

# Fractal Company

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## ABSTRACT

More and more branches are confronted with fast changes of products, technologies and markets and it is hard to manage its position with the traditional methods of reorganization, re-engineering, computer integration or by new more flexible technology. The only chance is to create such adaptable organization which will react adequately to these changes by itself. Living organisms that are strongly adaptable to changed conditions because they are designed with self-organized elements; similarly to them the fractal organization uses suchlike principle. Individual organizational sections are autonomous, they organize and optimize themselves and so create the vital structure that is focused on processes and client.

## KEYWORDS

fractal company, change, adaption, optimization, aim orientation, dynamics, self-organization, fractal teams, corporate culture, change strategy, motivation, improvement.

## INTRODUCTION

Motto:

*Clouds are not spheres, mountains are not cones, coastlines are not circles, and bark is not smooth, nor does lightning travel in a straight line. (Benoît Mandelbrot)*

Greek mathematicians professed an order of ideal shapes - lines, triangles, squares, spheres. The world of disorder and chaos was not admitted to their considerations. However the clouds maintained their disordered shape patiently and waited to the moment when modern mathematics accepted the existence of fractals - objects having fractional dimension (Fractals). Fractal shape always has variation that is self-similar at all scales. It is a figure that repeats the same pattern ad infinitum. See Fig. 3.

Even modern natural sciences came to conclusions that with traditional methods it is not possible to describe and optimize complex systems with many elements that are often with non-linear relations. It works with probability and approximations with the intention to try to bring in order into the chaos.

Fractal company comes out from principles that are valid in the whole nature - everything works together in balance, everything is "just right", everything complements one another mutually and it works perfectly economically. People, animals and plants on this planet live because they have adaptability and they were able to gradually adjust to the living environment.

## WHAT IS THE FRACTAL COMPANY?

**Fractals** are used to describe organisms and nature creations with the aid of few elements which repeat themselves and create various complex structures adapted to tasks that they are designed for, Fig. 1.

**Fractal company** is an open system that consist of independent pro-active performing elements - fractals, whose structure repeats itself and follow the same target. Dynamic organizational structure of such company then resembles a vital organism. See Fig. 2.

Main attributes of fractals are:

- Dynamics
- Similarity
- Self-optimization
- Self-organization lies in small and quickly operating circuits. Every circuit has certain requirements, creates profit for other circuits and obtains a commensurate consideration.

Analogous to a bee community the fractal organization is also oriented on common targets that are developed from the highest company vision and strategy to the lowest level (fractals) in production and individual workers. These targets must be interconnected in such way that everybody pulls at the same end of the rope. And not only that - it is important to pull in one direction as well. Every worker and organizational unit behaves according as it is measured and evaluated. Thus the target system must be linked to the measurement, evaluation and reward system.

Bee-hive is a target-oriented structure. Survival of its members dominates to all its activities and efforts, see Fig. 4.

On the first view the hive life is a mess of flying bees, looking for and collecting nectar, building honeycombs and nurture offsprings. In reality all processes are coordinated, economical and serve to one purpose.

Bees pass during their life through different development phases. If it is necessary they perform works that are not typical for their age. This high degree of flexibility and adaptability is an endowment that ensures continuous existence of this community. Acquiring and transferring information about new food sources as fast as possible is a matter of life and death for the hive community. That is provided by their "chaotic dance".

Nature does not differentiate between the thought and act, between project and implementation. The groundwork of well balanced functionality of natural processes is the holistic task performance.

