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The systemic-praxeological approach to the methodology of primary scientific activity of the management science system

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ABSTRACT

The scientific methodology of management science (MSc) is consistent in terms of direction with the overall methodology of sciences. Still, it continues to pose significant challenges. One such challenge is the problem of system characteristics of MSc methodology at the highest level of scientific practice, i.e. praxeology and systems theory. There are also the problems of MSc synthesis, i.e. the definition of its universal scope, in the light of its increasing diversity and specialisation of domains. This paper aims to elaborate on the achievements to date in management science on the grounds of the systemic-praxeological approach, scientific synthesis of methodology, with a particular focus on the role of reasoning and inference.

My assertion is that methodology is a subsystem of the core of primary scientific activity of MSc, comprising the components of scientific practice focused around the scientific method (methods). Its objective domain extends beyond the cognitive function (C), also encompassing value assignment (A), determination of post-diagnosis scientific action (R), decisions about scientific models (N) and implementation of scientific models (I) –CARNI system. The scientific methodology of MSc is specifically a product of scientific problems as well as the goals, principles and methods used to solve them, forming an exceedingly complex system. Scientific reasoning and inference are not stand-alone scientific methods – they are ingredients of every scientific method. What sets the scientific method apart is the capability of a given scientific manner to solve a given scientific problem.

Keywords: Action system; scientific functions of the MSc system; scientific methodology system of MSc; dialectics, paradox and chaos of the MSc methodology system.

1. Introduction

The current approach to the scientific methodology of MSc is debatable when it comes to scientific synthesis, understood as the universal, systemic-praxeological scope of its domain (material, objective and spacetime-oriented scope), process and outcomes. The functional foundation for shaping the MSc system is primary scientific practice (activity), including its methodology. Here, we are dealing with at least three hierarchical levels: the “MSc system”, “primary scientific activity” and “methodology of primary scientific activity”.

My assertion is that there exists a problem with scientific synthesis of MSc methodology, with no less than several particularly complex aspects (the problem of this paper), of which the first two are at the highest level of generalisation. First, there is the difficulty of establishing the nature of the system characteristics of MSc from the praxeological point of view. Problem number two is whether we accept the theorem about the universal principles of synthesis of the MSc system, including its methodology. The third problem, at a somewhat lower level, refers to the difficulty of determining the role of reasoning and inference within the structure of

the MSc methodology system.

For the most complete synthesis, it is best to combine two approaches: praxeological and systemic, and this is the vantage point of this paper. Praxeological – because its domain is “action” as a universal category; and systemic – because categorical, generic and scientific system characteristics provide a complete description of actions and their systems, including scientific activities and within them: scientific methodology.

The aim of this paper is to try and achieve progress in solving the cognitive problem of synthesising the MSc methodology system on the grounds of systems theory and praxeology. I am venturing a partial diagnosis – only detection and categorical exploration – of the domain in question. The specific objective of this paper is comprised of three endeavours: 1) to describe MSc as an action system in the praxeological sense; 2) to determine the nature of the MSc scientific methodology subsystem; and 3) to place scientific reasoning and inference within this subsystem. The present considerations will cover action systems (AS – material scope), MSc scientific methodology (objective scope), in a universal spacetime, at the categorical level. The cognitive problem of MSc synthesis is defined so deliberately because of the particular complexity of the scientific domain, exceeding the premise (including size) of this paper, and because of addressing questions of a fundamental nature, i.e. at the level of concepts and definitions.

The key hypothesis of this paper can be summarised in the following assertion: progress in achieving the universal synthesis of the methodology system of the primary scientific activity in MSc is possible if we apply the praxeological and systemic approach in combination. MSc is a specific action system, having categorical, generic and scientific characteristics of a system. The scientific method is a holistic method for solving a given scientific problem, and that requires reasoning and inference, which are not stand-alone scientific methods as such (unless some scientific problems in MSc are limited to reasoning and inference).

When defining the assumptions for his study (doctrine of the study), the author is entitled to make an arbitrary choice of research methods on grounds extending from volition to testing their usefulness to solve the scientific problem (in a continuum extending from extreme volition to extreme testing). It is essential that he provide reasons for his approach to the choice of methodology. For instance, a volitional choice may be justified by the length limit of the publication and lack of literature on the subject

in question. Hypothetico-deductive reasoning is well known in scientific methodology. Papers addressing reasoning and inference are classified under methods in logic and as scientific methods (more broadly), but they are mainly limited to studies on deduction, induction and abduction. MSc literature (M. Lisiński) suggests that there are scientific methods based on reasoning and inference, which is doubtful. The literature treats science, including MSc, mainly as a cognitive activity, and only Ł. Sułkowski additionally allows for value assignment and other functions of science.

