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The Logic of Planning and Decision Making Behaviour in Business Management

- Scientific, praxeological, and pedagogical implications from an experimental investigation into decision making rationality and decision making efficiency -

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I. Introduction

This research paper is based on substantial findings of the research project "Empirical Management Learning Laboratories in an International Context", which was conducted within the academic development program "Improvement of Business Management Education" on behalf of the Hessian Ministry of Science, Research and Arts. The initial project intention is based on the fact that "traditional teaching methods" in business management education (classroom lectures, seminars, workshops, etc.) cannot, can no longer or can only partially contribute to an efficient transfer of academic curricula contents. Although the content by itself could be the object of critical reflection, reasons for inefficiency can, to a considerable extent, also be "located" in methodological and didactic shortcomings of traditional teaching methods.
Neuert (1993) divided those shortcomings into the following categories:

- Low learning efficiency, demotivation of the students caused by the "enforcement" to passive behaviour within the lectures,
- lack of curricular contents reflection, both in a substantial and societal context,
- "by heart learning" of selective and assessment relevant knowledge,
- the curricular contents relevance and its overall context are not well explained to the students,
- and a high degree of absence in the courses.

The main objective of the research project "Empirical Management Learning Laboratories in an International Context" was to develop a specific "technology of learning", which increases the teaching efficiency and supports the sustainable development of problem solving abilities of business management education. Based on an application-orientated view on business management, meaning the teaching of application-orientated problem situations and problem solutions[1], we are primary focusing on the teaching of empirical methods.
Empirical research methods provide a substantial set of tools to generate and discuss evidence about reality and specific economic situations.
In many cases empirical methods are introduced in preparatory courses as non-relevant tools and their actual application relevance often remains a mystery.
It will be necessary to develop new methods and to realign the curricula contents in the area of empirical problem solutions, in order to overcome the discussed methodological and didactical deficits and to meet higher acceptance from students and teachers, which will lead to a higher learning motivation.
Business management education has struggled with the necessity to enhance teaching and learning efficiency for a long time by attempting to implement "activating instruction methods". Those methods, in particular management simulations, action research projects and case studies, have significantly contributed to the improvement of efficiency in business management education. However, despite the usage of these modern methods, shortcomings in understanding and by solving complex problem situations in corporate management planning and decision making still exist. Therefore, it will be absolutely necessary to develop new methods of teaching, in order to close this "last" gap.
Recently, various European and American Universities have been testing the application of learning laboratories in business management education[2].
This includes elaborate, partly computerised, case studies and management simulations with a variety of complex problem situations.

[1] Bleicher (2011), pp. 41-46.
[2] Delhoum (2008), Baume (2009).

Practical case studies, which could be operated interactively and individually, might be a starting point for such learning laboratories. These case studies will contain a variety of realistic problem situations, transferred into a computerized management simulation.
This approach accentuates the following three characteristics:

- Temporal and personal independence in the usage,
- continuous repeatability of the application of various problem solving strategies,
- and multilingualism.

This paper presents substantial findings based on the application of a management simulation in a management learning laboratory in the study course "International Corporate Management" at Fulda University, Germany.
The management learning laboratory and the underlying management simulation were used with students and with a reference group of professionals. The main target was to explore in which structural and methodological decomposition problem solving tools and techniques in planning and decision making processes should be applied, in order to sustainably increase the participants' problem solving capabilities.
The main results of this investigation will be described in the next chapter.

II. Synopsis of the key findings of the empirical research study into the relationship between decision making behaviour and decision making efficiency

Planning and decision making processes are the key element of all managerial operations. Their outcomes ultimately determine their economic success in terms of profits and profitability, and contribute to the long term maintenance of a company's market position.
Therefore, we conclude that the achievement of long term objectives can only be secured if planning and decision making activities are designed in a (formal and material) way that their results turn out to be efficient according to the initially intended purpose.
Neuert (1987) has explored the cause effect relations of planning (and decision making) behaviour and the efficiency of planning (and decision making processes) by applying a laboratory experiment. Therefore, by reflecting Max Weber´s understanding of rational behaviour[3], more or less continuous degrees of planning (and decision making) rationality (PR) were operationalised and related to their outcomes (planning precision, profitability, liquidity, outcomes perception by the decision maker, etc.). The empirical design of the investigation was based on a complex management simulation. The results showed that planning and decision making efficiency is dependent on the variables:

1) Degree of target orientation (DTO),
2) degree of process organization (DPO),
3) degree of information acquisition and evaluation (DINF),
4) degree of decision making cognition (DCOG),
5) and degree of reflection (DREF).