Groundwork of the continuous existence of natural as well as company organisms is:

- Flexibility and adaptability
- Target-oriented structure

- Fast information acquiring and transfer
- Process coordination and economy
- Holistic approach

**Dynamics** is an equally important principle. Fractals do not wait for orders, instructions or opportunities; they work dynamically and develop to grow or reduce themselves according to the living environment. Also companies hold similarities to live organisms - those who cannot react to changes, those who will not have dynamics and adaptability to changes in their surroundings - those will end up as dinosaurs or Titanic (non-flexibility and pride). Fractal organization guarantees survival and growth with its vitality and dynamics. The fact that some fractals decrease or cease is the same process as in nature - ice melts at spring and deposits from water in winter. How much would it cost if we try to maintain ice for the whole summer through artificial cooling? Also in a company there are periods of conjuncture and recession of some branches. Fractal organization secures that those fractals that are growing at the moment will hire people from "fractals" that are deflating and give them new opportunities. These fractals can pay back in next period. So this is a dynamic structure that develops and reacts to changes very quickly. This multiplies the potential of the whole organization - multidiscipline teams solving complex projects can arise quickly, forces can be transported to required places - just like in a human body or in the nature. To be clear - fractal organization will not grow up by drawing a new organizational structure and naming "fractal" managers and their secretaries. This process must be initialized from above but it develops and grows from below. That is the same as in nature - the Hemisphere deflects from the Sun and the ice crystals start to grow ...

Fractals are organized in accordance with a principle called fractal similarity. Fractals give mutual services to each other and they follow company mutual objectives. Fractal cooperation is based on client - supplier relationship. We believe that Mr. Mandelbrot will forgive us if we name the individual company elements "fractals". Production teams enter into production fractal. Number of team members is usually 5 to 12 people. The teams are integrated into production fractals

