

PROJECT IRP

**„Creation of English Study Supports for Selected Subjects of the Follow-up
Master Study in the Quality Management Study Field“
IRP/2015/104**

CHANGE MANAGEMENT

Study supports

Petra Halfarová

Language review: Mgr. Karolína Slamová, PhD.

Title: Change Management
Author: Petra Halfarová
Edition: first, 2015
Number of pages:

Study materials for the study support of Change Managemeng, the Faculty of Metallurgy and Material Engineering.

Intended for the IRP project of:
Creation of English Study Supports for Selected Subjects of the Follow-up Master Study in the Quality Management and Economics Study Field
Number: IRP/2015/104

Execution: VŠB – Technical University of Ostrava
The project is co-financed by the Ministry of Education, Youth and Sports of the Czech Republic

STUDY INSTRUCTIONS

The module CHANGE MANAGEMENT is included in the master's degree in Quality Management and Economics and Management in the Industry's program in Economics and management of industrial systems but can be studied as well as applicants from any other field, if it meets the required prerequisites.

Course objective and learning outputs

- 1- First understand and analyze the reasons for strategic changes in the organization.
- 2- Apply the chosen methods of management changes.
- 3- Proposing approaches to value analysis.
- 4- Evaluate the effectiveness and efficiency of organizational change.

Objective:

Give students broader theoretical and practical knowledge in the field of innovation, change management, value management and methodologies TRIZ and WOIS.

Knowledge outputs:

- Students will be able to characterize the basic steps of the process of change and define the basic principles and practices of innovation management;
- Students will be able to define the meaning and use of value management;
- Students will be able to describe the basic principles of TRIZ methods;

Learning:

- Students will be able to use their knowledge for the use and application of the basic principles of value management
- Students will be able to decide on the suitability of step changes in management changes
- Students will be able to apply their theoretical knowledge in the field of TRIZ and WOIS in their future practice

Method of communication with the educator

This matter is presented to students within the frame of their lectures and practical exercises, where they practically learn the topic discussed during the theoretical lectures. But selected topics

suppose self-learning and elaboration of the written seminar works discussed with the lecturer during the consultations and via internet.

Who is the course intended for

The course is included in the follow-up master's study of the field of study of Quality Management, but it can be studied by an applicant from any other field of study, provided that he/she meets the required prerequisites.

This study support is divided into chapters, which logically divide the studied matter, but are not equally comprehensive. The estimated study time of the chapters may vary considerably, which is why large chapters are further divided into numbered sub-chapters and they correspond to the structure described below.

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1. PETER DRUCKER AND INNOVATION



Time to study

4 hours



Goal

After reading this paragraph, you will be able to

- define basic types of innovation opportunities;
- describe the seven sources of innovation opportunities;



Lecture

Innovation involves finding a new and better way of doing something. Much of our modern society is based on innovations that have occurred in the past that provide us with the standard of living we enjoy today.

Entrepreneurship and innovation are companion terms. Entrepreneurship involves looking for a new innovation and taking advantage of it. Peter Drucker is a leading authority on entrepreneurship and innovation. Below Drucker outlines seven sources or places to look for innovative opportunities. Then he outlines five steps to follow to take advantage of an innovative opportunity.

Drucker's Seven Sources for Innovative Opportunities

Drucker outlines seven sources for innovative opportunities that should be monitored by those interested in starting an entrepreneurial venture. The first four are sources of innovation that lie within the industry.

The last three arise in the societal environment.

- 1. The unexpected** - An unexpected success, an unexpected failure or an unexpected outside event. can be a symptom of a unique opportunity.
- 2. The incongruity** - A discrepancy between reality and what everyone assumes it to be, or between what is and what ought to be, can create an innovative opportunity.
- 3. Innovation based on process need** - When a weak link is evident in a particular process, but people work around it instead of doing something about it, an opportunity is available to the person or company willing to supply the missing link.
- 4. Changes in industry or market structure** – The opportunity for an innovative product, service or business approach occurs when the underlying foundation of the industry or market shifts.
- 5. Demographics** - Changes in the population's size, age structure, composition, employment, level of education and income can create innovative opportunities.
- 6. Changes in perception, mood and meaning-** Innovative opportunities can develop when a society's general assumptions, attitudes and beliefs change.
- 7. New knowledge** - Advances in scientific and nonscientific knowledge can create new products and new markets.

Drucker's Five Principles of Innovation

Below are five principles that can help you take advantage of a new innovation you may have discovered.

1. Begin with an analysis of the opportunity.
2. Analyze the opportunity to see if people will be interested in using the innovation.
3. To be effective, the innovation must be simple and clearly focused on a specific need.
4. Effective innovations start small. By appealing to a small, limited market, a product or service requires little money and few people to produce and sell it. As the market grows, the company has time to fine tune its processes and stay ahead of the emerging competition.
5. Aim at market leadership. If an innovation does not aim at leadership in the beginning, it is unlikely to be innovative enough to successfully establish itself. Leadership here can mean dominating a small market niche.

How to generate ideas

When you are stuck in problem solving – that is, when the techniques you have applied successfully in the past are not working – try a more creative thinking approach. You may be trying to dig the same hole deeper, worrying at your problem like a terrier, when perhaps you should be digging your hole somewhere else.

Brainstorming

The best-known and most widely used creative thinking technique is brainstorming. It was introduced in the 1930s, so it has been around a long time – a sign of its usefulness. You can employ its principles when you are thinking alone, but they work better in a team setting.

When brainstorming, don't overlook the obvious! The obvious solution is sometimes the best. It may not, anyway, be obvious to everyone; and it may be possible to twist an obvious idea into something not so obvious. Don't fear repetition, either! Accusing someone of being repetitive is a form of adverse criticism and should be avoided. The same idea may trigger a different response at a different time in the brainstorming session.

Take the common paper-clip as an example. In five minutes one brainstormer came up with the following new uses.

Pipe cleaner	Fuse wire
Nail cleaner	Letter opener
Tie-clip	Catapult missile
Ear de-waxer	Toothpick
Picture hoko	Cufflink
Small-hole poker	Ornament
Screwdriver	Typewriter cleaner
Fishing hook	Tension reducer(like worry beads)
Broken bra-strap mender	Zip-fastener tag mender

I expect you can do even better than that! Are you ready to have a go? Look at the Guidelines opposite first.

Guidelines for brainstorming

- Suspend judgement** Give imagination the green light by with holding the critical evaluation of ideas until later. Accept ideas without judging them.
- Welcome free-wheeling** Take off the brakes in your mind and go with the flow of your ideas. The more unusual the idea, the better – it is easier to tone down than think up.
- Strive for Quantity** The greater the number of oysters, the more likely you are to find some pearls in them.
- Combine and improve** Listen to the ideas of others and see if you can build on them. Their way-out ideas may stimulate some buried memories or sleeping brain cells in your Depth Mind.
- Do not edit** Ideas should not be elaborated or defended, just quickly stated and recorded.

One major reason why brainstorming is useful is that it helps to free us from ‘functional fixedness’. We have a fixed idea, for example, that a thing has only one function and that is what it is there for. By banning the use of that familiar function (in the case of scissors, the function of cutting), the mind is released to consider other possibilities. With a little adaptation, scissors would make an interesting geometrical instrument. Take the modern British Army bayonet. Did you know that it is ingeniously designed to combine with its scabbard to form a pair of wirecutters? Or that it has a third function (officially!) built into it – that of a bottle-opener?

Case studies

Pilkington Brothers Limited in the UK had a technical problem... During the final inspection of sheet glass, small globules of water were identified by the inspection machine as flaws in the glass. A brainstorming session produced 29 ideas in less than five minutes. After research and development, three of these were used in the system, which solved the problem.

H J Heinz in the USA had a marketing problem... The company wanted to get sales promotional material to consumers more quickly. Brainstorming produced 195 ideas. After

evaluation, eight were immediately used. A member of Heinz, when talking about another brainstorming session said, 'Brainstorming generated more and better ideas than our special committee produced in 10 meetings.'

How to run a brainstorming session

No more than 10 people should be involved. Some may know about the field, others may not – a mixture of both is desirable.

They should ideally have been trained in the brainstorming technique before the meeting.

When you run the session:

- Define the problem (using your analytical and briefing skills).
- Help people to understand the problem by highlighting the background information and history.
- Clarify the aim in a succinct sentence: 'In how many ways can we...?'
- Have a brief warm-up session, using a common problem or object.
- Brainstorm 70 ideas in 20 minutes, or a similar target. One person should write up the ideas on a flipchart. Allow time for silent reflection. Check that no critical remarks are made. Encourage cross-fertilization.
- Establish criteria for selecting the feasible ideas. Choose the best.
- Reverse brainstorm: 'In how many ways can this idea fail?'

About 40 minutes is the optimum time for a brainstorming session. But you should ask the participants to go on considering the problem and let you have further suggestions.

Remember that they have programmed their Depth Minds by the brainstorming session, and other ideas will come to them unexpectedly.

Case study

A leading US firm of jigsaw-puzzle makers held a brainstorming session to think up ideas for new puzzles. It produced some worthy ideas but nothing brilliant. A month later, one of the participants went to see an exhibition of Tutankhamun's treasures in Washington DC. The

gold mask of the pharaoh struck him as a great jigsaw-puzzle idea! He was right – it broke all records for jigsaw-puzzle sales in the United States.

Key points

- Being creative involves the use of the imagination or original ideas in order to create something. Creative thinking is that part of it which produces the new ideas.
- ‘It is the function of creative people,’ writes the poet William Ploner, ‘to perceive the relations between thoughts, or things, or forms of expression that may seem utterly different, and to be able to combine them into some new forms – *the power to connect the seemingly unconnected.*’
- Brainstorming is a useful technique, for generating ideas, whether you practise it on your own or in a team context. The essence of it is to make a temporary wall in the mind between the analysing/synthesizing functions on the one side, and the (critical) valuing function on the other side.
- Ideas rarely arrive in this world fully-formed and giftwrapped. With a little practice you can learn to *build on ideas*, to take the germs of success in someone else’s halfbaked idea and to develop it towards fruition. By the same warrant, allow others to build on your ideas for the common good. Only God owns the intellectual property rights to truth.
- ‘I start where the last man left off,’ said the inventor Thomas Edison.
- Creativity is so delicate a flower that praise tends to make it bloom, while discouragement often nips it in the bud. *Any of us will put out more and better ideas if our efforts are appreciated.*

Thinking outside the box

Valuable though brainstorming is, not least as an introduction to one or two of the fundamental principles of creative thinking, it is not the whole story. To develop your skills as a creative problem solver you need to adopt and practise the strategies set out below.

Towards a more creative approach

Brainstorming challenges one kind of unconscious assumption, namely that hammers are for knocking in nails or that scissors are for cutting. But there are other forms of unconscious assumption that may inhibit your thinking.