A holistic treatment of the scientific method, as a systemic solution to a given scientific problem comprises several scientific methods, including the diagnostic, prognostic and mixed models (prognostic-diagnostic and diagnostic-prognostic). To solve the scientific problems addressed in this paper, as outlined above, the most appropriate approach is prognostic-diagnostic, rather than diagnostic or diagnostic-prognostic. This is because the diagnostic premises of the primary scientific activity are weak (the current body of knowledge in the field of MSc synthesis), and the “gap” between the current status of MSc and propositions for scientific synthesis cannot be filled using diagnostic methods. The diagnosis, in the form of an overview, is conducted exclusively with regard to the body of knowledge in the relevant domain, aiming to define the scientific problem of this paper. Only then do I go on to shape an outline of the concept solving the scientific problem, using hypothetico-deductive reasoning on the grounds of heuristics.

The paper is of a preliminary nature, so naturally it does not exhaust the subject. Following a brief discussion of the current body of knowledge in the domain under analysis, I present an introduction to the systemic-praxeological synthesis of the MSc methodology concept. The paper is made up of three parts: an introduction, the main body (with five subsections), followed by conclusions and a list of sources.

2. Status of MSc in the relevant domain

My brief diagnosis of the status of MSc in the domain of methodology is based on representative statements from papers written by selected authors (Czakon 2015; Sułkowski 2005; Sułkowski 2012; Sułkowski 2014; Sułkowski 2016; Lisiński 2013 a & b; Lisiński 2016; Lisiński 2018). The papers referred to above have the advantage of reflecting the current global body of knowledge in the relevant domain, with the added value of the Polish perspecti-

ve. Nevertheless, what emerges is an image of MSc that is not fully systemic, and not fully praxeological, not fully consistent with the foundations of MSc synthesis.

Taking into account the categorical requirements of systemic-praxeological synthesis (see subsections below), I suggest the following validation approach to detecting and exploring the current body of knowledge in the domain of MSc methodology.

1) There are no studies dedicated specifically to MSc synthesis, and those that address the subject at all, do so in passing or in a preliminary manner. Hence the list of literature (sources) at the end of this paper. The problem of scientific synthesis is also multidimensional, both in terms of science as a sphere of human activity and individual sciences. This is not a problem that is new or overlooked, but theorems in this domain are fuzzy and practically devoid of scientific value [with the sole exception of O.E. Wilson's 2002 work, which is not so much analytical as postulative]. Meanwhile, a synthesis of science/sciences entails questions like: a) accumulation of knowledge (a simple sum or a new structure of knowledge?); b) opposition: overall body of knowledge vs. specialist knowledge; c) approval/purification of the knowledge system (problems of falsification and verification of knowledge; paradigms and research programmes) and so on. The current body of knowledge in this domain cannot be accepted indiscriminately. I am trying to suggest a preliminary outline of systemic-praxeological synthesis of MSc at the level of concepts and definitions.

2) The system characteristics of MSc are interpreted so freely that it is impossible to present their synthesis. This is also partly due to a certain atrophy of research based on systems theory and praxeology, following its heyday in the first three quarters of the 20th century. The present paper is an attempt at elaborating on MSc as an action system, referring to categorical system characteristics (applicable to any system) and generic system characteristics (applicable to action systems only).

3) The domain of MSc gives rise to various doubts, starting from the sphere of semiotics, but diverse scientific discourse permits: a) separation of MSc from science; b) the pragmatic and apragmatic nature of MSc; c) operation between the simultaneously existing extremes in terms of forms of practice and theorems. Such a position is more of a statement of possibility than a normative ruling, which I am in favour of.

4) There is a serious difficulty with accepting the full-cycle nature of MSc [such a position is argued in Sułkowski 2005: management as a

neo-positivist science, praxeological, assigning value (axiological) and radical (pragmatic) science]. Consequently, outcomes in MSc are limited to scientific theorems, while scientific facts are ignored. I am in favour of the full cycle, which I understand as a systemic-praxeological scope: material/objective, of problems, spacetime and results.