The results proved a significant (positive) relationship between the previously outlined five criteria of planning (and decision making) rationality (PR) and the planning and decision making success.
Moreover, it was demonstrated that all three subcomponents of the planning efficiency (PE):

1) The formal efficiency (planning accuracy),
2) the material efficiency (reach of performance target, liquidity target, growth target, independency target),
3) and the personal efficiency (motivational effect of the planning execution),

are in line with an increasing planning (and decision making) rationality (PR).
The material efficiency is the one most influenced by the degree of rational decision making, followed by the formal efficiency and by the personal efficiency.

[3] Weber/Winckelmann (2002), Hartmann (1998), pp. 102-116.

In an additional analysis Neuert (1987) provided further evidence by demonstrating that experience has a solid but relatively weak effect on the planning and decision efficiency (PE).
However, the assumption that experience within a certain field of problem situations is a most important success factor in planning and decision making processes has to be reconsidered.
Finally, Neuert (1987) demonstrated that problem orientated conflicts within planning processes could also lead to a higher planning efficiency.
The following chapter introduces the praxeological and pedagogical implications of the empirical study, mentioned above. Furthermore, we discuss opportunities to integrate our research results into an application orientated model for the "training" of planning and decision making behaviour.

III. Considerations of the "scientific" task of problem solution tools development

"Scientific research can be interpreted as an effort to describe and understand the reality based on methodologically relevant and systematic research approaches and as the application of research findings to control and predict the reality"[4].
Based on this epistemological understanding we advise that the aims of scientific research should not be primarily understood as self-serving acquisition of knowledge, but, moreover, research should develop application oriented solution procedures based on substantial research findings in order to support practical operations.
Whereas "scientific" description and explanation are part of the epistemological area concerning the context of justification of research findings, the fulfilment of the "scientific construction" of problem solving instruments can be assigned to the area of scientific delusion. That particular field deals with methods of operational formulation and empirical probation of conjectures and hypothetical models. It is part of the area of "scientific logic", which is supposed to develop answers for the question, how theories and hypotheses can become open to scrutiny in terms of their "verisimilitude" in an intersubjective manner[5].
The context of delusion however pertains to the utilization of gained scientific knowledge. In this sense is belongs to the field of "scientific policy", which is supposed to serve the purpose of "reality configuration" and the required instruments for that[6]. "Scientific policy" always assumes the existence of goals and systems of objectives, because without them activities would end up with no possibility of review and validation.
Often, especially in a professional context, managers represent the opinion that theory and reality (practice) are strictly separated "objects" of human interactions. Max Weber´s commitment to science as a value-free system is often misinterpreted as an isolated and autonomous ambition without the primary focus on the concerns of modern society. Especially in the Marxist and Neomarixst literature this approach has been misinterpreted in a way that, due to "the positivistic abstinence of values in modern sciences, their norms have been subject to irrational and arbitrary decisions, whereas, on the other hand, modern science has emancipated itself by its relative autonomy from the true interests of society"[7].
If that schism between theory and reality actually existed, one would indeed have to ask the question, whether "rational scientific policy"[8] as the transfer of knowledge in order to influence the real world would be possible at all. This association of the vision maybe already rejected by the fact that the history of mankind is doubtlessly characterized by continuous progress in numerous areas e.g. in technology, medicine, and generally in the "quality of life".
On the other hand it is obvious that the notion of "separation" between theory and reality (practice) really exists in the history of science and also in such a fundamentally empirical discipline like business management. It is denoted by the frequent and sometimes implacably conducted controversy of the doctrines of "pure" versus "applied" business administration and economics.
Whereas Rieger is tremendously opposed to the idea that business administration as the discipline of "private" business operations creates any recommendations of good behaviour at all[9], Schmalenbach

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[4] Zinn (1976), p. 15.
[5] Raffée/Abel (1979) p. 166 ff., Porstmann (2004) p. 53 ff.
[6] Raffée/Abel (1979) p. 167 ff., Porstmann (2004) p. 53 ff.
[7] Albert (1971) p. 93.
[8] In terms of Max Webers' understanding of "Science as a Vocation", Weber (2006).
[9] Rieger (1984) p. 14 ff., Brockhoff (2009), p. 155 ff., Busse v. C. et al. (1991) p. 13 f.

has heavily supported the idea that the real world business community is supposed to develop measures for dealing with its empirical environment. In this sense he understands business and economics also as "academic arts" which have to develop decision making heuristics for real world operations[10].
This epistemological self-understanding of business management as a "scientific" discipline which has to fulfil the tasks of explanation and problem solution simultaneously, has become ever more popular among its representatives[11].
Therefore, in our opinion, we are permanently drawing practical conclusions in a scientifically and formally correct manner from the previous scientific tasks of empirical explication of the interdependency between decision making behaviour and decision making success as, what we call, praxeological implications.