Take the ‘Nine dots’ and ‘Six matchsticks’ problems in Chapter

1. The reason why many people cannot do the first one is that they put an unconscious or invisible framework around the dots, and try to solve the problem within it. That is impossible. But if you break out of that self-imposed limitation, the solution to the problem is easily reached.

Incidentally, I first published ‘The nine dots’ problem in 1969, in a book called *Training for Decisions*. It was the origin of a new phrase in the English language, now credited to me – *thinking outside the box*. There is a similar assumption made in the second problem. People *assume* that they must arrange the six matches in a pattern of four equilateral triangles in only one plane. If they take one small step and give themselves permission to place the matches on top of one another, they can reach the first solution. But if they break out of the two-dimensional constraint into three dimensions, they achieve the most elegant solution.

Please don’t mistake me: you cannot think without *making assumptions*. But they should be conscious ones from which you can retreat when they become indefensible. The assumptions that trip you up are the unconscious ones, the constraints or limitations that you are not aware of. That is one reason why effective thinking needs social interaction. We need critical input from others to remove these filters from our eyes.

A senior manager in the UK marketing department of, Hoover, the household appliance company, once had the bright idea of introducing a ‘free flights’ promotional scheme as an incentive for buying their products. It was a spectacularly bad decision. Some 200,000 people flew with the scheme, but it cost the company around £48 million. Some 127 people sought compensation in the courts, facing Hoover with a possible bill of millions of pounds if they succeeded. The president of Hoover Europe was dismissed from his £500,000-a-year post, and the US owners quickly sold the company for a knock-down price. You do not get decision making more wrong than that.

Why did this fiasco happen? Because the Hoover managers concerned made a *false assumption*. They assumed that when most of the people who bought appliances saw the small print wrapped about the ‘free flights’ offer – the complex restrictions and qualifications they deliberately built in to deter applicants – these new customers would not bother to go through such a complex approach for the sake of a free air ticket. They underestimated the public! Enough people persevered in finding route through all the complex rules and conditions that their free flights brought the company to its knees.

This true story is a parable to remind us of the importance of checking to ensure that we are not allowing unconscious assumptions to act like hidden reefs and rip the bottom of the ship.

Look wider for solutions

My phrase *thinking outside the box* ties in with the concept of lateral thinking, introduced by the well-known thinker and writer Edward de Bono in *The Five Day Course in Thinking* (1968). Lateral thinking means abandoning the step-by-step approach and thinking, as it were, ‘to one side’.

Vertical thinking

Chooses

Looks for what is right

One thing must follow

Concentrates on relevance

Moves in the most likely

directions

Lateral thinking

Changes

Looks for what is different

Makes deliberate jumps directly from another

Welcomes chance intrusions

Explores the least likely directions

The sideways (or lateral) thinking involved often leads to reversing what appears to be the natural or logical way of doing things. For example, the earliest method of making cars involved teams of men moving from one car to another. Henry

Ford turned it all upside down. He put the car frames on belts and moved them past the men – the birth of the assembly line. It is important to think sideways because the seeds of a solution to a problem may lie outside the box you are working in. Really creative people have a wide

span of relevance: they look far afield, even to remote places or times in history, for solutions to the problems they face. When the eighteenth-century agriculturalist Jethro Tull invented the seed drill he summoned up his previous experience as an organist: he was creatively transferring technology from one area to another. Most of us, however, tend to think in compartments, and the divisions in work that make specialization possible encourage this blinkered thinking.

Always be willing to challenge widely accepted assumptions. As the exercise ‘The nine dots’ and ‘The six matches’ illustrate, thinking outside the box means being able to spot assumptions, habits or customary ways of thinking that are widely and uncritically accepted but have no basis in reality. Many of these we breathe in by virtue of the society in which we live. They are among the everyday conventions we accept as true truths without too much examination. ‘As everybody knows...’

Case study

When ‘everyone knows’ something to be true, nobody knows nothing

Andy Grove, later the Chairman of Intel, always remembered the oft-repeated saying of one of his professors when he was a student: ‘When everybody knows that something is so, it means that nobody knows nothing.’ It stayed with him throughout his career, and he gave the following example of its relevance. ‘Our little research group at Fairchild [Semi-conductor] some 40 years ago started to study the characteristics of surface layers that were the heart of modern integrated circuits. At that time, “everybody knew” that surface states, an artifice of quantum mechanics, would interfere with us building such chips. As it turns out, nobody knew nothin’ We never found any surface states; what we found was trace contamination. When we identified and removed this, the road opened up to the chip industry as we know it today.’

How to use your Depth Mind

Creative thinking cannot be forced. If you are working on a problem and getting nowhere, it is often best to leave it for a while and let your subconscious – your Depth Mind – take over.

Your mind does not work by the clock, although it likes deadlines. Sometimes the answer will come to you in the middle of the night.

Grasping the principle of the Depth Mind could open the way for you to a more creative approach to problem solving. Many people are still not even aware that their depth minds can carry out important mental functions for them, such as synthesizing parts into new wholes or establishing new connections while they are engaged in other activities.

Imagine your mind to be like a personal fax machine. It would be nice and tidy if you could sit down for an hour each morning before breakfast and receive inspired fax messages from your Depth Mind. But it is not like that. The fax machine might start whirring at any time of the day or night. If you are thinking along a certain line and nothing happens, stop. Instead of investing more time – throwing good money after bad – analyse the problem again and see if you can come up with a new approach.

The processes of analysing a problem or identifying an objective are themselves means of programming the mind. Possible solutions and courses of action almost instantly begin to occur

to us. Where there is a time-delay this means that the deeper parts of the brain have been summoned into action and have made what contribution they can.

How important *preparation time* is for creative thinking! Careful and clear analysis, conscious imagining or synthesizing (using such techniques as brainstorming either in groups or solo), and exercising the valuing function of thought in a positive rather than negative way – all these are vital to lay the foundations for thinking creatively. If you are planning to experiment and try a session before

breakfast, it is useful always to have a preparation phase the night before. Imagine yourself as a house decorator, scraping down the woodwork and filling in holes and priming here and there, prior to painting a first coat the following day.

The creative thinking process

Preparation The hard work. You have to collect and sort the relevant information, analyse the problem as thoroughly as you can, and explore possible solutions.

Incubation This is the Depth Mind phase. Mental work – analysing, synthesizing and valuing – continues on the problem in your subconscious mind. The parts of the problem separate and new combinations occur. These may involve other ingredients stored away in your memory.

Insight The ‘Eureka’ moment. A new idea emerges into your conscious mind, either gradually or

suddenly, like a fish flashing out of the water. These moments often occur when you are not thinking about the problem but are in a relaxed frame of mind.

Validation This is where your valuing faculty comes into play. A new idea, insight, intuition, hunch or solution needs to be thoroughly tested. This is especially so if it is to form the basis for

action of any kind.

Although it is useful for you to have this framework in mind, remember that the actual mental process is a lot more untidy than the above table suggests. Think of the phases as being four notes on a piano which can be played in different sequences or combined together in complex chords.

Case study

Mozart

When I am completely myself, Mozart wrote to a friend in a letter, entirely alone or during the night when I cannot sleep, it is on such occasions that my ideas flow best. Whence and how they come I know not nor can I force them. Nor do I hear in my imagination the parts successively, but I hear them at the same time all together.

Mental roadblocks

Lack of facts If you are not sure you have all the relevant facts, you naturally hesitate to commit yourself. Do some more research, and that may get you moving again.

Lack of conviction Maybe you find it difficult because you lack conviction in the value of this exercise or the way in which you have been asked to do it. Re-establish a worthwhile objective.

Lack of a starting point Possibly the problem seems so large that you do not know where to start. If so, make a start anywhere. You can always change it later. Inspiration comes after you have started, not before.

Lack of perspective Perhaps you are too close to the problem, especially if you have lived with it a long time or have been worrying about it incessantly. Try leaving it for a week. Consult others. Simply explaining it to them may help. They may see new angles.

Lack of motivation Do you want it to happen enough? Creative thinking requires perseverance in the face of surmountable difficulty. If you are too easily put off, it may be a sign that, deep down, you lack the necessary motivation. Reinvigorate your sense of purpose. The function of creative thinking in problem solving is to come up with new ideas. But remember that at some stage your valuing skills have to be brought into play. Here are six questions to ask about any new idea, solution, or course of action:

- Is it really new?
- Is it both relevant and practical?
- Whom will it involve?
- How much will it cost?
- How much will it save?
- Will it require more formal evaluation?

In times of rapid change, like our own age, there is a premium on your skills as a creative thinker. If you can think productively and constructively, as well as analytically and logically, it will give you a third dimension in all your decision making and problem solving.

Key points

- One of the most valuable principles for improving your creative approach to work and life is to learn to *think outside the box*. Essentially that means be willing to challenge the assumptions – often unconscious – that put an invisible cage around the bird of thought.
- One form of thinking outside the box is to think sideways – lateral thinking. For sometimes the solution to a problem – at least in embryo – lies in a field of enterprise adjacent to one's own but quite distinct from it.

■ There is a danger in formalizing any aspect of the creative process – it is a delicate balance between following a conscious process or framework and being guided by the mind’s natural inclinations. But it is worth bearing in mind the common-sense sequence:

PREPARATION

INCUBATION

INSIGHT

VALIDATION

INCUBATION – sitting on eggs until the young birds of ideas emerge – is a metaphor for the Depth Mind’s work. We all have a purposive and helpful Depth Mind; we differ as to the use we make of it.

What is an effective practical thinker?

Forming a clear picture of the kind of thinker you would like to be is the first step you need to take. A clear concept of what you might be one day can act as your magnet. Remember that point about formulating where you want to be and then working backwards?

You could do it in abstract terms, listing all the qualities, the knowledge, and the functions or skills you would like to acquire by such-and-such a date. I have to admit, though, that that does not work for me: it is a bit too academic. I suggest a more homely method, which any South Sea cannibal of olden times would have relished.

In Exercise below I invite you to recall people whose thinking skills you have admired. They can be people you have known personally or have studied in some depth (by, say, reading more than one biography of them). In the right-hand column, write down as concisely and specifically as you can those thinking skills that impressed you and that you would like now to ‘eat’ by gobbling up and inwardly digesting, so that they become part of you. Write down, for instance, any key remarks or sayings by which the person concerned encapsulated his or her practical wisdom.

Key factors in choosing your field of work

What are your interests? An interest is a state of feeling to which you wish to pay particular attention. Long standing interests – those you naturally like – make it much easier to acquire knowledge and skills.

What are your aptitudes? Aptitudes are your natural abilities, what you are fitted for by disposition. In particular, an aptitude is a capacity to learn or acquire a particular skill. Your aptitude may range from being a gift or talent to simply being above average.

What are the relevant factors in your temperament? Temperament is an important factor. Some people, for example, are uncomfortable in decision-making situations of stress and danger, while others thrive on them. Some prefer to be problem-solvers rather than decision-makers.