5) The system characteristics of MSc methodology are notably discussed by M. Lisiński. I try to elaborate on his ideas and express them in fully systemic and praxeological terms, in reference to the action system. However, Lisiński does not differentiate inference, reasoning and theorem-proving from methods of scientific problem solving, which is debatable. In this paper, such a differentiation is made to try and resolve this debate.

6) I do not share the opinion that there is no single methodology of MSc (Sułkowski 2005). One does exist, but it is dialectic, paradoxical and chaotic, just as the MSc system – a generic category of action systems.

3. MSc as an action system

Science is a category of human activity, separate in a given domain from pre-scientific and non-scientific activity. Nowadays, it is present nearly in every domain, developing as a distinct and singular sector of activity. MSc is a category of AS (fig. 1), because each scientific activity has an acting entity – at the least, a human individual. Below, I am describing the MSc system, but using the example of AS as a category, which means that MSc components must be put into the respective subcategories. For instance, **the portfolio of scientific processes, actions and activities**, which result in **scientific products and services**, i.e. scientific theorems (opinions) and facts. At the heart of the AS are elements included in **the core of the AS**. First of all, it comprises **the portfolio of processes, actions and activities**, which produce results in the form of **products and services**, dedicated to specific **customers and their needs**. Of course, it is assumed here that we are discussing ASs involved in socially acceptable activity. The processes engaged in by any AS may be inferred from the AS life cycle. They include “AS shaping” processes: 1) *AS creation*; 2) *AS existence*; 3) *AS decline*; 4) *AS changes*. In turn, the “AS existence” processes may be subdivided into: a) *fundamental processes*; b) *auxiliary processes*; c) *management processes*; d) *economic processes*; e) *communication processes*.

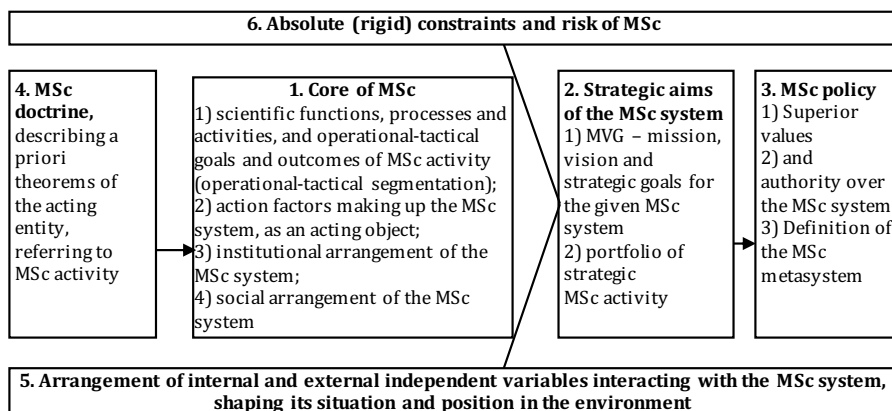


Figure 1. MSc as an action system

Source: own work

Of these, the most important are fundamental processes, which enable the given AS to interact with the environment. The last category, “processes of interaction between AS and the environment”, comprises: 1) complex *exchange processes*, including transactions; 2) complex *co-existence processes*, including competition; 3) complex *self-organisation processes* aimed at achieving active longevity in the environment. The second category of the core is made up of **action ingredients** which, integrated into a single whole, form the management system as an **acting object**. The most important action ingredients are:

- 1) acting entities (managerial and executive), so far exclusively human individuals;
- 2) objects of action, relevant to the goals and conditions;
- 3) operational goals of action;
- 4) impacts (component activities; functions; processes) targeted at selected objects, sometimes of a very complex structure (real and transcendental), for instance including the principles of reasoning and inference and language of communication;
- 5) use of appropriate methods to act, in other words, an appropriate composition of constituent impacts to ensure successful action;
- 6) use of appropriate intermediaries between the acting entity and object of action, that is broadly understood instruments of action (machines, appliances, tools);
- 7) use of adequate resources (matter, energy and information), including financial and capital resources;
- 8) conducting activity in a given spacetime (space and time), starting from the location to the use of time and space;

9) achieving specific operational outcomes of action (products and services, real and transcendental).

Action ingredients may be also put together into a whole by aggregating subsets. As a consequence, we can identify such categories as *technologies*, or *techniques of action*, linking impacts primarily to methods, instruments. The third category of the core is the **institutional arrangement of the AS**. Its essence is *regime and dynamic and static organisational structure of the AS*. Their role is to determine congruence, including particularly the rights and obligations of the AS and its component parts. All of the AS core is infiltrated by **an arrangement of social variables**, such as culture, emotions, interests, faith, hope, trust, etc. They permeate the entire AS, at various levels and in different structures, forming the complex social fabric of the AS.