IV. Exemplary catalogue of explanatorily relevant conjectures for application-based problem solution approaches

1. Praxeological implications

In order to submit application based implications for practical application it is necessary to explore proven statements about reality.
Our empirical studies have (preliminarily) confirmed the following observations:

- The rationality of planning behaviour, measured by the five criteria DTO, DPO, DINF, DCOG, DREF has a substantial influence on the planning success.
- The rationality of planning behaviour is determined by a "healthy" combination of intuitive and discursive pre-conditionalised of participants' traits and further influenced by intensive pre-situational problem solving instructions of the decision makers.

By combining those findings we can conclude that the success of planning and decision making processes can be enhanced by activities in personality development, by "mixing" intuitive and discursive personality traits and by pre-situational problem solving instructions.
Further, our empirical study has shown that rationality-based approaches in planning and decision making processes still have substantial shortcomings, perhaps with the exception of the information awareness necessity.
As a result, the average degrees of target orientation (DTO), process organization (DPO), decision making cognition (DCOG) and reflection (DREF) are below 50% of the "maximum" values, which demonstrates a huge potential in the optimization of rationality-based approaches. Therefore, efforts in staff training have to be implemented, aiming at the improvement of rationality in planning and decision making processes as a substantial pre-condition for planning and decision making success.

1.1 Staff training as an instrument to increase rational behaviour in planning and decision making processes

Efforts to increase rational behaviour in problem solving processes (based on our understanding that the planning process can be seen as a specific form of problem solving processes[12]) could be assigned to the area of "psycho-motoric" educational objectives within staff training[13]. "Psycho-motoric" training implies the teaching of techniques and the development of skills to understand and apply certain methods in various problem situations[14]. Therefore, it is necessary to achieve "cognitive" educational objectives by imparting knowledge and by developing intellectual skills and capabilities[15].
In this case, Schönfeld defines under education and staff training "all activities […] which increase the qualification of managers and the human resources potential in general"[16].

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[10] Schmalenbach (1970) pp. 490-498., Brockhoff (2009), p. 155 ff., Busse v. C. et al. (1991) p. 13 f.
[11] For further information see Brockhoff (2009), Wassmuht (1997), Busse v. C. et al. (1991) p. 13 f.
[12] Neuert (1987) p. 15 ff.
[13] Bihler (2006) p. 75, Schröder (2002) p. 80 f., Kraiger et al. (1993) pp. 311-328.
[14] Pätzold (1996) p. 27-29.
[15] Bloom et al. (1976) p. 24 ff.
[16] Schönfeld (1975), p. 889 f.

Since the rationality of planning behaviour, as we have demonstrated by our previous findings, is not one of the already sufficiently "existing" quasi-pre-conditionalised abilities of human beings, rather tremendous deficits of behavioural prudence can be observed. It is one of the foremost goals of scientific research to decrease "irrational" behaviour in decision making. Furthermore, we have demonstrated in our study that rational behaviour can be significantly increased by pre-situational problem solving instructions and training initiatives.
In our experimental research study (Neuert 1987)[17] training initiatives have been carried out in form of a seminar with problem based instructions. We attempted to demonstrate possibilities to improve rational behaviour trough lectures and discussions. However, in the recent literature, in this context the question of alternative problem solution instructions and better concepts of staff training arises[18].
The previously discussed "psycho-motoric" educational objective of staff training implies the transfer of knowledge and methods and poses an additional question: Is it possible to artificially create or modify specific personality traits via training initiatives in order to achieve a better execution of planning and decision making heuristics?

1.2 Alternatives of staff training efforts

1.2.1 Personality development

The manifestation of personality traits determines human behaviour and in particular shapes planning and decision making behaviour.
In this context, we have formulated a hypothesis stating that discursive personality traits tend to cause a higher degree of rational behaviour in planning processes than intuitive ones. However, our empirical investigation could not confirm this hypothesis. The empirical findings indicate that a "healthy" combination of intuitive and discursive personality traits could achieve the highest degree of planning behaviour (Neuert/Hoeckel 2013).
If it would be possible to create certain personality characteristics through specific training programmes, all efforts should focus on the constitution of a "healthy" combination between intuitive and discursive personality traits.
However, we have to consider that the current state of socio-psychological research indicates that the "creation" or "modification" of personality traits through training initiatives cannot be performed with sufficient reliability[19].
Pure plausibility considerations make us presume that personality traits can be at least partially modified in the course of time by specific external influences.
Research into problem solving approaches has developed a number of instruments to increase systematic and analytic thinking, which in our terminology will increase the discursive personality characteristics and the intuitive potential. Schlicksupp introduces the "heuristic principles of ideas creation" and distinguishes between discursive traits supporting and intuitive traits supporting methods[20]:

