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Volatile Rationality of Industrial Organizations

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Abstract

The first step in the analysis and argumentation is the building of an analytical concept of rationality to be applied in the case study. The analytical work follows the distinction of actors, relations and processes as constructive axes of the paradigm of social interaction. The second step is the selection of the highly intriguing case of the volatile organizational rationality of the Nokia Corporation for subject matter of the analysis. Third, the research questions for guiding the efforts for precise descriptions, explanations and forecasting have been formulated. Fourth, the specifics of the actors influencing changes of Nokia's organizational rationality have been described and explained. Fifth, the relevance of the relational networks has been analysed as factor for organizational volatility of Nokia. Sixth, the numerous small- and medium range processes are presented as a major factor influencing the organizational rationality of the Corporation. Seventh, the fusion of the information about actors, relations and processes as factors of the volatility of Nokia's organizational rationality and interpretation of the changes of Nokia's rationality as part and parcel of the global trend of upgrading and degrading of the rationality of industrial organizations. .

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Introduction

Competition puts industrial organizations under permanent and often severe pressure. The typical reaction consists of efforts to improve the cognitive basis of the organizational decisions, to keep the activities under control and bring about efficient results of the activities. These parameters of survival and potential success characterize the *constructive rationality of organizations*. "Rationality" is understood here as the *capacity of organizations to base their decisions and actions on sound knowledge and to achieve creative adaptation to changing environments* [1]. Max Weber understood this the process as organizational rationalization [2]. The long national lists of companies' insolvencies make the relevance of this issue clear enough. A fluctuating but substantial percentage of industrial companies falls victim to deviations from patterns of rationality in decision-making and the implementation and evaluation of decisions.

Referring to this practical experience and the long tradition of studies on the topic [3-7], the rationality of industrial organizations is typically related to the quantitative and qualitative parameters of their decisions and implementation of decisions for tasks resolution. First, are the ends, means and processes considered by the decision-makers for task resolution efficiently adapted to the conditions of the organization? Second, are the parameters of ends, means and processes properly coordinated with the vision of the possible or desirable outcomes of the activities for task resolution? Third, what kind(s) of action (interaction) are going to take place and with what effects?

Under changing conditions, the decisions and actions of an industrial organization might turn to deviations towards irrationality. Spiegler [8] had good reasons to assume that *rationality in the problem-solving activities of industrial organizations is always bounded by circumstances which are potentially or manifestly accompanied by irrationalities.* Industrial organizations' rationality is tied to situational circumstances. This understanding of the limited rationality has fundamental implications for the theory and management of industrial organizations [9].

The market selection of industrial organizations is a painful and merciless process. Some organizations pass through it successfully due to their outstanding command of the principles and practices of organizational rationality. Negative selection because of deviations from these principles threatens the very existence of industrial companies, branches and territories in modern and post-modern

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societies. What are the factors bringing about constructive or destructive developments of organizational rationality in high-tech industrial organizations today? At the level of strategic analysis, the most important answer concerns organizational innovations. There are ongoing debates on the content and functioning of the very concept of innovation, and the diversity of views is great. A brief definition of the conceptual framework guiding the analysis and argumentation would be advisable. So, *innovation is organized change for the purposeful introduction of new structures, processes and practices meeting neglected, new or modified human needs* [1].

The major drivers of high-tech innovations are recognized needs and interests of individuals, groups or organizations. Some organizations have command over advanced knowledge and skills, while others might be at a much lower level of competence. The high level of rationality of the first type makes it attentive towards obtaining precise information about public needs and interests. The general tendency within these processes is clear. The rationalization of activities in R&D, production and commercialization leaves less and less social space for spontaneity in the building and reproduction of technological infrastructure and processes. Technological change increasingly keeps to the patterns of rationally organized and controlled innovations.

Interaction can be specified by the double contingency of actors' mutual orientations and mutual influencing with their respective "generalized other". The background of the approach is a vision of social interaction as the core of stability and change in social reality. The stress on the embeddedness of organizational rationality in the context of interactions supports an adequate understanding of the rationality or irrationality of the management in the organizations. The cognitive consistency and instrumental efficiency of the suggested concept should be testable in systematic descriptions and explanations [10]. Tidd and Bessant [11] convincingly emphasize the relevance of integrated tests measuring the efficiency of organizations' problem-solving. The guiding assumption of such studies is that organizational change takes its incentives from the interplay of organizations with their organizational environments.

Experts assume that organizations which are able to learn faster and possess richer informational and material resources tend to achieve better, or possibly optimal, results in their efforts for goal attainment [12]. Organizations with difficulties in learning and rely on smaller resources are expected to achieve sub-optimal results in their goal attainment. Organizational potential, processes and results can facilitate or constrain organization's rationality. The complexity of these issues related to social rationality and irrationality makes the task of conceptually differentiating and synergizing the sub-types of rationality and irrationality urgent but rather difficult [13].

These theoretical ideas will be tested here in a case study focused on the invention, development and fast commercialization of mobile phones by Nokia Corporation [14]. The story resembles a fable about the millennia-old human desire for long-distance communication using natural language. Approaching the end of the 20th century, the expectation rose that the time had come to make this option practically available for millions of consumers. It was technically and economically possible to turn desire into widespread practical need. Investment in the development of human capital was secured by specialized education and vocational training. Moreover, Nokia's local hero was the right man who appeared in the right place at the right time to resolve the problem, thus providing need satisfaction. Global economic life, the global technological division of labor, international political relations and global culture had to be managed using sophisticated information channels, including audio telecommunication. The management of increasingly complex tasks in everyday life also fostered an R&D focus on the technical means for resolving the task by means of audio telecommunication. The Finnish Nokia Corporation was one of the major actors dedicated to the resolution of this task after 1992.

