

The impact of COVID-19 on bounded rationality, understood in the tradition of H.A. Simon

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ABSTRACT: This research paper is an analysis, based on grounded theory, to prove the hypothesis: COVID-19 can lead to a shift from rational to bounded rational decision-making. The first step is an economic-philosophical literature research, to gain an understanding of the behavior of the "decision-making process" of people in the Corona crisis and the influence of leadership and artificial intelligence (A.I.) on this behavior. Based on this knowledge further literature research is done in the field of bounded rationality, understood in the tradition of the Nobel laureate H.A. Simon. The result supports the hypothesis and a shift from rational decision-making to bounded rationality, as well as an increase of bounded rational decisions, influenced by the COVID-19 crisis. A possible application of the results of this paper can be appropriate leadership methods and the implementation of artificial intelligence for the decision-making process.

Keywords: leadership, Corona crisis, employee behavior, Automotive Industry

JEL classification: I15, F60, F61, H12, I12

I. INTRODUCTION

In a decision-making process, behavior is "rational" when the chosen action brings the greatest benefit to the decision-maker. In economics, rationality is often used as an assumption to explain behavior in economics and/or provides the basis for simplifying models. However, unlimited rationality also requires unlimited cognitive abilities (to perceive and process environmental signals), so this assumption can only be of a purely theoretical nature, i.e. rationality is limited or bounded (Selten, 1999).

The term "bounded rationality" was introduced by the American scientist Herbert A. Simon (1959) for a specific practice of decision-making. The researcher described that the theory of fully rational behavior quickly reaches its limits in relation to reality. In order to predict human behavior in a constantly changing environment, one must not only determine its goals, but also how the decision maker adapts the behavior to the changing environment. Research results clearly showed that people behave rationally in simple situations, but with increasing complexity of the decision-making process, they mostly resort to heuristics. Rational behavior assumes that companies strive to maximize profits, but this is not always a priority and clearly recognizable, often a "satisfactory" profit is already sufficient to consider the goal as fulfilled. For this contribution to the modern business economics, Simon won the Nobel memorial prize in economic science in 1978 and other prizes in computer science in the area of artificial intelligence.

Related to Simon's work about bounded or non-rational behavior, the COVID-19 crisis is exactly such a "complex situation" in people's social environment for making bounded decisions. In their book "Psychology in Times of Crisis", Erich Kirchler, Julia Pitters and Barbara Kastlunger (2020) carried out scientific research with an economic psychological analysis in order to analyze how the crisis affects people's social environment and to find ways to deal with this situation and the immediate social environment to consider the reaction and the consequences.

The analyses by Kirchler, Pitters and Kastlunger and the connection to leadership and A.I. outlined in the author's previous publication is an important part. Moreover, it is the basis for this paper, continuing Simon's research to analyze the impact of the COVID-19 crisis on the behavior of the decision-making process and to find possible solutions to minimize that impact.

II. THE IMPACT OF COVID-19 ON THE DECISION-MAKING PROCESS

At the beginning of the COVID-19 crisis at the end of 2019, there was little significance for Europe when infections and disorder were largely reported from China. The scenario is similar to how previous crises, such as the refugee crisis, are assessed: As long as the refugee tragedies do not occur at our own borders, they are only seen in a peripheral way. As soon as there are examples "inside one's own ranks," the risk is rated as unreasonably high. As this happened and the disease reached Europe, the virus overshadowed all other media topics, establishing itself as especially dangerous in our brains.

During this time, it was all about exchanging thoughts and regularly following media, both serious and less serious, to gain an idea and to learn about the virus and its consequences.

People were looking for facts and they were completely addicted to it. Government leaders had a crucial role in the development of metaphors, speaking of an "invisible evil" or "Easter, of death and resurrection." People attempted to develop a "social representation" - formulations based on truths and fakes, experimentally proven data and speculative conspiracy theories - about the phenomena in order to be able to act, prepare, and protect ourselves as a consequence. On the one hand, information availability is determined by how dangerous sources of hazard are assessed and effective judgments are made. The perceived distance from an event, on the other hand, is frequently a deciding factor. The more closely an event is seen (temporally or geographically), the more significant it is deemed. People rely on decision-making aids, sometimes known as "decision heuristics," to keep the unpredictability of tasks, especially crisis-related modifications, under control so that they can make decisions and act. Decision heuristics are mental shortcuts that help people to make rapid judgments based on compelling and relevant evidence. (Kirchler, Pitters and Kastlunger, 2020, p. 11).

Nobel laureate Simon published the book "Administrative Behavior" first time in 1947 and made an update with the 4th edition for the 50th anniversary in 1997 with commentaries on current interest and concerns, created by the rapidly changing VUCA world (volatility, uncertainty, complexity and ambiguity). During these 50 years, also the study of human thinking has been developed and researched with much more solid results, which is the reason the author of this current paper took that edition by Simon as the basis of his research.

