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Abstract

These days, management decisions have to be made faster than ever before but still be of high quality. Managers often have a lot of information but with little structure and lack of time. Decisions still have to be made NOW. Instead of really accept and handle the complexity of the problem case managers quite often tend to simplify the problem - and then decide. Most of the time managers won't follow a problem solving process. They decide purely based on their intuition and business experience. Many other business areas such as marketing, development, supply chain and production today use highly evolved methodologies and data processing power. Why not the top management of the company?

The TRIZ Technology with its unique thinking offers a well-structured and high power problem solving process. The competence of fast and optimized decision making in business and management can be achieved and enhanced by using a TRIZ-based approach for non-technical problems.

1. TRIZ for Business and Management

Applying the TRIZ ‘thinking’ tools of inventive problem solving in engineering successfully replaces the unsystematic trial-and-error method in the search for solutions in the everyday life of engineers and developers. The majority of organisational management decisions made by the executives and managing directors however are still based on their intuition and personal experience. Therefore often complex contexts are extremely simplified, alternatives ignored, constraints avoided, risk not evaluated correctly and resources, knowledge and potentials not utilised for the best problem solving at the right time.

This is part of the reason for the growing demand from management people for systematic and powerful thinking tools, which assist the executives processing the information and making the right decisions in time.

The TRIZ Innovation Technology offers such thinking tools (1-5). TRIZ knowledge and professional TRIZ application experience together with TRIZ-based thinking for management tasks helped to identify the technology tools which come into play:

- TRIZ tools, such as Innovation Principles for Business and Management as well as Separation Principles for resolving organisational contradictions and conflicts, for example.
- Substance-Field Analysis for visualizing highly complex systems.
- Procedures and checklists of the anticipatory failure recognition for prediction and evaluation of risks.
- Operators for revealing and utilising system resources as a basis for effective and cost-saving decisions.
- Patterns of evolution of technical systems to support systematic and multi-dimensional thinking.

Today commercial TRIZ-tools for electronic data processing allows to build a specific idea and data base including own case processing (6).

2. Components of the demanded management thinking structure

If agreement is obtained that management decisions should be based on more methodology, the TRIZ knowledge base along with its analytic methods can effectively be used. TRIZ for business and management basically use these five components:

2.1. Identification and theoretical exaggeration of conflicts

Non-technical conflicts such as organisational or administrative contradictions and conflicts on different levels (personnel, team, company area, entire company, branch of industry etc.) should be identified, theoretically exaggerated and then resolved in the next stages. The desired result is to substantially decrease or even eliminate all unwanted tendencies and features, while at the same time keeping and intensifying all positive and useful factors.

2.2. A positive attitude towards complexity

Instead of simplifying complex combinations and interactions when analysing a task, the TRIZ method allows even highly complex and multi-dimensional interconnections to be clearly explained. The complexity of a task itself becomes the prerequisite to finding the best solution.

2.3. Consideration of patterns of evolution

The hierarchic (systematic) consideration and evolutionary development of the conflicting entities and factors play an important role in the analysis and evaluation of possible decisions. Further TRIZ evolutionary criteria such as adaptability, controllability and periodic occurrences complete the systematic approach to the problem.

2.4. Anticipatory evaluation of risks

Decisions and strategies are tested by the method of the Anticipatory Failure Identification. The strength of this method is to find weaknesses within the proposed management solution by systematically trying to “prove them wrong”. All available resources are utilised deliberately to

cause the concept failure. Hidden risks of a decision are effectively revealed and can be avoided in further steps.

2.5. Utilisation and expansion of resources and knowledge

The central function of knowledge and idea management is to utilise the personal and collective knowledge in time, to broaden the boundaries of knowledge and to provide timesaving access to knowledge and idea pools. The TRIZ Idea database with its many thousands of effects and examples offers a solid knowledge basis.

3. The process for problem solving in business and management

For the first step a non-technical problem should be formulated in terms of a conflict or contradiction with positive and negative aspects similar to the technical contradiction. This conflict can then be strengthened in terms of deepened physical contradiction. By using the 12 double innovation principles or the separation principles for the deepened conflicts the problem can be overcome.

The amount of generated ideals is considerably faster and higher compared with the solutions managers usually come up with. Especially for critical cases a problem solving process with the following main phases is suggested: Function and Conflict Analysis, Mobilisation of Resources, Generating of Ideas, Evaluating of the Results and Anticipatory Risk Analysis.

Figure 1: The process for problem solving in business and management

4. 12 innovation principles for business and management

The 12 double principles for Business and Management, partly derived from (1,2), assist the user resolving organisational contradictions and conflicts. They broaden the individual experiences and intuition of the manager and in addition help them to quickly formulate several different approaches to difficult situations.

Each principle represents two contradictory lines of action, which have to be taken into consideration when searching for solutions. There is no recommendation as to which action is the more suitable. The user is thus stimulated to think in a dialectic and creative way.