The second set of subsystems within each AS includes its **aims (blocks 2 and 3)**. The arrowhead of the “AS core” contains operational and tactical aims, preceded by strategic (block 2) and political (3) aims. Strategic aims position the AS, its activity and results (AS domain) in the wider context of the environment and change, and constitute values governing the AS domain. Political aims represent the ultimate justification of the highest order, determining the superior values of the AS and the principles defining the authority over the AS and its relations with the environment.

The **AS management doctrine** constitutes another subsystem. It includes sets of theorems selected a priori (i.e. prior to taking action) by the entities managing the AS concerning the object of management: a) nature of the AS; b)

its relations with the environment; c) and the principles of managing the AS. They reflect the beliefs of these entities on the subject and constitute a virtual external framework for the AS, which these entities can refer to when justifying attitudes, practices and – generally speaking – the principles for managing the AS.

The next block 5 describes the **internal and external independent variables impacting on** the action system. Internal variables emerge from the structure and interactions within the AS. External variables, in turn, represent the arrangement of the AS environment. By pro-

jecting the internal potential of the AS onto the potential of the AS environment, it is possible to explore and shape the situation (position) of the AS within the environment.

The final block (6) contains the **absolute (rigid) constraints and risk of the action system**. Absolute (insurmountable) constraints define the limits of the freedom of organisational behaviour. Their absolute nature may be objective and/or subjective. This category also includes risk levels unacceptable to these entities.

Table 1: Categorical and generic system characteristics of MSc

Generic singularity of MSc	MSc – categorical system characteristics	A comprehensive set, including the human individual	Amechanistic; probabilistic	Relational; ordered; coherent	Interactions with the environment	Functional
Open-ended						
Fuzzy						
Hybrid						
Variable						
Autopoietic						
<i>In statu nascendi</i>						
Evolutionary and teleological						

Source: own work.

It is crucial to observe that all ingredients and subsystems of the MSc system are interdependent and integrated. However, the level of interdependence and integration (levels of integration: Witczak 2008) extends from amorphous (addition), through coordination, coalition, union, federation, to holition (acting machines are non-existent). This stems from the categorical and generic characteristics of the MSc system (tab. 1). As a consequence of the systemic, categorical and generic characteristics, it is necessary to shape MSc, including its methodology, following the principles of dialectics, paradox and chaos. To expect that they will always comply with the science requirements of natural sciences is completely unreasonable. Such requirements can only be fulfilled locally, or in other words –idiographically.

4. Selected elements of the systemic-praxeological doctrine of MSc

Management science is part of science in the general sense. As such, it serves a number of functions in the social division of labour, among which the key role is played by primary scientific practice (activity). The statements above lend themselves to the conclusion that nearly everything can be studied for the purposes of systemic-praxeological synthesis. The domain of MSc and its methodology, apart from some transcendence, is not limited. In other words, the characteristics of scientific methodology are commensurate with the qualities of AS, qualities of systems as categories, and qualities of scientific methodological activity. The baseline material scope of MSc is the practice of management systems of any AS, with MSc potentially serving an auxiliary function (tab. 2).

Table 2: Primary functions of MSc in shaping systems (AS, SAS, CS, SS)

Shaping systems	System creation	System existence	System change	System decline	Synthesis of functions of science
Primary functions of MSc					
Scientific activity- primary scientific functions CARNI	Primary scientific activity encompasses all phases of system shaping. Of course, to perform them, the MSc system also develops the other functions: supporting MSc, managing MSc, et al.				Refers to the synthesis of each MSc function (row-wise) throughout the system-shaping cycle
Organising, checking and improving theorems about management systems	Proposed forms of shaping scientific theorems and facts come from scientific and non-scientific sources, including practice. The task for MSc is to collect, check, organise and improve them according to scientific principles.				
Lifelong learning, including at the higher level (university education)	Here, MSc serves the function of science understood as "learning". According to doctrine, specialised professional management skills can and must be learnt.				
Implementation of scientific outcomes in practice (applied science, implementing scientific facts)	MSc is closely linked to practice, and together they shape how various systems are run (managed). Here, MSc serves not only to implement, but also to improve management performance.				
Supporting practice (e.g. various forms of advisory services)	Management practitioners must solve various managerial problems, some of them incidental, non-standard and exceeding their ability (complexity). MSc supports practice in this area.				
Raising awareness and educating the public about MSc	The cognitive potential of societies in terms of management is a necessary precondition for every member of society to be able to cope with managing systems, including themselves.				
Meta-management of MSc	Here, the domain of MSc is MSc itself in any spacetime. As a result, MSc manages itself (quality of an autonomous system).				
Synthesis of system shaping	Applies to the synthesis of each stage of system shaping (column-wise) for all functions of MSc				Total synthesis of MSc functions