<u>Discursive traits supporting methods are:</u>

- Morphological analysis: The morphological analysis is a collection of problem elements and their sub-characteristics in form of a matrix. The design of the morphological analysis has to be done in according to the following five steps: 1) Description and definition of the problem situation, 2) Exploration of all factors which will have an influence on the prospective solution of the given problem 3) Identification of all possible combinations, 4) Analyses of all possible solutions, 5) Choice of the best solution based on individual assessment criteria[21].
- Design of problem areas (morphological matrix): Similar to the morphological analysis the problem will be displayed in a matrix. At the same time, the disadvantages of the morphological analysis (it´s complexity caused by a multitude of parameters and

[17] Neuert (1987) p. 200 ff.
[18] Laurillard (2013) p. 81 ff.
[19] However, the opposite opinion that personality traits are eternally unchangeable characteristics of the individual has also not been empirically substantiated yet.
[20] Schlicksupp (2004) p. 16 ff.
[21] Vahs/Burmester (2005) p. 171 ff., Schlicksupp (2004) p. 78 ff.

characteristics and the related difficulties in evaluation) are eliminated because of the clearly arranged and comprised representation (usually two to four parameters). The main target is to list suitable solutions for the problem situations. This method appears to be useful in order the higher the degree of decision making cognition (DCOG)[22].

- Listing of Attributes: All relevant problem characteristics are listed in form of possible problem solutions[23]. The aim of this method is to search systematically for all possible variations and their consequences in the planning and decision making process.
- Function analysis: This analysis is based on the, in the process of the problem solution, achievable tasks[24]. The use of the function analysis could cause a higher degree of target orientation (DTO)
- Tree of problem solutions: All directions for possible solutions are systematically captured and displayed. The problem situation is stepwise and top-down decomposed into possible alternatives[25]. This technique could higher the degree of information acquisition and evaluation (DINF) and the degree of decision making cognition (DCOG).

Intuitive traits supporting methods are:

- Brainstorming: The brainstorming is a special form of a group session which should create creative solutions. The following principles should be applied: Each participant will develop and express his ideas, proposals from all group members will be collected as suggestion as a starting point for a prospective solution and they have to be further developed by everyone. Any kind of criticism is prohibited during the session, review and selection of ideas. The overall target is to create as many creative ideas as possible. Brainstorming could improve the degree of target orientation (DTO) and the degree of information acquisition and evaluation[26].
- Brainwriting: This method is an further development of brainstorming, as it´s conception is focusing on a systematic documentation of the previously created ideas. The most popular method of brainwriting is the called the 635 method[27]. Like brainstorming it could improve the degree of target orientation (DTO) and the degree of information acquisition and evaluation.
- Synectics: Syenctics attempts to simulate creative processes. The method consists of four phases: 1) Clarification of the problem situation, 2) Exploration of cause-effect relations, 3) Obscuration of the problem situation by an allocation in other unfamiliar situations 4) Finding problem solutions by the analysis of step 3[28]. The Synectics can be used to improve the degree of target orientation (DTO) and degree of decision making cognition (DCOG).
- Semantic intuition: This method tries to combine terms which are in some way combinable with the given problem situation. In this way, associations for new and creative solutions should be generated[29]. This technique could higher the degree of information acquisition and evaluation (DINF).

Of course, it is beyond the scope of this paper to consider all available methods of intuitive traits supporting and discursive traits supporting staff training approaches. Our attempt is to provide a short overview of potential tool sets in this field of research. The application of those methods could be a first attempt to jointly increase discursive and intuitive personality traits in order to achieve higher degrees of rationality in planning and decision making processes.

1.2.2 Instruction approaches for problem solving methods

Most of the staff training methods are generally based on the two aspects of 1) personality development and 2) problem solving instruction. While the main task of personality development is

[22] Schlicksupp (2004) p. 91 ff., Sartorius (2014) p. 49 ff.
[23] Schlicksupp (2004) p. 89 ff.
[24] Schlicksupp (2004) p. 91 ff., Sartorius (2014) p. 49 ff.
[25] Großklaus (2008) p. 157 ff.
[26] Vahs/Burmester (2005) p. 168 f., Sartorius (2014) p. 37 ff.
[27] Vahs/Burmester (2005) p. 169 ff., Sartorius (2014) p. 39 ff., Linneweh (1999) p. 98 ff.
[28] Vahs/Burmester (2005) p. 173 f., Schlicksupp (2004) p. 130 ff.
[29] Schlicksupp (2004) p. 141, Winkelhofer (2006) p. 195 ff.

aiming at the enhancement or change of individual personality traits, problem solving instruction should provide useful techniques and instruments to strengthen a formal-rational problem solution process. One and the same training procedure could be used to “enrich” both 1) personality traits and 2) problem solving capabilities, meaning that all previously described methods for personality development could also be used for the improvement of problem solving capabilities.
Business management research and educational research have provided a number of methods which could be used for the teaching of problem solving relevant techniques. The main purpose is to instruct professionals in management functions in handling instruments, which allows for a rational processing of their daily managerial tasks, especially in the execution of planning and decision making processes. In general, we can distinguish between the following methods:

