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A New Approach to Organisational Change Using Social Systems Theory and Generative AI.

Mogens Grosen Nielsen Nielsen
Statistics Consulting, Copenhagen, Denmark.
mogensgrosen@gmail.com

Abstract

Statistical organizations can enhance their role as providers of impartial and trustworthy information by leveraging Generative AI as a communication partner, rather than merely an automation tool. This paper proposes customizing Generative AI to integrate a robust knowledge base for improved internal and external communication. It argues that traditional hierarchical decision-making often neglects the complex interplay of cultural, organizational, and technological factors. Applying Luhmann's social systems theory, the paper emphasizes communication and self-observation for effective change. By distinguishing between first-order and second-order observations and integrating emergent knowledge, statistical organizations can use AI to enhance their decision-making and communication processes, thereby strengthening their reliability and independence.

1. Introduction

Organizations can benefit from using Generative AI, not merely as tools automating or replacing what humans do today, but as communication partners. To do so, an organization must customize Generative AI, so it has a solid and relevant knowledge base and so it is used in such a way that this knowledge is integrated into the actual communication. This includes both communication inside the organization and communication in society. To introduce AI in this way requires a solid understanding on how communication works and the role of knowledge in the organisation.

Having production of official statistics as a case, there is a widespread conviction that traditional hierarchical organization and international guidelines lead to rational and suitable decisions. However, this view discards how cultural, organizational and technological dependencies often play a dominating role in actual communication and decision-making in an organization. E.g., power positions, neglecting of trust, IT dominance, neglecting independence and impartiality. (Davies 2017, Asche 2008, Radermacher 2021b, Nielsen 2022)

Thus, changes (including AI) cannot be deduced from the vast number of theories, manuals and guidelines, as there are simply too many factors that cannot be observed from the outside, e.g., by a consultant, a university or a donor organization. Consequently, successful

changes can only be reached from within the systems themselves—both psychic and social systems—as only they can adequately address the intricate complexities they face (Luhmann 2018, 2006b, Seidl 2006, Nielsen 2022)

So, what role should theory play? The paper argues that we can benefit from social systems theory. This is not to advocate for more theory, but instead advocating a kind of 'abstract theoretical detour', in order to get new concepts and a new mindset on changes enabling organisations to observe and reflect about themselves. Niklas Luhman introduces the idea in this way

"Organizations are clearly non-calculable, unpredictable, historical systems each of which assumes a present it has itself generated. They are clearly systems that can observe themselves and others, which thus oscillate between self-reference and other-reference. They clearly owe their stability to a network of loose couplings and not to a "technology" of tight couplings. But this does not exclude writing texts about organizations that organize observations more stringently than do organizations themselves. Such a text will not seek to present a normative model of a rational organization; it promises no gains in rationality let alone lower costs. Nor does it seek to portray reality in the form of a reduced overview - as a map does of a country. It ventures beyond the classical opposition between normative and descriptive theories in an attempt to show that a theoretical text can generate more cognitive consistency than is apparent in the everyday operations of systems." (Luhmann, 2018)

The paper envisions that, in the future, organizations can adopt a new mindset regarding organizational change. By integrating social systems theory and AI, they will be able to improve decision-making and change processes.

The paper argues that:

a) Social systems theory can provide a conceptual framework for better understanding of the dynamics of an organization, including improved communication by distinguishing between first order and second order observations and thereby improve the ability to observe and reflect about itself.
b) Social systems theory can be applied to organizations by distinguishing between generic and emergent knowledge. Industry specific quality frameworks and standards represent generic knowledge. When integrated into communication, they are transformed to becoming emergent contextual knowledge. This knowledge is used in change and decision processes. In decision-making, emergent knowledge helps prepare decision premises, which involve second-order observations distinguishing the current from the future situation to create decision options.
c) Generative AI as communication partners can help organizations by improving the self-observation and communication. This is done by customising Generative AI, so the knowledge mentioned in item b is loaded into GPTs and used in such a way that this knowledge is integrated and amplified in the actual communication being used in the organization and in the communication with users.

2. Systems theory and organisations

In systems theory, one often comes across the following paradigms: closed systems, open systems, and self-referential systems (Nielsen 2022, Harste 1992, Lies 2020).

The **closed system** operates with a simple view of the system as parts (elements) put in relation to the system as a whole. The system forms a totality. It is closed and has no outside world. Handling complexity in organizations in this perspective is a matter of designing relevant functions (parts) forming the structure of an organization (whole). It is often seen as the one of the functions of management, denoting practices that enable or support goal-oriented interventions. Max Weber's concept of bureaucracy is an example of a closed system. A practical example in a typical statistical organization forming a whole by dividing tasks into organizational departments – social, economic, business (elements)

The theory of **open system** sees organizations as several elements that interact internally and with the outside world. A variant of the open systems can be found in cybernetics. It includes feedback and transformations mechanism. Handling complexity in this perspective can be exemplified via the "cybernetic circle" / "thermostat circle" of planning with feed-back loops. In the thermostat, this takes place via: 1. inserting the desired temperature; 2. thermostat measures the actual temperature (feed-back); 3. compares the desired temperature with the actual temperature; 4. if deviations, then the thermostat adjusts the heater accordingly.

This model is widely used in organizational work-plans and often recommended by quality frameworks, e.g.: 1. Define goals. 2. Implement actions to achieve the goals (breaking down strategic plans into operational programs). 3. Measure results and compare with goals. 4. Prepare new work plan with new and adjusted goals and actions.

This kind of handling complexity does occur, but it is overly strict and disregards that organizations don't act in a strictly rational way. This type of systems wrongly assumes rationality being means-end rationality or rational actors with preferences and interests.

"Decision-makers in general and managers in particular are not guided by the rules put forward by models of rational decision-making. What is at issue is the ability to adapt in experience and action to constantly changing situations with ever new pasts and ever new futures. This includes adaptation to the social interdependence of preferences, thus also willingness to change one's own preferences. If rationality is to include these requirements, it can be seen neither as a long chain of means and ends nor as clinging to particular preferences" (Luhmann 2018)

This quote paves the road towards self referential systems.

Self-referential (Autopoietic) systems

Autopoietic (Self-referential) systems are defined as self-producing entities that maintain their own boundaries and internal structure through recursive operations. They continuously regenerate its elements and relations, ensuring its autonomy and operational closure within a given environment. Autopoietic system can be biological systems or meaning system (Luhmann, 2018)

The diagram in figure 1 shows a classification of systems distinguishing autopoietic systems from open and closed systems. At an overall level it also divides autopoietic systems into biological systems and sense making systems.