Table 1: 12 Principles for resolving organizational tasks in Business and Management

1. Combination - Separation 2. Symmetry - Asymmetry 3. Homogeneity - Diversity 4. Expansion - Reduction	8. Action - Reaction 9. Continuous action - Interrupted action 10. Partial action - Excessive action

5. Mobility - Immovability 6. Consumption - Regeneration 7. Standardisation - Specialisation	11. Direct action - Indirect action 12. Preliminary action - Preliminary counteraction

5. Example

In companies quite often problems arise due to difficulties in communication. As an example the communication lack between a highly technically competent and thus important individual and the rest of the staff can be used. The resulting personal conflicts then have a negative effect upon the productivity and the working climate. Here are some suggestions using the principles as to how to defuse the problem:

Principle 1. Combination - Separation:

- “Isolate” the person for the staff to avoid direct contact and organize a central counsellor.
- Arrange for the “difficult” person to work at home or to have flexitime.
- Set up a database or an Expert System to make the expertise of the person available to others.

Principle 2. Symmetry - Asymmetry:

- Reduce asymmetry in company expertise; internally train or hire several experts.

Principle 3. Homogeneity - Diversity:

- Encourage psychological homogeneity and raise the tolerance threshold of the colleagues.

Principle 4. Expansion - Reduction

- Reduce the individual’s direct involvement with colleagues and in projects.

Principle 5. Mobility - Immovability:

- educe the individual’s sphere of movement within the company through organizational means.

Principle 7. Standardisation - Specialisation:

- Standardise company knowledge and working methods. Introduce knowledge management.
- Use the unique (or specialist) knowledge of the individual to build up the knowledge management system or have them organise this task.

Principle 8. Action - Reaction:

- Arrange a social and psychological guidance program for the individual.

Principle 9. Continuous action - Interrupted action:

- Only involve the individual in a consultative role and in certain phases of a project.

Principle 10. Partial action - Excessive action:

- Reduce the amount of time that the individual spends in projects.

Principle 11. Direct action - Indirect action:

- Provide a mediator or a social buffer for the individual in the team or in the company.

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- **Bruno Ruchti: Dipl. Ing. /** Management Consultant. Based on experience in business process re-engineering, quality management, TQM and Innovation Management he started to implement TRIZ to problem solving for business management in various business fields.

Appendix: 12 Innovation Principles for Business and Management

Principle 1	**Combination - Separation**
Description	Combine parts of an object or the phases of a process to form a uniform object or process. Separate a uniform object or a uniform process to form independent parts or phases.
Recommendation	1. “Combination and Separation” can be applied to similar as well as dissimilar parts. 2. Combine or separate only for a specific amount of time. 3. Combine (connect) objects in parallel or in series. 4. Separate the harmful, or conversely isolate, the only useful part (property, phase) from an object or a process. This part can be treated separately and re-introduced later on. 5. Change the degree of fragmentation of objects and processes (increase or decrease). 6. Go to the extremes of combination and separation. Separate or fragment objects down to the lowest micro-level. Combine objects to create the largest possible formations.

	7. Try to obtain new effects and properties by combining similar objects to form a bi or poly-system.
Related technical TRIZ Principles	1. Segmentation; 2. Extraction; 5. Combination

Principle 2	**Symmetry - Asymmetry**
Description	Change a symmetrical shape or property to an asymmetrical shape or property or vice versa.
Recommendation	1. Change the degree of asymmetry (increase, decrease). 2. Replace rectilinear outlines and shapes by curved, spherical or spiral outlines and shapes or vice versa. 3. Replace rectilinear processes by iterative or periodic actions or vice versa.
Related technical TRIZ Principles	3. Local Conditions; 4. Asymmetry; 14. Spheroidality.

Principle 3	**Homogeneity - Diversity**
Description	Change from homogeneous structures, systems or environments to compound structures, and dissimilar systems or environments. Reduce the degree of diversity in the structures, systems or the environment.
Recommendation	1. The different components are to perform different functions and should be individually matched to the local requirements. 2. Minimize losses (cash, personnel, energy) during restructuring or re-organisation processes. 3. Remove all “foreign bodies” from the systems and organisations wherever possible. 4. Try to remove the unwanted interaction between two elements of a system not by introducing foreign “separating substances” but rather by modifying the existing resources. Every system defends itself “foreign” elements. 5. Avoid ‘gaps’ (personnel, information, finances etc.) in systems or organisations. Immediately fill every available ‘gap’ with up-to-date information, tasks, etc.
Related technical TRIZ Principles	3. Local Conditions; 12. Equipotentiality; 33. Homogeneity; 31. Porous Material; 40. Composite Materials.

Principle 4	**Expansion - Reduction**
Description	Increase or reduce the number of functions in a system or process. Increase or reduce the amount, duration, cost, speed or other properties of a process.
Recommendation	1. Invert the processes - turn them “upside down”. 2. Increase or reduce the number of dimensions in a system: instead of a single level (layer, coat, floor etc.) build a system with several levels (layers, coats, floors etc.).