- Lecturing: The instruction based on lecturing can be described as the “classical” method of training and education par excellence. Their purpose is to impart knowledge and problem solving techniques by a competent speaker. Their disadvantage is that the persons or groups which should be trained are not actively involved in the development of the learning objects, but only passively follow the lessons. Empirical studies have shown that the lecture method is the least successful type of learning in terms of goal achievement compared to all other methods[30].
- Conference method: In contrast to the lecture method the main characteristic of the conference method is the idea of involving all participants in the problem solution process through various discussions. The conference method could be divided into the following types: Teaching conference to impart knowledge, problem solving conference for the development of solutions to real or for training purposes simulated problems and brainchild-conferences for the creation of new ideas[31].
- Case studies: Case studies as an instrument for education are focusing on the “representation” of a real-life situation which confronts the involved participants with a multitude of decision making processes[32]. The primary educational objective is “the application of theoretical knowledge in realistic problem situations”[33]. The case study method was developed at Harvard University and aims to actively integrate the participants in problem solving processes and to make them familiar with appropriate problem solving techniques[34].
- Role play: In this situation the participants play certain roles based on specific descriptions (e.g. General Manager, Company I), while the observers are force to criticize their authenticity[35]. The main objective is to train the ability to think in diverse roles and gain manifold experience in problem solving processes.
- Management simulations: These simulations have been designed with the intention to represent an isomorphic or at least a homomorphy object of economic reality. A simulated competitive environment is merged with the results of the participant´s planning and decision making processes and all effects of various interactions are calculated by the simulation model. The main objectives of management simulations as a training method are: 1) Analyse complex and realistic situations, 2) identify possible problem solutions, 3) execute and practice rational decision making and 4) defend their ideas in a group of decision makers[36]. The main advantage of the management simulation as a training method is the involvement of the participants in an at least quasi-real context which demonstrates complex interdependences and various problem situations[37].

[30] Laurillard (2013) p. 107 ff.
[31] Stock-Homburg (2010) p. 230 ff.
[32] Matzler et al. (2003) p. 3 f.
[33] Matzler et al. (2003) p. 3, Kosiol (1957) p. 49.
[34] Matzler et al. (2003) p. 3, Lynn (1999), Heath (2002), Barnes et al. (1994).
[35] Stock-Homburg (2010) p. 230 ff.
[36] Günther/Kruschwitz (1975) p. 12 ff.
[37] For further information see Steyrleithner(2006), Rempe/Klösters (2006), Baume (2009), Trautwein et al. (2010), Kirchner/Röben (2013), Ullrich (2005), Eisenführ et al (2014).

Since management simulations are a promising training method according to business management education research[38], we will consider this instrument in more detail and discuss its applicability in the training of rational behaviour in planning and decision making.

2. Management simulations as an exemplary instrument to train problem solving capabilities

2.1 The educational function of management simulations

The tasks of business and economics as empirical scientific disciplines can be outlined as follows:

- Description of actual and relevant microeconomic facts and conditions,
- Explanation of relevant microeconomic cause-effect relations,
- Forecast of relevant future microeconomic developments,
- Development of problem solving instruments for microeconomic problem situations[39].

However, this popular framework ignores the fact that without a clear and well-accepted transformation of knowledge all efforts of science and research would just end in itself. This means that business and economics as scientific disciplines have to deliver their results to those who need help in solving practical problems. This requires that it includes the task of imparting knowledge as an elementary function.

Management simulations are, in the meantime, a widely recognized instrument to achieve the task of imparting scientific knowledge into practical management. Applied as a method for management education, management simulations are suitable to transfer knowledge for problem solution in various problem situations by "demanding" actions from the participants and by immediately displaying their achieved results.

Management simulations reflect a simplified economic "reality" which allows the participants to gain specific business management knowledge and to improve their problem solving abilities[40]. Since students of business and economics, in contrast to e.g. medical students, are not able to practice on "living" objects, business simulations ultimately have to provide a somewhat "realistic" environment for business management education and practice[41].

In business education research a number of so-called teaching and learning catalogues are being discussed, which should evaluate the use of business simulations as an instrument for business skills development training. In this context, the involvement of the students is an intensively discussed issue. In contrast to the classical methods of teaching ("passive" transfer of knowledge to the students), the students are forced to participate with own their proposals and subjective approaches of problem solutions.

The traditional teaching methods (lectures, seminars, colloquia, etc.) provide either no or only very few possibilities to apply the passively acquired knowledge to specific problems. Furthermore, it is not possible to develop knowledge which is based on the success or failure of applied problem solving methods. The educational objective of improved knowledge transfer relies on the successful integration of the students and on an "intra-individual" knowledge transfer, based on the instructional effects of "real world" problem situations.

Management simulations provide the opportunity to apply previously learned problem solving methods and to motivate the participants to document, control, correct and optimize their "behaviour" and the results of their planning and decision making processes in the course of the simulation.