Notes: SAS – acting supersystems (e.g. organisations of enterprises); CS – civilisation systems (a non-simple sum of natural systems and ASs); SS –systems of the cosmos.

Source: own work.

I would differentiate MSc from ME – management education. The latter is a component of the former, due to its educational functions (tab. 2). All functions draw on the primary scientific practice, the main function of MSc, whose domain is the practice of the management system. It has different scientific goals than that of supporting practice: scientific theorems and facts (pragmatic MSc – tab. 2). Another domain of MSc is the science itself, when it deals with meta-management of itself (tab. 2) – this being the apragmatic domain. Each of these functions has a separate domain, also in the cycle of shaping a given AS (header of tab. 2). Hence, each of these domains requires its singular methodological system. This fact contributes to the particular dialectic, paradoxical and chaotic complexity of MSc methodology. The subsystem of the core of primary scientific activity (CARNI) is elaborated on in table 3. Cognition (C) is the traditional, classical function of science in general, including MSc, with the goal of producing

cognitive scientific theorems in different forms (laws, rules, principles, recommendations and scientific references) shaping the overall structure of data, information, knowledge and scientific wisdom. Verification and falsification of their scientific strength shapes cognitive scientific paradigms.

The assignment of value of an object (A) explored at a particular level leads to its evaluation and measurement of value on a continuum stretching from "good" to "bad", in any given domain of scientific evaluation. MSc cannot evade value assignment in any form, despite the obvious difficulties in this scope. The reason is as simple as can be: value is the essence of goals and autonomous aims of any action, and therefore of any AS (fig. 1). They are therefore the source of the "drive" of any AS, including MSc. The processes shaping the approach to scientific action (R) are undertaken following the diagnosis (conclusion of C and A) of a given domain, determining whether and on what terms

any further primary scientific activity is to be continued in the given domain. It also requires a scientific elaboration in MSc, as no further scientific action can be carried out according to pre-scientific or non-scientific rules. The next primary function is deciding on scientific models of a pre-examined object (CAR) in a given domain (normative models – N). Such an approach is the source of the diagnostic scientific method of the full cycle of the primary scientific activity (CARNI). It culminates in processes

implementing (I) scientific models, i.e. materialising scientific facts – introducing scientific models into reality (MSc as an applied science). Columns 2 through 5 identify the remaining ingredients of the core of the MSc subsystem, and column 5 – subsystem synthesis. Please note the subsystem “3. Other auxiliary scientific activities and their ingredients” (col. 2), where, for instance, within the framework of “MSc management” we can shape “MSc models” – e.g. research plans and programmes.

Table 3: Core structure of MSc founded on the processes of primary scientific activity

Categories of basic scientific processes	Scientific objects serving those processes (made up of process components)	Scientific institutions conducting these processes	Social setting of the core of basic processes of MSc	Operational scientific outcomes of basic processes	Row synthesis – subsystems of individual basic scientific processes
1. (C)ognitive processes 2. (A)xiological processes 3. Processes shaping the approach to scientific action (R) 4. (N)ormative processes of scientific model development 5. Processes (I)mplementing scientific theorems	CARNI 1. Scientific goals and problems 2. Methodology of scientific inquiry 3. Other auxiliary scientific activities and their ingredients 4. Scientific resources 5. People – researchers 6. Object of inquiry	CARNI regime, dynamic and static organisational structure	CARNI values, interests, emotions, culture (et al.)	CARNI theorems and scientific facts about managing civilisation systems	Synthesis of scientific cognitive processes and their outcomes
Synthesis of basic processes of the core of MSc	Synthesis of scientific objects of the core of MSc	Synthesis of institutionalisation of the core of MSc	Synthesis of the social setting of the core of MSc	Synthesis of scientific outcomes of the core of MSc	Total synthesis of the core of the MSc subsystem

Source: own work.