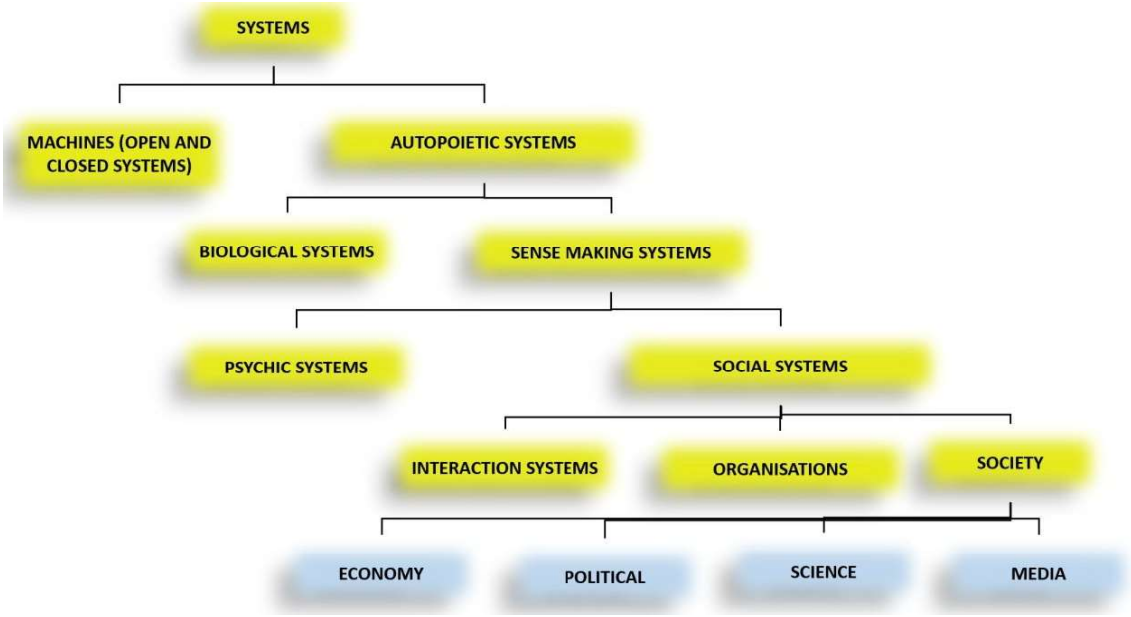

Figure 1. Classification of systems

Starting from the bottom, regarding sensemaking systems, the all-encompassing system is society. In the conceptualizing by Luhmann, society is not simply a collection of individuals or a set of institutions; rather, it is a network of communications that continually reproduces itself through ongoing interactions. Historically this communication has created areas with specific kinds of communication: economy, politics, science, art, religion, etc. Luhmann calls this phenomenon a functional differentiated society. The transformation to functional differentiated societies in Europe is often associated with creation of nation states at the end of the 17th century. This idea on modernity is e.g. expressed in the outcome of the Westphalian Peace in 1648. In this, religiously based societies are replaced by nation-states based on political power (Gøtke, 1997). The transformation can also be seen in statistics. In chapter *3.3.2 The Co-construction of Statistics and the Society,* Radermacher stresses the parallel development of statistics and the nation state (Radermacher, 2021).

In this paper we start our focus on psychic system and social systems as autopoietic systems. They both work in the medium meaning or sense. I will come back to this later. As psychic systems (individuals) we produce and reproduce ourselves via thoughts and feelings. Thoughts and feelings are basic "elements" of a psychic system. Social systems reproduce themselves via communication. Thus, a social system is made up of communication events, which serve as the "elements" of the system.

All elements (thoughts or communications) cannot be connected to one another. The connections need to be chosen. The selective connectedness between the pieces is what we mean when we talk about complexity and uncertainty absorption.

The complexity of environment is always more complex than the internal system complexity. Thus, the selective connectedness of communication (system complexity) expresses a reduction of the external complexity (environment complexity). Statistics as observations of communication in society are less complex than the actual communication. E.g. statistics on inflation are less complex than the communication expresses in myriads of economic transactions being expressed in figures about inflation.

Social systems and psychic systems are structurally open and operatively closed. We speak of ‘‘operational closing’’ because the system’s states and processes are only determined by their own structures. The environment cannot directly influence the system; any influence will be pro- cessed through system-specific structures.

An example on handling complexity can be the decision concerning a one-year work program in (communication element) in a statistical organization (social system). The work program has among other things specific initiatives handling external pressure on improving dissemination. The decision on implementing the work program is followed by various other decisions (communication elements) on dissemination, IT, quality, etc. All decisions cannot be connected. The example shows how an organization absorbs uncertainty by building internal complexity.

Communication

In a wide-spread understanding, communication is seen as a straightforward process where information is transferred from a sender to a receiver. This perspective is overly simplistic and problematic because it assumes a passive receiver, it fails to take account of the complexities of human interactions, it overlooks the importance of feedback and context, and ignores the possibility of multiple interpretations or senses / meanings. This linear model doesn't adequately reflect the dynamic nature of real-world communication. (Luhmann 2002)

The social systems theory offers a more nuanced alternative. It proposes that communication involves three steps: selecting information, selecting an utterance, and selecting (mis)understanding. See figure 2. Communication only continues if all three elements are selected.

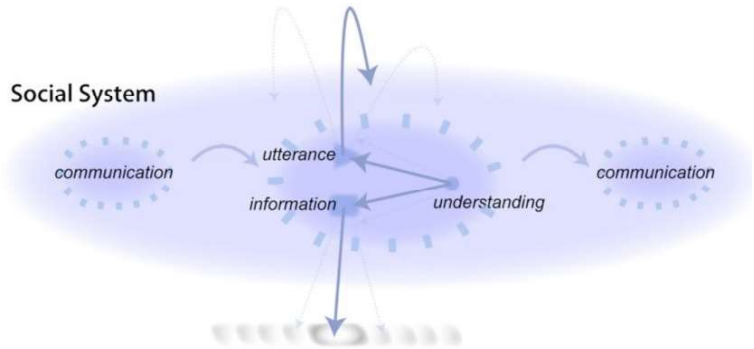

Figure 2. Communication as information, utterance and understanding

An example: a survey manager and a director discuss two project proposals on improving user dialog: The survey manager says, "I suggest the first proposal as I find the most feasible due to costs." The director can accept or reject this, and the next communication get or do not get started.

In system theoretical terms: The communication is an element put into the network of already existing communications. The communication consists of the utterance by the survey manager (self-reference – the top arrow in figure 2) referencing how the project proposal will improve user dialog (reference to the environment as information included in the communication – the bottom arrow in figure 2. The communication element is completed by acceptance of rejection.