That year became a historical turning point in the corporation's development. The exceptional manager Jorma Ollila took the position of Nokia CEO. His appointment fulfilled the factors promising the success of an industrial organization. Ollila was already known for his obsession with innovations, a drive firmly supported by the well-educated and trained personnel of a company possessing one hundred years of history, a strong sense of corporate identity and readiness to follow the Protestant ethic of responsibility in hard work. Last but not least, Nokia could rely on the organizational and legal support of the national state to promising Finnish companies. Though the corporation had a broad range of production lines, the R&D unit working on wireless communication had the most promising strategy for a technological breakthrough. In the beginning of the 1990s, the need for broad access to affordable wireless means of communication was both a public and private need in the advanced part of the world. It is striking to notice the broad range of technological innovations successfully carried out by a small industrial organization in a small country like Finland. The freedoms and responsibilities of discretion in the work seemed to be secured. The same applied to the mobilization of the industrial organization for the satisfaction of public needs. Thus, circumstances would catapult Nokia Corporation from its position as a local Finnish firm to one of the global leaders in telecommunications: after just a dozen years, Nokia occupied a large share of the global mobile phone market [15,16].

The rapid spread of mobile phones as a technological innovation triggered profound changes in social structures and processes, as well as patterns of thinking and behavior. All over the world, people received a tremendous boost of freedoms together with the unbelievable rise in their capacities for communication and connectedness. Communities and organizations received a revolutionary push towards the rationalization of information flows and their utilization [17].

The fast supply of the market with millions of mobile phones and, shortly thereafter, billions of smartphones per year intensified the acquisition, structuring and purposeful use of knowledge about technological options for need satisfaction and need management, both elements of upgrading the rationality of organizations. The effect was technologically provoked social rationalization. In praxis, it took the form of increasingly sophisticated technological innovations which were intensified by global competition. The organizational actors involved in the process tried to be maximally rational in their decision-making and implementation of decisions. This concerned companies, banks, governmental institutions, international organizations, etc.

How did this jump in Nokia's productivity, market success and organizational prestige become possible within such a short time? This is a great achievement, but the story is even

more intriguing. After the corporation's unbelievable success in conquering the global mobile phone market, a dramatic decline of its share in the same market followed. The former star of mobile phone research, development, production and marketing reached the brink of insolvency. Fusion was what saved the brand of Nokia. Now with shared ownership, the company is struggling to recover. The question immediately arises: What caused this destructive development to take place? Is there any promising way to reclaim its status as one of the leading actors in the global telecommunications market?

The answers are searched for here by using the paradigmatic concept of social interaction. The analysis and argumentations are organized around the concepts of social actors, relations and processes, which are key parameters of the paradigm of social interaction. The material reference of the theoretical discussion is the immense technological and social innovation of the introduction of mobile phones.

Challenges to Rationality of Industrial Organizations

Fluctuations in the rationality of the industrial organization Nokia are clearly identifiable alongside the periods of its rise, fall and struggle for recovery. The indicator for its rationality status is the organization's efficiency of need satisfaction for the public at large. Both experts and "lay" people involved in Nokia's functioning had their expectations about its organizational efficiency in coping with the challenges of its external and internal environments. But an irregular supply of production line electronic components is a clear indicator for rationality fluctuations in the functioning of an organization like Nokia.

The volatility of rationality in Nokia's case has strongly depended on the proper orientation of its activities against the changing supply–demand situation in which the company is involved. In practical terms, users in the nascent mobile phone markets were ready to absorb this new product since they understood the need to be satisfied. The analysts, designers, engineers and managers at Nokia Corporation managed to be among the first in the world to properly diagnose the changing balance of demand and supply — a precondition for any adequate, rationally guided innovation. Nokia's analysts developed a winning marketing strategy; the company's management applied it. At the first stage of marketing this technological innovation, the quantity and quality of consumers' need satisfaction had to be mostly determined by the supply side. Consumers had to learn the parameters of the new product. In the middle of the first decade of the new century, the initial wave of need satisfaction was over. Large quantities of handsets had been produced and supplied to the world's markets. The outcome was a new situation: the determination of technological innovations mostly by demand. The rising complexity of demands had to be managed by the rising number and variety of applications for more sophisticated and reliable smartphones. The gradual resolution of this task provoked intensive competition. Nokia tried to keep the pace in these socially determined developments but was no longer as successful as during the first stage of the introduction of cellphones for mass use.

The learning process on both sides of supply and demand continued. Nokia's analysts took a social vantage point and studied the social effects of the large and growing use of cellphones, among them the constructive upgrading of rationality for various social activities. In fact, the technological innovation of mobile phones brought about social innovations. This applied to their intensive use in industrial production and services, state administration, transport, households, etc.

The numerous constructive elements in the process notwithstanding, the administrative leadership of Nokia demonstrated strong social sensitivity, as well. This was obvious in the company's work with trade unions [18,19] and its concern about some destructive effects of the spread of mobile phones. This largely referred to the sharp decline of the social relevance of shipments by post and other postal services; instead, new chains of administration and services appeared. Important innovations took place in the thinking and behavior of individuals. In broad swaths around the globe, the activities of individuals are now rather difficult or practically impossible without the use of cellphones.

