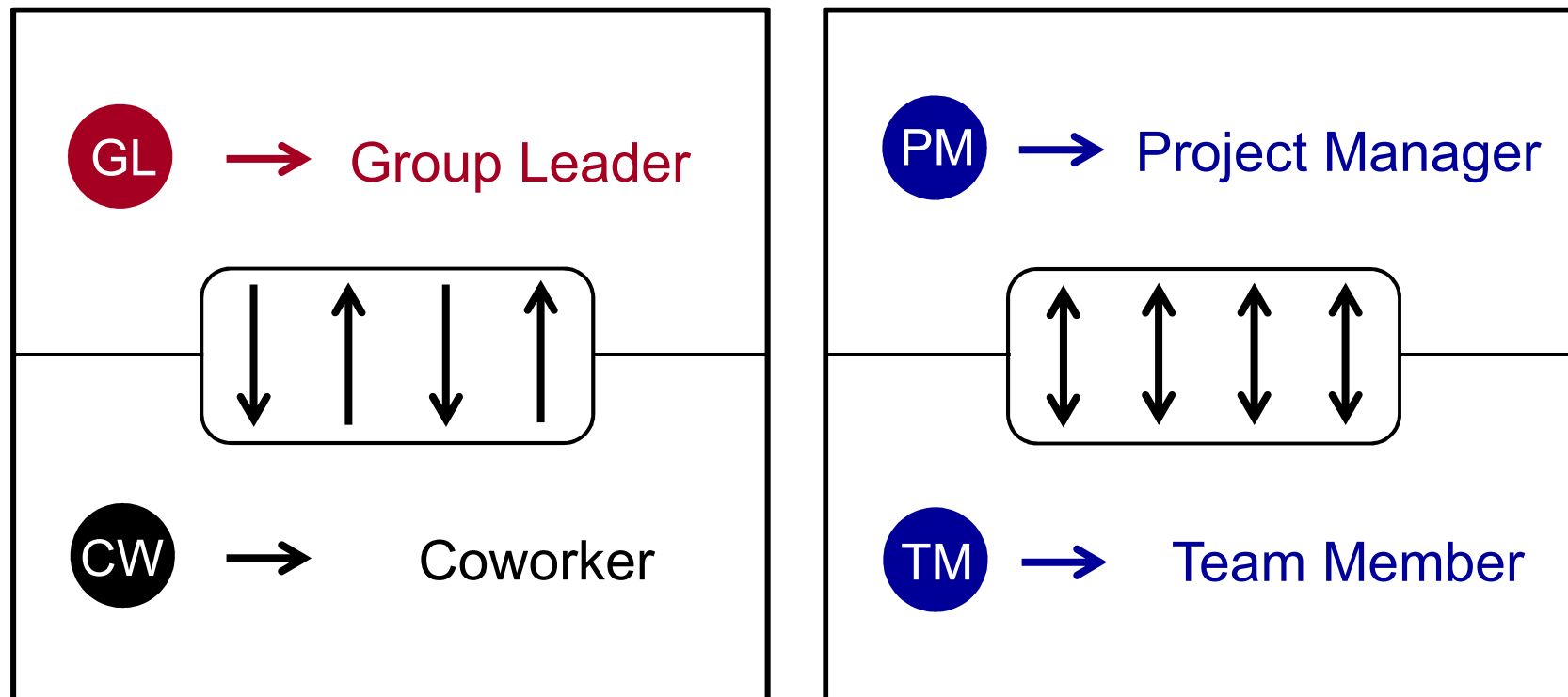
Moderation of Team Meetings:

Effective **moderation** is the art of structuring a group conversation, guiding it impartially and leading to a feasible, goal-relevant outcome.

A good moderator (m/f/d) will ensure both a structured agenda and an adequate liveliness (dynamics) in his team discussion.

Project Manager (m/f/d): Tasks and Leadership Functions

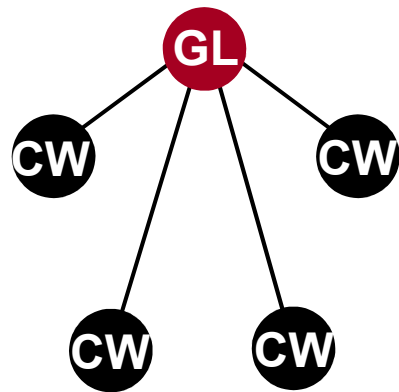
Network Dynamics in a "Full-Structure" Project Team:
→ **Need for Effective Moderation!**



Project Manager (m/f/d): Tasks and Leadership Functions

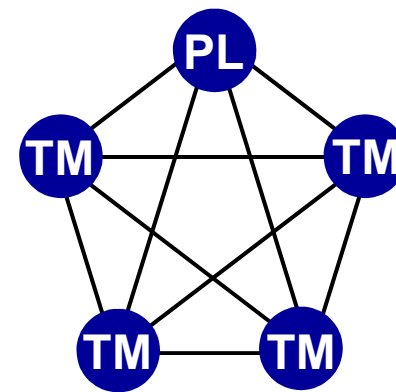
Network Dynamics in a "Full-Structure" Project Team:

→ **Consequence: Need for Effective Moderation!**



(Tree: 4 Edges)

Conventional Group



(K_5) $\begin{bmatrix} 5 \\ 2 \end{bmatrix}$ (10 Edges)

"Full-Structure"- Team

Project Manager (m/f/d): Tasks and Leadership Functions

Tasks of the Moderator (m/f/d):



- Clear definition of the meeting goal.
- Structuring of the topics, setting of priorities.
- Distribution of roles and posts.
- Division of time, ensuring time compliance.
- Guarantee of involvement of *all* team members.
- Visualization of the individual contributions.
- Arbitration of disagreements.
- Summary of (intermediate) results.

Project Manager (m/f/d): Tasks and Leadership Functions

Steering Techniques of the Moderator (m/f/d):

- Asking questions.
- Emphasising, stimulating, provoking...
- Requesting proposals and additions.
- Making (joint) interpretations.

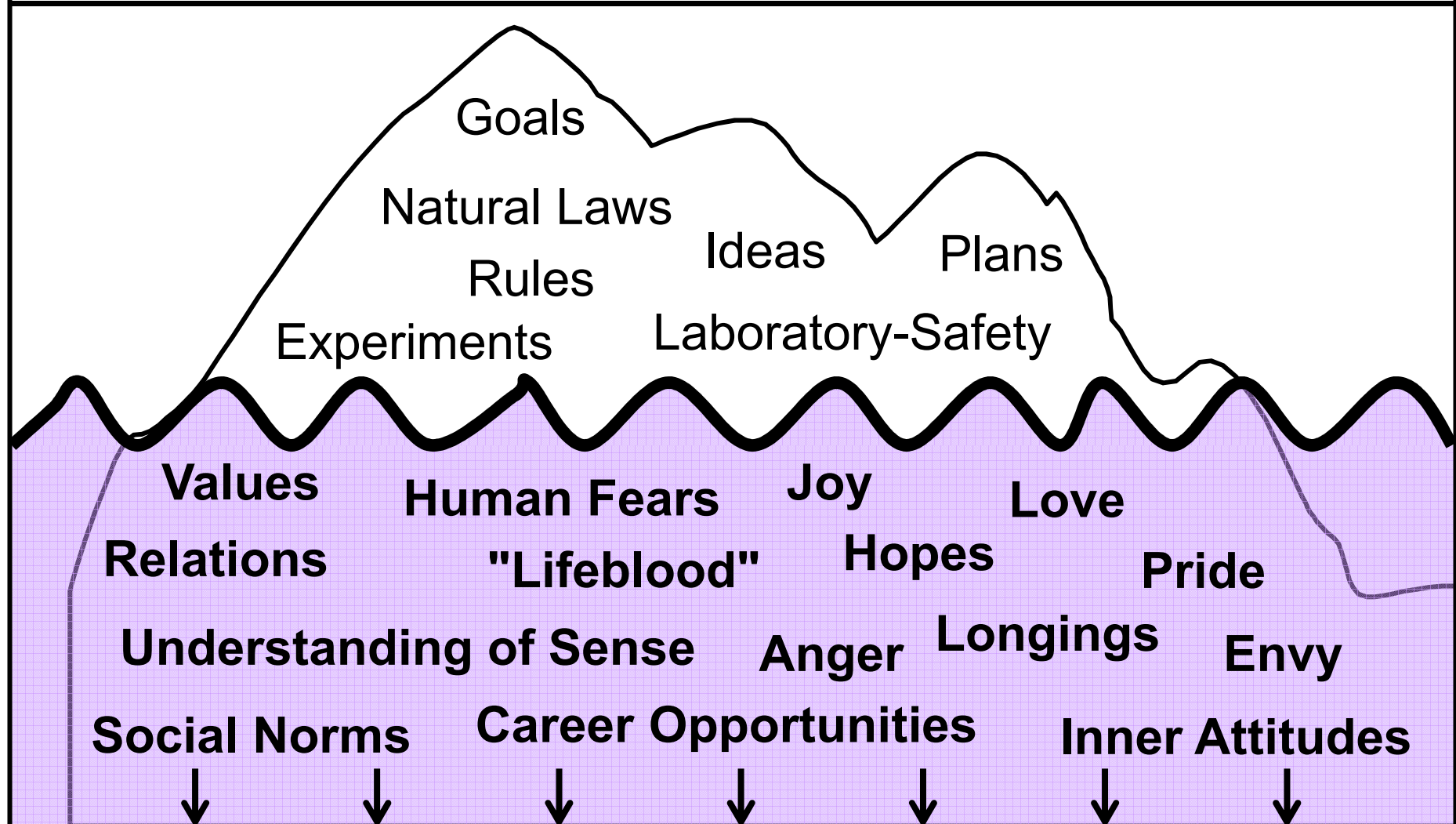
- Concretizing.
- Taking breaks.
- Making recollections to the real topic.
- Making restrictions with regard to the real topic.
- Summarize.



Project Manager (m/f/d): Tasks and Leadership Functions

Communication within the R&D-Project Team:

The "Iceberg Principle" According to Sigmund Freud



Project Manager (m/f/d): Tasks and Leadership Functions

Communication within the R&D Project Team.

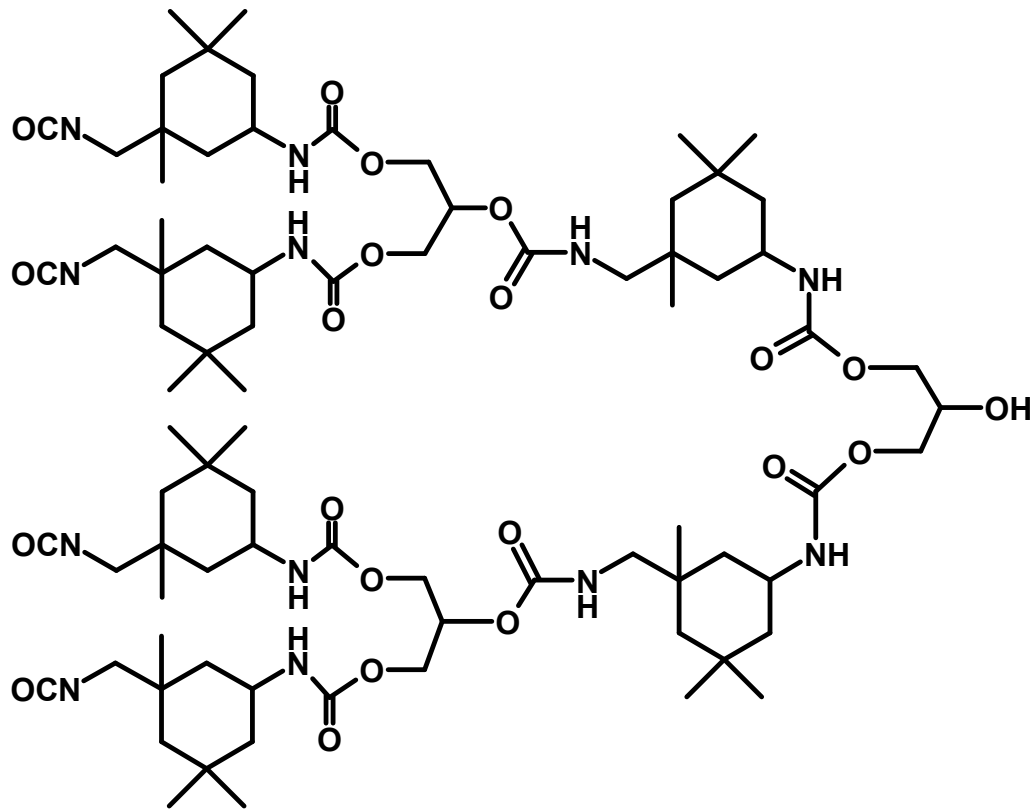
Different Efficiency Rates:

The members of the project team memorize that

- ■ what they read: $\approx 10\%$.
- ■ what they hear: $\approx 20\%$.
- ■ what they see: $\approx 30\%$.
- ■ what they see *and* hear: $\approx 50\%$.
- ■ **what they present themselves: $\approx 70\%$.**
- ■ **what they do themselves: $\approx 90\%$.**

Project Manager (m/f/d): Tasks and Leadership Functions

Four Types of Perceiving Spoken Messages:



A4B-Building Block

Example

Message from a chemist in the project team:

"The synthesis of the new crosslinker is now working!"