5. MSc scientific methodology subsystem

The nature of the primary scientific activity (CARNI) as a whole is hybrid. Cognition (C) differs fundamentally from value assignment (A), as does determination of post-diagnostic action (R), development of models (N), and their implementation (I). The move from the original domain to its exploration, just like the move from N to I takes the form of an interstage crossing. As a result, the activity as a whole also has the systemic-praxeological characteristics as discussed here. For this reason, a scientific inquiry in a given domain may comprise: 1) only a single subsystem of exploration and cognition (C); 2) a subset of subsystems, e.g. CAR; 3) a full-process system (CARNI). Research may employ, for instance, a comprehensive diagnostic method for solving a chosen scientific problem (CARNI), or a prognostic method (CAN), wherein after defining the scientific problem

(CA) we move straight to shaping the scientific model (N), disregarding the diagnostic sources of that model, and relying exclusively on a heuristic and/or volitional approach. Unquestionably, such scientific activity must provide for internal and external corroboration of the process and outcomes of scientific inquiry (logical and positive verification and falsification). The hybrid nature mentioned above also extends to scientific processes at a lower level, e.g. in cognition (C), we can differentiate detection, exploration, classification and explanation, which involve distinct methodologies. The scientific methodology subsystem (fig. 2) is part of the MSc system. Its main constituent is the subsystem of the core of MSc methodology (operational methodology subsystem), shaped roughly following primary scientific processes (CARNI). The scientific methodology of MSc carries a significant stigma of constructivism, subjectivity and extra-rationality. The

science requirements of MSc methodology are determined by the scientific expert community, taking into account the cumulative nature of the methodological CARNI of pragmatic and apragmatic MSc. The core of MSc methodology is engaged in mutual interactions with other subsystems, as a result of which the methodology system as a whole has a particularly complex structure and orientation. For instance, purists and advocates of the monopoly of science methodology may press for the use of the doctrine of that methodology in MSc, as a focus for the whole MSc methodology system. Likewise, those putting emphasis on constraints and risk will focus the system around orthodoxy, and proponents of aims – a teleologically oriented

system of MSc scientific methodology (predominance of blocks 2 and 3 in fig. 2). The highest level of the system is occupied by strategic and political aims of MSc scientific methodology, also encompassing the arrangement of MSc scientific methodology, e.g. as the methodological policy of MSc. To provide another example, the structure of the MSc scientific methodology system may be focused around forms of practising science, e.g. such as schools, directions and trends in methodology. This is the way to form a particularly complex network-hierarchical structure of the MSc scientific methodology system, whose foundations, at the lowest level, contain the operational-tactical core in the form of the scientific method.

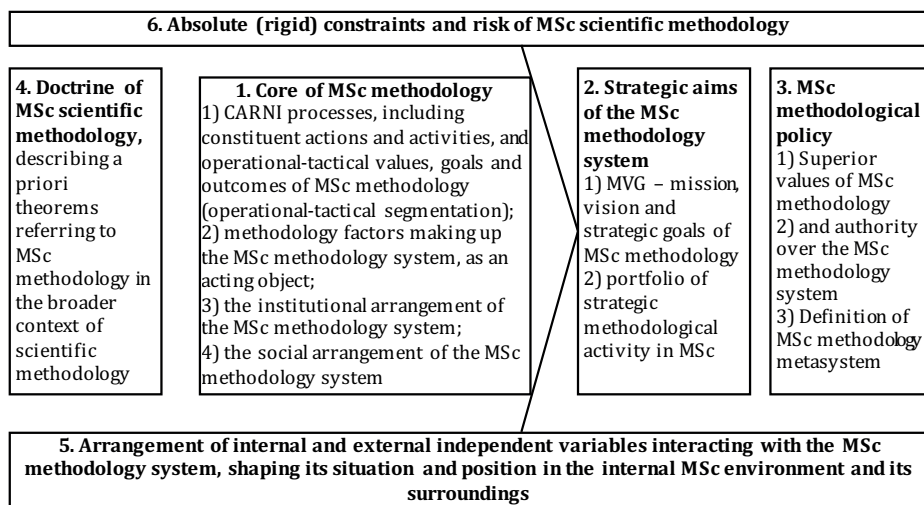


Figure 2. MSc methodology subsystem within the MSc action system

Source: own work

The *scientific method* is:

- 1) conscious, derived from a priori foundations, adapted to circumstances (situation; constraints and risk), scientifically justified, reproducible, systematically applied and standardised,
- 2) arrangement of activities and selected components of the given primary scientific process,
- 3) in such a way as to directly serve a merit-oriented and accepted internally by the scientific acting entity, methodologically and materially efficient solution of the scientific problem (scientific theorems and facts) and achievement of the scientific goal.