Another interesting teaching and instruction postulate (as formulated in most curricula) is the opportunity to test the applicability of previously gained knowledge by confrontation with "real world" problem situations[42]. This educational objective is described by the term "reflection". Through the use of management simulations the participants can test and reassess their knowledge in "actual" problem situations. Furthermore, critical reflections should lead to additional and improved problem solving capabilities. Therefore, management simulations can be used to reconsider and modify "traditional" management tools and "traditional" problem solving techniques.

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[38] Trautwein et al. (2010) p. 104 ff.
[39] Peters et al. (2005) p. 8 ff.
[40] Trautwein et al. (2010) p. 87 ff.
[41] Wossidlo (1966) p. 125.
[42] Koller (1969) p. 120 ff., Eisenführ et al (2014) p. 13 ff.

Finally, with the use of management simulations in business administration, participants will learn about problem solving techniques for various management areas based on a "realistic context" by using formally logical calculi and heuristics.
Since the majority of planning processes requires teamwork and groups of decision makers, interaction and communication skills and team building trainings must also be considered in business management education.
The following table displays an aggregation of various categories of educational objectives for the use of management simulations as an instrument for staff and management training:

1. Cognition	11 Knowledge	111 Learn management terminologies 112 Learn economic and managerial interdependencies 113 Learn target categories 114 Learn management methods 115 Study the applicability of management knowledge
	12 Ability	121 Managerial competence 1211 Analysis of complex economic interdependencies 1212 Synergetic development of complex plans 1213 Study decision making processes 12131 Problem awareness, -perception, -analysis 121311 Identification of problems and profitable situations, formulation and classification of problems 121312 Formulation of long-term targets, decomposition into sub-targets per period 121313 Target adjustment 121314 Initiative to start new decision making processes 121315 Ability to analyze problems 12132 Synthesis of various solutions 121321 Detection of information sources for problems 121322 Collection and structuring of information 121323 Development of alternative solutions 121324 Definition of priorities 121325 Forecasting of effects 12133 Control 121331 Comparison of results 12332 Analysis of deviations 121333 Evaluation of results 1214 Assessment of external and internal development 122 Development in the area of human resources 1221 Organization of teamwork 12211 Role allocation 12212 Communication 12213 Learn conflict resolution mechanisms 1222 Leadership

2 Affection		21 Learn a system (overall) perspective (overcome department egoism) 22 Learn and consider economic interdependences (anchorage an economic mind-set) 23 Study cooperation-orientated behaviour (e.g. group sensitivity) 24 Study appropriate risk awareness

Table 1: Educational objectives for management simulations (Bleicher 1974)

2.2 The application of management simulations as an instrument to enhance rational behaviour in planning and decision making processes

In an empirical study Cohen et al. have ascertained that especially the fulfilment of the following categories of educational objectives can be trained by using management simulations[43]:

- Identification of economic target categories,
- Identification of sources of information,
- Acquisition and structuring of information,
- Organization of group work (roles, communication, conflict solution, etc.),
- Learning of making decisions (recognition and formulation of target criteria, development of alternative solutions, development of weighting factors, forecasting of effects, etc.),
- Learning of control operations (comparison of results, analysis of deviation, assessment of results, etc.)[44].

These categories of learning criteria largely concur with our “isolated” variables of planning and decision making rationality.
In the previous sections we have outlined the suitability of management simulations for the use in our empirical laboratory experiment research. In addition, the empirical investigation by Cohen et al. and a number of further studies[45] point out that management simulations are suitable tools in training and education as well.
Furthermore, we will explain why management simulations are valuable instruments to increase rational behaviour in planning and decision making processes.

2.2.1 Enhancing the degree of target orientation (DTO)

Our empirical research has confirmed the hypothesis that the DTO within planning processes has a positive effect on the planning success. The statistical analysis indicates an above-average impact within the complex of the rationality criteria. The independent variable DTO represents an impact factor of 0.2045 in our standardized multiple regression function[46].
Furthermore, our study also revealed that, standardized to a maximum value of 1.0000, the DTO (resulting in an average value of 0.3536 during the entire experimental procedure) shows a significant potential as a criterion for rational planning behaviour. In a nutshell, we can conclude that significant efforts can be made to increase the DTO.
Management simulations as a training instrument provide the following approaches to increase the DTO:
Firstly, the complexity of the problem solving task by itself, accurately described as the execution of planning and decision making processes in all functional areas, forces the participants to establish guidelines in order to structure the planning process. Based on our “empirical impressions” we state that at the beginning of the management simulation the target orientation of the participants was implicit. During the duration of the experiment the participants recognized the necessity to shift to a more explicit way of target orientation. This is probably based on the fact that the planning groups