Going into detail about the title of the book, administration is explained as the way of getting things done. A general theory of administration must include principles of organization that will ensure correct decision-making just as it must include principles that will ensure effective action. Simon compares this to a major, who probably has more influence on the outcome of a war than an individual soldier, although it is the soldier who is at the front fighting in the battle. It is the non-operative employees of an organization who influence the decisions of the operatives in the lowest hierarchies through their decisions, for example by positioning the various regiments and soldiers in the battle and assigning specific tasks and goals to them (Simon, 1997).

2.1. Choice and behavior

Every conscious or unconscious behavior or better "choice" influences the end result - the goal. This choice can very often be a reflex action. E.g. a typist presses a key on the computer because a reflex is established between the letter in a summary and a particular key. It can also be the result of a very complex chain of activities. E.g. a decision of an architect, based on an analysis, to use an additional bridge pier (Simon, 1997).

According to Kirchler, Pitters and Kastlunger (2020) in figure 1 below in the left column, the COVID-19 crisis is changing people's behavior in such a way that many decisions are no longer made in a rational and planned manner, but out of reflex. A good example are the panic purchases in supermarkets of seemingly not logical products such as toilet paper. Another example is the very quickly adapted behavior to fight the virus by measures such as keeping distance, wearing masks or regular hand washing. The authors verify this on the basis of adaptation strategy and coping strategy.

Table 1. Influence of leadership and A.I. on people's behavior in the COVID-19 crisis

Crisis behavior	Leadership impact	Artificial intelligence impact
Communication	de Vries, Bakker-Pieper and Oostenveld, 2009 Ebner, 2020 Harrison and Mühlberg, 2014	THOR project Kejriwal, 2019
Decision making	de Vries, Bakker-Pieper and Oostenveld, 2009 Drucker, 1967 Ebner, 2020 Harrison and Mühlberg, 2014 Kayode, Mojeed and Fatai, 2014	Kayode, Mojeed and Fatai, 2014 Rabova, Konecny and Matiasova, 2005 Duan, Edwards and Dwivedi, 2019
Social habits	Grant and Hoffman, 2011 Kotter, 1997	Phelps and Cooper, 2020

Adaptation strategy	Blickhan, 2015 Ebner, 2020 Grant and Hoffman, 2011 Kotter, 1997	Stahl et al., 2021
Coping strategy	Blickhan, 2015 Ebner, 2020 Fook and Sidhu, 2010	Fook and Sidhu, 2010 Tian, 2020
Virtual work	Ebner, 2020 Thomas, 2014 Harrison and Mühlberg, 2014	Susskind, 2018 Kejriwal, 2019 Hurst, 2020 Tunyaplin, Lunce and Maniam, 1998
Fairness	Blickhan, 2015 Ebner, 2020 Khaola and Oni, 2020	Hughes et al., 2019 Chen et al., 2020

Source: Solderits (2022)

This behavior supports the hypothesis that COVID-19 can lead to a shift from rational to bounded rational decision-making. To discover the reason for this change from rational to not rational decision, the author of this paper refers to J.P. Kotter and his 8-step plan, in which the implementation of each change begins with "create a sense of urgency" - this urgency was created by the global Corona virus!

2.2. Fact and value

A great deal of behavior, particularly the behavior of individuals within administrative organizations, is goal - oriented. This can be to the extent that decisions lead to the selection of ultimate goals which are called "value judgments" or to the extent that they concern the implementation of such goals which are called "factual judgments". For most people, economic gain is not usually an end in itself, but a means to achieving more end goals: safety, comfort, and prestige (Simon, 1997).

Exactly these values, especially "safety". Changed drastically with the beginning of the Corona virus because suddenly nobody was safe from the virus anymore. On the contrary, reports in the media regularly reported how many people died - weekly at first, but then there were so many that there were daily charts of deaths to be seen. Of course, the virus also limits comfort - not only the measures introduced by governments such as wearing masks, keeping distance and washing your hands regularly, but also a ban on going out, early barring times and short work regulations restricted us enormously (Kirchler, Pitters and Kastlunger, 2020).

Thus, Simon's behavior of "value and fact in decision" is clearly influenced by the COVID-19 crisis - the hypothesis is supported.

2.3. The hierarchy

Simon's concept of expediency is based on the idea of a decision hierarchy. Each level in the hierarchy is based on the implementation of the goals set at the level above. The behavior is, thus, "purpose-oriented" since it is guided by goals or target specifications which are conducive to the achievement of the goals set at the level above. Government employees, for example, are simultaneously focused on several goals, the implementation of government-mandated activities within the established budget (Simon, 1997).