Project Manager (m/f/d): Tasks and Leadership Functions

Communication within the R&D Project Team.

Four Types of Perceiving Spoken Messages:

Speaker



Listener

Four Types ("Sides") to perceive a message:



1. Factual Side (**F**)

2. Relationship Side (**R**)

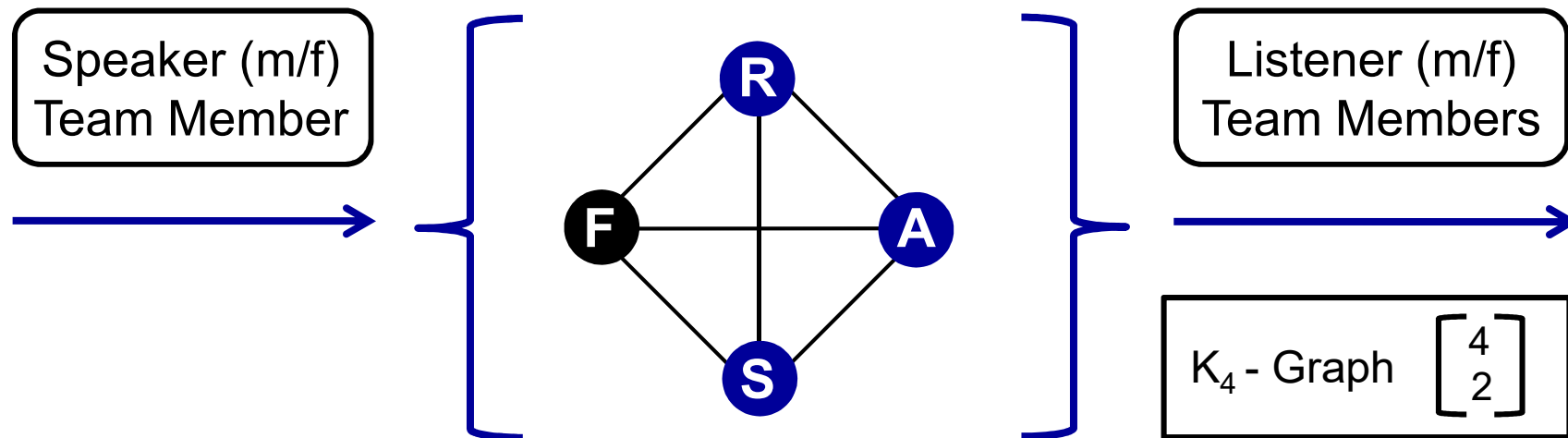
3. Self-Revealing Side (**S**)

4. Appeal Side (**A**)

Source: Friedemann Schulz von Thun, University of Hamburg

Communication within the R&D Project Team.

Four Types of Perceiving Spoken Messages:



Four Basically Different Ways of Perception by the Listeners:

- **Factual Side (F):** What does this fact mean for the project?
- **Relationship Side (R):** What does he/she think about us?
- **Self-Revealing Side (S):** What kind of person is he/she?
- **Appeal Side (A):** What should the listener(s) do or think?

Project Manager (m/f/d): Tasks and Leadership Functions

Communication within the R&D Project Team.

Four Types of Perception by the Listeners:

Speaker: "The synthesis of the new crosslinker is now working!"

Messages, perceived at the listeners (receivers), e.g. :

Facts	F	Isophorone diisocyanate + Glycerine (2:1) give the pure, highly branched crosslinker in a good yield.
Relationship	R	"You are less successful than me, and you in the team do not bring the really valuable project results!"
Self-Revealing	S	"I am delighted with my laboratory success, and I am proud to advance our project!"
Appeal	A	"You all have the duty to immediately start the new lacquer formulations and the varnish series with my substance!"

Project Manager (m/f/d): Tasks and Leadership Functions

Communication within the R&D Project Team.

Four Types of Perception by the Listeners:

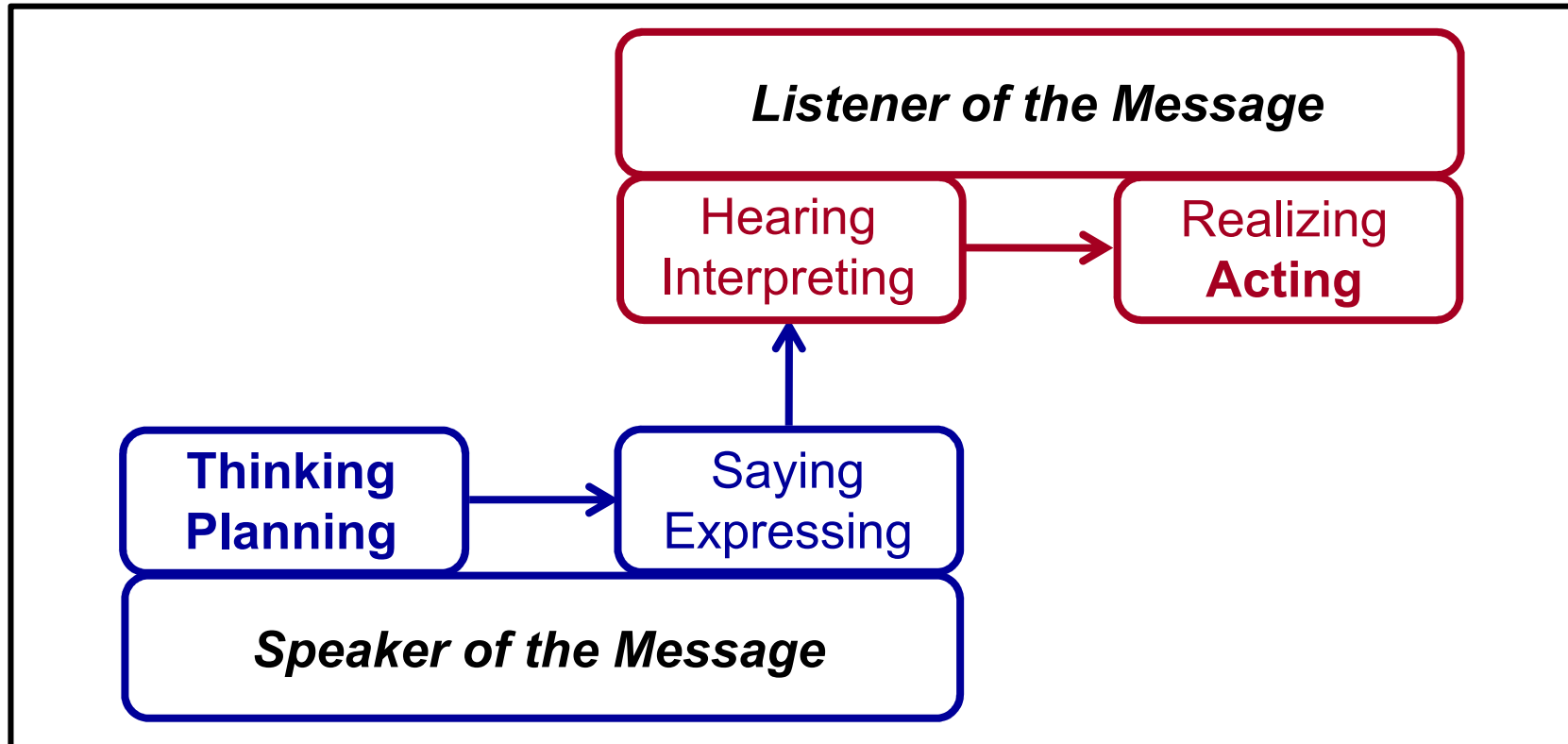
Speaker: "The synthesis of the new crosslinker is now working!"

Effect, reactions at the listeners (receivers), e. g.:

Facts	F	Knowledge of chemical results, which are essential for the success of the project.
Relationship	R	Incentive to do it equally; Ambition will be aroused; Delimitation, averting, rivalry, envy, ...
Self-Revealing	S	Collegial joy; Applause, admiration, laudation; Pitiful smiles, ignoring of the message...
Appeal	A	Immediate actions to prepare the next steps; Categorical rejectionist attitude, ...

Project Manager (m/f/d): Tasks and Leadership Functions

Communication within the R&D Project Team:



*The decisive factor is **not**:*

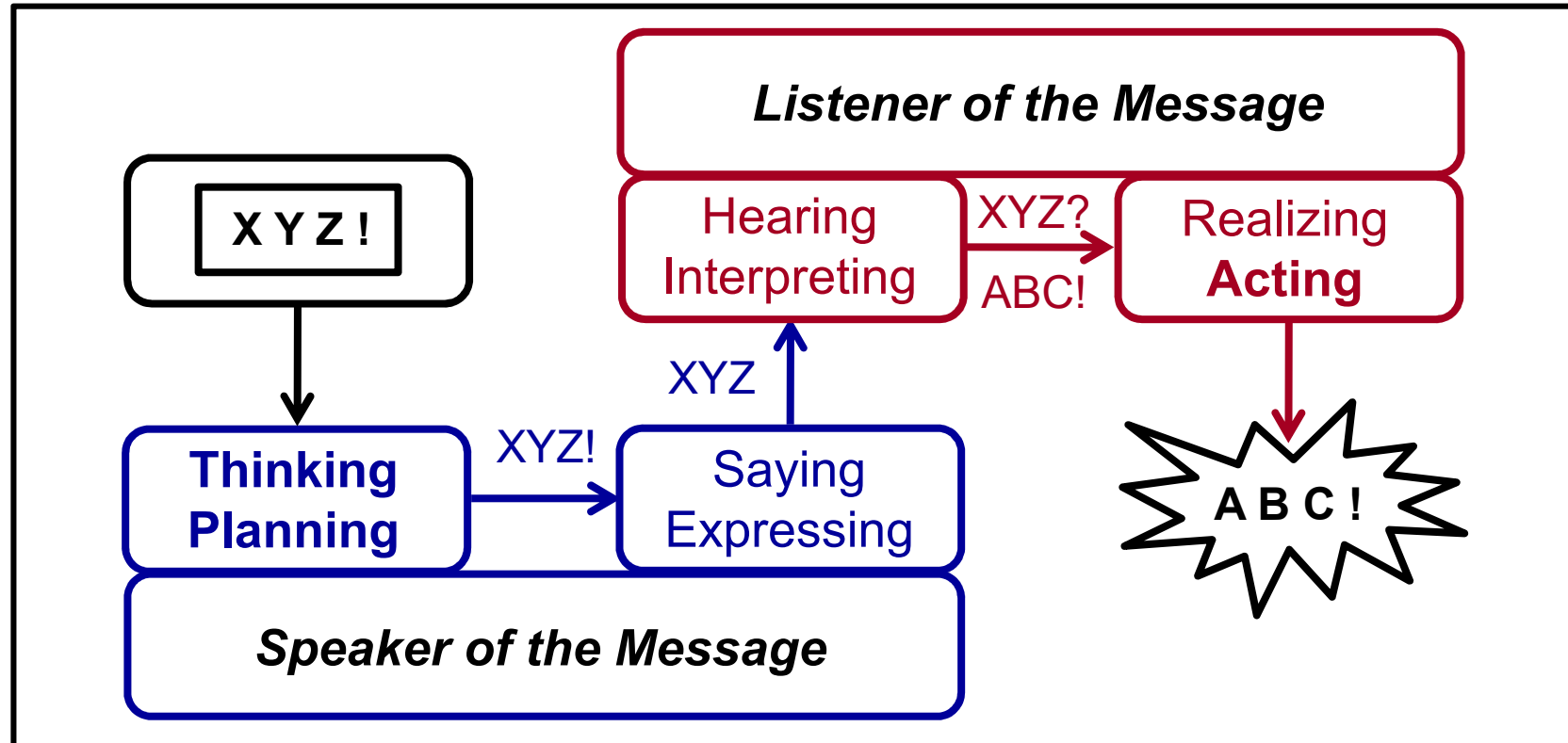
What does the message do with the listeners (m/f/d)?