It is usually easier to identify the fields that you are not suitable for, because you lack the necessary level of interests, mental aptitude, or temperamental characteristics to do really well in them.

Let me now make the assumption that you are in the right field. You have more or less the right profile of aptitudes. You have been able, in other words, to acquire the knowledge and professional/technical skills needed and have enjoyed doing so. You have already laid the foundations of success at the team, operational and strategic levels of leadership. You will have credibility among your colleagues. Now what you have to do is focus upon the process skills – the more generic or transferable ones – in decision making and problem solving. How do you acquire them?

Key points

■ Knowledge is only a rumour until it is in the muscle, says a Papua New Guinea proverb. Think of your mind as a muscle – or a set of muscles. This book tells you in an introductory way how to develop those muscles, but it is you who have to put in the effort. Are you keen to do so?

- Don't think of *thinking* as being hard, painful or laborious – if you do that you certainly won't apply yourself to shaping and sharpening your thinking skills. Thinking is fun, even when – or especially when – we are faced with apparently insurmountable difficulties.
- You are more likely to be effective as a practical thinker if you succeed in finding your vocation, your right niche in the world of work. The guide here is to choose a function and field or work that is optimum for your *interests*, *aptitudes* and *temperament*.
- 'I have never met a man so ignorant,' said Galileo, 'that I couldn't learn something from him.' Prize especially those people you meet – in person or in books – who can teach you things in how to think.
- Practical wisdom should be your aim as a thinker, especially in the applied domain of decision making. Practical wisdom is a mixture of intelligence, experience and goodness.



Summary of terms

- Creativity
- Principles of Innovation
- Ideas
- Brainstorming
- Thinking outside the box
- Vertical thinking



Questions

- 1/ How would you find in the history of innovation typical Innovation sources of innovation opportunities according to Drucker.
- 2/ How would you define and describe Drucker's Five Principles of Innovation?
- 3/ How would you define and describe methods for generating ideas?
- 4/ How would you define the principles of brainstorming.
- 5/ How would you define and describe the creative thinking process.



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2. BUILDING THE INNOVATIVE ORGANIZATION



Time to study

3 hours



Goal

After reading this paragraph, you will be able to

- define the concepts of innovation, process innovation, innovation strategy.
- describe the different types of innovative strategies and key practices to maintain and develop business growth and profitability.



Lecture

‘People are our greatest asset.’ This phrase – or variations on it – has become one of the clichés of management presentations, mission statements and annual reports throughout the world. Along with concepts like ‘empowerment’ and ‘team working’, it expresses a view of people being at the creative heart of the enterprise. But very often the reader of such words – and particularly those ‘people’ about whom they are written – may have a more cynical view, seeing organizations still operating as if people were part of the problem rather than the key to its solution.

In the field of innovation this theme is of central importance. It is clear from a wealth of psychological research that every human being comes with the capability to find and solve complex problems, and where such creative behaviour can be harnessed amongst a group of people with differing skills and perspectives extraordinary things can be achieved. We can easily think of examples. At the individual level, innovation has always been about exceptional characters who combine energy, enthusiasm and creative insight to invent and carry forward new concepts. James Dyson with his alternative approaches to domestic

appliance design; Spence Silver, the 3M chemist who discovered the non-sticky adhesive behind 'Post-it' notes; and Shawn Fanning, the young programmer who wrote the Napster software and almost single-handedly shook the foundations of the music industry, are good illustrations of this.

Innovation is increasingly about teamwork and the creative combination of different disciplines and perspectives. Whether it is in designing a new car in half the time usually taken, bringing a new computer concept to market, establishing new ways of delivering old services like banking, insurance or travel services, or in putting men and women routinely into space, success comes from people working together in highperformance teams.

This effect, when multiplied across the organization, can yield surprising results. In his work on US companies, Pfeffer notes the strong correlation between proactive people management practices and the performance of firms in a variety of sectors. A comprehensive review for the UK Chartered Institute of Personnel and Development suggested that '... more than 30 studies carried out in the UK and US since the early 1990s leave no room to doubt that there is a correlation between people management and business performance, that the relationship is positive, and that it is cumulative: the more and the more effective the practices, the better the result'.³ Similar studies confirm the pattern in German firms.⁴ In a knowledge economy where creativity is at a premium, people really are the most important assets which a firm possesses. The management challenge is how to go about building the kind of organizations in which such innovative behaviour can flourish.

This chapter deals with the creation and maintenance of an innovative organizational context, one whose structure and underlying culture – pattern of values and beliefs – support innovation. It is easy to find prescriptions for innovative organizations which highlight the need to eliminate stifling bureaucracy, unhelpful structures, brick walls blocking communication and other factors stopping good ideas getting through. But we must be careful not to fall into the chaos trap – not all innovation works in organic, loose, informal environments or 'skunk works' – and these types of organization can sometimes act against the interests of successful innovation. We need to determine appropriate organization – that is, the most suitable organization given the operating contingencies. Too little order and structure may be as bad as too much.

Equally, 'innovative organization' implies more than a structure; it is an integrated set of components which work together to create and reinforce the kind of environment which

enables innovation to flourish. Studies of innovative organizations have been extensive, although many can be criticized for taking a narrow view, or for placing too much emphasis on a single prescription like ‘team working’ or ‘loose structures’.

Missing the boat

On 10 March 1875 Alexander Graham Bell called to his assistant, ‘Mr Watson, come here, I want you’ – the surprising thing about the exchange being that it was the world’s first telephone conversation. Excited by their discovery, they demonstrated their idea to senior executives at Western Union. Their written reply, a few days later, suggested that ‘after careful consideration of your invention, which is a very interesting novelty, we have come to the conclusion that it has no commercial possibilities . . . we see no future for an electrical toy . . .’ Within four years of the invention there were 50 000 telephones in the USA and within 20 years there were 5 million. In the same time the company which Bell formed, American Telephone and Telegraph (ATT) over the next 20 years grew to become the largest corporation in the USA, with stock worth \$1000/share. The original patent (number 174455) became the single most valuable patent in history.

Innovation leadership and climate

Organizations have traditionally conceived of leadership as an heroic attribute, appointing a few ‘real’ leaders to high-level senior positions in order to get them through difficult times. However, many observers and researchers are becoming cynical about this approach and are beginning to think about the need to recognize and utilize a wider range of leadership practices. Leadership needs to be conceived of as something that happens across functions and levels. New concepts and frameworks are needed in order to embrace this more inclusive approach to leadership.

For example, there is a great deal of writing about the fundamental difference between leadership and management. This literature abounds and has generally promoted the argument that leaders have vision and think creatively (‘doing different’), while managers are merely drones and just focus on doing things better.

This distinction has led to a general devaluation of management. Emerging work on styles of creativity and management suggests that it is useful to keep preference distinct from capacity. Creativity is present both when doing things differently and doing things better. This means that leadership and management may be two constructs on a continuum, rather than two opposing characteristics. Our particular emphasis is on resolving the unnecessary and unproductive distinction that is made between leadership and management. When it comes to innovation and transformation, organizations need both sets of skills. We develop a model of innovation leadership that builds on past work, but adds some recent perspectives from the fields of change and innovation management, and personality and social psychology. This multidimensional view of leadership raises the issue of context as an important factor, beyond concern for task and people. This approach suggests the need for a third factor in assessing leadership behaviour, in addition to the traditional concerns for task and people. Therefore we integrate three dimensions of leadership: concern for task, concern for people, and concern for change. One of the most important roles that leaders play within organizational settings is to create the climate for innovation. We identify the critical dimensions of the climate for innovation, and suggest how leaders might nurture these. By using a Situational Outlook Questionnaire (SOQ) as a diagnostic, we identify nine dimensions to help decide what kind of interventions might be helpful in establishing the appropriate context for innovation.

The vision thing – How leadership contributes to transformatinal change

Moving from a diverse and clumsy conglomerate with origins in the wood and paper industry to the market leader position in mobile telephones is not easy. Yet the story of Nokia is one of managed transformation from a nineteenth-century timber firm to the fifth largest company in Europe, with 44 000 people employed in 14 countries, over a third of whom work on R&D or product design. Much of this transition – which, like many transformations, contained an element of luck – is attributed to the energy and vision of the CEO, Jorma Ollila, who took up this role in 1992 from the mobile phone division.

The transition was not easy – a series of problems, including logistics and availability of chips meant that the phone division made serious losses in 1995 and the stock value was cut in half. In order to meet this challenge Ollila effectively ‘bet the company’ disposing of almost all of

its non-telecoms businesses (which ranged from television sets to toilet paper!) so that by 1995 90% of Nokia was concerned with telecommunications.

A similar pattern can be seen with the case of Siemens. Again with roots in the nineteenth century, Siemens grew to be one of the great names in electrical engineering and a major force in the German economy. But recent years have seen concerns about the company, criticizing it for a lack of focus and for being slow and unresponsive. Faced with this developing picture the company appointed a new board member in 1998 – Edward Krubasik – who came from outside the firm. Restructuring under his leadership has led to the divestment of nearly £10bn of old businesses and to the repositioning of Siemens as a major IT and software player. In 1999 profits surged and the sales price tripled and 60% of the business is concerned with software. Perhaps most significant as an indicator of this new vision is the fact that Siemens employed 27 000 software engineers in 2000 – more even than Microsoft!

It is doubtful whether there is a single person living who does not wish they were more skilled in the art of communication. This should not be surprising as recent surveys of people working in the major professions in Great Britain and North America have shown that less than ten per cent classify themselves as good communicators. Perhaps less surprising is finding that a large number of the good communicators were either priests, politicians or lawyers.

However, what is of most interest is the finding that nearly 60% of those surveyed classified themselves not just as average communicators but as poor communicators. Therefore, logically, you are likely in your role as a Change Management agent to come into contact with many poor communicators. I know that I have! Fortunately, NLP offers you some excellent techniques which are easy to learn and, when applied correctly, can produce startling results. These techniques have also given me the advantage of knowing when I was being deliberately misled, or when someone with whom I was communicating was being economical with the truth. They have also been extremely useful in gaining an understanding of where the other person I was communicating with was coming from, and this can be vital in achieving success in Change Management projects.

The techniques used in communication and derived from NLP have often in the past been termed manipulative, and, when used to gain an unfair advantage, I would agree. However, provided that my intention is an honest one, then I have no problem in manipulating people. After all, this is what I am being paid to do for a large percentage of the time in order to bring

about change. If these techniques enable me to get the right results with more consistency, then I tend to treat them like any other tool in my Change Management tool kit. Please also remember that there is an extremely fine dividing line between manipulation and gentle persuasion anyway.

Being an excellent communicator in all its various forms, but especially speaking and writing, is, of course, of great importance to anyone contemplating becoming a consultant and even more so to those who wish to work in a Change Management environment.

However, developing listening skills and other techniques which allow you to understand fully your client's needs is also of crucial importance.