The upgrading of organizational rationality very much depends on developments which take place in the general context of social space and time. The explosion of inventions and technological breakthroughs in the area of telecommunications during the 1990s was not the result of accumulated knowledge and professional skills among researchers, engineers, technicians and workers alone. One specific determining factor of the historical situation was the enthusiasm and optimism owing to the disappearance of the division of the European continent during the Cold War. Full-fledged globalization was becoming reality. The remarkable period of the 1990s remains in the historical memory as marked by the introduction of the Internet and mobile phones. In just a few years, they became key elements of a plurality of social activities. There were changes full of organization and spontaneity, rationality and irrationality, successes and failures. All these characteristics of the socio-cultural situation facilitated the dynamics of technological and social innovations to come, as well as the cases of upgrading or degrading organizational rationality [20].

The upgrading of the rationality of organizations also depends on the general spirit in each cultural setting. The freedom, creativity and innovation widespread during the 1990s had a direct impact on the positive changes in organizational rationality. The result of this development was the emergence of a variety of innovations, with Finland as a special case. After the Second World War, the country had been an important supplier of industrial products to the Soviet Union. The collapse of the political and economic system of the USSR provoked a deep economic depression in the country. This was a powerful social incentive for Finnish researchers, engineers and workers to be inventive and eagerly look for technological innovations. Nokia's human capital was up to the challenge in terms of education, professional skills, knowledge about cutting-edge technology, a culture of cooperation in the division of labor, ambition for achievement, discipline, etc. [15]. The specific situation in Finland at the beginning of the 1990s required exactly these qualities. Nokia Corporation had enough promising potential to resolve urgent new tasks.

The crucial component for the emerging technological and social breakthroughs would be the ambitious manager Jorma Ollila. Taking charge of the company in 1992 and serving until 2006, he turned out to be the very much needed, talented manager who was able to bring about substantial upgrades in the rationality of the organization while fostering productivity of work. The end effect was improved quality in the mobile phones that were designed, produced and commercialized by Nokia.

The organizational improvements and the spirit of creativity inside and outside Nokia made its achievements in the field of telecommunications respectable. The company managed to design, produce and supply global markets with dozens of models of cellphones with hundreds of modifications. Moreover, it managed to supply world-leading products like the Nokia 1011 (1992), the first mass-produced GSM (2G) phone. This high-quality model sold very well and provided the resources needed for new rounds of inventions and innovations. The successful marketization of this phone model catapulted a hardly known local company into the circle of the most efficient and respected players in a highly competitive telecommunications market. The high level of acceptance of the Nokia 1011 by consumers immediately indicated that Nokia had achieved a technological breakthrough. A new industrial sector appeared, immensely increasing connectedness between people. The best-selling Nokia 3310 (2000) became symbolic of the company's best times between 1998 and 2008.

This was a time of great success for Nokia. By 2006, it had reached a 36% share of the global mobile phone market in about 150 countries and continued to increase its production and marketing. In only a handful of years, Nokia had become one of the most attractive faces of globalization. It was the standard example for best practices in human relations and particularly in the productive cooperation between its corporate administration and young employees who shared their. It seemed that Nokia had reached an optimal balance of controversial trends. The rationality of the company's decision-making and actions was stable and could ensure coping with all kinds of volatility in design, production and markets. At that time, hardly anybody could even imagine the looming sharp decline in Nokia's organizational rationality. The transformation of once-unstoppable Nokia to a loser in the international competition for smartphone commercialization became the subject of various discussions. Their major conclusion read that it was down to irrationalities in the management.

Nokia's share in the total turnover of smartphones declined continuously after 2008, reaching a miserable 1% in 2015. This rather unusual development has attracted the attention of numerous analysts. Some have tried to explain the process with the global financial and economic crisis of 2008–2009. Others have identified mistakes made by Nokia's governing bodies in its marketing strategy selection as the major cause for such rapid decline. Still others believe that the success of competitors like Samsung, Apple and Google was the major reason for Nokia's downward trajectory. All of them are right in their identification of the causes behind this negative process. They amounted to increasing deviations from the sound rationality of the company's best times. First of all, after the market entry of Apple's iPhone in 2007, Nokia's smartphone products were no longer competitive. The iPhone was based on the advanced platform of Android, while Nokia's platform was outdated, slower and less reliable. Efforts to develop its own platform came too late and were poorly organized and funded [21]. Obviously, Ollila's uniting strategy and disciplining power were missing. The legendary readiness of Nokia personnel to work hard in a highly organized manner was no longer as strong as it had been during the 1990s. Instead, complacency and disorganization predominated. Nokia Corporation's dramatic situation was largely due to those extraordinary efforts and achievements in the 1990s and early 2000s.

The decision to replace the outdated Symbian Operating System with the unreliable Windows OS was a wrong decision preventing the completion of Nokia's own platform. The Nokia Lumia 920 (2012) introduced a series of innovations, but the process of organizational decline had already gained strong momentum. Its destructive mechanisms repudiated more optimistic assessments of the situation, which was marked by signs of decline most visible in the dramatic reduction of Nokia's share on the global smartphone market [21]. The company's leaders "after Ollila" were disunited and waged "fierce internal competition 'between factions'" [21]. This development threatened to paralyze organizational structures, surprising shortsightedness among Nokia experts concerning the rapid changes in international competition. There are also explanations stressing the determining role of emotions: "Nokia lost the smartphone battle because divergent shared fears among the company's middle and top managers led to company-wide inertia that left it powerless to respond to Apple's game changing device" [22]. No doubt, all these determining factors had their impact on the spectacular decline of Nokia Corporation. It is certainly not advisable to approach multidimensional phenomena with one-dimensional explanations or action strategies.