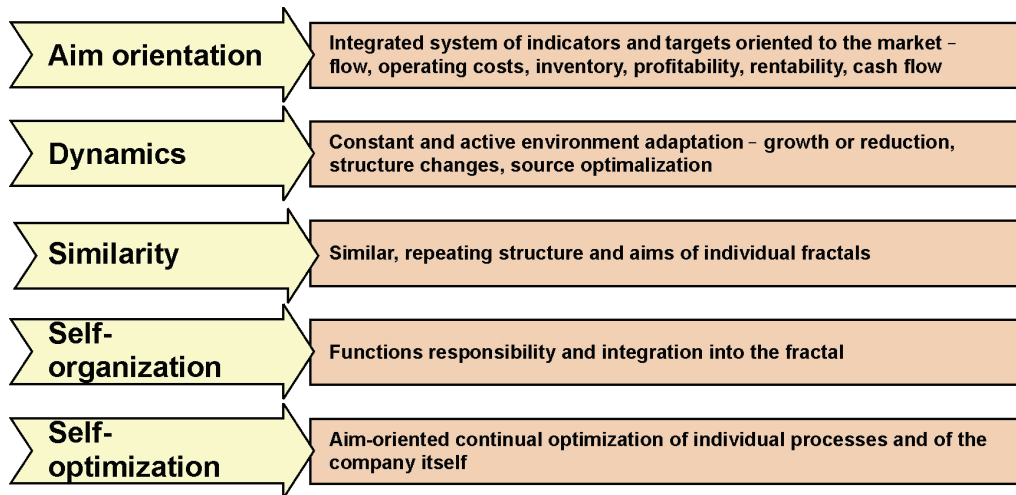


Fig. 1: *Organizational scheme.*

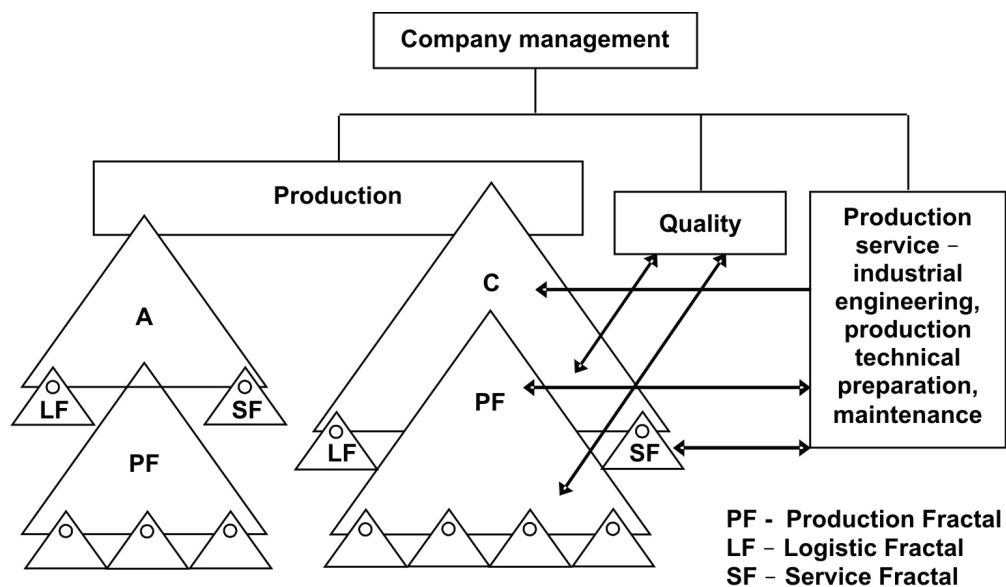


Fig. 2: *Scheme of a fractal company.*

through its selected members. The production fractal is a part of superior fractal and this organizational scheme repeats. Central tasks of maintenance, logistics, quality, technical preparation of production and other areas are supported through specialized fractals - e.g. logistics fractal, service

fractal. Fractals self-optimization runs in small and very quick control sphere. Each sphere has certain requirements, creates benefits for other spheres and gets appropriate consideration. Fractals have clearly defined areas of activity and aims; yet they have resource and method independence in how

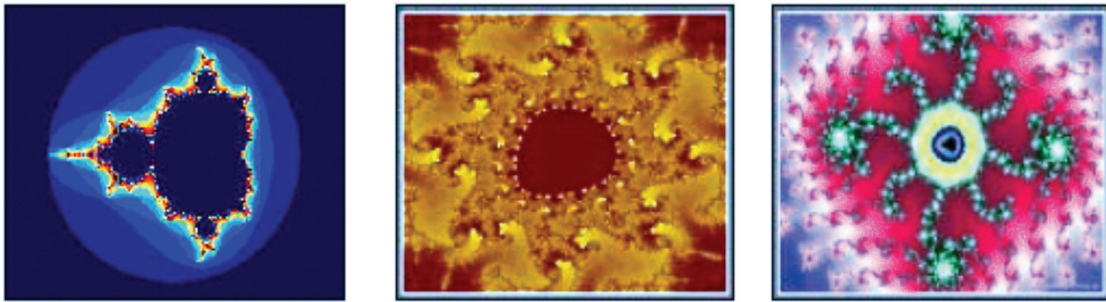


Fig. 3: *Examples of natural fractals.*

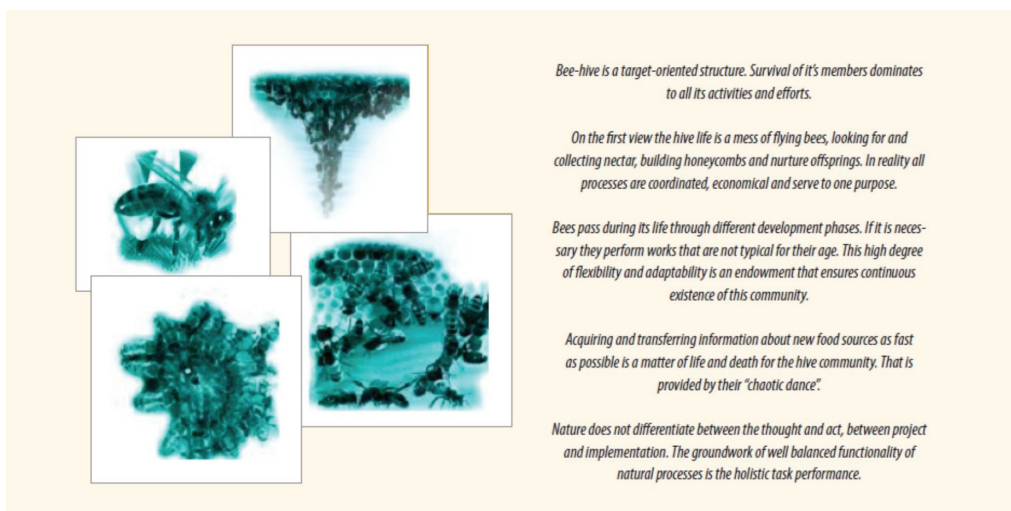


Fig. 4: *Bee-hive oriented structure.*

they reach these aims. This feature is called **self-organization**.