It is here that NLP scores again with a number of really powerful techniques to assist the listener in gaining a complete understanding of what the speaker is saying. I have lost count of the number of times that I have been told by someone with whom I was communicating that I must be psychic, simply because it appeared to them that I was able to "read their mind". In reality it was simply employing a few NLP techniques that allowed me to gain a better understanding of what was being communicated to me.

The Important Role Of Rapport In Communication

During their early exploratory work in communication, the originators of NLP, Bandler and Grinder, discovered that in order to communicate well one first had to develop a high level of rapport with the person or persons one wished to communicate with. In instances where rapport was not established and held throughout the process of communication, the intended message would not get through. Consequently, the person attempting to communicate would have an exceedingly low chance of successfully achieving their objective. Bandler and Grinder came to realise that even when we are not in rapport we are still communicating something, but it may not be the message we intend. It may be something of a different nature. This phenomenon has given rise to one of the early "laws" of NLP which states, "Whatever we are doing, we cannot not communicate". This may sound strange at first, but when we realise that a large proportion of what we are communicating is not contained

in the words that we use but in our body language, facial expression and tone of voice, etc., perhaps this becomes a little clearer.

Various researchers over the years have looked closely at this subject and have apportioned slightly different weighting to each of these functions within the process of human communication. The overall consensus is that approximately 60% of communication stems from body language including facial expression, 30% from our tone of voice and just 10% from the actual words that we choose to use.

So even when we do not wish to communicate, and have our mouths tight shut, we are still communicating a lot of information, but in a non-verbal form. A large proportion of this non-verbal information is processed by our minds at a very deep level and out of our conscious awareness. Recognising this is of prime importance, as our brains are far more likely to interpret as correct information coming from our unconscious minds, than any language input that we may be receiving via our ears. This is a simple function of our evolution. Man has had to trust and react to his senses for many millions of years in order to survive, whereas language is a relatively recent development.

An example of this would be to welcome someone with words like, “Hello. It’s great to see you again”, while at the same time standing in an aggressive stance and with an angry expression on your face. In such a situation the recipient would almost certainly feel very confused and become defensive and would probably not be able to remember the words that had been spoken. Whilst such incongruence is extreme and unlikely to happen often in practice, we need to be aware that excellent communication occurs only when we are 100% congruent in all aspects of our presentation. When we have complete congruence we have started on the path of establishing rapport, but this is only the first step.

Unfortunately, we cannot just pop down the road and buy some rapport skills! Personal skills of this nature exist in us all to a greater or lesser extent but most of us have to work at them if we want to improve them. Obviously, knowing when we are in or out of rapport with other people is the most valuable skill to acquire.

Fortunately, this is easy. All that is needed is, whilst involved in a conversation, to observe what happens when we change our posture in some way. If after a few moments the other person changes their posture to something approximating ours this is an indication that we are in rapport.

It is worth observing other people who are in conversation. Notice that when they are in rapport they will display similar body postures. They will tend to retain much more eye contact. They are also likely to have similar expressions on their faces. Look closely at what they are doing with their bodies, notice that when one person changes posture the other will follow, almost as though they are engaged in some form of dance, one leading and the other following.

By watching other people we can quickly learn to pick out those who are in rapport and those who are not. In NLP terms this is known as increasing our “sensory acuity”. In plain language this simply means we are becoming more observant of other people and taking in more detail about the way they move and use their bodies.

As with most things in life, practice makes perfect. So after observing other people for a while, and when we feel we have obtained a reasonable understanding of this dance which we call rapport, we can experiment with someone we know. This is most easily achieved by engaging the person in conversation and then observing what happens when their body language is mirrored. Then by changing our posture in some way we can see whether they imitate our new posture. In most instances they will naturally follow and move to mirror our posture in order to stay in rapport with us.

Practising this process with several people successfully will take us more than half way towards a full understanding of the subject because 60% of communication is about body language. In NLP jargon what you have been doing is referred to as “matching” or “mirroring” and then “leading” when you change your posture and they follow.

Most human beings do not have too much of a problem with building rapport because it is something we do quite naturally. However, the more we practise the better we become at it, until a point is reached when we do not have to think about it much – like any unconsciously learned skill such as driving a car or riding a bicycle.

The next level at which we can build rapport is in the language we use. By this I don’t mean French, German or another foreign language; it is more about the words we choose to use and the tonality and expression that we put into delivering them. Let us start with tonality, which research suggests is 30% of communication. We are all very aware of the major differences that exist in the forms of expression that we put into what we say, which are controlled by our emotions. When we are excited we tend to talk more quickly, and often our voice goes up in tone slightly. If we are angry the tone of our voice will often be louder than normal, and if we

are sad our voice tends to be quieter and the words delivered more slowly than usual. However, all our language is affected to some degree by our emotions all the time.

With a little practice we can learn to become more aware of the changes in rhythm, pitch, volume and speed of delivery of the voice of the people we are communicating with. Again, we can match and mirror this in order to further build rapport. We can also use this on the telephone to great effect. Then, because there is no body language present, a large proportion of what is being communicated will be locked up in voice tonality. A little effort in matching the speed, volume and rhythm of the other person on the end of the line can pay enormous dividends. On occasions when I have had to make a difficult phone call to a client I have put a lot more effort into matching and mirroring tonality, and many times this has, I am sure, assisted me in achieving the outcome that I wanted.

Finally, to the language that we choose to use, always remembering that this accounts for only a very small proportion of our intended communication. Much of language is sensory-based, i.e. we tend to use words that give some expression of our senses. Words such as: seeing, picture, outlook, focus, horizon, vision, hindsight, reflect, are all words associated with our sense of seeing. Similarly, words such as: sound, hear, wavelength, loud, tone, music, are words associated with our sense of hearing. Words associated with our sense of feeling include words such as: touch, feel, pressure, sharp, tight, hassle, weight. All of us have a preference for using one of our senses more than the others. The most common preference seems to be vision, with hearing second and feeling last.

There is one further group of people who have a preference for what is termed digital or logical language. In this group we often find people who work in or with IT, but we also come across its use very commonly with people who work with the hard sciences: chemists, physicists, engineers, etc. This group uses words like: analyse, think, review, balance, judge, surmise, rationalise, perceive. Mirroring and matching the type of language used by your client can be a very powerful way of building rapport. Do not, however, attempt to copy regional accents, speech impediments or other more personal attributes as it could be seen as mimicking, and that is not likely to assist you in achieving your goal.

Most of us in this day and age are familiar with “computer jargon” and we have some understanding of many of the terms peculiar to the world of computing and Information Technology. However, almost every branch of industry and many commercial sectors have also developed their own particular sets of jargon which are unique. Therefore, before taking

up any work in an unfamiliar sector it makes good sense to find out what terms are used, what their meaning is, and how, specifically, they are applied. I will always remember being told by a director of a large supermarket chain that we had failed to win a contract worth several million pounds because a key member of my team was not familiar with the term “shrinkage” (a polite term for theft). This was particularly galling as he went on to tell me that our price was the most competitive and our final presentation was by far the best. The lesson in this instance was if you can’t walk the talk you don’t get the business.

Liking the other person is not a prerequisite for establishing rapport, but mutual confidence in your competence for the task in hand *is*. So personal credibility is likely to play a key role at an early point in establishing rapport. Turning up to address a Top 100 Companies Board meeting in a pair of jeans and a T-shirt is not likely to do very much for your credibility unless the meeting happens to be with Richard Branson! Even then I am sure I would have to think very hard before donning this gear. The simple message is: never do anything which creates a mismatch with your audience’s expectations of your behaviour or of their expectations of your capabilities.

Before making contact with a new or prospective client, invest some effort into finding out as much as you can about their business. One of the best sources of information can be obtained from the published company accounts. These are usually freely available from all public companies and many other institutions. To obtain a copy, just pick up the phone and call the switchboard of the head office or call the company secretary’s department. They are usually only too happy to oblige. Many companies also have a potted history available and other promotional material such as sales literature, just for the asking. All of these are mines of useful information.

If you do not wish to approach a company directly you can always use the Free Annual Reports Service provided by the *Financial Times*. This service covers all the major UK quoted companies and they will send the latest set of accounts of any of these companies. They can be contacted by phone on 0208 770 0770, or fax on 0208 770 3822, or via the Internet at www.worldinvestorlink.com. All reports are sent out by second class post and take two to three days to arrive.

For more detailed information about UK companies, the *Financial Times* offers another excellent service known as FT Company Focus, currently at a cost of £8.45. This provides a very comprehensive 10 to 18 page report. This contains: key news stories from the last year;

the latest survey of City profit forecasts and investment recommendations; 5-year financial and share price performance review, balance sheet and profit and loss account data; all recent Stock Exchange announcements.

For even more information in addition to that above, another service known as FT Company Focus Plus is available at a total cost of £10.95. This provides further information derived from *The Investors Chronicle*. All of these FT services provide excellent value for money, particularly when you consider how much time needs to be expended in researching such information. If you are going to be working for a company quoted on the London Stock Exchange, do find out what the share price is and whether it is rising or falling. All of the above can give you a multitude of ideas for starting a conversation and will permit you to demonstrate to your client your interest in his/her company. Most senior members of staff will chat on for quite a while about “their” company whilst you can just sit nodding appreciatively and asking the occasional appropriate question. This is a great way to “break the ice” and to build instant rapport. It is also a great way for you to gather information about the particular characteristics of how the person talks and what their language preferences are, etc.

It is also vital that you understand precisely what the client is expecting of you. It helps a great deal if you can develop a high degree of behavioural flexibility, but this doesn’t require you to develop schizophrenia or the skills of a “method actor”.

Remember that your client will have a model in his or her mind of what the perfect consultant might be. This could be someone such as Sir John Harvey Jones with his love of brightly coloured ties, his soft, slow but deliberate tone of voice and his total concentration on what the client has to say. Conversely, the client may expect a typical management consultancy prodigy, straight out of business school, very assertive, boiling over with self-confidence and having all the answers to every possible question before they are asked. Clearly these two examples are poles apart. However, the point to remember is that your client will have a preconceived idea of what “a good consultant” should be. If you can closely match their expectations you are already halfway towards establishing rapport.

Perhaps the most important aspect of behavioural flexibility involves the actual role that you are fulfilling. By this I mean the way you are to be perceived by those around you. Sometimes a client will expect you to take charge of a situation, and this places you in a leadership or guiding role where you are seen as the expert and are expected to tell people what to do. In

other situations you may be seen as playing an advisory role where you will offer your opinions which the client may or may not act upon. In yet other situations you may be seen as a more junior member of a team consisting mainly of the client's staff and taking instructions from the team leader. All these situations require you to behave in different ways, and you will come across many more besides. Having the ability to react like a chameleon in changing circumstances instead of having one limited mode of behaviour can certainly pay huge dividends. In the early days of NLP much was made of building and maintaining rapport, and large amounts of time (several days) were devoted to learning and practising the skills associated with the subject. Over the last decade less time has been devoted to the subject, but it still forms an important part of NLP courses. Many of the items above are not taken from NLP but are based on simple common sense. I have concentrated upon those elements that I have found to work well for me and that I have seen others use to effect.