The Corporation's efforts at recovery started with the breaking of its detrimental agreement with Windows and intensified with a decisive move towards the development of telecommunications networks. One major step in this direction was the acquisition of Alcatel-Lucent in 2016. In the same year, some recovery of the company's smartphone production also took place despite tremendous organizational difficulties. The smartphone production line had been given to Microsoft in the divorce process between the two companies. The periods of failure for phone models on the Windows platform and the separation of Microsoft and Nokia were rather dangerous developments threatening the very existence of Nokia as an autonomous organization. The complicated structure of its cooperation with HMD Global since 2014 seems to be efficient means of keeping Nokia alive as a producer of smartphones. How strong and efficient this cooperation could be in the future will depend on the circumstances.

A turn towards the design, production and maintenance of electronic networks as a matter of priority has taken place within the company in an effort to diversify its production lines and renovate the whole process of designing, producing and marketing software. Nokia developed a new strategic program when Pekka Lundmark took the position as Nokia's new CEO in 2020, promising heavy investments in research and development and announcing numerous job cuts in the near future. All these measures are timely and practically the only ones which could make Nokia's return to the top possible — by restoring the organization's strong constructive rationality. No illusions can be allowed, however. Lundmark has the difficult task of coping with heavy competition from Swedish Ericsson, Korean Samsung and Chinese Huawei [23]. The future of Nokia is still uncertain. It has great promise, but this remains without any measurable achievement. Nevertheless, the unique success of Nokia Corporation in making a breakthrough in technology and organization patterns is still an example of extraordinary achievement.

Upgrading and Decline of Actors' Rationality

The interaction of *social actors* is the major driving force of the upgrading or decline of the rationality of industrial organizations. Among the numerous *individual actors* who have

shaped the phenomenal success of Nokia and done their best to get the company out of trouble, the most outstanding was Jorma Ollila. The summary of his personal characteristics and deeds provides clues for understanding and explaining his strong Protestant sense of rationality. It also illuminates quite well the causes and reasons for changes in the cognitive and practical rationality of the collective actor called Nokia Corporation. The analysis and argumentation about these research fields are further guided by *status, power* and *prestige* indicators. The intended outcome is capturing specifics about the rise, fall and efforts for recovery of Nokia Corporation.

Between 1992 and 2006, Ollila had the *status of Nokia's CEO*. His imagination, strong will and managerial skills were crucial in this period for strategic decision-making and the implementation of corporate decisions. During these years, he was the ideologue and organizational leader catapulting Nokia Corporation from provincial Finnish company to respected global player in the highly competitive field of high-tech telecommunications. His organizational status was particularly high between 1999 and 2006, when he was simultaneously CEO and Chairman of the Board of Directors of the corporation. He remained Chairman of the Board until 2012 and directly experienced the bitter disappointment following the fast decline of Nokia's share in the global smartphone market. What made Ollila so efficient as Nokia's CEO? What went wrong in the wonderful coordination between individual and collective rationality in Ollila's time as CEO and Nokia's development thereafter?

Not much of Ollila's education or previous professional experience indicates his tremendous managerial potential. Before joining Nokia in 1985, he had worked as a financial manager. Unlike Bill Gates or Steve Jobs, he had no specific knowledge or skills related to working with electronic hardware or software. His first encounter with managing the production of electronics came after he took responsibility for the cellphones division in the Conglomerate of Nokia in 1990. In 1992, he took the *status* of Conglomerate CEO with an ambitious program for rationalizing Nokia's management. The first step in the implementation of this program was the establishment of a small group of well selected advisers. Besides the usual requirement for competence in a specific field, another criterium for selection was the variety of competences among potential advisers [24]. Initial advice from the group concerned the need for concentrating resources and attention on the most promising production line or lines. Cellphones were identified as the most promising product. Consequently, research was focused on strengthening this selected department. The results soon followed. Based on previously prepared models of wireless phones and new research results, the Nokia 1011 was ready to enter the market in 1992. The device went into mass use everywhere, bringing about revolutionary changes in communication habits and patterns. Its financial success was overwhelming, too. The Nokia miracle [24] had begun. The financial situation of the company stabilized, making possible investments in intensive R&D. The organizational model of these first steps made by the new CEO were repeated several times.

Given the complex challenges, Jorma Ollila and the company showed striking strategic flexibility and managerial skill in dealing with foreign companies and pursuing the interests of Nokia and Finland. This particularly applied to the organizational mergers and splinters carried out during Ollila's mandate as CEO. He was not afraid of the structural chaos accompanying such processes and managed to be on the winning side as a rule. One of the major reasons for this extraordinary success was his ability to mobilize followers and maintain their support. He describes Nokia's impressive story in his autobiography: "We knew how phones were designed, manufactured and marketed. Our machinery was supreme. Nokia's phones worked reliably in all countries, networks and conditions. Nokia's engineers were the best in the world. We had taken over all markets …" [24].

Jorma Ollila knew very well how to build his *power* and how to apply it. Some Nokia managers disliked his authoritarian interventions in collective decision-making. From time to time, his words could hurt. But few interpreted this rough style of communication as an abuse of power in a period of rapidly improving finances for the company and its personnel. One retrospective diagnosis of the situation at Nokia during the times of its flourishing puts it clearly: "Trust, loyalty, and commitment were the key values within Nokia under Ollila's leadership, while employees enjoyed a freedom and took responsibility" [25]. His activities brought about enormous *prestige* for him, for Nokia and for Finland. The huge contribution of Nokia to the national budget fascinated politicians and state administrators. They understood their support for the corporation as an honorary obligation in favor of the nation [26]. In addition, Nokia attracted the kind of international attention and respect that the small country otherwise would never have enjoyed. These developments strengthened the national identity and self-confidence of the Finnish people. They affected various structural levels and modalities of the revolution in global communications. This process started as a technological revolution with far-reaching impacts on the global division of labor. Meanwhile, global changes in the organization of production, distribution and consumption exerted their impact on the aims and means of technological development.