The scientific problem and its domain, including the category, is the key determinant of the scientific method and, consequently, also methodology: method is a comprehensive ap-

proach to solving a scientific problem, irrespective of its category. Method, above all else, co-determines the other ingredients of operational scientific activity, decides the choice of specific scientific tools, etc. There can certainly be a feedback mechanism at play: sometimes the choice of the scientific approach, available tools or other scientific factors, decides on the manner of scientific activity, etc. Nevertheless, as I am trying to demonstrate here, the scientific method is merely one of the ingredients of the methodology subsystem within the primary scientific activity subsystem.

Methodology (also meta-methodology) of a given action (here: scientific action) is the arrangement of selected action ingredients, focused around action method (methods), including: 1) language (definitions; semiotics); 2)

doctrines and approaches (choice of doctrines) to the action, its course and arrangement; laws, principles, rules of conduct in the course of action; 3) logic – principles of reasoning and inference; 4) methods – constituent actions and their arrangement (dynamic organisation + procedures) – including process categories discussed in subsection two above, together with corroboration of the process and outcomes of scientific activity; 5) outcomes of scientific activity: a) from the point of view of effectiveness in problem-solving (also in connection with the consequences of activity) and action tasks; b) in the context of other activity ingredients, especially instruments (instruments in a predominant role, serving as a focus for other ingredients, are typical of technology and techniques); c) with shaping outcomes into systems of scientific theorems and facts, including forms of theorems and their approval (paradigms); 6) instruments of action understood broadly, due to their strong and immediate interaction with the manner (method), from the point of view of performance; 7) relation of (scientific) activity in space and time; 8) mutual interactions between the core of methodology subsystem and the subsystems of surroundings [a) the internal environment (here: MSc) and its relation to the external environment, b) rigid constraints and risk]. Such mutual interactions result not only in placing focus on certain methodology subsystems (e.g. teleological) or methodological policy and strategy of MSc, but also impact on its scientific nature, e.g. by requiring a particularly elaborate use in MSc of triangulation and scientific replication.

6. Reasoning and inference in MSc methodology

In the proposed perspective, methodology, including method, is an ingredient of any type of action, including autonomous reasoning and/or inference. The fundamental differentiating criterion is the role of methodology in the entirety of the given action, regarded as an acting object. The second criterion is how methodology is situated within the principles of solving scientific problems. The “reasoning method” can be applied to any manner of solving a given problem, but then it constitutes only an ingredient of the manner, referring to reasoning itself.

On the other hand, we can only talk about the “scientific reasoning method” when the overall manner of solving a given problem meets science criteria. In MSc, the objects of application of scientific methods, meeting the general science criteria as well as the specific

MSc science criteria, are scientific problems. Seen as reasoning/inference (logic) is used in any scientific activity, MSc methodology will fulfil the science criteria, as long as the reasoning/inference used in the given methodology/method of management and MSc meets science criteria (particularly those of logic).

Inference is part of reasoning, one that addresses the problems of reasoning, including but not limited to the problem of drawing conclusions (inference output) from adopted arguments (inference inputs) and/or vice versa (inferring arguments from consequences/conclusions). Its material scope in the given domain is the very process of inferring conclusions based on arguments, and/or vice versa, that is the process of formulating resultant theorems (conclusive opinions derived from reasoning in the given domain). The field (domain) of methodology/method of reasoning/inference is restricted to that process. On the other hand, the sphere of a positively corroborated scientific methodology/method of MSc is broader. Apart from the sphere of reasoning/inference, it encompasses the other variables of the given process/system and of solving a scientific problem in MSc. The same applies to primary scientific activity.

In this context, please note that method is just one of many ingredients of the “system”, whether related to inference or action. Therefore, it is better to use the concept of the “system”, for instance in respect of “inference”, “problem-solving”, “action”, etc. If we want to solve a given problem, we must adopt specific a priori assumptions (doctrine), goals (aims), use a specific operational system (core), and allow for constraints and context. All these elements/subsystems/systems are inter-related, which entails a necessity for ongoing mutual adjustment and harmonisation.