Possessing excellent rapport skills is vital for effective communication in this day and age.

Without them in a consultancy setting you are as good as dead. Operating as a Change Management consultant nearly always means handling resistance to change and resolving conflict. Become excellent in your use of rapport skills and you will have a much easier and more successful life as a consultant.



Summary of terms

- Innovation leadership
- Innovation climate
- The vision thing
- Mind map



Questions

- 1/ The company Google is Innovative Organization, and why?
- 2/ The company 3M is Innovative Organization, and why?
- 3/ How should behave Innovative Organization, and that the rules should be observed?



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3. TRIZ



Time to study

3 hours



Goal

After studying this paragraph, you will be able to:

- define the concepts of value, function, functional approach, value analysis;
- describe the value for the customer and selected methods and techniques to support area value management;
- solve problems related to the area of value management
- handle describe the object using functions



Lecture

What is TRIZ?

Nominally, TRIZ is a Russian language acronym for the Russian words *Teoriya resheniya izobretatelskikh zadatch*, which can be translated into *the theory of the solution of inventive problems*. This title is somewhat of a misnomer, because TRIZ has moved out of the realm of theory and into a bona fide, scientifically based methodology. The development, evolution, and refinement of TRIZ have consumed some 50 years of rigorous, empirically based analysis by some of the brightest scientific minds of the 20th century.

Nevertheless, the whole notion of creativity and innovation mentioned in the context of science makes for an unusual pairing. Innovation and creativity are typically thought of as spontaneous phenomena that happen in a capricious and unpredictable way in the vast

majority of people. Historically, only a precious few individuals, such as Michelangelo, Leonardo da Vinci, Henry Ford, and Thomas Edison, seem to have possessed an innate natural ability for creativity and inventiveness. The name, the theory of the solution of inventive problems, implies that innovation and creative thought in the context of problem solving are supported by an underlying construct and an architecture that can be deployed on an as-needed basis. The implications of such a theory, if true, are enormous because it suggests that lay individuals can elevate their creative thinking capabilities by orders-of-magnitude.

The origins of TRIZ

The inventor of TRIZ was Genrich Altshuller, a Russian (1926–1998). Altshuller became interested in the process of invention and innovative thinking at an early age. He patented a device for generating oxygen from hydrogen peroxide at the age of 14. Altshuller's fascination with inventions and innovation continued through Stalin's regime and World War II. After the war, Altshuller was assigned as a patent examiner in the Department of the Navy. As such, Altshuller often found himself helping would-be inventors solve various problems with their inventions. In due course, Altshuller became fascinated with the study of inventions. In particular, Altshuller was interested in understanding how the minds of inventors work. His initial attempts were psychologically based, but these probes provided little if any insight on how creativity could be engineered. Altshuller then turned his attention to studying actual inventions and in a sense reverse-engineering them to understand the essential engineering problem being solved and the elegance of the solution as described in the patent application. It should be noted that in the former Soviet Union patent applications (called authors certificates [ACs]) were concise documents no more than three or four pages in length. The author certificate consisted of a descriptive title of the invention, a schematic of the new invention, a rendering of the current design, the purpose of the invention, and a description of the solution.

Altshuller's first discovery

The brevity of the certificates facilitated analysis, cataloguing, and mapping solutions to the problems. As the number of inventions he scrutinized grew, Altshuller uncovered similar patterns of solutions for similar problems. This was a remarkable discovery because it essentially paved the way for a scientific, standardized way to approach a problem and to incorporate a latent knowledge base as an integral element of the solution process. In other words, Altshuller discovered that similar technological problems gave rise to similar patents. This phenomenon was repeated in widely disparate engineering disciplines at different periods of time and in geographically dispersed areas. The logical conclusion reached by Altshuller was that the possibility existed of creating a mechanism for describing types of problems and subsequently mapping them with types of solutions. This discovery led to just such a mechanism, which consisted of the 39 typical engineering parameters, the contradiction matrix, and the 40 inventive principles.

Altshuller's secondary discovery

Altshuller's second enlightening discovery was made as he assembled chronological technology maps. Altshuller uncovered an unmistakable, explicit regularity in the evolution of engineered systems. Altshuller described these time-based phenomena in his lectures and writings as *The Eight Laws of Engineered Systems Evolution*. The term *laws* does not imply that Altshuller defined them as conforming to a strict scientific construction, as in the fields of physics or chemistry. The laws, though general in nature, are nevertheless recognizable and predictable; more importantly, they provide a road map to future derivatives. Today, these eight laws have been refined and expanded into more than 400 sublines of evolution and are useful in technology development, product planning, and the establishment of defensible patent fences.

Altshuller's third discovery

The third truism that emerged from Altshuller's analytical work was the realization that inventions are vastly different in their degrees of inventiveness. Indeed, many of the patents that Altshuller studied were filed simply to describe a system and provide some degree of protection. These patents were useless in Altshuller's determination to discover the secret of

how to become an inventor of the highest order. To differentiate inventiveness, Altshuller devised a scale of 1 to 5 for categorizing the elegance of the solution.

Note that only level 3 and 4 solutions are deemed to be inventive. Within the body of TRIZ knowledge *inventive* means that the solution was one that did not compromise conflicting requirements. For example, strength vs. weight is an example of conflicting parameters. To increase strength, the engineer will typically make something thicker or heavier. An inventive solution would increase strength with no additional weight or even a reduction in weight.

Altshuller's levels of inventiveness

Level 1: Parametric Solution

A parametric solution uses well-known methods and parameters within an engineering field or specialty. This is the lowest level solution and is not an inventive solution.

For example, the problem of roads and bridges icing over can be solved by using salt or sand, or by plowing. Calculating stress on a cantilevered structure is accomplished by using well-known mathematical formulas.

Level 2: Significant Improvement in the Technology Paradigm

Level 2 is a significant improvement in the system, utilizing known methods possible from several engineering disciplines. Although a level 2 solution is a significant improvement over the previous system, it is not inventive.

A level 2 solution of the icing problem would be required if conventional means were prohibited. This type of solution demands a choice between several variants which leaves the original system essentially intact. The roadways or bridges, for example, could be formulated or coated with an exothermic substance that would be triggered at a certain temperature.

Level 3: Invention within the Paradigm

Level 3 eliminates conflicting requirements within a system, utilizing technologies and methods within the current paradigm. A level 3 solution is deemed to be inventive because it eliminates the conflicting parameters in such a way that both requirements are satisfied simultaneously.

A level 3 solution to the conflicting requirements of strength vs. weight has been solved in aircraft by the use of honeycomb structures and composites.

Level 4: Invention outside the Paradigm

Level 4 is the creation of a new generation of a system with a solution derived — not in technology — but in science.

A level 4 solution integrates several branches of science. The radio, the integrated circuit, and the transistor are examples of level 4 solutions.

Level 5: True Discovery

Level 5 is a discovery that is beyond the bounds of contemporary science. A level 5 discovery will oftentimes spawn entire new industries or allow for the accomplishment of tasks in radically new ways. The laser and the Internet are examples of level 5 inventions.

Basic foundational principles

The three discoveries made by Altshuller provided the construct for the formation of the foundational underpinnings upon which all TRIZ theory, practices, and tools are built. The three building blocks of TRIZ are *ideality*, *contradictions*, and the maximal use of *resources*.

Ideality

The notion of ideality is a simple concept. Essentially, ideality postulates that in the course of time, systems move toward a state of increased ideality. Ideality is defined as the ratio of useful functions FU divided by harmful functions FH.

$$\text{Ideality} = I = \frac{\sum F_U}{\sum F_H}$$

Useful functions embody all the desired attributes, functions, and outputs of the system. In other words, from an engineering point of view, it is termed *design intent*.

Harmful functions, on the other hand, include the expenses or fees associated with the system, the space it occupies, the resources it consumes, the cost to manufacture, the cost to transport, the cost to maintain, etc. Extrapolating the concept to its theoretical limit, one arrives at a situation where a system's output consists solely of useful functions with the complete absence of any harmful consequences. Altshuller called this state the ideal final result (IFR). The IFR is not actually calculated; rather it is a tool to define the ideal end-state. Once the end-state is defined, the question as to why it's difficult to attain flushes out the real (contradictory) problems that must be overcome.

One might argue that it is absurd to think of solving problems from the theoretical notion of the IFR instead of explicitly defining the current dimensions of the problem. It is, however, precisely this point of view that opens up innovative vistas by reducing prejudice, bias, and, most of all, psychological inertia (PI).

Contradictions

The second foundation principle is the full recognition that systems are inherently rife with conflicts. Within TRIZ these conflicts are called *contradictions*. In TRIZ, an inventive problem is one that contains one or more contradictions. Typically, when one is faced with a contradictory set of requirements, the easy way out is to

find a compromising solution. This type of solution, while it may be expedient, is not an inventive solution. If we return to the example of weight vs. strength, an inventive solution satisfies both requirements. Another example would be speed vs. precision. A TRIZ level 3 solution would satisfy both requirements utilizing available “in paradigm” methods, whereas a level 4 solution would incorporate technologies outside the current paradigm. In both cases, however, speed and precision would be achieved at a quality level demanded by the contextual parameters of the situation. In TRIZ, two distinct types of contradictions are delineated, technical contradictions and physical contradictions. Methods for solving technical contradictions are discussed later in the chapter.

Technical Contradictions

A *technical contradiction* is a situation where two identifiable parameters are in conflict. When one parameter is improved, the other is made worse. The two previously mentioned, weight vs. strength, and speed vs. Precision.

Physical Contradictions

A *physical contradiction* is a situation where a single parameter needs to be in opposite physical states, e.g., it needs to be thin and thick, hot and cold at the same time. This type of contradiction has, at least to the author’s knowledge, never been articulated prior to the arrival of TRIZ in North America.

A physical contradiction is the controlling element or parameter linking the parameters of the technical contradiction.

The physical contradiction lies at the heart of an inventive problem; it is the ultimate contradiction. When the physical contradiction has been found, the process of generating an inventive solution has been greatly simplified. It stands to reason that when a physical contradiction is made to behave in two opposite states simultaneously, the technical contradiction is eliminated. For example, if by some means, pulley C could rotate in opposite directions at the same time, both A and B would increase, hence eliminating the technical contradiction.

Resources

The third foundation principle of TRIZ is the maximal utilization of any available resources before introducing a new component or complication into the system. Resources are defined as any substance, space, or energy that is present in the system, its surroundings, or in the environment. The identification and utilization of resources increase the operating efficiency of the system, thereby improving its ideality. It is understandable that in the former Soviet Union where money was scarce necessity did in fact prove to be the mother of invention. In the West, on the other hand, system problems were often engineered out by the proverbial means of throwing money (and complexity) at the system. The utilization of resources as an “X” agent to solve the problem was and still is not widely practiced.