Structural coupling

Autopoietic systems cannot purposefully influence each other in the sense of strong causality: To explain the fact that psychic and social systems nevertheless obviously evolve in a way that shows that they are closely related to each other, Luhmann introduced the term ''structural coupling''.

Psychic and social systems are structurally coupled by language. They observe each other closely and create stable expectations about how meaning is processed in the other system. Then, they use this expectation to build up their own structures. Stabilizing expectations in social systems means stabilizing meaning structures (e.g., while growing up, a child watches her family closely and builds up structures of expectations that she uses to create meaning but she does so according to his/her own cognitive organization). Therefore, whenever meaning-processing systems co-evolve, the mechanism of structural coupling enables them to use each other's meaning creation to build up their own expectation structures.

In short: psychic systems and social systems have meaning or sense-making in common. In psychic systems added information creates thoughts and feelings. These are connected to previous thoughts and feelings. Psychic systems can have divergent thoughts and feelings. Therefore, fostering sense-making across individuals within organizations necessitates structural coupling between psychic systems (individuals) and communication in the organization to work properly.

This leads us to double contingency focusing how interaction takes places based on expectations from each part. Double contingency is a concept in social systems theory that explains how social interactions depend on the mutual expectations of the participants. In any social exchange, each person's actions are contingent upon their expectations of how the other person will act. At the same time, the other person's actions are also contingent upon their expectations of how the first person will act. This mutual dependence requires both parties to continuously adjust their behaviours based on their understanding of the other's expectations, creating a dynamic and adaptive communication process.

To simplify, imagine a conversation between two people. Each person decides what to say next based on what they think the other person is expecting. For instance, if one person asks a question, they expect the other to give an answer. Similarly, the second person answers are based on the expectation that the first person wants to know the information. This back-and-forth adjustment is what Luhmann calls double contingency.

Double contingency is crucial because it shows how communication and social interactions are inherently unpredictable and require constant adjustment. It highlights the complexity and adaptability of social systems, where every interaction is shaped by the participants' ongoing interpretations and reactions to each other's behaviour.

The term resonance is used to denote this complexity (Luhmann 1989). The term has its origin in physics. A system can be made to resonate with another physic system only on the basis of its own frequencies (e.g., a playground swing). Resonance refers to the system and environment interactions (e.g., two psychic systems forming an interaction system) via structural coupling and double contingency, thereby mutually influencing each other based on their own operations.

Sensemaking

Sense is defined as the medium that works with the difference between the actual and the potential. This difference is to be taken in the sense that the unity of the difference always also plays along, which is to say that everything one can actually see also contains perspectives of possibilities, and vice versa. In other words, meaning serves as the medium that connects the actual with the potential, allowing us to navigate and understand choices between what is and what could be. (Luhmann, 2007)

Consciousness (Individual Meaning): On a personal level, the proposal involves assessing the potential impact of the change on your situation. In example above about choosing proposal A or proposal B this dimension of meaning involves a reflective process where you weigh the benefits and drawbacks of selecting proposal A or proposal B. It integrates your own judgments and anticipations about how this change might alter the current state of affairs. This internal deliberation helps you articulate a reasoned stance on the proposal, considering both immediate effects and long-term implications.

Communication (Social Meaning): When the proposals is discussed with the director, it shifts to the social dimension of meaning. Here, the communication process becomes pivotal. The proposals are subjected to scrutiny, debate, and negotiation. The discussion involves negotiating the proposal’s validity, addressing concerns, and possibly incorporating

alternative suggestions. This social interaction reflects the complexity of the social system, where meaning emerges through mutual expectations.
Sense making has three dimensions.

- Factual Dimension: This dimension deals with distinctions between inside and outside, whether concerning physical objects or conceptual entities. For the proposal, it involves analyzing the internal aspects of the proposals versus the external context of the organization. The factual dimension helps situate the proposals within a broader framework, considering how proposals fit into the organization's structure and goals.
- Temporal Dimension: This dimension involves the relationship between past, present, and future. This dimension considers past experiences with the proposals the potential benefits from each proposal. It also involves projecting the possible future outcomes of the change, influencing how the proposal is perceived and acted upon.
- Social Dimension: This dimension focuses on the interaction between involved parties, acknowledging that meaning is shaped by double contingency on how others perceive and respond to the proposals.

Each dimension of meaning features a "double horizon," where internal versus external aspects, past versus future, and self versus others interplay to construct a comprehensive. understanding of the proposals. This structure allows for a nuanced view of how meaning is negotiated and understood across different contexts.

Let us revisit the dialog between the survey manager and the director. Here sense-making take place at both the individual level (consciousness) and at the social level(communication). It has three dimension factual, social and time. The double horizon on actuality vs potentially plays out in the three dimensions both at individual level by the survey manager and at the social level in the dialogue between the survey manager and the director.

First order and second observations

In the approaches on closed and open systems described above, the system is often seen as something that exists independently of an observer. Yet this ignores an epistemological premise of recent systems theories: A system is not seen as something that exists in itself, but something that only makes sense if it is related to the psychic system or the social system who sees and recognizes it; in other words, to the observer. Systems do not just lie around for us to stumble over; observers create them with their observations and descriptions. (Luhmann, 2007, Maturana 1987). In the example above the interaction system formed by the the survey manager and the director only 'lives' as long communication is continued.

"When addressing epistemology, one must be able to distinguish various distinctions. The social system science, for instance, does not only observe itself by the code true/untrue, but also—and perhaps predominantly—by the secondary code of reputation. On the level of

epistemology, i.e., when observing and describing systems that observe their observing, one has, after all this, to be able to distinguish various distinctions, namely.

1. the distinction between operation and observation, in which case an observation is a specific operation, namely, the operation of distinguishing.
2. the distinction between the system-reference 1 (system and environment) of the first-order observer and the system-reference 2 (system and environment) of the second-order observer
3. the distinction between other-observation and self-observation which presupposes the distinction between system and environment,
4. the distinction between an observation of an observation based on what the observed observer observes (what he/she is dealing with) and one based on that which he/she cannot observe (his/her distinction);
5. the distinction between the binary code true/untrue and other forms of self- or other-observation." (Luhmann, 2006a)

Examples:
Ad 1) In the above case the survey manager distinguished between the topic on user dialog and all other things like methodology, staff etc. (system-reference 1) It is an operation, but also an observation with the mentioned distinction.

Ad 2) As second order observation (system reference 2) it uses the distinction between information about user dialogue (system reference 1) and the utterance used in the dialogue with the director.

Ad 3) The second order observation under item 2 is a self-observation in the communication inside the organisation. Other observations e.g. by a consultancy company can observe the statement about user dialogue. This observation used the system-environment distinction where the organisation is environment and the the consultancy company is system.