[43] Eisenführ et al (2014) p. 13 ff.
[44] Bleicher (1974) p. 35 ff.
[45] For further information see: Steyrleithner(2006), Rempe/Klösters (2006), Baume (2009), Trautwein et al. (2010), Kirchner/Röben (2013), Ullrich (2005), Eisenführ et al (2014).
[46] The average rationality degree impact factor of the five degrees of rationality in planning and decision making is 0.2.

adapted their behaviour during the planning periods[47], based on the experience that they cannot operate without defined tactical/short-term and strategic/long-time targets. A lack of formulated targets and missing target systems directly affect (in contrast to non-reactive teaching methods[48]) the participants in terms of their (quantitatively measured) achieved results of their planning process. This immediate feedback could be the starting point for reconsiderations in their planning approaches for the next planning periods.
Secondly, the instructors can take the opportunity to influence the target orientation behaviour by active steering interventions in the problem solution process.
Thirdly, the competitive environment of management simulations forces the participating teams to compete with each other based on predefined criteria. The competitive notion, trying hard to "defeat" the competitors, can create a learning effect via management simulations which should not be underrated.

2.2.2 Enhancing the degree of process organization (DPO)

In our empirical study the DPO within the planning processes turned out to be another critical determinant. Its impact on the planning success is above the average resulting in a calculated impact factor of 0.2781, nearly 30%.
Similar to the target orientation we revealed remarkable deficits in the process organization as a criterion for rational planning behaviour. Standardized to a maximum value of 1.0000 the DPO displayed an average value of 0.3768 during the entire experimental procedure. Therefore, we can conclude that further efforts must be made to increase the DPO.
Management simulations as an instrument for decision training provide various approaches to increase the DPO:
Firstly, the handling of planning tasks within groups requires additional actions concerning the division of labour. The instructors are able to influence the planning success by changing organizational concepts and organizational structures of the participating groups.
Secondly, the complexity of the planning tasks (the management simulation FINIS i.e. requires a total of 15 types of decisions in the functional areas of purchasing, inventory management, investment planning, production, sales and finance) forces the participants to divide their workload into well-structured work packages within their planning groups. Instructors can influence this by appropriate briefing.
Thirdly, additional time pressure can demonstrate the effect of process organization orientation on the planning success. The participants experience the importance of disaggregated work packages and effective task assignment. The instructors can provide additional suggestions to increase the degree of planning organization.
Finally, the participants are instructed, based on their own experience or additional suggestions from the instructors, which person within their group is most suitable for a specific predefined field of activities. The impact of previous assignments of tasks to specific group members can again be illustrated by the respective decision results.

2.2.3 Enhancing the degree of information acquisition and evaluation (DINF)

Our empirical investigation identified the DINF as the most developed sub-component of rational behaviour within our experimental groups, resulting in an average value of 0.8127. Again, the maximum value was standardized to 1.0000. This result demonstrates valuable insights into the information necessity awareness of human beings per se, meaning the planning and decision making relevant applicability of previously gained knowledge, but it does not provide sufficient evidence about the information application and knowledge transfer abilities.
The degree of information acquisition and evaluation has a minor effect on the planning success, resulting in a below-average factor of 0.0920, based on our five rationality criteria framework (the average impact factor is about 0.2). Nevertheless, our statistical analyses support the assumption that the existence of relevant information has a significant effect on the planning efficiency.
In sum, we observed deficits in the information behaviour which could be diminished by the following initiatives:

[47] Typically at least 8 planning periods.
[48] E.g. lecturing, conference and case studies method.

Firstly, management simulations as a method of staff training are a useful tool to instruct about appropriate information behaviour. The main target is to elevate the information awareness of the participants by outlining that efficient decisions need target-orientated sources of valuable information. Based on the fact that within the management simulations several decisions require specific information, which is not available at the beginning, the participants will have to develop strategies to identify useful information contents and sources.
Secondly, instructors could use the possibility to retain problem-relevant data and information to force the participants to start information acquisition processes. The participants will experience that actions of information acquisition are absolutely necessary for their decision making processes, especially in an uncertain environment[49].
Further, the participants have to adapt their strategies and information acquisition and evaluation processes in the course of the planning periods due to continuous changes of the competitive environment. Therefore, management simulations turn out to be a "realistic" instrument for adopting the appropriate handling of information within planning and decision making processes.