A practiced TRIZ problem solver will marshal any in-system or environmental resource to assist in solving the problem. It is only when all resources have been exhausted or it is impractical to use one that the consideration of additional design elements comes into play. The mantra of a TRIZ problem solver is never to solve a problem by making the system more complex. More on this when the algorithm for problem solving (ARIZ — Russian language acronym) is discussed.

Classical TRIZ – knowledge – based tools

The Contradiction Matrix

The first of the classical TRIZ tools invented by Altshuller is the contradiction matrix. The objective of the matrix is to direct the problem-solving process to incorporate an idea that has been utilized before to solve an analogous “inventive” problem. The contradiction matrix accomplishes this by asking two simple questions: “Which element of the system is in need of improvement?” and “If improved, which element of the system is deteriorated?” This is, as has been pointed out, a technical contradiction. A portion of the 39 x 39 matrix is shown below:

<div style="display: inline-block; width: 100%; height: 100%; border: 1px solid black; position: relative;"> Deteriorated Feature Feature to Improve </div>		1	2	3	●	22
		Weight of a moving object	Weight of non-moving object	Length of a moving object	●	Waste of Energy
1	Weight of a moving object			15,8 29,34	●	6, 2 34,19
2	Weight of a non-moving object				●	18, 19 28, 15
3	Length of a moving object	8,15 29,34			●	7, 2
4	Length of a non-moving object		35,28 40,29		●	6, 28
5	Area of a moving object	2,17 29,4		14,15 18,4	●	15, 17 30,26
6	Area of a non-moving object		30,2 14,18		●	17, 7 30
7	Volume of moving object	2,26 29,40		1,7 35,4	●	7,15 13,16
●	● ● ● ● ● ● ●	●	●	●	●	●
33	Convenience of use	25, 2 13,15	6,13, 1, 25	1,17 13,12	●	2,19 13
34	Repairability	2,27 35,11	2,27 35,11	1,28 10,25	●	15, 1 32,19
35	Adaptability	1,6 15,8	19,15 29,16	35,1 29,2	●	18, 15 1
36	Complexity of device	26,30 34,36	2,36 35,39	1,19 26,24	●	10,35 13,2
37	Complexity of control	27,26 28,13	6,13 28,1	16,17 26,24	●	35,3 15,19
38	Level of automation	28,26 18,35	28,26 35,10	14,13 17,28	●	23,28
39	Productivity	35,26 24,37	28,27 15,3	18,4 28,38	●	28,10 29,35

Picture 1 The Contradiction Matrix; References: [7], [8]

The matrix is constructed by juxtaposing 39 engineering parameters along the vertical and horizontal axes. At the intersections Altshuller filled in from one to four numerical values hinting at ways to solve the problem. The numerical values identified one of the 40 inventive principles that were culled from the knowledge base as ways in which an analog to the

specific problem had been solved previously. The 39 engineering parameters are general in nature and act as surrogates for the specific real parameters in conflict. The inventive principles are broad and nonspecific as the exact way in which they should be applied. In Figure the problem is trying to improve “convenience of use” but when this is attempted, it results in waste of energy. The matrix suggests that when this type of problem is encountered, principles 2, 9, and 13 have been utilized to resolve the contradiction.

Physical Contradictions

A physical contradiction is the controlling element in the system that links the two conflicting parameters in the technical contradiction. The physical contradiction expresses the most extreme form of contradictory requirements because the conflict must be resolved solely within a single entity.

Analytical tools

In addition to the knowledge-based tools, Altshuller also developed several analytical tools. The two most widely used are substance field modeling and the algorithm for inventive problem solving. The former is referred to as sufield and the latter according to its Russian language acronym — ARIZ.

System of Standard Solutions

Class 1. Increasing performance

1.1 Synthesis of the substance field models

- a/ Constructing the sufield field models
- b/ Internal combined sufield model
- c/ External combined sufield model
- d/ Sufield model with the environment
- e/ Sufield model with environment and additives
- f/ Minimum regime
- g/ Maximum regime

h/ Selective maximum regime

1.2 Destroying the sufield model

Class 2. Eliminating harmful actions

Class 3. Transition to the super-system and to the microlevel

Class 4. Eliminating problems in measurement

Class 5. Eliminating problems caused by applying standard solutions

A respiratory problem

In a CNN scientific broadcast, the narrator stated that astronauts aboard the shuttle were experiencing respiratory problems due to residual dust and other minute particulates that passed through the shuttle's filtration system. A typical (Western) response to this problem would revolve around reengineering the system to make it more efficient. If the cost of this solution was too high, another approach that might work equally as well is figuring out how to transform small particles into large particles. This is a totally different problem. The advantage of the latter is that the current system would not have to undergo a costly major redesign. Is this possible? An inventory of the resources available yields moisture in the form of water vapor and very cold temperatures outside of the shuttle. Given these resources, it is conceivable that small particles can be encapsulated in water vapor and frozen with the result that small particles are transformed into large ones, thereby allowing the filtration system to capture and retain them.

TRIZ is a powerful comprehensive problem-solving tool. It is the product of a massive analytical study of the output of the world's best inventors and the world's most creative inventions. The fundamental underlying principle of TRIZ is Ideality. The ideality principle holds that over time systems evolve to higher levels of functionality through the elimination of internal contradictions and the efficient utilization of available resources. In time, the study of inventions by Altshuller and others yielded a number of knowledge-based and analytical tools. Knowledge-based tools include the contradiction matrix, the 40 inventive principles and the laws of systems evolution. Analytical tools include substance field analysis and the algorithm for inventive problem solving (ARIZ).

The General Review of 40 Principles

Below is a list of all 40 principles. Alternate names come from a variety of translations of the original Russian research.

1. Segmentation (fragmentation)
2. Separation (taking out, extracting)
3. Local quality
4. Symmetry change (asymmetry)
5. Merging (consolidation)
6. Multifunctionality (universality)
7. Nested doll (nesting, “Matrushka”)
8. Weight compensation (antiweight, counterweight)
9. Preliminary counteraction (preliminary antiaction, prior counteraction)
10. Preliminary action (prior action, do it in advance)
11. Beforehand compensation (beforehand cushioning, cushion in advance)
12. Equipotentiality (bring things to the same level)
13. “The other way around” (do it in reverse, do it inversely)
14. Curvature increase (spheroidality, spheroidality curvature)
15. Dynamic parts (dynamicity, dynamization, dynamics)
16. Partial or excessive actions (do a little less)
17. Dimensionality change (another dimension)
18. Mechanical vibration
19. Periodic action
20. Continuity of useful action
21. Hurrying (skipping, rushing through)
22. “Blessing in disguise” (convert harm into benefit)
23. Feedback
24. Intermediary (mediator)
25. Self-service
26. Copying
27. Cheap disposables
28. Mechanical interaction substitution (use of fields)
29. Pneumatics and hydraulics

- 30. Flexible shells and thin films
- 31. Porous materials
- 32. Optical property changes (changing the color)
- 33. Homogeneity
- 34. Discarding and recovering
- 35. Parameter changes (transformation of properties)
- 36. Phase transitions
- 37. Thermal expansion
- 38. Strong oxidants (accelerated oxidation)
- 39. Inert atmosphere (inert environment)
- 40. Composite materials

Principle 3

Local quality. Change an object's structure or an external environment (or external influence) so that the object will have different features or influences in different places or situations. Make each part of an object or system function in conditions most suitable for its operation. Make each part of an object fulfill a different and useful function. Often the object should have an additional feature, but the introduction of this feature causes new problems or makes the system more complex and expensive. We should change the system, and we should not change it.

It is easier to change the system locally. There are many examples in technology. Quenching and other treatments of the surface layer of metal components make the surface properties different from the bulk properties of the material. We use a different wrench for every nut because fixed-size wrenches are much stronger than adjustable wrenches. Specialized compartments in a lunchbox for each type of food keep hot things hot, cold things cold, and make it safe and economical for workers and schoolchildren to carry their lunches with them. In business, the segmentation of the market also illustrates the local quality principle. *Segmentation* is used to divide the market into small markets with specific attributes, and then *local quality* is used to treat each of those markets appropriately. To tailor its approach in the automatic washing machine market to the cultural preferences of each group, the Whirlpool Corporation has hired marketing people in India who speak 18 different languages.

Local quality applies to people, as well. Some are most effective working on their own, and others are most effective in teams. Intensive professional specialization is needed for certain skills, and a broad liberal arts background is required in other situations.

More examples include:

- Precision farming using the correct amount of chemicals where needed
- Pencil with eraser
- Hammer with nail puller
- Kids' areas in restaurants

Principle 25 Self-service.

Make an object or system serve itself by performing auxiliary helpful functions. Use resources, including energy and materials—especially those that were originally wasted—to enhance the system. Some examples are

- In a tire that repairs itself, liquids are sprayed inside the tire. When the tire is punctured, the liquid fills the hole. When it contacts the outside air, it solidifies, forming a permanent repair.
- A classical example of self-service in business was presented in the beginning of the book: a self-service fast food restaurant. Many electronic business ideas are based on including the customer and the customer's resources in the system as resources of the system—this includes everything from communities of interest and chat rooms to data exchanges such as Napster and Gnutella.
- Some search engines use the frequency of use of a Web site as the indicator of quality, so the more often a site is used, the higher it rates on their recommendation list. This is a combination of feedback (24) and self-service.
- Self-treatment and self-test. Patients themselves can perform some medical tests, like the measurement of blood pressure or blood sugar or testing for fertility (then later testing for pregnancy) previously done only by medical personnel. In some cases, patients also adjust their treatment or behavior based on the test results.

Self-service is a way to use the object's resources. This principle illustrates the pattern of increasing ideality. What is more ideal than a system serving itself.

More examples are

- Halogen lamps regenerate the filament during use—evaporated material is redeposited.
- Lend out temporarily underutilized workers to other organizations. (Load capacity balancing across companies creates a win-win situation where the worker [or player, in the case of football teams] stays match fit, the lender saves wages, and the lendee fills the skill shortage).
- Self-charging quartz watch is powered by the wearer's movement.
- Self-righting lifeboat can capsize and right itself again.
- Modern technology of melting steel scrap uses the energy of scrap itself; carbon and silicon are burned.

Principle 26 Copying.

Instead of an unavailable, expensive, or fragile object, use simpler, inexpensive copies. Replace an object, system, or process with optical copies. If visible optical copies are already used, change the wavelength to infrared or ultraviolet.

Some examples are

- Make measurements from an image instead of directly. This includes a wide spectrum of technologies, from satellite photographs of farm and timber resources to ultrasonic images of a fetus in the womb.
- Use a simulation instead of the object. This applies to many business processes
- as well as to products and services.
- Use prototypes for testing new systems so that any harm is detected early.
- Use virtual prototypes instead of physical ones.
- Use video-conferencing instead of travel.
- Use virtual reality to test new processes or to train people to do work in difficult situations.
- Surgeons now test new operating procedures on virtual patients, and automobile assembly workers practice new procedures in virtual factories.