## TEAMS IN FRACTALS

Three types of teams are interconnected in fractals:

- **Production teams** are teams in production workplace and they follow the exactly defined part of production process. We will state their basic features below because they create the base and the first level of organization.
- **Managing teams** - these teams are created from process teams or from teams of change that worked on some of the projects described in previous parts. Working on projects of change or in process teams improves individual members at necessary abilities and also demonstrates their competency to manage different tasks at fractal managing teams. Managing teams are sometimes called business teams; that expresses their focus on "business" because they work with the business process team are responsible for the process outcome. These teams usually create an inter-level to the fractal organization because after creating fractals some of their members are moved to managing teams of individual fractals.

ness plan itself as a highly autonomous organizational unit.

## FRACTAL STRUCTURE

Fractal build-up procedure

Fractal organization enables evolution changes in the company that hold on following principles:

- **Change from inside with support from outside** - change focus is based on people and teams within the organization. Function of external specialists is mainly in training people and in public education work (what are fractals? Why is it necessary? Where does it already work?) In next phase the external specialists should work mainly on independent analysis, benchmarking and audits, process projects that require special instruments (e.g. simulation, segmentation, optimization of material flows, etc.) or by moderating workshops. The change from inside must be initialized by top management. However, not formally or without knowledge of problems. Top managers must know also the professional side of fractal organization operation in detail and must play the role of leaders of the change process. One of the first steps of building fractal organization is breaking the "walls" that are dividing people within company and that are holding them back to overcome the local view of their section and position at the expense of the common objective.
- **Orientation to constraints - (TOC - Theory of Constraints)** - every real system has at least one constraint that prevents it from reaching its objectives. Because the constraint limits system in reaching the objective the manager that wants to e.g. realize a higher profit must necessarily manage this constraint and company changes are focused on its elimination. In fact he has no choice - either he manages the constraint or the constraint manages him. To have the changes effective it is necessary to start from constraints that must be properly defined.
- **Progressive overcome of the resistance layers** - there are different resistance layers against the change that needs to be discovered and overcome. Overcoming them requires logic (instruments for problem solving) and the appropriate technique of communication. The resistance

layer cannot be overcome by force but arguments and reasoning. Force can repress and urge people to follow us with stiff upper lip but with arguments we attract active allies we can rely on.

- **Change progresses as a coordinated and controlled process** - many companies try to realize all necessary changes fast; thus there are running many actions at the same time - some of them are controlled as a project and some run chaotically. Management understands their meaning, supports them but loses outline and people that are involved in projects are missed somewhere else. The most skillful workers are usually "punished" by commitments in other actions and continuously work on their usual work duties as well. Output of one project or activity directly influences other consequential projects. All is related to capacity problems (insufficiency of time or people) and to financial problems too. Company must also produce and sell at the same time. Do you know this situation? It runs practically in every company. The difference is that good companies have control and worse companies are drown in chaos because they cannot handle this process. Besides rules of project teams and change project management it is necessary that managers emancipate from "operation" to stop removing consequences of problems but remove the problem causes for good and to be able to delegate part of their powers to their subordinates and thus gain time for the main mission - conception, improvement and change management.

## FRACTAL PROJECTS

On the picture there are shown basic levels of an organization that needs to be focused on at business changes towards the fractal organization. Traditional re-engineering approaches of production processes and continual improvements processes are focused usually on the lowest level - production process and material flows. Re-engineering of business process is more attentive to information and financial level. Nowadays, competition advantage or slowing in these three organization levels are measured in order of months. But competition advantage measured in years can be reached in next three levels; however these changes proceed much slower.