Ad 4) As second order observation (system reference 2) using the cost as an argument cannot see other aspect e.g. compliance with quality requirements. This second order observation can be a self-observation or an other-observation (see item 3).

Ad 5) As second order observation (system reference 2) using the true/false could include the distinction between observation complying with quality requirements or complying with work-plan and other form forms of self and other observations.

Organizations, decisions and decision premises

Organizations has been of special interest for Luhmann in many of his books and articles (Seidl 2015). He is not especially a fan of the traditional conceptualising and understanding of organisations. The quote below presents Luhman as his best with humour and irony about organisation's and decisions:

When we speak of decisions, we normally think of an act of selecting, which is characterised by a certain arbitrariness. Something that has already been determined in all respects cannot be decided. Therefore, a decision involves some degree of unpredictability, even irrationality, which is precisely why people are tempted to exert influence. (…) The classical notion that good decisions are correct decisions and that correct decisions can be reached by rationally calculating means and ends is in the process of being dismantled. (…) Not all behaviour in organizations is designated in those organizations as "decision", and the decision-making burden – and with it responsibility, experience, authority, and possibly wisdom – increases, we assume, along the chain of command from bottom to top; or at any rate this expectation is encouraged by the way decisions are talked about in organizations. By resorting to whatever ruse possible, we let our superiors take the decisions – and we let them enjoy doing so. They reinforce their role with the expectation that has been linguistically institutionalised, that it is only up to them (or especially up to them) to decide; even though everybody (themselves included) knows that they are being controlled through the preparation of the decisions. (…) The mystery of decision and the mystery of hierarchy support each other mutually. Both develop an inexpressible (should we say divine?) moment, which makes them what they are. Or what they appear to be? (Luhmann 2006e)

Now the scene is set. For now, we will focus on the conceptual part. Luhmann conceptualises organizations as autopoietic social systems that reproduce themselves on the basis of decisions (Luhmann 2018). This draw heavily on classical organization theory, especially the works of James March and Herbert Simon (March & Simon, 1958; Simon, 1957). In the transition Luhmann adjusted the theories based on the key idea of autopoiesis. More specifically, he recast decisions as 'decision communications', which he treated – like all communications – no longer as the product of individual human beings but as an emergent social product.

In everyday language a decision is "a choice among alternatives". However as Luhman points out, this creates paradoxes:

"a decision must give information about the alternative that has been selected, as well as about the alternative that was not selected. In doing so, however, it communicates at the same time that, on the one hand, the alternative is a real alternative (given that, in the absence of choice the decision would not be a decision) and, on the other hand, that this is no longer an alternative (given that, if choices are still pending a decision cannot be regarded as such), which creates a paradox" (Seidl, 2015)

The paradoxical form described above renders decision communications highly fragile. Luhmann, in this regard, speaks of the necessity of 'deparadoxification' of the decision paradox, which involves concealing the decision's paradoxical form (Luhmann, 2006e).

This can take place via the attribution of decisions to human beings as 'decision makers'. This idea, however, i.e. that decisions are the product of the decision maker rather than of the organization, is an 'organizational fiction' to conceal the paradox according to Luhmann.

Another form of deparadoxification is the recourse to the organizational structures, i.e. the decision premises. Decision premises regulate which decisions have to be accepted under

what conditions, including who can make what kind of decisions that are binding for certain other decisions.

In other word, decision premise is a concept related to reduction of complexity to help in decision making. A decision takes previous decisions as decision premises or formulated the other way around: every decision serves as a decision premise for later decisions. Decision premises can be programs, plans, quality framework as conditions for decision making.

Thus, in a system theoretical perspective program, plans, quality frameworks are second-order observations expressing the system-environment perspective. They work at the structural level "representing" internally the system/environment distinction of the system.

Take, for example, the decision about a one-year work program including the use of quality frameworks for a statistical organisation. This program refers, on the one hand, to the policy decisions by government, characteristics of users, or something similar, and on the other hand, to the necessary decision processes in the organization. By taking this program as a decision premise, decisions orient themselves according to the two aspects of the program as if to the organization/environment distinction itself. In this way, the program including quality requirements about processes and products can be seen as decision premises.

Figure 3 seeks to summarize the concepts presented above:
a) the distinction between first order and second order observations.
b) the distinctions between psychic and social systems, how the interaction via resonance both in first order observations and second order observations work with resonance.

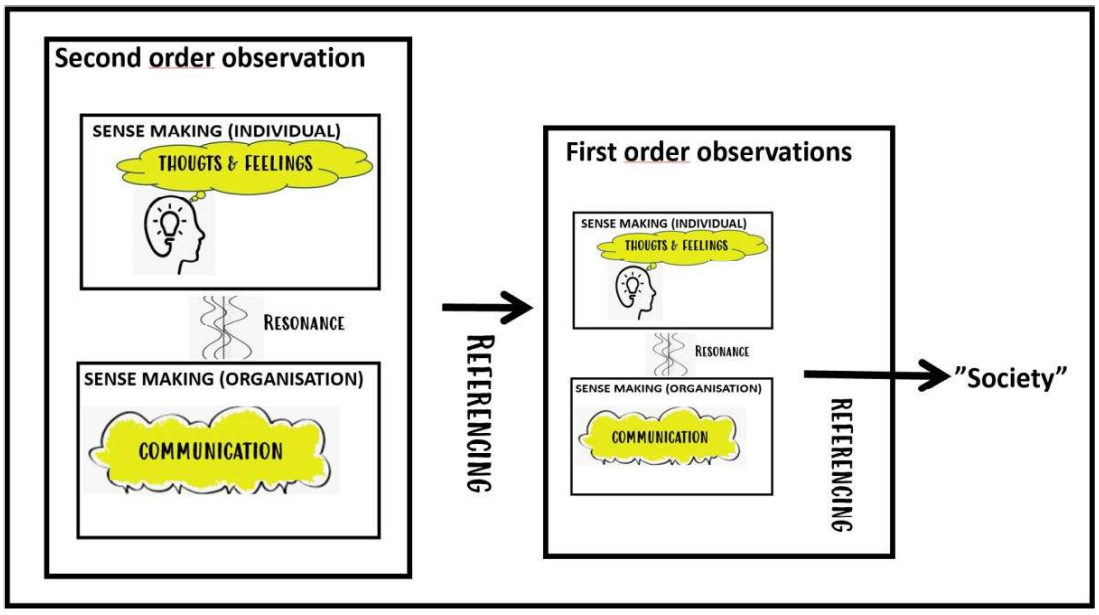

Figure 3. First order and second order observations

Change management Steering and planning

Conventional change management attempts to extensively optimize structures, functions and processes to control costs or other success-related indicators. This mindset of “change” is equivalent to re-engineering, which means the radical redesign of business processes. It assumes that any action is individually planned to satisfy needs efficiently. The success of change management depends on direct interventions by means of top - down management measures (Lies 2020). The implementation follows the tradition of management encountered in early system theory on open and closed system, as described above.