- Scan rare historic books, documents, and such so they can be made accessible to all, while the original remains protected.
- Use telepresence instead of fully independent robots.

Fake furs and leathers are also examples of the copying principle. Artificial grass might be an acceptable alternative in some places. No need to mow. Compare with plastic flowers and plants.

Ultraviolet light shows certain kinds of skin lesions better than visible light; dyes that are sensitive to ultraviolet are used to find cracks in metal parts. Infrared images show the heat—this is the basis of most night-vision systems.

Principle 28 Mechanical interaction substitution.

Replace a mechanical method with a sensory (optical, acoustic, taste, or smell) method. Use electric, magnetic, and electromagnetic fields to interact with the object. Change from static to movable fields to those having structure. Use fields in conjunction with field-activated (e.g., ferromagnetic) particles. Some examples include:

The best-known example of the use of a smell as a warning is the incorporation of bad odors into natural gas to warn users when the system has a leak.

The JIT manufacturing systems use Kanban cards or objects such as portable bins to indicate visibly when supplies are needed.

- The history of technology is full of examples in which the mechanical means of doing something is first supplemented by an electrical system and then replaced by an electrical or electronic system. Automobile steering systems are mainly mechanical, but control by wire (already used extensively in aviation) is intensively studied in the automotive industry. In telecommunications, infrared and radio waves and other wireless technologies are increasingly used.
- In the case of automatic solar lawnmowers, something must prevent them from escaping to a neighbor's lawn. One solution is a sensor picking up a signal from a low-voltage (also solar-powered) cable buried out of sight.

- In communication and business, we also clearly see the increase of new interactions. When human society began, all communication was face-to-face, which has since been augmented by writing, telegraph, telephone, fax, e-mail, videoconferencing, and other means.
- Transition to more easily controllable interactions is often associated with transition to the microlevel or segmentation. In inkjet printers, ink particles are controlled by thermal or electromagnetic fields. In video displays, text and figures are produced, changed, and removed using electromagnetic fields to control microparticles or molecules—for example, many flat-panel computer displays use liquid crystals, in which the image depends on the reflection of light from the molecules and the reflection is modified by changing the orientation of the molecule.
- Maglev vehicles use magnetic fields to levitate above a guideway.
- Magnetic strip cards and smart cards are used instead of paper cash and checks.
- A ring laser gyroscope, unlike the old mechanical gyroscope, has no moving parts.
- CD devices with laser beam have superseded old record players with the diamond-tipped pickup arm.
- Have retail customers enter data by means of a touch screen, instead of filling out a form.

Principle 40 Composite materials.

Change from uniform to composite (multiple) materials and systems. Some examples are Rubber reinforced with woven cords, reinforced concrete, and glass-fiberreinforced plastics are typical technology examples.

- The use of *nothing* (air or vacuum) as one of the elements of a composite is very typical of TRIZ—no resource is available in all situations. Examples include honeycomb materials (egg crates, aircraft structures), hollow systems (golf clubs, bones), and sponge materials (packaging materials, scuba divingsuits.) These combine Principle 31, use of porous material, with Principle 40, use of composite materials.
- In business, we can speak of composite structures as well. Multidisciplinary project teams are often more effective than groups representing experts from one field. Multimedia presentations often do better in marketing, teaching, learning, and entertainment than single-medium performances. Other examples are less tangible but

not at all less important. Fanatic commitment to cleanliness is one famous feature of McDonald's. Consistent preparation of food is another major commitment. These are two principles or values or fibers that tie together a loose organization.

The principle of composite materials or, more generally, composite systems, is a good conclusion for this section on using inventive principles. If you have a system, you can improve the result by combining it with another system. Innovative principles are also systems. Composite principles often do better than single ones.

More examples are

- Combined high risk/low risk investment strategy
- Flammable polyurethane coated with fire-resistant Kevlar (e.g., in airplane seat cushions)



Summary of terms

- TRIZ
- Ideality
- Contradictions
- The Contradiction Matrix



Questions

- 1/ How would you define the principles of TRIZ?
- 2/ How would you describe Artshullers levels of inventiveness?
- 3/ How would you define and describe principles of TRIZ?
- 4/ How would you define in detail and provide a practical example of the ten principles of TRIZ?



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4. WOIS



Time to study

4 hours



Goal

After reading this paragraph, you will be able to

- Define the methodology WOIS
- describe the individual steps of this methodology



Lecture

Especially for maintaining leadership, company's require strengthening the innovation power. Consequently companies necessitate a clear picture of the company's competitive situation in future as well as reliable innovation processes for heading towards this future in a focused way.

The innovation strategy WOIS combines these elements in a unique Contradiction Oriented Innovation Strategy by integrating key elements of known successful methodologies such as TRIZ with new aspects of encouraging a challenging innovation culture, designing highly competitive value creation chains and realising successful innovations in known and new created markets.

Partners that have already applied this innovation theory successfully are companies such as BMW, Bosch, Braun, Linde, Melitta, Nestlé Schöller, Ergoline, Grohe, Hilit, Siemens, Tesa and many others.

The combination of the innovation strategy WOIS with the company management throughout the value creation chain can offer the chance to unveil an extraordinary innovation power.

Further Development of the World:

Especially for long term success company's requires a clear picture of the future competitive situation as well as reliable innovation processes for heading towards this future. In particular "weak signals" become important as it is likely that they end up having "strong impacts".

Where to look and how to inspire new development directions?

For building a sustainable picture it is important to consider how the society, technology, resources and the thinking culture will develop. All four aspects will develop, including their interdependencies, no matter whether "our company" contributes to the future development or not.

Consequently the challenge will become to influence this development in a way that we design and meet future expectations of the markets. Facing this task from a business point of view:

Who is responsible for turning the switches towards the right tracks?

Is it only the management of the company? Frequently the top management faces a lack of detailed information. Therefore the decision making basis is not as accurate as desirable.

On the other hand it could be asked if employees with too little decision making empowerment and too little overview should take the decisions?

Throughout the industry detailed descriptions exist for all kinds of business processes. Often, future perspectives are developed based on 'roadmaps' that result from evaluating spontaneous ideas, former project results and preliminary concept proposals.

But this is not sufficient for developing a clear picture for the future of the business.

It can be observed, that many companies are confronted with a threatening gap especially within the early, strategic phases of development processes. The importance and impact of defining repeatable and reliable approaches for initiating strategic innovations is frequently underestimated.

One might think that companies that fail in defining sustainable strategic approaches will suffer considerable disadvantages - but due to similar behaviours of the competitors this is not the case.

Nevertheless, significant advantages can be gained through implementing systems that permanently allow the flexible adaptation of the development program, without losing the clear focus for medium and long term targets.

But how to fill the strategic gap? What can be the scientific basis for doing so?

In times of multi-criteria problems, company over spanning development networks and ever faster development processes, it is essential for companies to ground significant decisions on a reliable sustainable decision basis.

Especially 'stock market governed' company's belief in 'management by financial target agreements', but fail in implementing the ability for developing future perspectives. They are dead-locked in efficiency programs, unable to develop and implement strategies for future wealth creation.

Future orient companies require a system that consists of a

- growth oriented economical model,
- an energy focusing philosophy,
- a culture of a commonly shared understanding concerning future challenges and
- knowledge about hidden pattern of competition.

The innovation strategy WOIS integrates these aspects into one powerful strategy.

Is there a need for yet another approach?

When studying the literature hundreds of tools, tactics, methodologies exist for a wide range of situations. But there is no approach that would support business, marketing, product, process, organisation and resource innovations from the early strategic definition phases to its market implementation.

It is the intention of WOIS to provide a flexible mental model and innovation technology for innovation leadership, by supporting the processes required for recognising and realising innovative shortcuts in a more focused way.

How to Leaver Effective and Efficiency Approaches?

During the last years it became a strong tendency throughout Europe that companies as well as government programs became ever more efficiency oriented. Efficiency measures bear the advantage of being easily measurable. In addition they are useful to demonstrate short term quick wins.

Unfortunately it is the nature of efficiency instruments to work toward a natural limitation. Without creating additional benefit - and thereby increasing the effectiveness - there will be no long term success.

It is a reoccurring pattern of market evolution that competitive systems become more and more optimised and at the same time less differentiated. Unfavourable price competitions are the result of such developments until one of the competitors breaks the barrier of similarity. This usually happens by introducing a significantly changed solution that is characterised by new functionality and therefore also new benefit.

What Tools, Technologies and Methodologies already Exist?

A wide range of tools and methods exist to assist development processes. Most popular tools aim at reducing the effort and “ensuring against failure” - in principle following the line of argumentation “It cannot be my mistake I am certified”.

Nevertheless, companies do not gain leadership because they are not responsible and certified against mistakes, but due to people that are responsible for the success. Therefore, approaches are required that focus on generating new benefit prior to applying tools to minimise the effort.

As a consequence future oriented businesses first seek for solutions that offer new benefits for the customers before focusing on efficiency measures.

What Basic Science can be used as Background for Innovation?

Modern innovation processes must not rely on random intuitive ideas. They necessitate repeatable processes that increase the likelihood of delivering reliable short, medium and long-term perspectives with powerful corresponding concepts.

Searching for the common ground for modern innovation sciences it became obvious that neither engineering or economical sciences, nor natural sciences are a suitable basis as they do not incorporate all relevant aspects.

The origin of science is the philosophy. It defines basic interdependencies of the nature, society and thinking. This broad view combines all relevant aspects of modern challenges, despite of the aspect of technology. Accordingly, a modern innovation philosophy needs to combine the aspects of social, technological, natural and thinking aspects.

Such a definition would be too general to be of any help for modern innovation processes. Nevertheless, specifying this definition shows that successful approaches need to consider the Co-Evolution of the markets and needs, products and processes, raw materials and resources as well as of the culture and strategies.

What Internal Resources can Increase the Innovation Power of Companies?

Beside the innovation philosophy also the resource basis of companies defines its competitiveness. Modern hardware and software resources are the backbone of every business. Developing businesses additionally requires the people that are able to come up with unique, competitive ideas.

Nowadays the resource question became even more complex. Business relations need to cover so vast issues that it is nearly impossible for one person to integrate the brainpower to develop new ideas from the initial stage to its market introduction. This indicates at the same time, that the brainware of individuals is no longer the ultimate resource for business success.

It seems to be the ability of a business to implement a climate of cware - of cooperation, communication, contradiction, coalitions, common ... - that characterises its potential for competitive change. Despite of the cultural aspect of cware, forward thinking businesses are able to implement a challenging, resource focusing common vision that helps to align development activities toward a commonly shared target system.

How to Inspire a Positive Innovation Culture?