As already described in the previous chapter and referenced by Kirchler, Pitters and Kastlunger (2020), no other topic was covered in the media from the time the Corona crisis began. All economic areas, from macro level (governments and institutions) to meso level (group and company constitution), to micro level (families and individuals) were and are still affected by the COVID-19 pandemic.

The focus of the goals was suddenly adapted at all levels and geared towards combating the crisis. In addition to this realignment, the process of the "hierarchy of decision" is no longer guaranteed across all levels, since individuals no longer saw the goals from above as the first priority and changed or mixed them up with personal goals, influenced by the pandemic.

On top of these problems, government regulations such as short-time work and mobile work were added in a very short time, which also caused communication to suffer enormously - scientifically proven by the publications in table1 by de Vries, Bakker-Pieper and Oostenveld (2009), Ebner (2020) and Harrison and Mühlberg (2014).

As a result, decisions are no longer made rationally, but are driven by the effects of the crisis described above and the resulting behavior - the hypothesis is supported.

2.4. The relative element

Every decision is a question of possible alternatives and the resulting compromise of goal achievement - the best decision among the available alternatives. These alternatives, and thus the achievement of the purpose, are restricted by the overall environmental situation (Simon, 1997).

There is no question that these alternatives will be severely restricted by the outbreak of the Corona Pandemic. Kirchler, Pitters and Kastlunger (2020) describe these limitations based on seven behaviors, shown in figure 1. The COVID-19 crisis is shifting priority as well as enormously restricting the possible alternatives of the relative element in the decision-making process, the hypothesis is supported.

2.5. Modes of organizational influence

Decisions made in the upper levels of the organizational hierarchy have no impact on the activities of the operational staff if they are not communicated down. Simon distinguishes between two categories. First, the attitude of the operational employee himself - taking ownership – second, when the decisions are made elsewhere and imposed on the worker, which is common in factories on the assembly line (Simon, 1997).

In this area, the influence of the COVID-19 pandemic is very clearly visible and is documented in figure 1 in the "communication" area with scientific references from de Vries, Bakker-Pieper and Oostenveld (2009), Ebner (2020) and Harrison and Mühlberg (2014), which supports the hypothesis.

III. The influence of leadership and A.I. on people's behavior in the COVID-19 crisis

The author of this article has already discussed the influences of leadership and A.I. in the previous articles "Leadership influence on employee's behavior in the automotive industry in the Corona crisis" (2021) and "The impact of artificial intelligence on leadership in the corona crisis" (2022). Both papers refer to the social behaviors in the COVID-19 crisis by Kirchler, Pitters and Kastlunger (2020), visualized on the left in Table 1 above, the leadership effect in the middle and the effect for artificial intelligence on the right.

In this chapter, the respective areas of figure 1 "leadership" and "artificial intelligence" are discussed in detail again in order to be able to offer possible ideas for solutions for further research papers.

3.1. The influence of leadership

The mental problem of visualizing an event and its progression is typically connected to the heuristic judgment. Most people imagine the initial folds and a height of a few centimeters when asked how huge a piece of paper would be if it were folded 42 times. The minds are likewise overwhelmed by the term "exponential growth." It is, in fact, an exponential function, and with the 42-fold, the folded paper will have already reached the moon.

In the book "The effective executive" Drucker (1967) presents two case studies from US companies in decision making - from Theodore Veil in the company Bell Telephone and Alfred P. Sloan, responsible for the world's largest plant. Both followed Drucker's strategy (Drucker, 1967, pp.137-156):

- Is this a common occurrence or an unusual circumstance? The general must be addressed by a rule or principle, but the exceptional can only be dealt with as it is
- What are the desired outcomes of the decision? Establish the minimal objectives as well as the circumstances that must be met
- It's better to start with what's right than what's acceptable, since in the end, you'll have to compromise
- Acting after making a choice
- The decision must include feedback to allow for continual testing of the expectations that underpin the decision versus actual occurrences

In both cases of the mental imagination of a paper folded 42 times, as well as the case studies of Drucker, the decision maker can get out of the situation to make a decision in a "critical situation" following logical steps.

A transparent flow of information is priority 1 in a crisis so that it is avoided from the outset, so that people do not figure out the unimaginable themselves and decisions are made using heuristics or based on assumptions instead of facts. This transparency of communication is the responsibility of managers and leaders – especially important in a crisis!

The paper from paper Kayode, Mojeed and Fatai (2014) introduces how substantial decision-making and leadership styles relate to each other. They conducted qualitative research with semi structured interviews to generate data from the participants from the University of Malaysia on both leadership styles and decision-making.

The findings of the study show that leadership and decision-making greatly relate and influence each other and that every decision to be made goes with a particular leadership approach.

3.2. The influence of artificial intelligence

Information systems (IS) are software modules for decision support and are, therefore, considered a very important factor for competitiveness and business success. This is where A.I. comes into play, cause decision making is the big advantage, more than that, the supreme discipline of A.I.