	3. Perform a transition of a rectilinear development (movement) to a development (movement) in a flat plane (two-dimensional) or in space (three-dimensional). 4. Consider time as a 4th dimension. 5. Try to nest several multi-dimensional objects inside one another. Russian Doll principle. Utilise unexposed surfaces (e.g. reverse sides). 6. Change the colour, brightness and sharpness.
Related technical TRIZ Principles	7. Nesting; 13. Inversion; 17. Another Dimension; 32. Change the colour; 35. Transform the physical or chemical state.

Principle 5	**Mobility - Immovability (Dynamic - Static)**
Description	Make fixed parts of a system or the environment movable and vice versa.
Recommendation	1. Make unchangeable properties changeable or dynamic to obtain an optimum effect, or the other way round: reduce the mobility/ changeability. 2. Make a system or a process more adaptable, adaptive and intelligent - or vice versa. 3. Make a system or a process more flexible, easier to dismantle, renewable or restorable.
Related technical TRIZ Principles	3. Local Conditions; 13. Inversion; 15. Dynamism; 30. Flexible shells or thin films.

Principle 6	**Consumption - Regeneration**
Description	Elements, consumed in a system or process, are regenerated within the same system or process. Elements, which have been consumed and have fulfilled their purpose, are removed or modified for other applications.
Recommendation	1. Build a self-service system that carries out auxiliary, maintenance and repair functions by itself, utilising its own resources and waste products (energy, material). 2. Temporarily contract external support for business divisions where you do not have core competence and when currently it is neither sensible nor viable, financially or time-wise, to develop this area.
Related technical TRIZ Principles	25. Self-service; 34. Rejecting and regenerating parts.

Principle 7	**Standardisation - Specialisation**
Description	Use more standardised processes, procedures, methods and products. Gain an advantage by utilising special processes, products or methods.
Recommendation	1. Replace an expensive, purpose-built system by an assortment of cheap and easily available components. Use recyclable disposable products. 2. Make the application of additional systems and processes redundant by creating a universal system or procedure that can perform several different

	functions. 3. Repetitive actions should be carried out with standard procedures but allow originality and individuality within the creative fields of activity.
Related technical TRIZ Principles	6. Universality; 27. Disposable Objects

Principle 8	**Action - Reaction**
Description	Amplify the required effect. Obtain and amplify the opposite effect.
Recommendation	1. Utilise the undesired or harmful effects in the system or the environment to obtain a positive effect. 2. Try to neutralise or remove harmful effects through interacting or combining with other harmful effects. 3. Amplify an undesired effect to such a degree where it ceases to be harmful or troublesome. 4. Introduce feedback (control measure) into a system or process. Remove troublesome feedback. 5. Prolong the duration of the effect, slow down effects or repercussions.
Related technical TRIZ Principles	13. Inversion; 22. Converting Harm into Benefit; 23. Feedback; 39. Inert Atmosphere.

Principle 9	**Continuous Action - Interrupted Action**
Description	Important processes are to be carried out without interruption or idle time. They are to be performed at a steady load and constantly monitored. Interrupt a continuous action; arrange pauses in a continuous process.
Recommendation	1. Change from an uninterrupted action to a periodic action. Match the periodicity to the system requirements or to that of its environment. 2. Tricky or dangerous phases of a process are to be carried out quickly and with momentum. 3. Utilise the pauses between the individual actions to perform other actions or tasks.
Related technical TRIZ Principles	18. Mechanical Vibration; 19. Periodic Action; 20. Continuity of Useful Action; 21. Skipping.

Principle 10	**Partial Action - Excessive Action**
Description	To obtain a maximum or optimal effect, use surplus or excessive action. Protect sensitive areas from undesired excessive actions. To obtain a maximum or optimal effect, focus on essential tasks. Intensify your activity in areas that give optimal results.
Recommendation	1. It is often difficult to obtain exactly 100% of a required effect. Sometimes it is easier to obtain a little more or a little less. This may considerably simplify a problem.

Related technical TRIZ Principles	16. Partial or Excessive Action.

Principle 11	**Direct Action - Indirect Action**
Description	Replace an indirect action with a direct, immediate action. Replace a direct, immediate action with an indirect action.
Recommendation	1. For an indirect action use an intermediary- an element that transmits an action or passes it on. An intermediary can also be applied permanently or temporarily. 2. Replace expensive, valuable or inaccessible objects and systems with copies. Utilise cheap simplified copies, optical or electronic ones.
Related technical TRIZ Principles	24. Intermediary; 26. Copying.

Principle 12	**Preliminary Action - Preliminary Counteraction**
Description	Perform a necessary useful action or measure (completely or partially) in advance, to obtain a stronger effect. Carry out counteractions or preventive actions in advance, to avert unwanted effects.
Recommendation	1. Compensate a negative tendency by linking a process or business field in danger of jeopardy to a guaranteed successful and strengthening process or business field. 2. Distribute your resources in advance, such that they can act without additional costs or delay from the best position. 3. Ensure in advance the availability of suitable “life lines”, such as cash reserves, free production capacity, specialists and skilled personnel as well as technical measures.
Related technical TRIZ Principles	3. Local Condition; 8. Anti-weight; 9. Preliminary Counteraction; 10. Preliminary Action; 11. Preventative Measures.

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