The conceptualisation using social system theory provided a more complex understanding. It challenges the traditional rational model on planning and steering. (Asche, 2008, Scheytt, 2006). As indicated decision premises can be programs, quality framework etc in the form of plans and conditions for decision making.

Implementation as social subsystems operating self-referentially, operationally closed systems implies that steering can only ever be self-steering. Planning is only possible by way of influencing the different self-steering processes involved in a planning situation. In other words: any attempt at planning must take a detour via the self-steering of the different systems in a planning situation.

Luhmann’s theory outlines two primary mechanisms for indirect steering: structural coupling and programming (Asche 2008). Structural coupling involves creating connections between different subsystems, allowing decisions to impact multiple areas without disrupting their independence. Programming, on the other hand, involves altering decision rules or providing incentives within systems to shape their behaviour indirectly.

Cognitive capacity, emergent and generic knowledge

The question about knowledge could be phrased like this: How do cognition work in a functional differentiated divided into science, politics, economy, law, media etc working with their respective codes. Cognition as construction is defined as follows: “Cognition is manufactured by operations of observing and by the recording of observations (description). This includes the observation of observations and the description of descriptions. (..) The concept is indifferent regarding the system’s type of autopoiesis, i.e., indifferent to the form of operation that may be life, consciousness, or communication. It is also indifferent with respect to the type of recording (memory); it may be biochemical fixations, but it may also be written texts.” (Luhmann 2006a)

Cognitive capacity refers to the ability of a system, whether a psychic system (individual consciousness) or a social system (network of communications), to process, interpret, and utilize information. Cognition is manufactured by operations of making distinctions (observations) and by the recording of these distinctions. For psychic systems, cognitive capacity involves making and recording distinctions in a network of thoughts and feelings. For social systems, cognitive capacity is distributed across the network of communications and is manifested in the collective ability to generate, share, and apply knowledge.

Emergent knowledge is defined as a system's internalized information that has been processed and integrated into its operations. It is context-dependent and continuously evolves through communication and interaction with the environment.

Generic knowledge is defined as knowledge containing practice independent of practical implementation in an organization. There is lot of knowledge being produced as manuals, guidelines, etc in the society in general. In the global statistical community, you find generic models and activities in statistical organization, generic business process models, generic quality framework etc.

Key concepts and their definitions

Complexity and uncertainty absorption: All elements in social and pyshics system (thoughts or communications) cannot be connected to one another. Complexity refers to the condition where the number of possible connections and operations within a system exceeds the system's capacity to actualize them all, necessitating selective processing. The complexity of environment is always more complex than the internal system complexity. Thus the selective connectedness of communication (system complexity) expresses a reduction of the external complexity (environment complexity). The selective connectedness between the pieces is what we mean when we talk about complexity and uncertainty absorption.

Autopoiesis: Autopoiesis is the process by which a system self-produces and self-maintains its own elements and boundaries through internal operations. An autopoietic system is operatively closed and structurally open. It is operationally closed because the system's states and processes are only determined by their own structures. It is structurally open or structurally coupled to the environment. Psychic and social systems are structurally coupled by language. They observe each other closely and create stable expectations about how meaning is processed in the other system. Then, they use this expectation to build up their own structures. Thus the environment cannot directly influence the system; any influence will be processed through system-specific structures.

Psychic System: A psychic system is an individual's consciousness that operates through thoughts, emotions, and perceptions, continuously generating and interpreting meanings internally. It is self-referential, distinguishing itself from its environment by processing experiences based on its internal cognitive processes.

Interaction System: An interaction system is a type of social system formed through face-to-face communication where participants co-create meanings in real-time. It is characterized by direct, immediate exchanges that shape the understandings and interactions of those involved.

Social System: A social system is a network of communications that self-organizes and reproduces by continuously generating and connecting communications. It functions autonomously by distinguishing itself from its environment through these internal communications.

Communication: Communication is the fundamental operation of social systems, consisting of three components: information (what is being conveyed), utterance (how it is being

conveyed), and understanding (how it is interpreted by the receiver). It is the process through which social systems generate and maintain themselves.

Sense-making: Sense-making is the medium through which both social and psychic systems process and interpret information, enabling them to reduce complexity and navigate their environments. Sense-making is divided into 3 dimensions. The factual dimension deals with distinctions between inside and outside, whether concerning physical objects or conceptual entities. The temporal involves the distinction between past and future. The social dimension focuses on the interaction between involved parties, acknowledging that meaning is shaped by double contingency on how others perceive and respond to the proposals.

Resonance: refers to how the system and environment interacts (e.g. two psychic systems forming an interaction system) via structural coupling and double contingence. **Structural coupling** indicates that there are never point-for-point correlations between the system and environment. Instead, the system screens itself off from environmental influences and produces only very selective interconnections. **Double contingency** indicates that interaction mutually depends on expectation from the other system being either individual or social systems.

First-order observation is defined as the operation of distinguishing. Eg a survey manger distinguishes between user dialog and everything else.

Second order observation if defined as observations of first order observations using the distinction between itself and first order observation. E.g. an information and utterance, where the information refers to user dialog and uttterance refers til concrete utterance.

Organization: An organization is a specific type of social system that reproduces itself through a network of decisions

Decision and decision premises: Decision making involves selecting from a range of possibilities to structure the system's operations and responses. Decision and decision premises are second order description (strategy, plan, quality) that guide and constrain the decision-making process, while the actual decisions are the specific choices made within those constraints, shaping the system’s direction and activities.

Emerging knowledge is defined as a system's internalized information that has been processed and integrated into its operations. It is context-dependent, emerging and continuously evolves through communication and interaction with the environment.

Generic knowledge is defined as knowledge containing well elaborated good practice independent of practical implementation in concrete daily life in organization. There is lot of knowledge being produced as manuals, guidelines, etc in the society in general. In the global statistical community you find generic models and activities in statistical organization, generic business process models, generic quality framework etc.

Cognitive capacity refers to the ability of a system, whether a psychic system (individual consciousness) or a social system (network of communications), to process, interpret, and utilize information. Cognition is manufactured by operations of making distinctions (observations) and by the recording of these distinctions. For psychic systems, cognitive capacity involves making and recording distinctions in a network of thoughts and feelings. For social systems, cognitive capacity is distributed across the network of communications and is manifested in the collective ability to generate, share, and apply knowledge.