In his autobiography, Jorma Ollila occasionally refers to mistakes made during the period of his leadership as Nokia's CEO. In fact, the somewhat idyllic situation changed immediately after he left his executive position. The most relevant criticisms have claimed that the company had weakened R&D departments in 2006 and in subsequent years. Critical voices laid the blame on Ollila by arguing that he had left Nokia with no strategy for further corporate development. The discussion on this topic was intensified by the spread of information about a steady decline of Nokia's share in the global turnover of smartphones after 2008 [27]. Ollila cannot be separated from this development because he retained limited but real power to intervene in decision-making as Chairman of the Board. Criticisms focused on the company's delay in innovative activities at the beginning of the new millennium, the phenomenon of complacency, postponed reactions to looming technological and social changes, etc. [25]. Some mentioned the Ollila's aggressive temper and his confrontational managerial style [21].

Whatever the critical remarks and conclusions concerning the tenure of Jorma Ollila as Nokia's CEO, it was undoubtedly a perfect example of the decisive role managers have in the efforts of thousands of companies to bring global recognition for breakthroughs in their area of activities. Being left without the uniting power of Ollila's will and managerial skills, his successors sank the declining financial flows into several competing projects [21]. The end effect is common for organizations which have allowed themselves the luxury of internal, intellectual and organizational divisions and confrontations.

There was still another existentially important social and

economic issue that remained a dividing factor in Nokia's high-level management with destructive technological consequences. This concerned strategic preferences and the balance of investments. Due to economic considerations, Ollila's successors would opt for low-end products and smaller funding for R&D. As a result, Nokia's researchers and managers were surprised by Apple's invention and its very successful commercialization of the iPhone in 2007. The reasons for success were a touch screen, very attractive design and various applications. In the highly competitive environment, Nokia was increasingly losing positions.

It would be naïve to reduce the success and failure of a vast economic organization to the deeds of one individual. Even when that individual is Ollila, the organization is Nokia and the period after 1990 was marked by optimism. Between 2010 and 2014, the company was represented by Stephen Elop, who was the first non-Finnish Nokia CEO. He announced his diagnosis of the situation of Nokia Corporation by using a strong metaphor: the company was described as working on a burning oil platform in the rough North Sea.

After 2008, it became obvious that Nokia had lost the cutting edge in science and technology related to cellphones. Excessive growth after 1992 had pressed the company's management to choose between the rationality of financial growth and innovations. Different leaderships of the corporation regularly opted for the rationality of growth. This is the reason why its R&D departments only had access to rather limited resources.

Some negative consequences for Nokia's development had to do with the fact that talented researchers and designers were gathered in the town of Espoo. After 2003, these people were involved in introducing a matrix pattern of organization. This re-organization brought about organizational confusion. The researchers and designers no longer knew who was entitled to ask them for services and who would control their work. Some were so discouraged by this organizational disarray that they left the corporation. Others stayed there but were demotivated. No wonder that the collective actor Nokia could not manage the introduction of increasingly sophisticated smartphones.

In addition to the neglect of technological innovations, the dramatic decline of Nokia's commercial efficiency in 2012, 2013 and 2014 was influenced by social-psychological factors. Workers, technicians, engineers and managers used to overestimate the company's attractiveness for customers and investors. After the success of Apple's iPhone and Samsung's SGH series, this could not be valid anymore. The people at Nokia did trust the strong marketing strategy. But it was badly weakened after 2006. Last but not least, Nokia analysts could not foresee that people would prefer touch-screen phones rather than the traditional keypad. The manifest and latent resistance to innovations could not support Nokia's ambition for leadership.

In the meantime, Stephen Elop suggested a solution to the burning problems: Nokia would shift its cellphone production onto the Windows platform. This suggestion had been expected, since Elop had come from Microsoft to save Nokia [28]. For that purpose, a detailed Cooperation Agreement was signed by both companies. The Agreement was converted into praxis in the form of Nokia's Lumia production series. With little exception, the series was a failure: Lumia on Windows OS could not compete with the Samsung series on Android. The Agreement was dissolved with heavy losses on Nokia's side. Its separated partner Microsoft received Nokia's cellphone production division. The Windows experiment had taken valuable time. Other actors in the field — like Apple, Samsung, Blackberry, Huawei, TC and ZTE — took advantage of the situation. Nokia, once one of the major players in the field, seemed to have lost the battle. The reason was clear: Nokia did not have a strategic plan for coping with destructive organizational trends.

In that historical moment, the crucial issue was the absence of an efficient operating system for Nokia's cellphones. The Microsoft one was slow and unstable; Android was faster and more reliable but already occupied by competitors. The dilemma was obvious: Nokia lacked the conditionality to be successful in the competition for the most advanced smartphones. What was desirable was not possible, and what seemed to be possible was not desirable. Caught in this dilemma, Nokia was close to bankruptcy by 2013. But the trend was already moving towards the Corporation's re-integration after the splits and internal confrontations following the end of Ollila's reign.

The personal stories of Nokia's CEOs as well as those of thousands of Nokia's workers, technicians and engineers [21] are building blocks in the integral history of the *industrial organization* Nokia as a collective actor. Because of internal and external impacts, the organization went through ups and downs. Just before Jorma Ollila took the lead corporate position in 1992, Nokia was facing bankruptcy mostly due to the collapse of its Soviet market. After the company's unbelievable rise as a global player in the cellphone industry, another very real threat of total breakdown was facing the company. The all-encompassing reason for this destructive development was the decline of Nokia's capacities to continuously invent, design, produce and commercialize technological innovations.