Much more:

What do the listeners (m/f/d) make with the message?

Project Manager (m/f/d): Tasks and Leadership Functions

Communication within the R&D Project Team:



The decisive factor is **not**:

What does the message do with the listeners (m/f/d)?

Much more:

What do the listeners (m/f/d) make with the message?

Project Manager (m/f/d): Tasks and Leadership Functions

Communication within the R&D Project Team:

Project Manager

Example P1

"We need the FT-IR spectra of our new oligo-isocyanates until 20. 05. 2020!"

Team Member

The technician inwardly modifies this message:
(We do not have to be in such a hurry anymore ... Recently, we were done with the FT-IR-spectra two weeks too early. Our project manager seems to always plan a too big time buffer, so I will start the measurements only at a later time! That will be sufficient!)

The decisive factor is not:

What does the message do with the listener?

Rather much more:

What does the listener do with the message?

Project Manager (m/f/d): Tasks, Leadership Functions and Personality Profile.

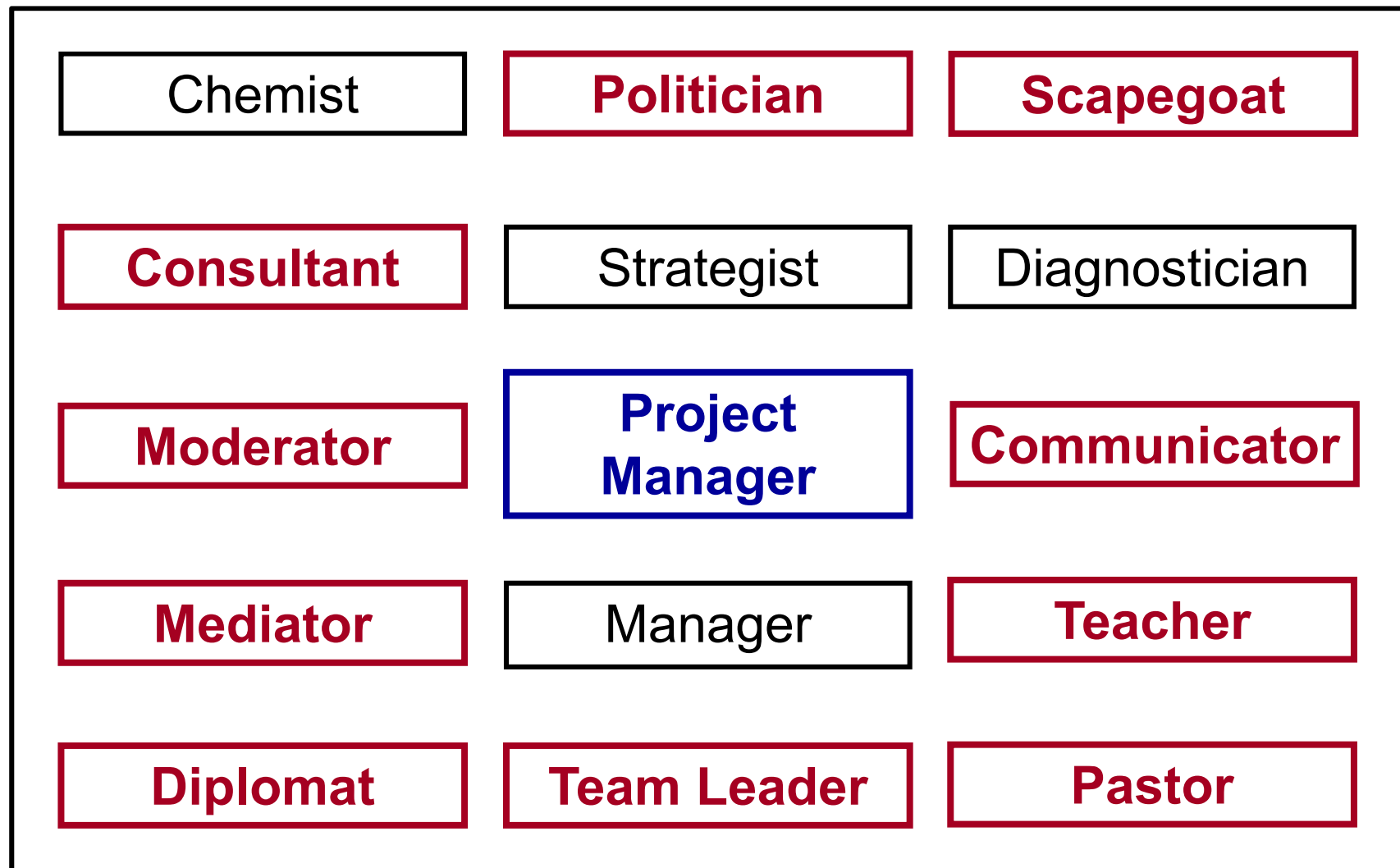
Requirements upon Social Skills:



- Credibility/Trustworthiness.
- Ability for constructive criticism, also towards one's own person.
- Tolerance to other "views".
- Social competence, perception of other interests.
- Emotional intelligence, a good "empathy".

Project Manager (m/f/d): Tasks and Leadership Functions

Numerous **"Social"** Functions:



Project Manager (m/f/d):

Tasks, Leadership Functions and Personality Profile.

Requirements upon Social Skills:

Emotional Intelligence (Source: Daniel Goleman).

- **Ability for Self-Reflection:** The reliable recognition and understanding of one's own feelings and their effects on other people. *Indicators:* Realistic self-assessment, self-confidence.
- **Self-control:** The avoidance of hasty assessments in the occurrence of all failures or in the case of entirely "unexpected" results in the project. *Indicators:* Use of reason in thinking and serenity in acting.

Project Manager (m/f/d):

Tasks, Leadership Functions and Personality Profile.

Requirements upon Social Skills:

Emotional Intelligence (Source: Daniel Goleman).

- **Ability for Self-Motivation:** The ability to work purposefully and perseveringly, for reasons significantly beyond the money, status and orders of others. *Indicators:* Strong personal commitment and noticeable "zeal for the future", combined with sound optimism in the swift implementation of the target system - especially in the critical phases of one project.

Project Manager (m/f/d):
Tasks, Leadership Functions and Personality Profile.

Requirements upon Social Skills:

Emotional Intelligence (Source: Daniel Goleman).

- **Empathy:** The tendency to empathize with the emotional worlds of other people in the R&D team. *Indicators:* Clear recognition of the situation-related strengths of others.
- **Social Competence:** The ability to maintain relationships "on equal terms" and to build solid, sustainable networks. *Indicators:* Fairness and helpfulness, the secure perception of the interests of third parties, "genuine" customer orientation.

Project Manager (m/f/d):

Tasks, Leadership Functions and Personality Profile.

**Requirements upon Leadership and
"Team Development" Skills:**



- Strong self-commitment, role model function.
- With "zeal for the project" and with the participants.
- The ability to lead people to success.
- Fairness, justice to all involved.
- Willingness to promote individual team members.
- The will to demand "reasonably" each team member.

Project Manager (m/f/d):
Tasks, Leadership Functions and Personality Profile.

**Requirements upon Leadership and
"Team Development" Skills:**



- Strong self-commitment, role model function.
- With "zeal for the project" and with the participants.
- The ability to lead people to success.
- Fairness, justice to all involved.
- Willingness to promote individual team members.
- The will to demand **"reasonably"** each team member.

Project Manager (m/f/d):
Tasks, Leadership Functions and Personality Profile.

Demands on the Team Members: "Flow" (Basis: J. S. Mill).

Requirements from side of R&D project managers	Skills of the commissioned team member	Type of the respective requirement	Consequence for the team member
Low	Low	No request	Apathy
Low	High	Too little demand	Boredom
High	High	Challenge	"Flow"
High	Low	Excessive demand	Anxiety

"Flow" during project work: Happiness experience after a realized, (challenging) process, when it has reached its real purpose.

Project Manager (m/f/d):
Tasks, Leadership Functions and Personality Profile.

**Excessive Demands on the Team Members:
"Anxiety" as a Natural Reaction.**

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Low	High	Too little demand	Boredom
High	High	Challenge	"Flow"
High	Low	Excess. Demand	Anxiety

Anxiety during project work: The action is necessary, but its execution is avoided or at least delayed by the commissioned team member.

Project Manager (m/f/d): Tasks, Leadership Functions and Personality Profile.

Excessive Demands on the Team Members, "Anxiety":

Form of Anxiety	Fundamental Attitude of the Team Member
Anxiety of changes in the course of the project.	"I'm a valuable team member, because I plan everything in detail in the project!"
Anxiety of obligations in the course of the project.	"I'm a valuable team member because I dare to do something unconventional in the project!"
Anxiety of dependencies on other (project)participants.	"I'm a valuable team member because I always act independently in the project!"
Anxiety of independence in Thinking, Planning, Acting.	"I am a valuable team member because I always help selflessly in the project!"

Important: Bringing the individual strengths to fully bear in the "most suitable" project processes!

Project Manager (m/f/d):
Tasks, Leadership Functions and Personality Profile.

Excessive demands on individual members of the project team: Types of individual "desperation" within the team as natural reactions to the assigned work packages.

Form of Anxiety	Objects of „Deperation“
Anxiety of changes in the course of the project.	About the "compelling" necessities. About the compliance of numerous specifications.
Anxiety of obligations in the course of the project.	About the many possibilities or chances. About the numerous action alternatives.
Anxiety of dependencies on others (project)participants.	About the own independence claims in a complex, networked project.
Anxiety of independence on thinking, planning, acting.	About the constant search for help. About the own need of support through "others".

Project Manager (m/f/d): Tasks, Leadership Functions and Personality Profile.

Excessive demands on individual members of the project team: Types of individual "desperation" within the team.

Forms of Anxiety	"Measures to cushion" on the part of the project management for a more effective leadership steering.
Anxiety of changes in the course of the project.	Joint, playful improvisations. Participation in creative meetings (inventor conferences, brainstorming sessions, etc.). These should ideally be carried out together with competent, open and innovative pilot customers!
Anxiety of obligations in the course of the project.	Promoting friendships and personal ties among team members. Also support of relationships that are cultivated outside of the real job-related project activities.
Anxiety of dependencies on others (project)participants.	Confidential conversations under "four eyes" with the project manager (m/f/d) or with individual steering committee members. Definition of individual restarts and personal milestones with corresponding action plans.
Anxiety of independence on thinking, planning, acting.	According to successfully achieved milestones: Participation of all team members in "social events" in leisure-related, cultural, sporting and / or social areas. Joint eating and drinking (canteen, etc.)...