Indirect planning and steering is defined as structural coupling or programming to interact with the different self-steering processes involved in a planning situation. Structural coupling involves creating connections between different subsystems, allowing decisions to impact multiple areas without disrupting their independence. Programming, on the other hand, involves altering decision rules or providing incentives within systems to shape their behaviour indirectly. Statistical quality frameworks is an example of programming and indirect planning and steering. It can work as a guides for decision making across sub-systems without disrupting the independence of each sub-system.

3. Application of social systems theory

Application of theory is typically named applied science, where theory is developed at universities and applied in organisation called practice. This distinction is dissolved using the perspective presented above. The organization, from outside, e.g., a consultancy firm, and the client organization both operate with theory and practice. A consultancy firm can distinguish between emergent and generic industry-specific knowledge. Additionally, the consultancy firm can use social system theory as a foundation.

Using the epistemology above, both the consultancy firm and the client organization can both practice second-order observations. E.g. they can each be brought to see blind spots. There is thus no talk of a traditional hierarchical understanding of theory and practice.

Second-order cybernetics dispenses with this comprehensive architecture and thus avoids any gesture of superiority The relations of observation remain strictly horizontal relations, no matter how intricate, demanding, and recursively ordered they may be. (Luhmann, 2006b)

The text below showcases how I've used social system theory in two 10-day training courses on quality in Bangladesh in 2023.

Statistical organizations often use quality frameworks to measure quality aspects stated in quality assurance frameworks. This typically takes places in internal or external audits. Audits help organizatons to assess the overall quality levels and address potential improvements. For example, Eurostat conducts audits in EU member states within the

European Statistical System. While useful, these frameworks can also help handle new challenges faced by statistical organizations.

Therefore, I introduced a new approach as summarized below. Besides from providing a simple audit exercise, the approach also resulted in improved communication and enhanced cognitive capacity among members of the National Statistical System.

Main aspects using the system theoretical approach:

- The class with 20 participants was seen as an interactions system. This interactions system was produced and reproduced via communication during the 10-day training course.
- Connecting participants (psychic systems) to the communication in the interaction system took place via resonance, where participant's actions are contingent on their expectations of the other's actions.
- The cognitive capacity was improved by including the sharing generic knowledge and building emerging knowledge about quality, by bringing the various topics into the communication.
- The communication took place by selecting information, selecting utterance followed by accept or reject in the class. This could be information about user satisfaction.
- Quality assessments, strategy, plans were seen as second-order observations guiding communication in the class. The second order observations prepared during the training were based on first order observations by the participants covering the day-to-day production of statistics.
- The second order observation uses distinctions provided by standards for product and processes, thereby paving the way for emerging knowledge making sense in the interaction system.
- Decision making as the main element in an organization as a social system was conducted by preparing decision premises as second-order observations, followed by simulated decisions.

To obtain these results, the training was organized as interaction between individual and collective learning, focusing on the integration of quality frameworks and standards into the practical aspects of statistical production in Bangladesh. The following process was used:

Step 1: The facilitator provides introduction to generic knowledge and frames the change process via 3 sense-making dimensions:

- Time. Past: problem encountered. Future: Fulfilment of requirements in quality framework
- Factual: inside: user needs dialog outside: all other user interaction
- Social: resonance individual and group

Step 2: Individual sense making – prepare 3 alternative solution that makes sense for you. What to do, who should do it and when.
Step 3: Group sense-making. Negotiate and agree on 3 alternative solutions for the group
Step 4: All participants: Negotiate and agree on 3 alternative solutions.

The result of this broader approach is a new way of thinking and practising change as sensemaking. In the factual dimension, quality concepts, as cognitive capacity, shape the communication in the organization. It helps prepare decisions premises and simulate the change process. In the time dimension, the participant simulated the before and after a change, by formulating the problem, preparing a description of existing situation and suggesting changes for a future situation, addressing the problem. In the social dimension, the course enabled participants, via double contingency among participants, to reach a solution in an environment with internal and external stakeholders.

4. Application of social systems theory and AI

a. History

Artificial Intelligence (AI) has evolved significantly since its inception, with its definition and scope changing over time. Initially conceptualized in the mid-20th century, AI aimed to replicate human intelligence through machines. Over the decades, the approaches and methodologies used to achieve this goal have shifted, particularly with the advent of deep learning. This shift has redefined AI's capabilities and applications, making it a pivotal area of technological advancement. Understanding the historical context and evolution of AI definitions provides insight into its current and future potential.

Alan Turing is hailed as a pioneering figure in the field of artificial intelligence (AI). His seminal 1950 paper, "Computing Machinery and Intelligence," laid the foundation for the development of AI by proposing the famous Turing Test. This test was designed to determine whether a machine could exhibit intelligent behaviour indistinguishable from that of a human. Turing's ideas have profoundly influenced AI research, shaping its goals and methodologies and in my opinion directed the discussion about AI away from understanding AI as machines and not similar to humans.

However, Turing's vision did not anticipate the advancements in artificial intelligence, specifically in deep learning, which enables machines to process and utilize vast amounts of data to generate human-like responses without truly understanding them. Turing's model assumed that such deception required a conscious, intelligent agent crafting responses based on a sophisticated understanding of human behaviour.

From a second order perspective the Turing test will not pass today asking the question “Are you human?”. The test might answer the question with ‘yes’ implicating that it is lying. The test will answer ‘no’ implicating that it is not human.

The development of AI has since demonstrated that machines can indeed produce convincing human-like interactions by analysing patterns in extensive data sets, rather than through genuine comprehension or consciousness.

Figure 4 shows levels in AI. It was introduced by the Danish company Conversio & Salecto at a training course in AI. I have introduced the distinction on AI with deep learning and without deep learning. This is indicated with the inner box.

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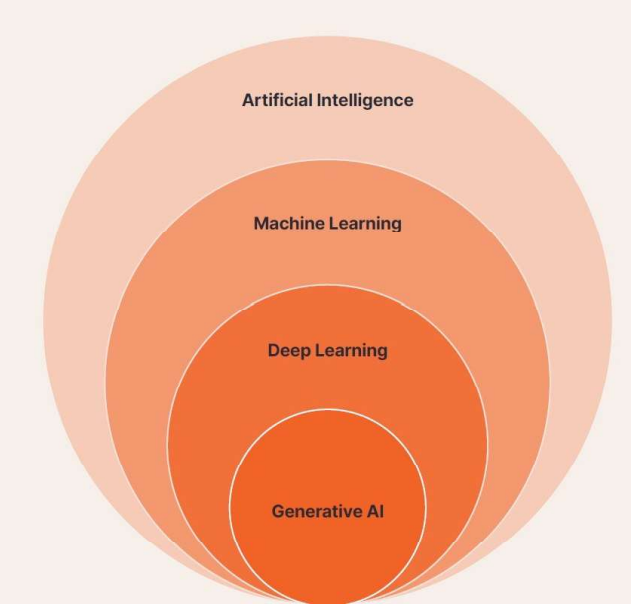


Figure 4. AI levels

AI Before and After Deep Learning
Prior to the advent of deep learning, artificial intelligence (AI) was dominated by symbolic AI and rule-based systems. These systems required human experts to encode specific rules and logic, attempting to replicate human reasoning through predefined algorithms. Such systems were limited in their capacity to handle unstructured data and adapt to new information, making tasks that required intuition or the recognition of complex patterns particularly challenging.