During the first decade of the new millennium, Nokia was gradually losing its close grip on the cutting edge of technological development. The Corporation had pioneering achievements in the transition from simple cellular phones to smartphones but lost the competition in the development of sophisticated smartphone applications. A decade later, the agile Nokia of the 1990s had become much too self-confident and sluggish. At that time, Henry Tirri was the leading researcher at Nokia. He certainly believed that the loss of connection to the cutting edge of global innovations would be a death sentence for any company. However, he did not believe at all that this might apply to Nokia: "companies that cannot identify and exploit the best approaches to innovation in their business will fail… Nokia has learned this lesson well" [29].

Tirri was not alone in his over-optimistic judgement about the technological situation. Other leading researchers also underestimated the advantages of the Android platform that was actively being used by competitors. The worst mistake in the company's strategic decision-making had to be the selection of the Windows platform for Nokia's smartphone production. The competitiveness of Nokia smartphones declined. After careful analysis of the most advanced models of smartphones and new practices for their commercialization, Nokia experts started developing competitive models of efficient and attractive smartphones. This happened under the conditions of HMD's involvement in the process. Rumors about the death of the company seem to have been premature. The Nokia brand has maintained its market presence. However, two types of dynamic relations made the revival of the Nokia smartphone production a complicated task. The first type is represented by the threat of a forthcoming recession generally reduces demand. Second,

in more specific terms, declining demand doesn't affect all segments of the market for smartphones. In relation to the more expensive products of Apple and Samsung, the smartphones supplied by Nokia are focused on the lower segments of the market. The purchasing power of these segments was strongly affected by the COVID-19 pandemic. The same segments are also affected by expectations about a looming recession. The examples underline the relevance of the social environment for the companies' rationality and for the relevance of social relations.

Social Relations Shaping the Bounded Rationality

Technological innovations take place within networks of social relations depending on the innovation's content and context. The rational way of studying such complex phenomena includes the application of approaches for decomposing relations. The decomposition is carried out by using analytically defined types of relations. The pairs of relation types follow the analytical concept of social interaction [1].

Nevertheless, in some cases the complexity remains high due to the activities of actors who try to adapt to the changing conditions of their rationality.

Probably the easiest way to study and control changes in organizational rationality is the approach focusing on *internal* and *external* relations. The tentative borders of the innovations implemented by Nokia Corporation concern its activities in the fields of R&D, production and commercialization in order to meet the cellphone needs of individuals, companies and states worldwide. Mutual understanding and cooperation dominate the external relations of Nokia as innovator, on the one side, and the Finnish state, on the other. Nokia has had the status of a state-within-the-state for decades: "Finland has been a good domicile for Nokia. Since the end of the 1960s up until around 2013, the country has taken Nokia's interests into account in many ways, sometimes even at the expense of other companies" [26]. The company maintains constructive relations with more than one hundred governments and governmental institutions worldwide. In countries like China and India, Nokia has joint ventures for research, development, production and commercialization of cellphones. These ventures function on the basis of Finnish investments, equipment, know-how, production and local product commercialization. In this way, the Finnish technological revolution in telecommunications has been internationalized and transformed into part and parcel of the global technological revolution. It is also a channel for spreading the impact of the rationalized industrial management typical of the Finnish economy.

The worldwide technological revolution in telecommunications was accompanied and supported by the social revolution of mass cellphone use. This became possible via the global supply of cellphones and the revolutionizing consequences of a total move towards the use of mobile phones. They are financially affordable and have radically changed the style of telecommunications as well as the style of thinking about time and space, decision-making habits and key patterns of individual and collective behavior [30]. These profound changes had a feedback effect of fostering technological revolution. This happened via motivating people in the sectors of research and development, design and work organization to supply the markets with increasingly sophisticated smartphones. The best way to attract potential clients was the spread of information about Nokia's achievements in producing cellphones and applications with high economic return.

The interplay of internal and external factors has substantial impact on the balance of supply and demand in production-oriented industrial organizations. This is a central topic in the interaction between the actors representing internal structures and processes related to innovations and the external actors who are involved in the dynamic relations of economic cooperation and competition. There are plenty of examples of Nokia's competitive relations with other companies focused on the design, production and commercialization of smartphones. The company's rise to the position of a key player in the global cellphone market came about in fierce competition with companies like Motorola and Ericsson. The rapid decline of the global impact of Nokia in the years between 2008 and 2013 was largely due to harsh competition from the rising technological and economic giants Samsung, Huawei and Apple. In the first round, Nokia managed to win; in the second, the odds have been at least partly against the Finnish company.

Internal relations at Nokia Corporation itself have often been tension-ridden in the context of the interplay of individual and collective interests and reactions to change. Not all the potential CEOs of Nokia were satisfied in 1990 with the appointment of Ollila to this position. Not all heads of Nokia's departments in 1992 readily agreed with the selection of the cellphone department as most promising and deserving particular support. Ollila's habits and rough style of argument and behavior were not palatable to everyone. The tensions and conflicts, either on principle or an interpersonal basis, intensified after he left the position of CEO in 2006. These tensions and conflicts would undermine the integrity and efficiency of the corporation's management.

The most dramatic case of declining managerial efficiency was the heated debate and uncertain actions concerning the outdated Symbian Operating System after 2006. Some Nokia experts argued that investments were very much needed for the further development of Symbian; yet the project had to be dropped after news broke about the faster and more reliable Android OS. Thus, decisions were made to develop two entirely new operating systems, resulting in large investments being planned to implement them. This uncertainty caused a rapid decline of market interest in Nokia's smartphones that were released after 2008. It was perfectly clear in 2013 that the Agreement |for cooperation between Nokia and Microsoft to use Windows OS had been a mistake [23].