Project Manager (m/f/d):
Tasks, Leadership Functions and Personality Profile.

**Excessive Demands on the Individual Team Members;
"Anxiety" as a Natural Reaction:**

Form of Anxiety	Behavior of the Team Member
Anxiety of changes in the course of the project. Strongly Pronounced: → Obsessive-Compulsion	Avoidance of any coincidences. Strong need for security. Dogmatism and harping on about rigid principles. High love of order. Hardly courageous behavior. Avoidance of ambiguities. Most actions are rigid and tense.

Positive 

"Reliability"

High diligence, accuracy; Careful planning; Sense of responsibility.

Project Manager (m/f/d):
Tasks, Leadership Functions and Personality Profile.

**Excessive Demands on the Individual Team Members;
"Anxiety" as a Natural Reaction:**

Form of Anxiety	Behavior of the Team Member
Anxiety of obligations in the couse of the project. Strongly Pronounced: → Hysteric Behavior	Avoids defined tasks. Circumvents precise schedules. Primarily searching for the applause. Often plays "theater". Loves the "show effect". Shows a slight egocentricity.

Positive 

"Flexibility"

Risk-taking, courage; Talent for improvisation; Strong enterprise.

Project Manager (m/f/d):
Tasks, Leadership Functions and Personality Profile.

**Excessive Demands on the Individual Team Members;
"Anxiety" as a Natural Reaction:**

Form of Anxiety	Behavior of the Team Member
Anxiety of dependencies on other (project)participants. Strongly Pronounced: → Schizoid Behavior	Barely shows feelings. Acts in a withdrawn manner. Distrusts other team members. Is sometimes hurtful. Acts only little sensitively. Strong delimitation from others.

Positive 

"Independence"

Clarity; Competence; Keen powers of observation; Sensitivity;
High self-responsibility; High objectivity; "Calmness", Serenity.

Project Manager (m/f/d):
Tasks, Leadership Functions and Personality Profile.

**Excessive Demands on the Individual Team Members;
"Anxiety" as a Natural Reaction:**

Form of Anxiety	Behavior of the Team Member
Anxiety of independency on Thinking, Planning, Acting. Strongly Pronounced: → Depressive Behavior	High dependence on others. No own opinion in the team. Acts hesitantly, dependently. Makes "lazy" compromises. Low assertiveness. Tendency to "moaning". Hardly courage for (calculated) risk.

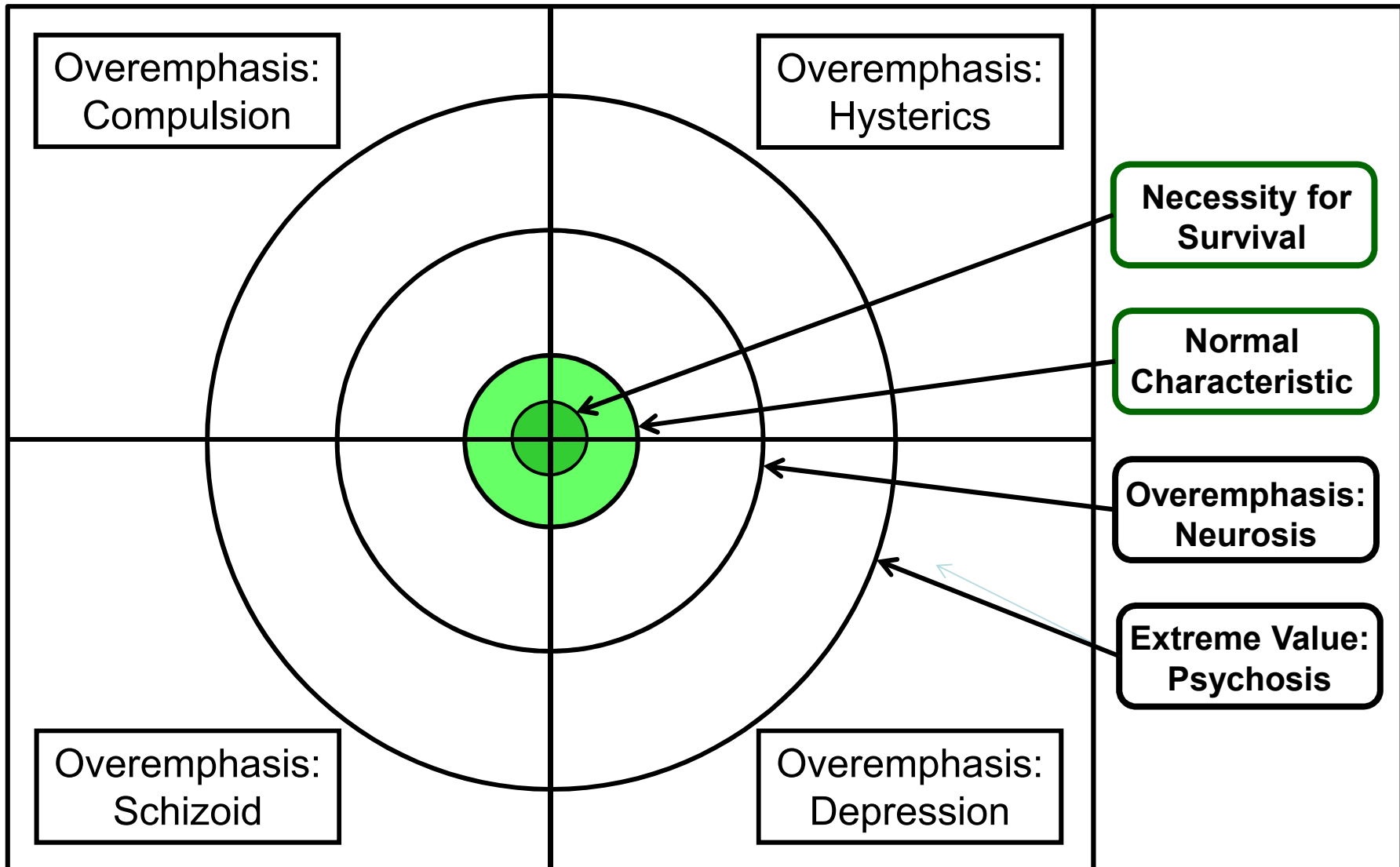
Positive 

"Selflessness"

Marked high helpfulness, striking friendliness, good empathy;
Constructive mediator in conflicts in the project team.

Project Manager (m/f/d): Leadership Functions

Four Basic Forms of Anxiety after Fritz Riemann:



Project Manager (m/f/d): Leadership Functions

Excessive Demands on the Individual Project Team Members:

Overemphasis: Compulsion

*Anxiety of
Changes*

→ Sticking to Scheme

Overemphasis: Hysterics

*Anxiety of
Necessities*

→ Flight from Problems

*Anxiety of
Human Proximity*

→ Isolation

Overemphasis: Schizoid

*Anxiety of
Independency*

→ Search for Help

Overemphasis: Depression

Project Manager (m/f/d): Leadership Functions

Excessive Demands on the Team Members; Individual Indicators with Clear **Signal Effect** for the Project Leaders:

- **Avoidance of Changes:**

Excessive need for hedge in terms of upcoming work packages. General tendency to "Scheme F".
Avoidance of "risky" improvements.

Overemphasis: **Compulsion**

- **Avoidance of Necessities and Immutability:**

Ignoring clear project plans, agreements, deadlines, clearly assigned work packages and obligatory commitments.

Overemphasis: **Hysteries**

Project Manager (m/f/d): Leadership Functions

Excessive Demands on the Team Members; Individual **Indicators** with Clear **Signal Effect** for the Project Leaders:

- **Avoidance of "Human Closeness" in the Group:**

Strong self-demarcation towards the other team members and the project leader. Problems with the own "subordination" and with the "we-feeling".

Overemphasis: **Schizoid**

- **Circumvention of the Own "Independency":**

Excessive dependencies on colleagues in the team and on the project leader. Often seeking help from the others, also for completing the own routine tasks.

Overemphasis: **Depression**

Project Manager (m/f/d): Leadership Functions

Reasonable Demands on the Team Members → "Flow"

Method: Targeted using of individual strengths!

- **"Reliable" Team Members** →

Subprojects and tasks that have to be done with great systematics, precision and punctuality. Intensive integration in processes of exact planning and in controlling.

- **"Flexible" Team Members** →

Use as "multi-taskers" and improvisers, especially in "risky" subprojects or even in the case of unpredictable, spontaneous actions that require a high level of flexibility.

Project Manager (m/f/d): Leadership Functions

Reasonable Demands on the Team Members → "Flow"

Method: Targeted using of individual strengths!

- **"Independent" Team Members** →

Transfer of subprojects and tasks, which are largely autonomous and self-responsible to do, which certainly demand courage and - especially in R&D - require a lot of sharp observation skills.

- **"Selfless" Team Members** →

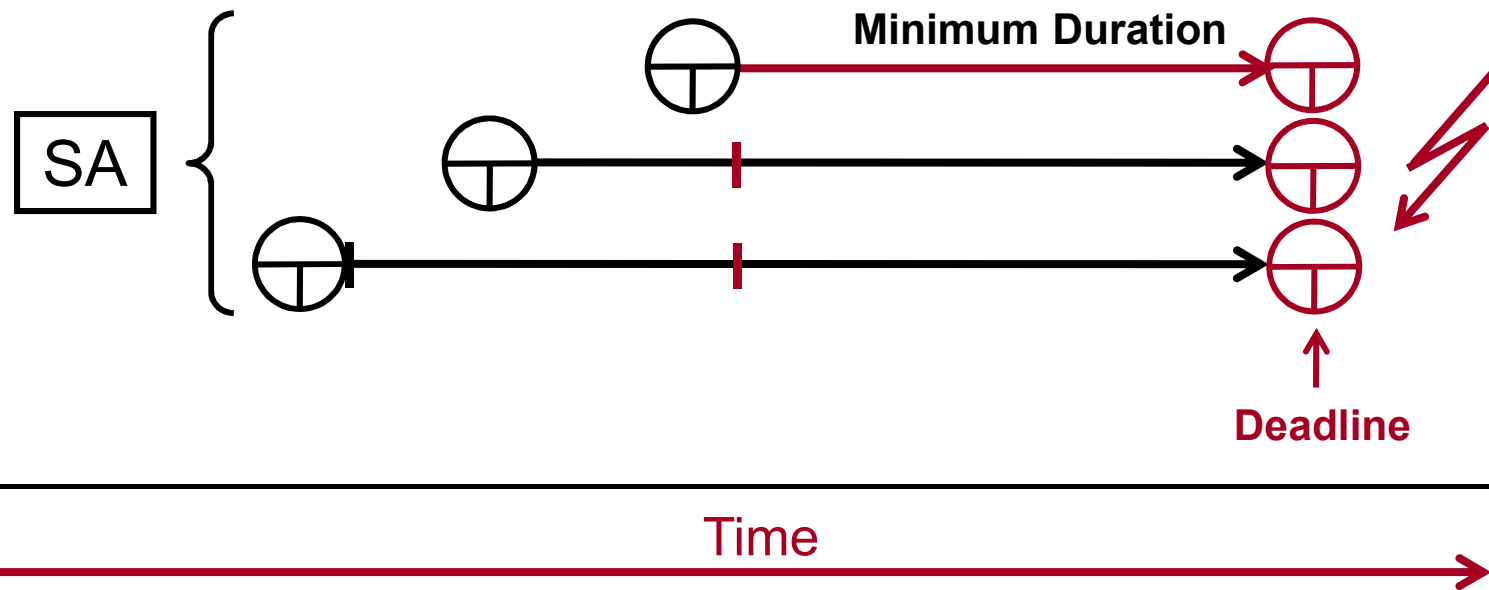
Involvement in true teamwork, in which the simultaneous reduction of the own interests is required. Actions in which the participation of others is necessary or at least useful.