The introduction of deep learning brought about a paradigm shift in AI. Deep learning models, especially neural networks, process extensive datasets to identify patterns and make decisions. Unlike earlier systems, these models learn from examples instead of following explicit rules, enabling them to handle complex tasks such as image recognition, natural language understanding, and autonomous driving. This approach departs from attempting to mimic human intelligence, instead leveraging computational power and vast datasets to achieve remarkable effectiveness in various domains.

b. AI and communication

Engaging effectively with AI systems, particularly those based on models like Generative Pre-trained Transformers (GPT), requires a rethinking of traditional communication and organizational concepts (Esposito, 2017, 2021, Watson 2023, Keenan 2023, Moeller 2023)

Communication with AI, called artificial communication (Esposito) involves a shift from traditional human-to-human interactions, characterized by resonance, to interactions where the AI's responses are based on virtual resonance. Virtual resonance refers to the AI's ability

to generate responses by identifying patterns in data provided by users, without true understanding or consciousness.

In terms of resonance for psychic systems (individual consciousness), it involves the interaction between thoughts, feelings, and perceptions. AI systems influence and adapt to these internal processes by providing feedback and insights that affect human cognition and emotions.

For social systems (networks of communication), structural coupling pertains to the interaction between various communications. AI systems contribute to this by processing and generating communications, thereby influencing how information is shared and understood within the system.

Viewing AI as communication partners rather than mere tools allows for the enhancement of human capabilities and the expansion of interaction dynamics within both psychic and social systems.

c. AI and organization

Organizations, as social systems, reproduces themselfes through a network of decisions. The integration of AI can ease decision-making and operational processes within these organizations. AI enhances decision-making by analyzing data, identifying patterns, and providing actionable insights, thus augmenting the organization's cognitive capacity for more informed and efficient decisions.

In a system theoretical perspective AI can facilitate second-order observation within organizations. Second-order observation involves the system observing itself and reflecting on its processes. Generic knowledge like quality frameworks, business process models are loaded into the AI system as foundational documents (Sheytt 2006).

These frameworks systematically describe and evaluate the organization's operations, paving the road for emerging knowledge and thereby reducing complexity.

AI-driven communication is characterized by virtual resonance, where the systems generate responses and feedback based on the provided information as second order observations.

In short AI-CATCH for Statistics is a generative AI tool with relevant use-cases and relevant knowledge (policies, standards, guidelines). The tool will be tailored to each organisation.

An organisation can use AI-CATCH for Statistics in two main ways:

a. Use AI-CATCH for learning, e.g. chat with AI-CATCH about standards, policies, or other documents in your organisation;
b. Use AI CATCH to support problem solving, e.g., insert problem and existing situation and get suggested changes. AI-CATCH does not provide solutions, final answers, nor decisions, but can help in preparing decisions about changes.

Decisions about change are, as we all know, complex, and take place in many ways. They are particularly dependent on and must be based on the individual organisation's knowledge, history, etc.

This complexity forms the background for five skills to be covered when using AI in change processes in organisations.

1. Change as structured problem-solving moving from existing to desired situation
2. Artificial intelligence as exploration tools supporting human thinking by filling the gap between human thinking and the powerful capabilities of the Generative AI.
3. Generic and emerging knowledge in your organisations, e.g. strategy, quality, processes, etc.
4. Co-create changes together with colleagues with help from AI-CATCH for Statistics.
5. Hold on to the change processes in your organization

d. A concrete case application of social systems theory and AI with the AI tool AI-Catch for statistics

The general conclusion above shows that Generative AI can be used for change in organizations, not just as simple machines that automate tasks, but a tool that an organization can use to make better decisions. This requires introduction on new practices in organization.

It can take place at workshops with three interacting parts at workshops: 1. the organization itself, 2. AI-Catch for statistics, and 3. dialog with experts having historical knowledge and experience. This ensures that those involved in the process are equipped to maximize the potential of AI-Catch and experience from experts to prepare decisions that align with the organization's needs and context. I will not go into detail here, but just show two cases about the AI part that is integrated into the processes of decision making.

Case 1: Improve statistical law

Prompt (formulated by an imagined statistical organization):

> Objective:
> You [meaning the statistical organization] have a specific problem related to statistical law, such as issues with data collection. My task is to conduct an analysis of the Base Document [our statistical law], focusing on sections related to your issues. I [AI-Catch] will compare the structures and content in the Base Document with those in the best-practice documents found in the knowledge base. Based on this comparison, I will recommend solutions for changes to the Base Document, in order to handle the issues you have entered.
>
> Steps:
> - Upload the Base Document: Please upload the base document.
> - Insert Issues: Please insert the issues you want me to analyze.
> - Conduct Analysis: I will analyze the sections in the Base Document related to your issues by comparing them with the corresponding sections in the best-practice document(s). I will then suggest changes to the Base Document.

Output:
Recommendations with suggested improvements to the Base Document. Each recommendation will include a specific change or improvement, referencing the Generic Law of Official Statistics where applicable. The revised text of the section in the Base Document will be provided in plain text, in italics, and within quotation marks. Each recommendation will also include the section number and section title in the Base Document.

Example Recommendation:

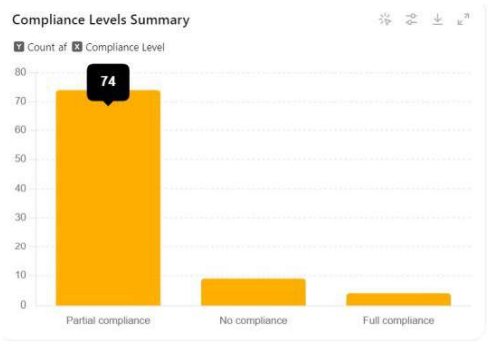
Section 2.1: Data Collection Procedures
Original Text:
"The agency will collect data through surveys and administrative records."

Recommendation:
Based on the Target Document, it's suggested to improve clarity and compliance with the Generic Law of Official Statistics.