The western culture is based on logic and is, as a consequence used to assess and judge new ideas at once. This is helpful to prevent substantial misunderstandings and wrong conclusions. The strength of logical conclusions during later development phases is at the same time the limiting factor for the early ones.

As soon as one comes up with a new idea, untrained people are used to start validation. At once all reasons are in our mind, why this new idea might not work.

Innovation processes require a climate that searches for the 'good idea behind' and to develop this seed to a growing plant. A simple, but most effective chance to switch this behaviour towards a more innovation friendly culture is replace the typical "yes, but" by a more future oriented "yes, and..."

How can - usually Negative - Contradictions Inspire Innovations?

Innovations break through current performance limits and thus also aim beyond current barriers and hurdles. The innovation strategy WOIS utilises this characteristic of innovations to focus available development resources on challenging such contradictions. By describing the logic of the constraints of existing leading edge systems the boundary of available technologies is characterised. The example of a connecting rod development in 1991 of the companies Krebsöge and BMW shows the idea behind the model of development contradictions and its use to aim beyond existing boundaries.

The ever increasing efficiency of engines required the fit of the connecting rod to be machined ever more accurately. At the same time the machining effort had already developed to a level that demanded a decreased manufacturing effort.

Such a situation describes a typical target conflict. The targets seem to contradict each other and target conflict management tools could assist in finding the most suitable compromise. Real innovations are not based on compromises and the theory of WOIS provides a model that assist in overcoming such development contradictions. WOIS searches for the reason behind the target conflict by defining a parameter that links both targets in a logic manner. To increase the accuracy of the fit, the number of operations has to increase.

At the same time, to reduce the manufacturing effort, the number of operations has to be reduced as possible.

Now this is a typical catch 22 situation. The number of operations has to increase and decrease at the same time!

The approach of WOIS is to define the favoured growth direction of the parameter and to require the target to be fulfilled that is usually linked to the opposite growth direction. In the case of the connecting rod there would be ideally no operation, but at the same time the accuracy of the fit as high as possible. The solution to this paradox task was the development of a cracked connecting rod: Realising the highest possible accuracy with only one machining operation.

The intension of shortcutting the track of evolution is the common intension of all competitors in the markets. The spiral of innovation is a model for discussing phenomenon the re-occur over and over again. The picture leads to a strategy for shortcutting the spiral of evolution in a more systematic but at the same time inspiring way.

What is the strategy behind the intension of shortcutting the spiral of evolution?

In general, the decision making processes can be described as a process of three distinct phases:

- An orientation,
- decision making and
- innovation-finding phase.

Knowing these phases is good, but not yet helpful for guiding a project team through a major innovation project.

Which elements are needed to run successful innovation projects?

For being able to allow chaotic association phases throughout the project it is essential to be able to rely on the governing overlaying process. Therefore, models exist for each of the phases that support project work with

- strategic orientation tools,
- distinct analysis perspectives,

- inspiration resources and
- models for deriving key findings.

When trying to consider developments of the society, technology, natural resources and global competition networks as well as there interdependencies:

What analysis process is able to guide a project team through such a journey without loosing the overview?

The experience with hundreds of projects has shown that the following process increases the likelihood of developing innovative results significantly: Initially it is important to re-focus the own thinking perspectives.



Summary of terms

- WOIS
- Innovation Culture
- Contradictions Inspire Innovations



Questions

- 1/ How would you define the principles of WOIS?
- 2/ How would you define and describe principles of WOIS?
- 3/ How would you define and describe principles of WOIS?
- 4/ How would you define in detail and provide a practical example of the ten principles of WOIS?



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5. Key practices to maintain and develop business growth and profitability



Time to study

3 hours



Goal

After studying this paragraph, you will be able to

- define the key growth practices
- describe the stages of creative thinking, factors affecting creative thinking,



Lecture

Innovate constantly

An important characteristic of a pacesetter company is that it emphasizes management innovation not as periodic events but as a general and constant theme, an ongoing process, a prevailing attitude. This orientation defines the organization. The company emphasizes innovation in order to increase its business value for customers and key stakeholders.

An increasing and evolving emphasis on developing and implementing management capital is the root of success in sustaining growth.

Promote innovation

One primary characteristic of the new management model—management capital—is how innovation is understood, appreciated, and emphasized. The focus is on the institutionalization of constant management innovation, integrated throughout the organization. The reason for this is that a successful business innovation is not an end in itself. It also positions a company for the next innovation.

In every industry, from silicon and steel to optics and genetics, it is also a necessary condition for connecting systematic product R&D throughout the entire company—not only focusing it on a central research laboratory—and enhancing the assurance of its timing and success.

Learn and innovate

The effects of innovation have long been recognized as a principal determinant of economic growth. In recent years the importance of management innovation has become one of the principal factors in that determinant. While difficult to quantify and measure, its results are recognized as one of the most significant influences on economic performance.

One important factor underlying this economic change is that long-term economic expansions create major business disconnects. In some companies, the relentless development of new areas of management leadership was not always institutionalized as the fundamental leading edge it had become.

Manage smart in new ways

Quality of management is central. Company leaders must systematically develop and integrate market and leadership capabilities, technology capacities, brand names, customer relationships, human resources, international connections, business processes, and supply networks.

Promote management Capital

From the brutally competitive economy of the opening years of the 21st century, two areas of corporate emphasis have emerged. The first is a fundamentally new character of business innovation. The second is a powerfully new focus on the carryover business issues from the expansive economy of the 1990s and the early 21st century.

One example of the new character of business innovation is a new, more effective, and fully integrated use of technology resources for broad company competitive leadership. This is very different from the self-contained islands of technology that characterized some organizations. Company technology is integrated across all product and service development and throughout all operations, marketing, and distribution areas as a fundamental competitive leadership strategy.

The power of hard and soft assets

Opportunistic attitudes lead directly to further fundamental change in management in leading organizations. Managers are recognizing how the character of companies is changing.

The new concept is that the business value of an organization resides in the way it combines the power of hard assets—finances, equipment, bricks and mortar— with the power of “soft” assets—productive, market, sales, human development factors. This combination includes such assets as these:

- Brand names and reputation for quality and customer satisfaction
- Technology, know-how, and patent rights
- Customer relationships and distribution arrangements
- Capacity to attract and retain capable people and provide training and development
- International connections
- Sense of public responsibility
- Integration of technology, management, and human resources
- Responsibility of corporate governance

Focus on customers

A consumer who is completely satisfied with a purchase tells six other potential buyers. A dissatisfied consumer informs 25 other potential buyers.

As companies get back to the business basics, managers must recognize the most fundamental of those basics: income comes from customers, not the financial community.

Quality is vital to shaping consumer sentiment, which powers the two-thirds of our economy that is consumer-driven. Quality of productivity is essential for shoring up the economy, especially when business slows down. The value of quality that consumers perceive in products and services exerts an increasingly powerful influence on their spending, especially when money is tight.

Lead with heart and head

Implementation of management capital capacity involves the following factors:

- Leadership and management passion, populism, and disciplined responsibility that bring focus to the theme of management capital, underpin the processes for its continuous implementation, and develop the character of the company.
- Creation and continuing development of the environment and framework for involving the creativity, knowledge, skills, and attitudes of all members of the organization in improving results.
- Systematic identification of the major business issues and opportunities confronting top-line growth and bottom-line profitability in terms of creating value for customers, investors, and employees. These issues may be visible - related to products, services, and markets – or invisible—related to how the company operates, with measurement of related business failure costs.

Create the future

Pacesetting companies discard management doctrines that no longer work, like these: Good management means getting ideas from the boss to the workers. Good management means

maximizing on the knowledge, skills, and attitudes of all employees to make improvements throughout the organization.

Corporate and management change must be incremental. Make improvements on a broad front, developing understanding and support throughout the organization. Establish a prioritization sequence to schedule improvements more time-efficiently. Deliver products and services quicker and cheaper, sell hard, and provide a service safety net for customer problems. Customer expectations have changed dramatically, so this approach costs a lot in lost customers and fixes. Competitive leaders make better products and offer better services.

Collaborate strategically

A major characteristic of the 21st-century business environment is that many companies are becoming more competitive through allying with companies that provide necessary capabilities—even though a high proportion of such alliances have not worked out. Acquisitions require fundamental changes in control and ownership. Mergers place correspondingly enormous management capital demands on the timely focusing of resources to achieve the business objectives.

Other forms of business relationships are very different from the pattern of trade mergers and acquisitions. The objective of creating strategic alliances is to develop forms of cooperation with organizations that provide competitive capabilities. These relationships require forms of integration that are completely different from management based on ownership and control.

End costs of failure

A basic key in creating new business opportunity is to increase product and service value for customers while simultaneously eliminating obstacles. This means measuring disconnects and backward creep as costs of failures and lost opportunities and working to reduce those costs.

Customer expectations, employee attitudes, technology shifts, international growth, and cost trends change quickly. Companies that seem to be doing well

in terms of growth and profits can become increasingly distanced from recognizing, evaluating, and improving the fundamental drivers of their performance.

The disconnects and the management capital deficiencies that are a primary cause of those disconnects can diminish a company's capacity for sustaining profitable growth. Frequently financial analysts and cost accountants who focus on hard assets are unable to identify the root causes of those costs and quantify them.

One way is to measure the quality costs of ensuring complete customer satisfaction with the company's products and services as a percentage of sales revenue. Costs measured in these terms have four components:

1. External failure costs—including costs generated by the unsatisfactory performance of products and services and related tasks
2. Internal failure costs—including costs generated within the company network by this unsatisfactory performance
3. Appraisal—including costs associated with key systems, processes, and Internet functions that provide controls to ensure customer satisfaction
4. Prevention—including costs associated with initiatives for preventing disconnects and backward creep that can affect customer satisfaction

Lead competitively

Business leaders must lead and manage successfully, systematically, and opportunistically for results that sustain profitability and growth in terms that confirm their company's character and combine its visible and invisible competitive strengths.

This means establishing overarching themes for capitalizing their management power to fit their particular requirements, personality, and customer and business demands.

There are four dimensions to leading competitively.

1. A new, more powerful emphasis on customer value for marketing and sales strength, including product and service development. Customers are becoming better informed and more demanding. Companies must fully meet the demands and expectations of their customers.

2. Operating cost leadership for the company's economic strength.
3. Management innovation and total resource use for competitive business improvement.
4. Empowering a company culture of superior performance.



Summary of terms

- business growth
- business profitability



Questions

- 1/ How would you describe basic principles of key practices to maintain and develop business growth and profitability?
- 2/ How would you find examples from practice for individual key practices to maintain and develop business growth and profitability?



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Departments: VŠB Technical University of Ostrava, Faculty of Metallurgy and Materials Engineering, Department of Quality Management

Title: Change management

Auhtor: Petra Halfarová

Place, years: Ostrava, 2015, First

Number of pages: 69

Released: VŠB Technical University of Ostrava