Project Manager (m/f/d): Leadership Functions

Reasonable Demands on the Team Members → "Flow"

"Work expands to the extent as time is available for its completion." (C. N. Parkinson)

→ "A single action (SA) takes as much time as there is time available for it!"



Job vacancies for filling R&D **project management positions are often advertised, e.g. by the following employers:**

Beiersdorf
AG

TAROS
Chemicals
GmbH

Roche
Holding AG

BASF SE

Novaled
GmbH

Hilti
Corporation

Merck KGaA

The Dow
Chemical
Company

Wacker
Chemie AG

Ems-Chemie
Holding AG

Evonik
Industries AG

Carl Zeiss AG

Fraunhofer-
Gesellschaft

Max-Planck-
Gesellschaft

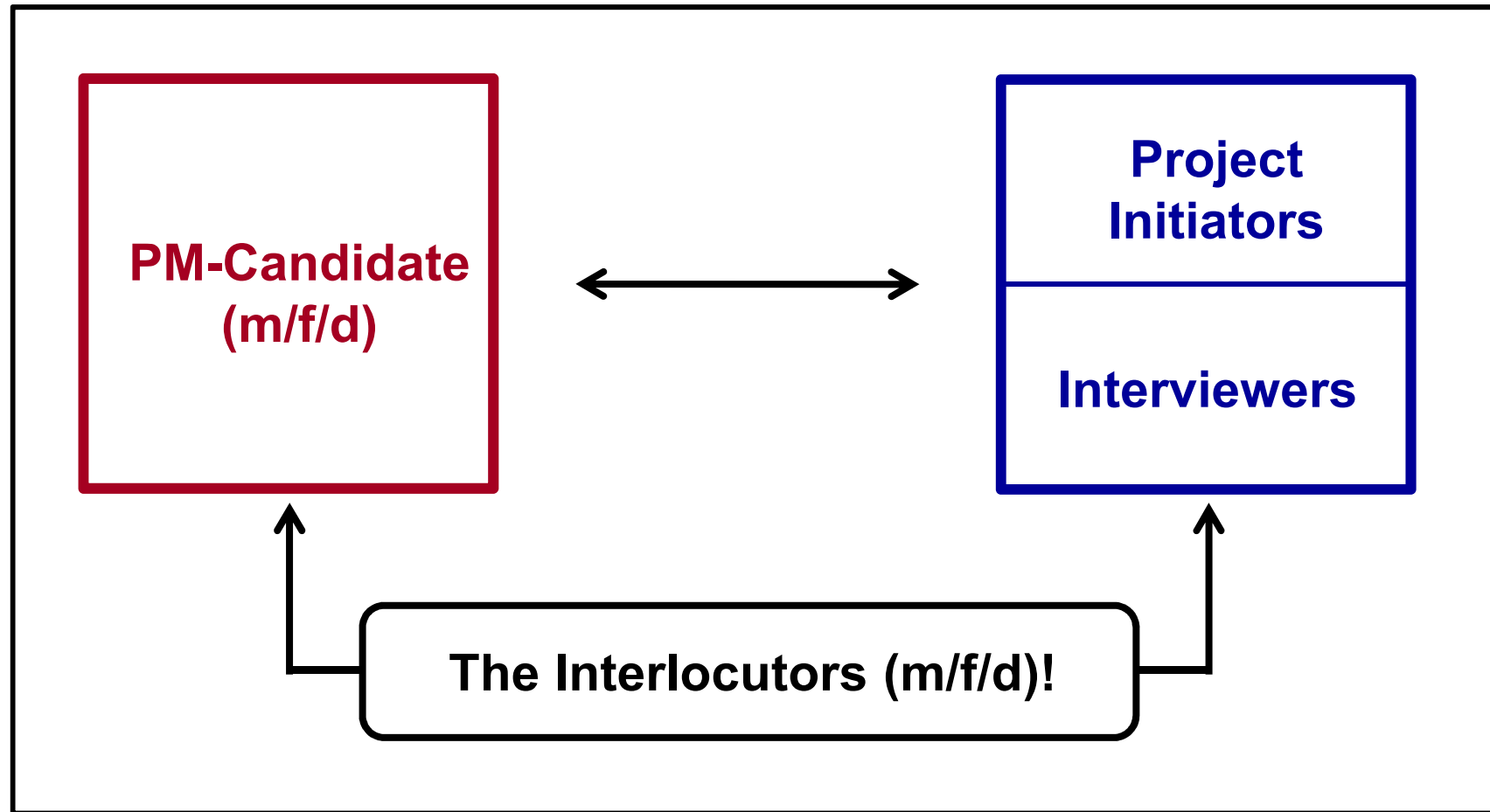
Karlsruhe
Institute of
Technology

Bayer
Aktiengesellschaft

Project Manager (m/f/d): Personality Profile

Application to a Project Manager Position.

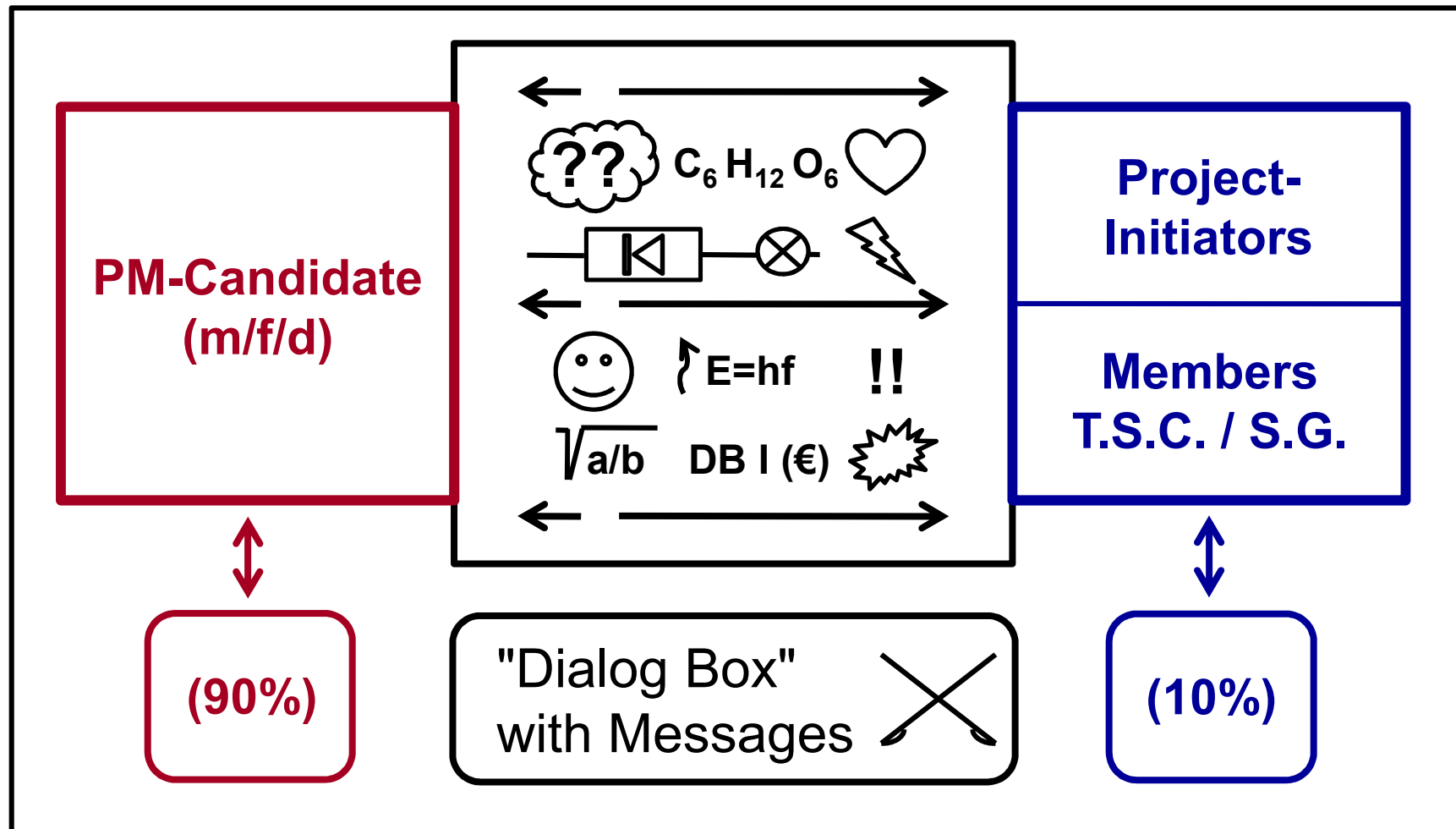
Successful in the Job Interview:



Project Manager (m/f/d): Personality Profile

Application to a Project Manager Position.

Successful in the Job Interview: (S.G.: Steering Group)

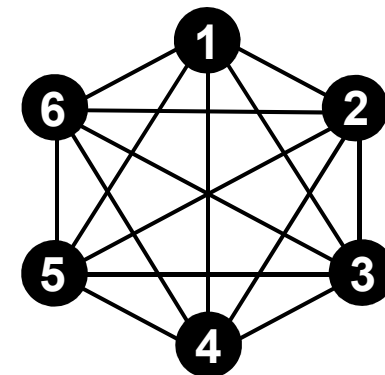


Project Manager (m/f/d): Personality Profile

"Orientation Guide" for the Project Management Candidates.

Fields of Competence for the Effective Project Management:

1	Professional Skills
2	Manual and Methodical Skills
3	Practical Experiences, "Wisdom"
4	Effectiveness, Efficiency
5	Emotional Intelligency
6	Social Competency
1 ⋮ 6	R&D Project Manager (m/f/d): Control of the R&D project until the target system is reached.



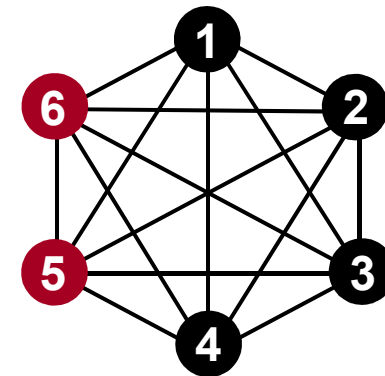
$$(K_6): \begin{bmatrix} 6 \\ 2 \end{bmatrix}$$

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4	Effectiveness, Efficiency
5	Emotional Intelligence
6	Social Competency
5 6	"Soft Skills": Personal Attitudes and Values.



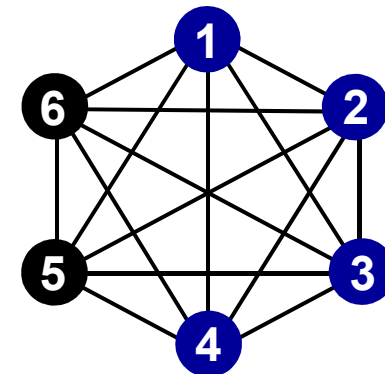
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5	Emotional Intelligency
6	Social Competency
1 ⋮ 4	"Hard Skills": Methodical-Professional Competencies

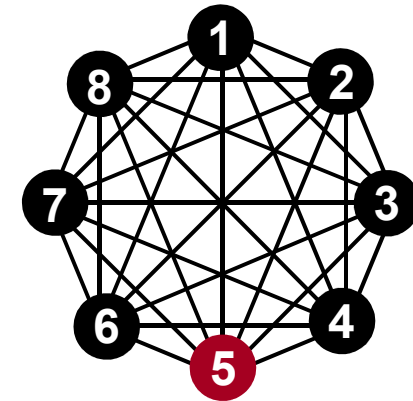


$$(K_6): \begin{bmatrix} 6 \\ 2 \end{bmatrix}$$

Project Manager (m/f/d): Personality Profile

"Orientation Guide" for the application to a job advertisement:
Contribution of the new project manager to the *future* success.