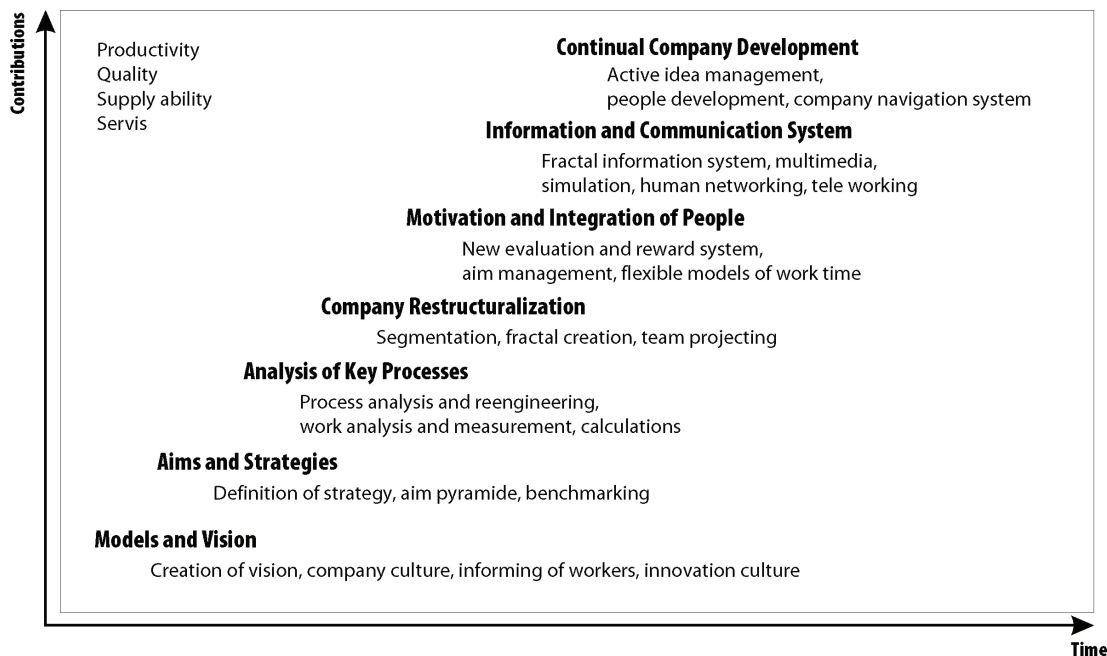


Fig. 5: Realization procedure of fractal company.

If we want to reach permanent positive changes at the three lowest levels they must be supported by changes in three upper levels - social-psychological realm, strategic realm and corporate culture realm. In these three levels the top concerns and world-class enterprises differ from average companies.

**Corporate culture** is a pattern of basic habits that were created in a group to solve problems of adjusting to its environment and to its inner integration. It is a set of rules, values and attitude of mind which are recognized and used by all at all organization levels. Corporate culture is the attitude towards everything that is done within the company, the reason why it is done (or not done) and the feeling coming from things that are done. Corporate culture must be measured and monitor its progress and develop it.

There is no "corporate culture guide" that could be used in every organization successfully because that is what distinguishes enterprises from each other. In corporate culture there is a piece of company history and tradition but it is also strongly influenced by present, management level, top-managers charisma, relationships that are branded by change of ownership in Slovakian conditions,

etc.

Desire to change must come from above - from top management. It is necessary to know answers for these three questions:

- What is the present state of an organization at all six levels?
- What has to be reached by application of the change in single time periods?
- How is the change going to be accomplished?

We can serve answering first two questions by audits and analysis. Answering the third question is a subject of change project where the change has to be prepared technically (segments, processes, workplace systematization, information and material flow) and organizationally (overcoming resistance layers against the change and change control).

Corporate culture change must lead to the fact that people will stop dividing them to those who think and decide and those who work and execute orders. Fractal company leads to relationships client-supplier, it is an organization of a "company within a company" where every worker becomes a

co-enterpriser and takes his part of responsibility, powers, success and failure.

**Strategy** must result from perfect understanding of company insight and its surroundings. Although we said that it is hard to define the long-term unchanging strategy on constantly changing markets - every company has to have instruments to analyze and strategically develop following areas:

- Markets, clients, competition.
- Finance, business processes, products.
- Knowledge, people, innovations.
- Organization and business processes.