Research from the Mendel University of Agriculture and Forestry in Brno, is based on the targeted implementation of modules to support decision-making processes through the use of artificial intelligence methods. The article mentions the possibility of choosing an artificial intelligence tool to support decision-making processes related to the conditions and information available for creating variant solutions. The basis for

choosing a tool is the method of finding a solution. Using the exact method, then considering the possibility of logical programming. In the opposite case, the choice of tools is based on the representation of knowledge (rules, vague rules, solution patterns), the need to prove the solution, the possibility of self-learning. The volume of internal and external databases is growing rapidly and the problem is how to use the data they contain. The problem of creating applications to support decision-making processes with modern methods in the field of A.I. was solved by the Institute of Computer Science as part of the research task no. MSM 6215648904 and presented at international conferences and publications in scientific journals such as *Agricultural Economics* or *Acta Universitatis Agriculturae* (Rabova, Konecny and Matiasova, 2005, p.388).

Many specialists will say their solution needs the ability to judge. This is said to be impossible for a computer, however powerful, but it is probably the wrong way to ask "Can a computer judge?" Instead Susskind (2018) brought up the question in the IEDC Annual Presidents' Forum: "Why do people require experts' advice?" Uncertainty is the solution. People get confused when the facts are obscure due to confusing information. They require professional judgment based on experience to make sense of uncertainty.

So the actual issue is not whether a computer can judge, but whether it can cope with ambiguity better than a human. In many circumstances, the answer is "Yes". That is what these devices excel at. A.I. can process significantly more data than humans and make sense of it.

As an example, a computer can assess a snapshot of a freckle as precisely as top dermatologists. How does it work? It does not attempt to think like a human doctor. It knows nothing about medicine. Instead, it uses a library of over 130,000 pictures and a pattern recognition algorithm to compare them to the target image. This is a study of more instances than any human doctor could ever handle. Even if a human doctor cannot describe how a patient is diagnosed, a computer can do it (Susskind, 2018).

IV. Result and interpretation

Based on Simon's book "Administrative behavior" the following decision-making areas were identified and analyzed in detail in this paper:

- Choice and behavior
- Fact and value
- The hierarchy
- The relative element
- Modes of organizational influence

As a result of the COVID-19 pandemic, decisions in the areas listed above are not made rationally anymore, but driven by the effects of the crisis and the resulting behavior in crisis-mode – the hypothesis is supported.

On top, it is clear that the COVID-19 crisis is shifting priority as well as enormously restricting the possible alternatives - the relative element - in the decision-making process.

The following two important chapters from Simon's research, beneficial to the decision-making process in the COVID-19 crisis, should be highlighted as follows:

4.1. Coordination and expertise

Decisions in simple situations can be made quickly and easily by individuals. However, as soon as the situations become more complex, a single person very quickly reaches their limits and processes become necessary to involve several people or groups and departments of a company in the decision-making process - so-called administrative processes. The point of involving several groups lies in the allocation of specialized skills to individuals or groups with those skills (Simon, 1997).

All governments of the world were taken by surprise and completely thrown off track by the virus. It was virtually impossible for individuals to make decisions about how to fight the virus, so specialists from around the world were consulted. However, the virus, which has never been seen before, is difficult to assess even for specialists and its consequences are unpredictable. Even now, after two years of the pandemic, many governments are overwhelmed and involuntary lock-downs are still necessary. The attention of the decision-process, as well as coordination and expertise, is focused on the virus. Simon's research is very important here, in order to become aware of the crisis in this special, very complex situation and to make the right decisions and/or adapt the decision-making process to the lessons learned.

4.2. Training

Like organizational loyalties and efficiency, and in contrast to the other avenues of influence, training is a potential factor in influencing decisions "from the inside out" and preparing organizational members to make good and satisfactory decisions without the constant exercise of authority or advice (Simon, 1997).

Training is an important factor in preparing people for different situations. Even if the COVID-19 crisis is an unprecedented pandemic, lessons can also be learned from this crisis and experiences can be taken for future, similar situations. This situation is now also known in the field of artificial intelligence and appropriate

programs, tools and data can be used to solve future problems e.g. Kejriwal's THOR project. Another good example which can be used with just small adjustments is the research "Decision making with support of artificial intelligence" by Rabova, I., Konecny, V. and Matiasova (2005).

V. Conclusion

With the knowledge that leadership is an effective method to influence the behavior of people in the Corona crisis, this paper is the basis for leadership-guided strategy for decision-making in a crisis. Furthermore, the process of decision-making is the specialty of artificial intelligence, the development of which has been very strongly promoted, especially in recent years. A.I. tools are ready to make independent decisions - these tools should at least be consulted when it comes to important questions that are decisive for the company's success, especially in complex situations such as crisis.

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