1	Market Position in Core Business
2	Innovative Strength
3	Growth in Digitization (Robotics, A. I.)
4	Productivity (Work, Time, Capital, Knowledge)
5	→ My future Project Results!
6	Top Environmental / Climate Protection
7	Solvency and Cashflow
8	Profitability and Profit Margin
5	R&D Project Manager (m/f/d): "Precision landing" in the goal system.



$$(K_8): \begin{bmatrix} 8 \\ 2 \end{bmatrix}$$

Project Manager (m/f/d): Personality Profile

Success in the Job Interview: →

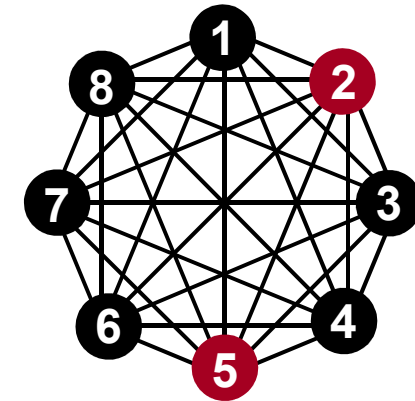
What should the PM-candidate (m/f/d) do in advance?

- Get detailed information about the project (Internet; Print media; "Word of Mouth")!
- Establish clearness for yourself about your *own* contribution to future project success. For this purpose, both, the point of view from the company *management* and that of the members of the steering committee have to be taken!
- Recognize/note the effects of the intended, own project results on all vertices in the "Orientation Guide" in order to internalize the latter as a "Guideline" for later action within the company!

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2 5	→ Chemist (m/f/d): Primary Results.

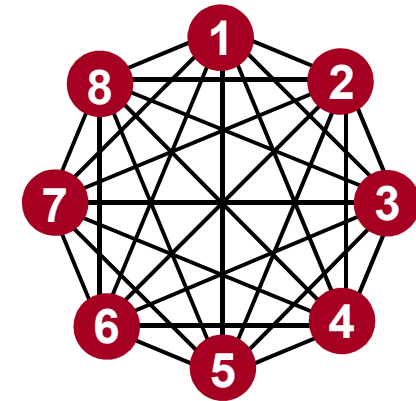


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8	Profitability and Profit Margin
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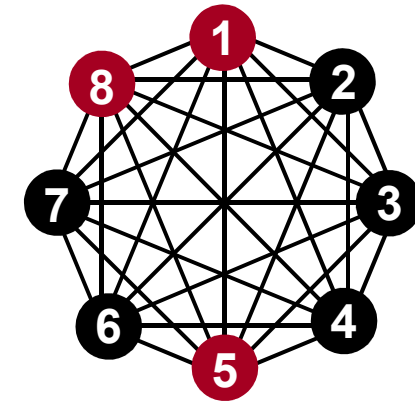


$$(K_8): \begin{bmatrix} 8 \\ 2 \end{bmatrix}$$

Project Manager (m/f/d): Personality Profile

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Contribution of the new project manager to the **future** success.

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2	Innovative Strength
3	Growth in Digitization (Robotics, A. I.)
4	Produktivität (Work, Time, Capital, Knowledge)
5	→ My future Project Results!
6	Top Environmental / Climate Protection
7	Solvency and Cashflow
8	Profitability and Profit Margin
1 5 8	→ Business(woman): + Indirect Results.

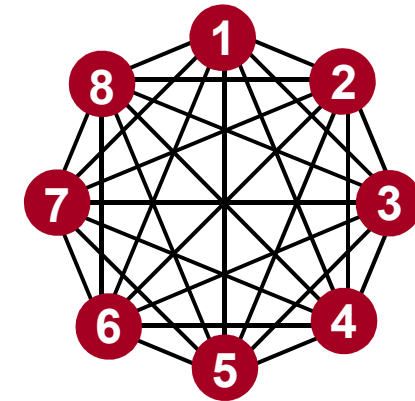


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6	Top Environmental / Climate Protection
7	Solvency and Cashflow
8	Profitability and Profit Margin
1 ⋮ 8	→ Business(wo)man: Primary Results.



$$(K_8): \begin{bmatrix} 8 \\ 2 \end{bmatrix}$$

Project Manager (m/f/d): Personality Profile

Project Management, Application for a Position.

Written Documents and Related "Attachments":

- Short (!) letter of application.
- Tabular CV (orthograde or retrograde).
- Passport photo (Voluntary! Unwanted: U. S. A. , G.B.; Unusual: NL, Scandinavia; Usual: E, I, P).
- Copy of the relevant certificates (school, study, work).
- Publication list, bachelor thesis, master thesis, diploma thesis, doctoral thesis, (hardcopy, weblink or e. g. CD-ROM).
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Cambridge, Massachusetts, 01.10. 2020

Dear Sir or Madam

The excellent reputation of your company as market and technology leader in the coating technology as well as your appealing internet presence have convinced me. Therefore, I am sending you my application for the position of a project leader at [...GmbH1].

I am 27 years old and achieved my highschool degree at the Maximiliansgymnasium in Munich with a grade point average of 1,0. After my military service at Bundesluftwaffe in the staff of the fighter squadron Erding, I studied chemistry in Heidelberg and Zürich with excellent success in only nine semesters. Subsequently, I did my doctorate under the guidance of Prof. Dr. XXX in Marburg with the mark „summa cum laude“. Currently, I am successfully completing a postdoc stay at Harvard University with Professor Dr. YYY, nobel laureate for chemistry in the year ZZZZ. Subject is the 23-step, stereospecific total synthesis of natural material A.

With [...GmbH1], I connect a high competence in research and innovation, a high reputation and sustained economic success. I am sure, that I can successfully improve my professional qualification in your company in a goal-oriented way. My high learning aptitude and my openness for new, challenging duties give the best preconditions for this.

The ability to work in a team, communication skills, independence and entrepreneurial initiative are my strengthes. I can well imagine to increase my professional skills in the technical marketing or in the strategic planning of your house.

I would be pleased about the invitation for a round of interviews!

With kind regards, Dr. Muster.



Example

**The message: "I'm excellent and therefore, I want to make a career!"
(The applicants motivation is necessary – but it is not sufficient!).**

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I would very much like to play an active part in planning and realization of challenging research projects at [...GmbH1]! I am sure that I will get concrete results for the achievement of your innovation goals in order to make a verifiable contribution to your companies future success. I bring with me a far-reaching mobility and a high flexibility as well. I am open for future Project work, also in an other function outside from research.

Besides my technical skills, I am characterized by my own initiative, high dedication, the ability to work in a team and by strong intention to strive for the achievement of results.

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The message: "I want to contribute to the success of your company with my results!" (The applicant motivation is necessary and it is sufficient!).

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Project Manager (m/f/d): Personality Profile

Project Management, Application for a Position.

The application documents can be forwarded to potential employers via the following "recruitment tools":

- Application dossier via postal delivery.
- Online recruitment websites.
- Online job exchanges.*
- Job exchanges.
- Live events at universities.
- Social media (Facebook®, Xing®, LinkedIn®, etc.).*

* "Digital Natives"

Project Manager (m/f/d): Personality Profile

Success in the Job Interview.

Important for the PM-Candidate (m/f/d) during the Interview:

- Concentrate yourself completely to the interviewer (!).
- Always remain authentic in conversations, only really describe "self-experienced" things.
- But also: As loosely as possible anticipate the effects of your own utterances on the counterpart.
- To strengthen the "preconscious": a few weeks before the interview, carefully work through an guidebook "job interview"!

Project Manager (m/f/d): Personality Profile

Success in the Job Interview.

Important for the PM-Candidate (m/f/d) during the Interview:

- Emphasise the positive sides of your own weaknesses (!)
- When describing your own bachelor-, master- or doctoral thesis, focus constantly on comprehensibility and on the important results achieved.
- Always be aware that the employer is mainly interested in the candidate's *future* work results when making the decision for hiring.

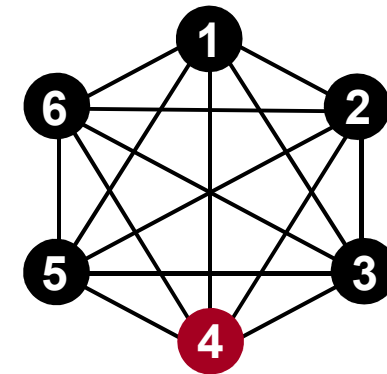
The Emerging Shortage of Specialists in Germany:

University Degree	2015	2030	Deficit Increase
Engineering Sciences	28.000	60.000	114 %
Natural Sciences, Mathematics, Informatics	9.000	25.000	178 %
Medicine	11.000	30.000	173 %
Educational Sciences	30.000	53.000	77 %

In 2030: Shortage of University Graduates in the following Job Fields:
Mechanical Engineering, Vehicle Construction, Civil Engineering, Electrical Engineering, Data Processing, Artificial Intelligence, Healthcare.

"Compass" for the "Performance" of **Universities or Research Institutes** (Analogy to the Scorecards for Industrial Companies):

1	International Reputation
2	Research Performance: Institutes, CRCs, GCs
3	Number of First-Class Publications/Patents
4	Attractiveness for Top-Students
5	Government Funds, Budget for R.&T.
6	Public Funding, Industry Sponsors
1 ⋮ 6	R.&T.: Research and Teaching. CRC: Collaborative Research Center. GK: Graduate College, etc.



$$(K_6): \begin{bmatrix} 6 \\ 2 \end{bmatrix}$$

Project Manager (m/f/d): Leadership Functions, Personality

Attractiveness: ↔ **True "Project Culture"!**
Latter Shapes the Expectations of Today's Top Applicants!

- Clear Target Agreements
- Limited Time Frame
- Novelty, Uniqueness
- Limited Resources
- Complexity

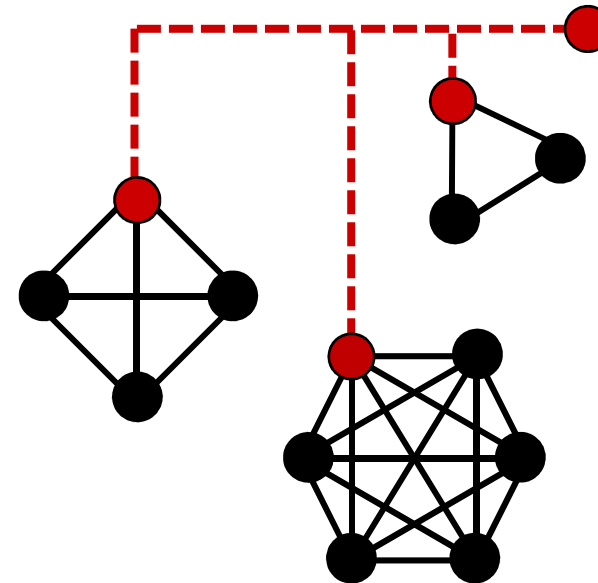
- Specific Organization
- Transdisciplinarity
- Fields of Exploration
- Uncertainties, Risks
- High Dynamic of Changes

The continuous development of the project culture has an influence on the **hiring criteria** as well as on the chances of an effective **"self-marketing" of one's own company** in the job interviews!

Attractiveness for Project Managers (m/f/d) by a Real "Project Culture":

Frame Conditions in the Own Company

- Clear target agreements.
- Defined appointments.
- Uniqueness and newness.
- Limited resources.
- Complex tasks.
- Special organizations.
- High transdisciplinarity.
- Exploration fields.
- Careful experiments.
- High dynamics.