Another important conceptual couple in innovation concerns *coordination* and *subordination*. The Nokia's strategic concentration on the production and commercialization of cellphones had immediate impacts on the relations of *coordination* and *sub-ordination.* At that time, Nokia had a classical vertical organizational structure; such structures usually put handicaps on innovations. Under the conditions of diversified production, a vertical structure of sub-ordination proves increasingly inefficient. Hopes for rising competitiveness are most often linked to changes in organizational structures. In the course of Ollila's reforms, efforts were invested to transform the company's vertical structures of subordination into a matrix-type structure of coordination. It is well known that the reorganization of production and services towards matrix patterns might bring about higher productivity but also disarray. Experts' opinions that disorganization is more important predominate.

The relationships between *cooperation* and *conflict* have had a complicated and highly intriguing history in the beginning, rise, fall and efforts at recovery of the cellphone giant Nokia. This history includes mergers with other companies in order to strengthen Finland's R&D, production lines or design of innovative products and their commercialization on domestic and international markets. Yet shared funding for closely related innovations is still a new phenomenon in conceptual and practical terms. In most cases, the specification of cooperation and conflict concerns the relationship between the organization-innovator and its environment. When more details are considered, the topic becomes truly multidimensional. The consolidation of Nokia's researchers, designers, engineers and managers under Ollila took years. Even under the conditions of his unquestionable leadership up to 2006, there were still individuals and groups that held different ideas about strategy and tactics. In the meantime, Nokia's strategic priorities changed substantially [31]. The Strategy of 2021 defines shifting priorities in favor of "critical networks", since "networks will play an increasingly important role for both society and the economy. They enable more and more mission-critical functions for both consumers and businesses" [32]. This turn to critical networks is ideologically sound. The harsh result is that Nokia managed to produce and sell only 55 million smartphones in 2020 [33]. This is the evidence that Nokia Corporation so far has been losing the battle for the global smartphone market.

Upgrading and Degrading Rationality in Innovations

The following analysis and argumentation provide the evidence that fluctuations in the rationality of industrial organizations might be best studied by focusing on situations in the problem-solving activity. In the case of the mobile phones produced and marketed by Nokia Corporation, the approach concerns the production cycle of each new model. Part of activities are always repeated. They cover the interplay of the organization under scrutiny with its external and internal environments. This interplay concerns the *systemic* rationality of Nokia Corporation as an organization and the *sub-systemic* rationalities of the company's departments. Both the organization as a systemic whole and its sub-systems are able to learn, act, interact and change in a relatively autonomous way [34].

The next situation in the problem-solving activity concerns the double-sided coordination of the activities of Nokia Corporation as a collective actor consisting of sub-systems and individual actors. These individuals occupy various organizational positions and implement specific roles in the organization. The interaction between individual and collective actors in the corporation's problem-solving activity has been marked by commonalities and differences. Most often they are due to similarities and differences of *collective* vs. *individual* rationality [35]. The rationality of individuals could support and strengthen or contradict and undermine the organization's collective rationality. In his "theory Y", Douglas McGregor presents the integration of individual and collective goals as a task to be resolved by efforts towards upgrading the aggregated efficiency of organizations. In the context of Nokia, the bearers of individual rationality are thousands of workers, technicians, engineers, managers and support personnel. The bearers of collective rationality are formal and informal organizations at various structural levels, from the shop floor up to national or supranational organizations.

The problem-solving activity is marked by one more dimension of rationality and irrationality. The decision to delve into problem-solving, the implementation of decisions to act and the analysis of attained results might vary greatly in terms of timing. Action is guided and evaluated by two different types of rationality — the *short-term* and *long-term* rationality of action [36]. The irrationalities accompanying each type of rationality are implicitly present as factors of the 'hidden organizational agenda'. The analysis identifies a variety of examples of Nokia's rational orientation, decision-making and action, as well as deviations from rationality in specific contexts and with varying intensity.

It is trivial to remember that the history of every economic organization is unique. However, the history of Nokia after 1992 goes beyond the triviality of uniqueness. The company came out of nowhere to join a tiny group of global giants in the telecommunications industry over only a few years. This tremendous achievement was thanks to the efforts of thousands of Nokia collaborators at various positions in the company. Nevertheless, it would be correct to stress the special relevance of Jorma Ollila's achievements. Like all CEOs of big economic organizations, Ollila was well aware of two interconnected rules. The first one is a strategic imperative: the organization has to innovate or it will die. The second rule refers to the tactical problems facing organizational innovations: "Big organizations are reluctant to innovate and are full of barriers; people do not want to change" [37].

The upward and downward trajectories in the development of Nokia Corporation are confusing in many respects. There is no other example of such a speedy and efficient rise in the industry. As seen from the opposite point of view, no other global telecommunications company has ever had such a dramatic decline like Nokia's between 2008 and 2013. Both processes are two sides of one and the same coin. It is the volatility of the deep contours of macrosocial processes and the interconnected processes of changing rationality of organizations.

A closer look at the dynamic phenomena beyond these contours brings a plurality of events into focus. Approaching Nokia's rise and fall from the point of view of its adaptation to global trends is basically correct. But it is insufficient to fully explain the corporation's complicated development. One major stumbling block is the composition of macro-social processes at societal, macro-regional and global level by many small-scale processes. The contours of innovations are only tentative borders of the processes within.