As we noted before - the company strategy is closely linked with the third **level - social-psychological**. We already talked about how it is important to pull in people into the changes; so they become changes that were prepared by **THEM** and they were not imposed to them from outside.

Social-psychological level of the company is most important related to co-operation and communication where there are big margins in most companies. Communication must feature directness, respect and aim orientation with efforts to solve the problem and reach the "win-win" solution. Every compromise where both sides must step back from its positions is often only a postponement of the problem to future and it is a "lose-lose" solution.

There are three traditional levels - economic-financial, information flows and material flows and processes.

**Economic-financial level** connects and expresses financially results of the other five levels. It is essential that the company has not only traditional accounting which files economic management but it is also necessary to have an integrated system of indicators that enables to verify every company decision in advance by the three basic criterion:

1. Does the flow (value added in time) and profit increase?
2. Do the assets fixed in system (inventory) decrease?
3. Do the operating costs decrease?

**Information flow and management system** in fractal organization have systemization and functions different from the present information systems. Instead of "data cemetery" it is a network of decentralized managing workplaces for individual fractals that can communicate between each other and they select information from system as necessary. These systems include only such functions which are really needed by the manager, operate production with the aid of dynamic scheduling supported by simulation and the whole management principle positively crosses the border of traditional MRP and ERP systems.

**Material flow** copies base processes and at its projection there are used algorithms for segmentation which we describe in next section. Material flow is usually connected with one main axis (Spine Concept - backbone) whereon individual fractals are linked up. In companies plugged into extensive supplier chain (e.g. automotive industry) it is necessary to solve the material flow linked to suppliers that are usually connected directly to the assembly line.

Essential is to:

1. Create an environment and atmosphere for business behavior of autonomic teams.
2. Minimize number of hierarchic levels and complicated communication bonds among individual organization units.
3. Integrate all activities under one "roof" with common motivation system and common goals - substitute local aims of salesmen, production, logistics, technical preparation of production and maintenance for common goal - offer clients required products and services in required quality and time.
4. Delegate problem decisions and solutions to lower levels and create space for strategic management instead of solving operation problems.
5. Substitute bureaucracy, company e-mails and letters for direct open communication focused on problem solving and not focused on looking for an alibi.

Typical contributions of fractal organization:

- Overall order time shortening by 60 %

Table 1: *Other results achieved in fractal companies.*

	small electrical home appliances	automotive industry suppliers	electric devices	kitchen appliances
Inventory /Euro/	9 → 5 mil.	–	3 → 2,24 mil.	30 → 15 mil.
Running time	30 → 6 days	12 → 4 days	38 → 15 days	30 → 12 days
Productivity	+ 30 %	+ 20 %	+ 15 %	+ 30 %
Spoilage	–	7 → 2 %	–	–
Arrangement time	2,5 → 0,5 h.	2 → 0,25 h.	–	–

- Inventory decrease by 40 %
- Productivity increase by 30 - 40 %
- Expense reduction by 20 %

Other contributions:

- Flexibility and response
- People motivation and self-realization at work
- Quality increase
- Improvement in observance of terms
- Shortening of running time

## CONCLUSION

Successful application of this process was for example a project in a supplying company of automobile manufacturers. In this company there was created a new organizational structure based on independent teams. These teams had clearly defined

responsibilities for certain activities, quality, terms and expenses. Cooperation of individual teams was build on relationships client - supplier. This system reduced almost all vertical communication relations and created horizontal regulation circuits that increased the overall synchronization of production and service processes. One of the first steps was that the traditional production organization had transformed into object organization. It was necessary to prepare a number of training workshops for building teams and its involvement in the new organization. Gradually the new positive effects coming from use of people activity and initiative were displayed. Among quantitative results we can note that e.g. overall order proceeding time was shortened by 60 % and inventory was reduced by 40 %. Self-organization of individual fractals was demonstrated not only by improvement within the company. New forms of relationships among work groups caused also an improvement in smoothness of individual processes and positive results in production.