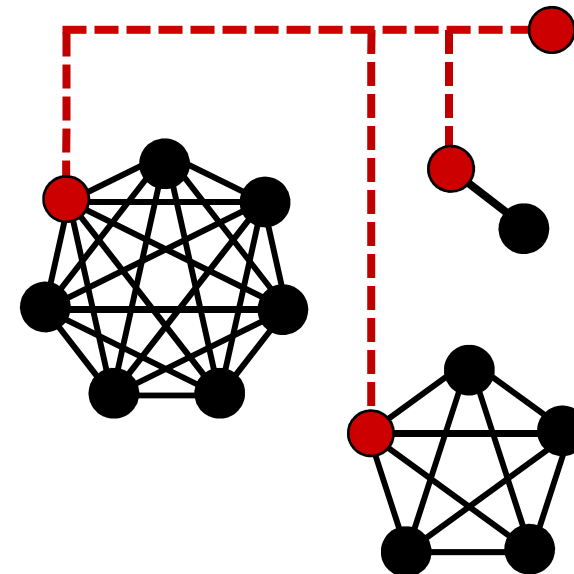
Frame Conditions "Project Operation"

- Full Structures (Simplexes)
- Project Mgmt. Governance
- Project Culture: Inklusion

Attractiveness for Project Managers (m/f/d) by a Real "Project Culture":

Frame Conditions in the Own Company

- Clear target agreements.
- Defined appointments.
- Uniqueness and newness.
- Limited resources.
- Complex tasks.
- Special organizations.
- High transdisciplinarity.
- Exploration fields.
- Careful experiments.
- High dynamics.



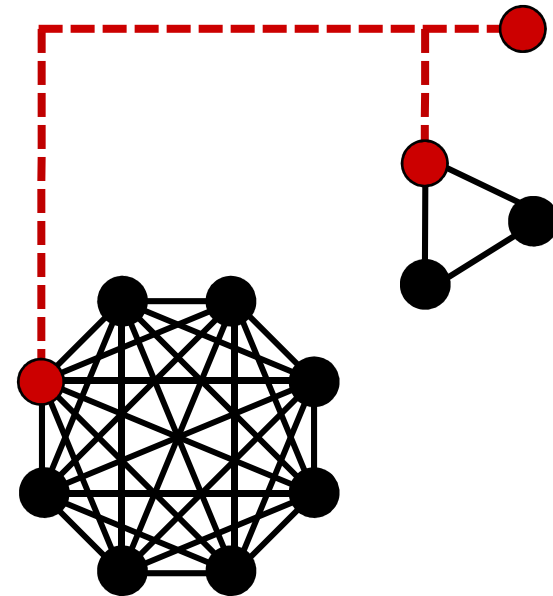
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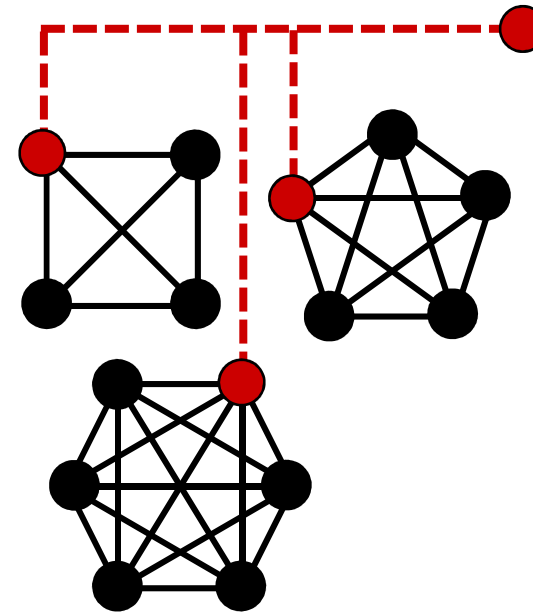
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Frame Conditions "Project Operation"

- Full Structures (Simplexes)
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The Professional Job Interview:

What should the interviewers (m/f/d) do?

- Make the job interviews, strictly following the rule that the applicants have >90% (!) of the available speaking time for themselves!
- Looking for candidates' strengths, not for the weaknesses ("Interrogation"). The latter reveal themselves anyway "between the lines"!
- Strictly avoid hierarchical thinking and any form of superiority behavior/gestures!

Project Manager (m/f/d): Leadership Functions, Personality

The Professional Job Interview:

What should the interviewers (m/f/d) do?

- Where possible, ask "open questions".
- Do not ask suggestive questions!
- According to the answers of the job applicant, always "follow up" ("view!") and, as far as the labor law allows, go into the "depth".
- No any external disturbances or interruptions (e.g. telephone calls!) during the interview!

Project Manager (m/f/d): Leadership Functions, Personality

Interview Technique, Questions to get started (Example):

Question: "What did you stimulate to study chemistry?"

Answer: "Our former chemistry teacher was great!"

Question: „What was so great about your teacher?“ (“Follow up!”).

A1: "The teacher always did exciting experiments: He burned sparklers, inflamed Bengal lights, and he fiddled around with oxyhydrogen gas..."

A2: "The teacher showed us the logical clarity of the periodic table of the elements, the clearly defined structure of the atoms and the exact predictability of the kinetics of chemical reactions ..."

A3: "The teacher was a representative from the good old school who was respected by us, and he really had his class under control ..."

A4: "..."

Project Manager (m/f/d): Leadership Functions, Personality

Main questions to "check" future project managers (m/f/d):

Reasons for the choice of field of study: —→ ?

Doctoral supervisor(s) (m/f/d), topic of the final thesis: —→ ?

Results of the (scientific) papers so far: —→ ?

Domain for the creation of the necessary "confidence" at the beginning.

Future success factors for the offered job, own view: —→ ?

Own leadership behavior to maintain motivation: —→ ?

Own leadership behavior in the case of massive pressure: —→ ?

Previous experiences with leadership tasks: —→ ?

Own medium-term career planning: —→ ?

Current professional activities: —→ ?

(Interests/Hobbies): —→ ?

Fields of Competence for a Project Management Task:

Entrepreneurship.

- **Ability and Urge to Entrepreneurial Action:**

The endeavor to identify opportunities or problems in a project and, in the light of this, to proactively formulate and implement objectives and action plans or make decisions. The own urge to make decisions ensuring the progress of the project and to take the responsibility for the follow-up results to the steering committee and stakeholders.

- **Innovativeness:**

Open attitude for new approaches to solutions, coupled with transdisciplinary thinking and acting. Meaningful integration and consideration of "external" pulse generators.

- **Analytical Thinking:**

Ability to quickly identify the essentials buried in a mass of data and facts, and to derive priorities for actions in the project.

- **Strategic Orientation:**

The preference to think in terms of realistic and targeted scenarios, and to always reconcile day-to-day operations with the long-term goal system.

Fields of Competence for a Project Management Task:

Social Interaction and Cooperation.

- **Communication and Interpersonal Understanding:**

The talent of clearly expressing oneself and the ability to empathize with the paradigms and pattern of thinking of the other project participants or stakeholders and to articulate oneself appropriately.

- **Understanding and Effective Utilization of the Project Organization:**

Understanding of the complete formal project structure and the ability to identify and integrate the real opinion leaders and decision-makers as well as the most suitable project promoters within or outside the company.

- **Achievement of Influence and Effect:**

The ability to convince other project participants or stakeholders and, if necessary, to change their minds so that one's own ideas can adequately be taken into account.

- **Professional Handling of Conflicts:**

Willingness to openly and objectively address problems in the project, to be accessible to the criticism expressed to the own project leadership and the talent to bring about generally accepted conflict solutions.

Fields of Competence for a Project Management Task:

Social Interaction and Cooperation.

- **Clearly Discernible Customer Orientation:**

Ability to find out the interests and activities of the customers and other stakeholders in the project and to take them into account in a targeted manner.

- **Intercultural Adaptability:**

Genuine interest in foreign languages, cultures and customs, as well as the ability to achieve a high level of acceptance among all project actors and decision-makers in a different national or cultural environment.

Fields of Competence for a Project Management Task:

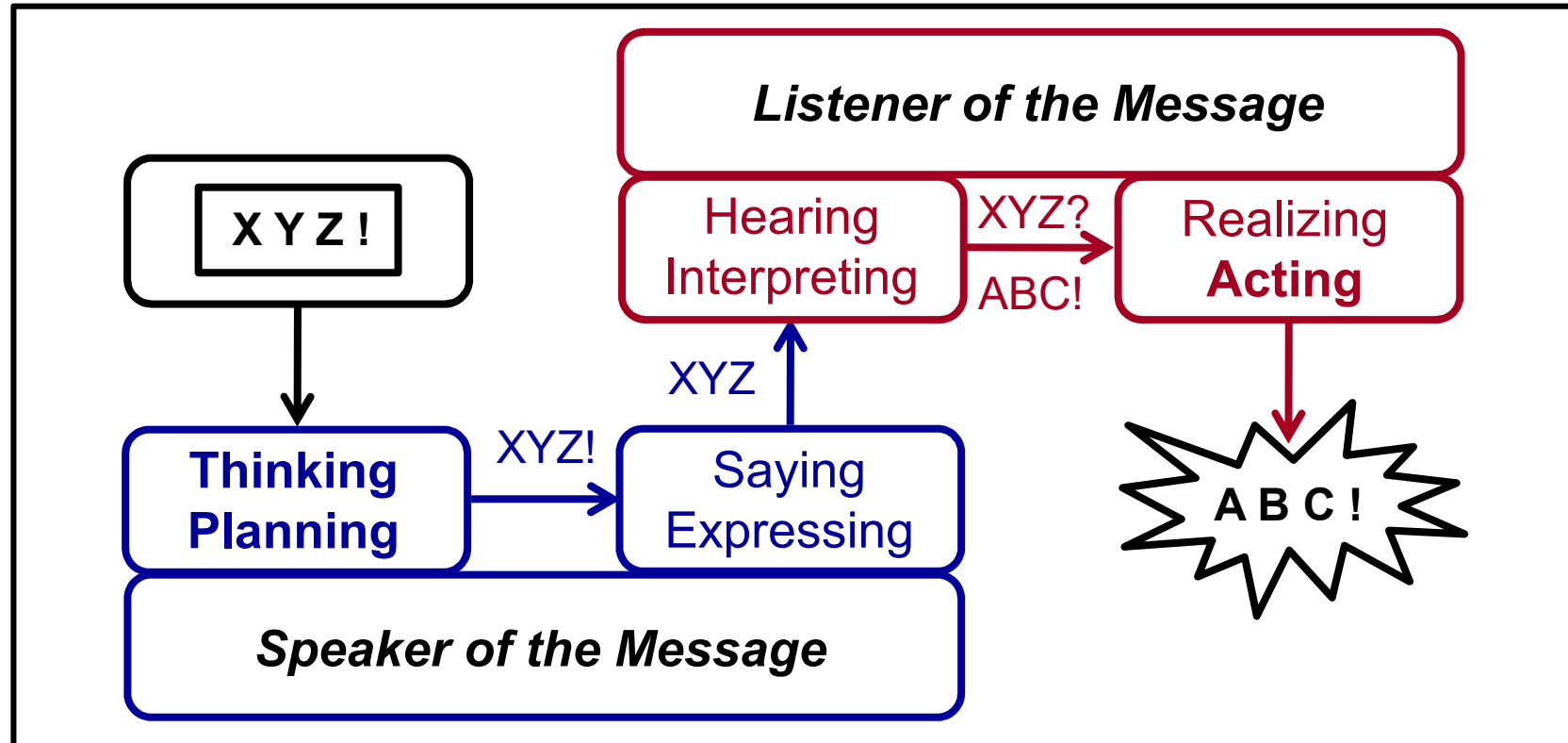
Effective Leadership.

- **The Ability to Lead all Team Members to Project Success:**

The ability to fill project teams with exactly the right people in their respective functions and characters and to challenge and promote them individually with a view to achieving the target system.

Project Manager (m/f/d): Leadership Functions, Personality

Communication in the Candidate Interview: —————>



The decisive factor is **not**:

What does the message do with the listeners (m/f/d)?

Much more:

What do the listeners (m/f/d) make with the message?