Various cases of organized change are marked by commonalities; all real innovations roughly follow a path from invention to the decision for implementation and ending in routinization. The stages along this path are marked by a series of intellectual and institutional processes. Among them, *differentiation* and *integration* are decisive in most cases. The trajectory of Nokia has been marked by organizational divisions, isolation, confrontations and other forms of differentiation. These typically result in efforts to re-establish economic, political and cultural balances. In Nokia's history, turbulences have usually started with failed or insufficient integration, followed by attempts at integration overcoming the accumulated tensions and conflicts.

The innovation cycles at Nokia have included periods of relative stability and change. These periods are marked by the fundamental difference between *development* and *functioning*. Both are very important in the intellectual

preparation and guiding of innovation, as well as in the varieties of its institutionalization and routinization. The process of development is the very essence of innovations which are defined by qualitative changes in the affected technological and social systems. Most innovations experience interrupted shorter or longer periods of relatively stable internal and external exchanges of matter, energy and information.

Both generalized patterns of processes taking place in all innovations can be exemplified by specific processes accompanying the changing trajectory of Nokia's development after 1992. Emotionally laden processes of building and practicing solidarity, mutual support and respect, enthusiasm and creativity accompanied the corporation's spectacular rise to global power in the design, production and commercialization of cellphones [18]. There are numerous indications that the same period was not free from various forms of harassment, disappointment and denigration of employees [38]. But the façade was perfect in terms of rising productivity and incomes, functioning human relations and environmental, economic, political and cultural sustainability. This type of collective happiness cannot last long due to competition and because employees grow tired of success as routine. The accumulated tensions and conflicts bubbled to the surface of public debates at the turn of the century. Due to the lasting feeling of Nokia's commercial success, the outbreak of suppressed negative emotions had to wait for the global financial and economic crisis of 2008–2009. What followed was a double-sided destructive development. The disappointment of technological and social processes seemed to be unmanageable. This impression of helplessness became a force paralyzing the will of researchers, managers and other employees alike [39]. In 2013, Nokia was deeply involved in a financial, organizational and moral crisis that had brought about and maintained a deficit of trust. Company morale was in ruins.

The major innovator in this new context was Nokia's Board of Directors, as it initiated the purchase of the production-oriented company Alcatel-Lucent. The economic effect was immediate. The need for dynamic and critical networks could be partly satisfied. Profits were invested in R&D initiatives as well as strengthening organizational integrity. In parallel with this, efforts to re-establish trust in the organization and in its actors also garnered some results. Cultural integration comes about more slowly as a rule [40]. The outcome of the stabilization and renovation of Nokia's organizational and value-normative integration after the divorce from Microsoft in 2016 has been positive [41]. Some analysts even envision a bright future for Nokia Corporation [42]. In fact, at least on the surface, there are indications that the disrupted balance between individual and collective interests is being righted. After a period of uncertainty, it seems that the *ultimate ends* of individual and collective action in the context of Nokia are more convincingly defined. There is also relative clarity about achieving the newly defined ultimate values with corresponding *instrumental ends.* Balancing *ultimate* and *instrumental* rationality is a task whose resolution tangibly influences the outcomes of the problem-solving activity. Following the assumption of bounded rationality, one may expect that there are always opportunities for deviations from both ultimate and instrumental rationality towards irrationality.

The recent evaluations of the achievements and potentials of Nokia phones are encouraging. The brand still has the power of attraction due to the prestige of its phones during the early days of mobile telecommunication. The current Nokia smartphones are very well equipped with a fast, flexible and reliable Android operating system and high-quality Zeiss lenses. Despite this relatively belated return to the smartphones market, a wide array of new models with numerous specifications are being produced. The new Nokia managers try to keep to the rules of the old Nokia generation by offering products at affordable prices [43]. These parameters promise a stable niche in the highly competitive market dominated by giants like Samsung and Apple.

Conclusion

Business people, politicians and citizens are witnessing the difficult rebirth of production lines for Nokia smartphones. The major conclusion concerns the approach to innovations in the context of efforts to balance ultimate and instrumental values of Nokia Corporation. Such efforts only exceptionally come about in isolation. The rule is different: in the case of Nokia, the vast majority of innovations have appeared in the context of innovations and should be conceptually grasped and practically managed as hybrid phenomena. That is why the conceptual framework applied in the descriptions, explanations and prognostications of innovations should be differentiated and integrated in order to cope with the complexities characterizing each innovation.

The typical multiplicity of innovations is exemplified by the interplay of two innovations which are very characteristic to the dynamics of contemporary societies: First, the technological innovation of design, production and commercialization of a new means of telecommunication (cellphones). Second, the accompanying social innovation within institutions alongside changes in personal habits, thinking and behavior in the context of the spread of mobile device use. Though intriguing, the phenomenon of these innovations' mutual impact has only been mentioned in passing many times but hardly ever carried out in serious studies. The results of the present study are relevant in scientific and practical terms, since they have been attained via the systematic application of an elaborated concept of social interaction. The key constructive elements of this concept of social interaction — being composed of the analytical concepts of actors, relations and processes — have efficiently guided the analysis and argumentation. The contribution of the present study is an elaboration on the theoretical vision of social actors, relations and processes. This approach is in full correspondence with the way Nokia's teams have dealt with problems: "…it is vital to embrace change and adapt to the future, even when it requires a thorough transformation" [16].

The transparently obtained cognitive results might be regarded as building blocks for self-understanding among contemporary modern and post-modern societies. As seen from another vantage point, the cognitive results obtained in this innovative way offer key parameters regarding efforts for the successful management of hybrid technological and social innovations. The applied differentiated concept of social interaction is an efficient guide for strategic visions in the study and successful management of innovations.

Biographical note

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