Science discovers (things hitherto concealed) and invents (creates something which did not exist before), but it may also have a mixed function. At the same time, science shapes, or in other words creates, maintains the existence, causes the decline and changes the given object (system). It opens up scientific problems (of a singular or complex nature); solves or records progress in solving existing scientific problems; changes existing approaches and solutions to scientific problems and concludes scientific problems.

With such an approach, any method, e.g. deductive, is just one of a number of inference methods. It is not a method for “conducting a given action”, or a method for solving problems of action, including management and MSc, other than the part of action within them:

“inference”. The same applies to “scientific activity”: methods of reasoning are just one of the ingredients of the overall solving of any scientific problems, including scientific methods. In this context, it is immaterial which method we choose for problem-solving – in each one we must apply methods of inference, for without it problem-solving would be impossible. In other words, inference methods are at a lower level (internally) than problem-solving methods - inference methods are part of methods of action, action in which they are applied and used. In principle, the scientific method may not be reduced to the inference method, but the inference method is a necessary and ubiquitous component of the scientific method.

For the reasons mentioned above, problem-solving methods and inference methods are interdependent. For instance, if we use the purely prognostic method for problem solving, then we use hypothetico-deductive or axiomatic-deductive inference method. The mutual relations discussed here also result from the nature and structure of the material scope of scientific inquiry. The world has a dual wave/particle nature. At the macroscopic level, which is specifically apt when it comes to management, corpuscularity (particulate nature) prevails. Adopting a definition of the corpuscle, which is a relative notion, is the reference point in research. At the level of systems, corpuscles may be individual categories (singletons), such as elements (E), properties (P), relationships (R) and systems ($S=EW$ R). The situation changes, however, when we try to give the scientific treatment to multi-element, distributive and/or collective sets. Scientific theorems and facts referring to single-element sets can be reached using different paths (methods) than in the case of multiple-element sets. When our starting point is a single empirical object, the classical cognitive procedure (partial from the point of view of CARNI) is an inductive scientific method of sorts. Starting from theorems about a singleton (or a multi-element set, but clearly defined as a unit under study), we move on to theorems about a multi-element set. The move entails an attempt to extrapolate the singleton theorem onto the other type of set. This approach is consistent with inductive reasoning, but the similarity is due to the characteristics of the sets under study. Deductive reasoning is limited to testing the veracity and reliability of the relationships between an argument and a consequence, irrespective of the nature of the object under study, including virtual categories, too. It needs to be added that primary scientific activity does not always involve the exploration of real domains, in many cases domains are

of a purely virtual nature, or mixed. Scientific inquiry may be targeted at model constructs of various nature, in which case the manner of reasoning plays a significant, sometimes crucial, role. Nevertheless, processes like shaping such models and simulating their functioning, examination of the consequences of such functioning may involve the application of diverse procedures of transformation, substitution, elimination, etc., making up the method for solving the given scientific problem of modeling. Even then, however, reasoning is only a logical component of the method.

7. Conclusions

MSc, as a social science, operates in a domain different from that of natural sciences. Its development reflects the characteristics of its domain and scope. The material scope of MSc encompasses any action, because only such action must be managed. The objective scope of MSc is founded on all processes of primary scientific activity (CARNI). The contemporary role of MSc emerges in a sinusoid-like manner (in terms of performance and scientific power) from its historic development, current aims, assumptions and circumstances, as well as the heuristic-creative prognostic approach. Such development of MSc is multidimensional in a spherical arrangement, dialectic, paradoxical and chaotic, as well as natural, and shall never be different. Synthetic examples of: dialectics (new evolutionary-creationist theorems emerge from the juxtaposition and friction between opposite extremes); paradox (cumulative and non-cumulative science; specialising and synthesising; etc.); chaos (methodology: stage-specific and interstage; turbulent and stable; attractor and non-attractor); sphericity (diversity, polymorphism). The scientific methodology of MSc is its pragmatic and apragmatic, systemic “toolbox”, referring fundamentally to management system practice. The synthesis of the MSc scientific methodology system emerges from the selected ingredients of primary scientific activity, with characteristics corresponding to the discussed determinants. The main factors defining and providing focus to the methodology system are scientific problems, aims and methods. From this perspective, scientific reasoning and inference (logic) are not separate scientific methods, but rather necessary ingredients of any scientific method, and therefore – scientific methodology. The relationship between MSc and practice is threefold: 1) MSc follows practice; 2) MSc precedes practice; 3) mixed.

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