Project Manager (m/f/d): Leadership Functions, Personality

Domain for Spontaneous Utterances in the Interview:

—————→ **(Prior) "Experiences of Happiness or Success"**

Requirements from side of R&D project managers	Skills of the commissioned team member	Type of the respective requirement	Consequence for the team member
Low	Low	No request	Apathy
Low	High	Too little demand	Boredom
High	High	Challenge	"Flow"
High	Low	Excessive demand	Anxiety

Reasons: multiple experience, talents and / or abilities.

"Flow": Experience of happiness after a realized (challenging) action (Source: M.Csikszentmihalyi).

Project Manager (m/f/d): Leadership Functions, Personality

Domain for Spontaneous Utterances in the Interview:

————→ **(Prior) "Experiences of Fear or Failure"**

Requirements from side of R&D project managers	Skills of the commissioned team member	Type of the respective requirement	Consequence for the team member
Low	Low	No request	Apathy
Low	High	Too little demand	Boredom
High	High	Challenge	"Flow"
High	Low	Excess. Demand	Anxiety

Reasons: No or little experience, low ability.

**Fear during project work:
The action is necessary, but is often avoided by the team member.**

Project Manager (m/f/d): Leadership Functions, Personality

Candidate (m/f/d) as a Future Team Member.

Evaluation of spontaneous utterances, derived questions:

Form of Anxiety (F. Riemann)	Fundamental Attitude of the Team Member
Anxiety of changes in the course of the project.	"I'm a valuable team member, because I plan everything in detail in the project!"
Anxiety of obligations in the course of the project.	"I'm a valuable team member because I dare to do something unconventional in the project!"
Anxiety of dependencies on other (project)participants.	"I'm a valuable team member because I always act independently in the project!"
Anxiety of independence in Thinking, Planning, Acting.	"I am a valuable team member because I always help selflessly in the project!"

Subjects of in-depth questions!

Project Manager (m/f/d): Leadership Functions, Personality

Conclusion for the P. Management-Candidates (m/f/d) (1):

- It doesn't harm to work through an application guide ***a few weeks before*** the interview date ...
- One should inform oneself about the hiring employer and about the project position offered in advance (e.g. via the Internet)!
- Applicants (m/f/d) should - on a trial basis - realize and adopt the viewpoints and thought patterns of the managers of the potential future employer as well as possible!

Conclusion for the P. Management-Candidates (m/f/d) (2):

- Always be aware of the fact that only the *future* work results achieved by the applicants themselves will count for the employer!
- Always stay relaxed, honest and authentic during the interview!
- Inform about the position to be filled and the results to be achieved with genuine interest!

Project Manager (m/f/d): Leadership Functions, Personality

Conclusion for the Project Initiators (T. S. C.) (1):

- There do not exist the optimal project managers who know everything, who can do everything, and who have everything.
- There remains only the search for the **best suited candidate (m/f/d) for a particular project**, equipped with strengths *and* weaknesses!
- Focusing the interview on the personal strengths of the candidates! The complementary "weaknesses" reveal themselves in the interview anyway "between the lines"! "Interrogations" immediately lead to tactical behavior or the internal blockade attitude of the job applicants!

Project Manager (m/f/d): Leadership Functions, Personality

Conclusion for the Project Initiators (T. S. C.) (2):

- Make structured interviews, but do **not use** any "questionnaires" or "**checklists**"! Pay particular attention to spontaneous utterances, note these down and analyze their signal effects with regard to the competence profile of the candidate (m/f/d).
- Lead the talks **always on "eye level"**!
Steady goal: Win-win result for both interlocutors.
- Remember that the job applicants could later work in a company in which they as a customer or as a principal may make decisions against the own companies interests.

Project Manager (m/f/d): Leadership Functions, Personality

Positive Experiences as Project Manager (m/f/d) Prepare the Way for Professional Success!

Necessary

- Expanding selectively the own (technical) skills and experiences.
- Lifelong learning, especially subjects from outside one`s own field.
- Recognize and use emerging opportunities as such.
- Acting actively as project manager/team member.
- Sometimes a little courage with manageable risk.
- One or two extra portions of luck! 

Project Manager (m/f/d): Leadership Functions, Personality

Common Mistakes and Disruptive Factors in R&D Project Work:

01. Project Inflation:

No or insufficient formulation and prioritization of the innovation strategy and the associated R&D project portfolio.

02. Lack of Resources:

Lack of specialist staff, insufficient financial budget and “outdated”, only partially suitable (laboratory) equipment.

03. Bureaucracy:

Internal and external bureaucratic obstacles with no added value. Any Project progress is "slowed down" by rigid regulations.

04. Problematic Project Management:

The project management focuses too much on just *one* of the target components or accepts “back delegations” from the team.

05. Only Restrictedly Suitable Team Members:

Inadequate technical and / or methodological skills of individual team members that cannot be remedied within a short term.

Project Manager (m/f/d): Leadership Functions, Personality

Common Mistakes and Disruptive Factors in R&D Project Work:

06.	"Power Games" between Line and Project: Executives from company management or line interfere into the ongoing project. The department's interests have "right of way".
07.	Permanent "Trouble-Shooting": All daily problems have more weight than the ongoing project work. Often new "projects" arise exactly here.
08.	Targetless and Inconclusive Meetings: Meetings without clear agendas and objectives. Missing results, e.g. in the form of accepted action plans.
09.	Rigid "Grandfathering Clauses": Lack of flexibility to take on necessary / urgent work packages. Misinterpreted time and work autonomy.
10.	Overestimation of the Project Software: Project management is seen solely as an IT-supported processing system, the rules of which can be bypassed at any time.

Project Manager (m/f/d): Leadership Functions, Personality

Common Mistakes and Disruptive Factors in R&D Project Work:

11. Communication Deficits:

Too little, project-relevant and goal-oriented information exchange between all those involved (including pilot customers).

12. No Effective Teamwork:

Individual team members see themselves only as contributors and not as cooperators with responsibility for the overall success.

13. Unused Strengths:

Project management and project team do not use or use too little the personal strengths of individual team members.

14. Deficits in Reporting:

Reports on project progress are formulated vaguely and are overloaded with details that do not have the character of a result.

15. Suboptimal Corporate Culture:

The people talk too little with each other and too much about the others. "Early warning systems" to avoid errors are not used.

Project Manager (m/f/d): Leadership Functions, Personality

Corporate Culture, Check of "Indicators":

- What are the style characteristics of in-house communication?
- How are decisions made, communicated and enforced?
- How conflicts are internally carried out?
- Who becomes promoted by whom on what basis?
- Are title and hierarchy strongly emphasized?
- What is the preferred letter style of the house?
- What is the behavior towards customers or guests?
- Is there the "real" willingness of the workforce to work overtime, especially in crisis situations?

Project Manager (m/f/d): Leadership Functions, Personality

Corporate Culture.

Indispensable: The support of the total R&D project team by the own`s company top management!

Corporate culture: It determines the importance that project management really has, how is thought and spoken about project management, and how it is practiced in the own company.

The corporate culture **is decisively influenced by the upper management.**

Here, its leadership behavior plays a crucial role, as well as the way the management itself realizes the leadership principles and thus shapes the thought patterns of its employees.

A really practiced value system is crucial for the success of R&D project management!

Project Manager (m/f/d): Leadership Functions, Personality

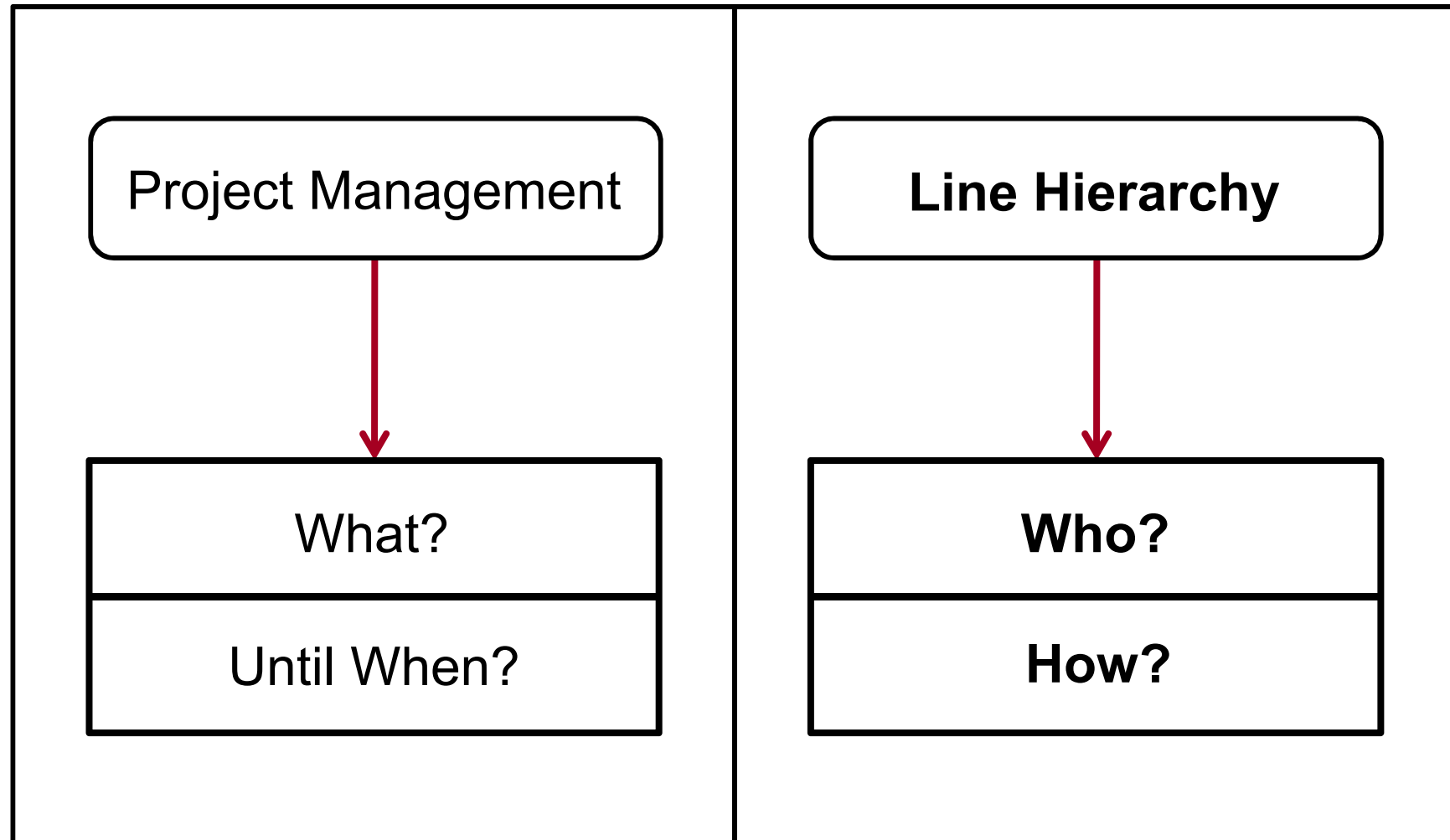
R&D Project Management as an Effective Leadership/Steering Task and as a "Counterweight" to the Permanent Existing Claim of Leadership from the Line Management.

Sometimes, there are individual **managers in line positions who openly or "covertly" omit to provide the necessary support for research projects.**

They see their personal influence in the company restricted by projects, as well as a reduction in their hierarchical authority if, despite their authority to give instructions, they need to subordinate to the project managers interests and have to resign themselves to the project plannings.

Project Manager (m/f/d): Leadership Functions, Personality

R&D Project Management, Leadership; Role of the Line:



**Further literature on the subject of "R&D project management in the chemical industry".
Selection of purchasable monographs and publications in journals or in internet.**

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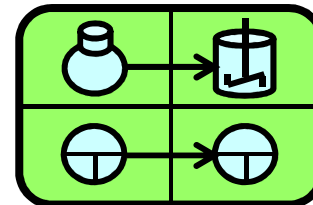
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R&D Project Management in the Chemical Industry



End of Lecture Module 06

Rainer Buerstinghaus