Revised Text:
"The agency shall collect data through systematic and periodic surveys, ensuring confidentiality and data integrity, as well as through administrative records, adhering to the guidelines set forth by the Generic Law of Official Statistics."

Case 2: Chat with your quality assessment

Quality assessment takes place using quality frameworks from UN or region-specific frameworks. E.g. quality frameworks from Eurostat. The figure below shows an example on how artificial communication. The organization can chat with the results of the quality assessment using emergent knowledge and thereby increase cognitive capacity in the organization.



ere is a summary of the compliance levels:

- **Partial compliance**: 74 requirements
- **No compliance**: 9 requirements
- **Full compliance**: 4 requirements

he bar chart above visually represents these compliance levels, highlighting the predominance of artial compliance among the requirements.

f you need any further analysis or specific breakdowns by levels or principles, please let me know!

The workshop has been tested with three interacting parts: 1. the organization itself, 2. The AI tool AI-Catch, and 3. dialog with experts having historical knowledge and experience. The tests showed that

- AI can extend the knowledge in communication through uploaded documents with standards and best practices.
- AI can increase the cognitive capacity in an organization through communication contributions. This occurs in an interaction between the facilitator, AI, and the organization.

Key concepts and their definition

The Turing Test is a measure of a machine's ability to exhibit intelligent behaviour equivalent to, or indistinguishable from, that of a human. In this test, a human evaluator interacts with both a machine and a human through a text-based interface without knowing which is which. If the evaluator cannot reliably distinguish the machine from the human, the machine is considered to have passed the test, demonstrating a form of artificial intelligence. From a second order perspective the Turing test will not pass today asking the question “Are you human?”. The test might answer the question with ‘yes’ implicating that it is lying. The test will answer ‘no’ implicating that it is not human.

Machine learning I without deep learning involves algorithms and techniques that enable computers to learn from data and make decisions without relying on deep neural networks. This includes methods such as linear regression, decision trees, support vector machines, k-nearest neighbors, and ensemble methods like random forests and gradient boosting. These techniques are typically simpler and require less computational power compared to deep learning, making them suitable for tasks where data is not excessively large or complex.

Machine learning II using deep learning refers to the application of deep neural networks, which are composed of multiple layers of interconnected nodes (neurons), to learn from large and complex datasets.

Generative AI refers to systems that use machine learning with deep learning models to create new, previously unseen data that resembles and combines the input data they were trained on. These models learn the underlying patterns and structures of the training data to generate new content such as text, images, music, or videos. Examples of generative AI include Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), and transformer-based models like GPT-3. These technologies have been used to produce realistic images, synthesize human-like speech, and generate creative text and artworks.

Artificial intelligence I - Without deep learning: AI was defined as the capability of a machine to imitate intelligent human behavior, particularly through logical reasoning, rule-based problem solving, and symbolic processing. For instance, Newell and Simon's General Problem Solver aimed to simulate human problem-solving processes using heuristic search techniques.

Artificial intelligence II - With deep learning: AI is defined as the ability of a machine to learn from data, adapt, and perform tasks that typically require human intelligence, such as visual perception, speech recognition, and decision-making.

Artificial communication refers to the exchange of information facilitated by deep learning e.g. GPTs. Recalling that communication consists of three selections: information (what is being conveyed), utterance (how it is being conveyed), and understanding (how it is interpreted by the receiver). Artificial communication is similar, but differs in three important aspects:

- it has powerful mechanisms for selecting information and utterance, but does not include understanding. We can accept or reject information and utterance, but this is not based on mutual sense-making as in communication where humans are involved.
- it gets information from data we have provided. The GPT selects information by finding patterns in the information and prepares the utterance. The utterance is also using patterns in the information we provided.
- it is characterized by resonance like communication, but conditioned by information we provided, the utterance by the GPT and our acceptance of rejection.

5. Conclusion

The paper started with this question: "How can Luhmann's social systems theory be applied to statistical organizations a) by focusing on communication and self-observation as the main elements in changes, and b) by using Generative AI as communication partners to support communication and self-observations?"

The answer was provided in a series of the steps. The paper **first** (chapter 2) gave a short overview on current challenges and reflections focusing on the global UN Sustainable Development Goals. The challenges included poor coordination in lower-income countries. Reflections on AI suggest potential for enhancing data analysis and automating processes, but fundamental use in addressing the complexities on improving coordination and decision-making is still unexplored.

The **second** step (chapter 3) introduced systems theory. It presented key concepts including first-order and second-order observations, decisions and decision premises and emergent vs generic knowledge.

The **third** step (chapter 4) showed an example of application of systems theory. It was shown how a social systems theory mindset was used successfully at training courses in quality in official Statistics. This included a new approach on practicing quality focusing on decisions making, first and second order observation and the role of knowledge in statistical organizations.

The **fourth** step (chapter 5) showed how generative AI can be used to increase cognitive capacity by including best practice knowledge and by implementing it in the change model as an organizational practice. The chapter showed how an AI tool AI-Catch can be integrated into changes processes using the insight from social systems theory.

As noted in the introduction, the paper advocated a kind of 'abstract theoretical detour', in order to get new concepts and a new mindset helping to build better statistical organizations. The paper envisions that, in the future, organizations should apply a new mindset regarding organizational dynamics. By integrating social systems theory and AI, they can strengthen decision-making processes, enhancing the ability of statistical organizations to provide impartial, independent, and trustworthy information to society.

However, the approach on transforming organization presented here is not without obstacles. One example is steering and planning. At the conceptual level, steering can only be self-steering or indirect steering via conditional programs, as described in the paper. This challenges the traditional hierarchical rationality having the complexity handled by structures and the illusion of mean-ends rationality. The conviction on the superiority of this way of organizing is strong for many reasons. It can be money, glory, history.

Another obstacle is, that the AI discourse is dominated by aspects using AI to automate, replace staff and reduce cost and in general strengthen the existing structures (in politics,

media, science, law etc). An example of this is structures related to elections using AI to strengthen the political campaigns using fake news.

The approach in this paper proposes part of the solution on these aspect, but also aspects in providing the "the abstract theoretical detour" towards a new mindset to improve the change processes in organizations. A new mindset with social system theory can open for improved AI applications to be integrated into the process including better reasoning, but also other capabilities developed by the AI. This includes focus on organisations as social systems reducing complexity, decisions and decision premisses.

The problem on strengthen the existing structures in directions we don't want can partly be politically regulated e.g. to avoid the dominance of tech-companies and more. However the regulation could also include 'positive' recommendations on how organisations can use AI to make better decisions by using industry-specific standard and framework in second-order observations. At a more global level organisational change could include the use of human rights, quality requirement for statistics and other global "ideas", that can help us toward a more democratic world with less inequality and less exclusion.

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