2.2.4 Enhancing the degree of decision making cognition (DCOG)
The DCOG as a measure for rational planning and decision making has the second highest influence on the planning efficiency. The "experimental" DCOG impact was 0.2720 in comparison to an average rationality degree impact factor of about 0.2. In our laboratory experiment the average degree of decision making cognition was 0.6237 which is above the average compared to DTO, DPO and DREF. Nevertheless, based on the experimental results, we still observed deficits in the degree of decision making cognition. The following measures can increase the DCOG:
Firstly, management simulations provide a useful instrument to advance the DCOG. The simulation model FINIS requires 15 types of decisions in several functional areas. Every single decision has to be made under the consideration of various target criteria. The participants will recognize that the complex tasks require at least an implicit formal structure of "rational" decision making, which implies the formulation of targets, the identification, structuring and evaluation of alternatives and their consequences, and a final coordination within the planning group. The participants will be immediately confronted with the (quantitative) results of their decisions and thereby obvious mistakes and inefficiencies can easily be identified. The "learning from mistakes and inefficient decisions" causes the highest learning effects[50].
Secondly, management simulations are, due to their format of complex interdependences, a very useful tool to display interactive relations in different areas and therefore provide opportunities to strengthen rational reasoning within complex systems[51].
Finally, the participants will learn that there is no single ideal solution rather than multiple sub-ideal decisions, which have to be made within a dynamic competitive environment.

2.2.5 Enhancing the degree of reflection (DREF)
The DREF within the planning process resulted in an impact factor of 0.1534. This is below the average of all five rationality criteria[52]. With an actual average value of 0.2280 (maximum value standardized to 1.0000) the DREF is the most underdeveloped rationality criterion. Therefore, management simulations will provide the following improvement approaches:
Firstly, management simulations are a valuable instrument for decision training because they improve the degree of reflection within planning and decision making processes.
Secondly, the dynamic environment of the simulation model forces the participants to constantly reflect and control their decisions. The continuous involvement in various interlinked planning processes demands an ongoing review of the periodical results, the execution of failure analyses and deviation analyses, and a consequent reflection for future decision making processes[53].

[49] Eisenführ et al (2014) p. 13 ff.
[50] For a comprehensive discussion of failures and mistakes in decision making processes see Geissler (1986) p. 4 ff.
[51] Bleicher (1974), p. 56 ff.
[52] Neuert (1987), p. 105 ff.
[53] Eisenführ et al (2014) p. 59 ff.

Thirdly, instructors can influence the degree of reflection by retaining reflection relevant information. This forces the participants to analyse the shortcomings of their planning instruments and to develop new procedures.
Fourthly, management simulations, more than any other method of decision training, are suitable to test knowledge and problem solving abilities in a multitude of complex problem situations.
Finally, since students of business and economics, in contrast to e.g. medical students, are not able to practice on "living" objects, business simulations are suitable as educational instruments in order to provide an "isomorphic" or at least a "homomorphic" projection of "real world" planning and decision making processes. In addition, as a research instrument, management simulations are appropriate tools in the context of scientific instruction, education and knowledge transfer.

3. "Calculating" the optimal degree of planning and decision making behaviour
We have already raised the question to what extent the relation between the "planning efforts" and the "degree of decision rationality" influence the planning efficiency. In our research we measured the "planning effort" by using the problem processing time. The degree of rational planning and decision behaviour within the planning and decision making process represents the "revenue" measure (Neuert 1987).
Since we were able to statistically prove the direct impact of rational behaviour on the planning success, the following additional research question arises: What will be the optimal proportion of "costs and benefits" in terms of "planning efforts" and "planning success" ("planning processing time" and "degree of planning rationality").
We further demonstrated that increasing degrees of planning rationality correlate with with increasing problem processing times[54]. Based on our multiple regression analysis we developed the the following "degree of planning rationality" function, including the five components of the degree of planning rationality:

$$Z=-6.25x_1+17.42x_2+22.97x_3+50.83x_5+76.71^{55} \quad \text{(F.1)}$$

By investigating the average results of all planning processes across the entire experiment we experienced consistently acceptable results[56]. By considering the highly significant correlation between the degree of planning rationality and the planning efficiency in our experimental study[57] we can assume that the average achieved degree of planning, meaning the average rational planning behaviour, tend to result in acceptable average planning results. In this case an above average value in the degree of planning rationality must cause an above average value in planning success.

Furthermore, based on these considerations, we will calculate an optimal degree of planning by applying a linear optimisation algorithm including the following restrictions:

- Minimize the processing time,
- the degree of rational behaviour within planning processes, based on the degree of planning rationality, should be above the average,
- the minimum processing time is set to 90 minutes[58] ,

[54] We calculated an average multiple coefficient of correlation of 0.50916.
[55] We used the coefficients of the multiple regression function which are mostly equivalent to the empirical multiple coefficient of regression; Z=Processing Time, x1=Target Orientation (DTO), x2= Process Organisation (DPO), x3=Information Acquisition and Evaluation (DINF), x4=Decision Making Cognition (DCOG), x5=Reflection DREF).
[56] The average formal efficiency was 87.4%, the average surplus was 125,000 monetary units, the average return on equity was 17%, the average growth in sales was 19%, the average rate of equity was 58%, the average motivation factor was 3.89 (which is above the average value of 3.00 on a scale between 1.00 and 5.00).
[57] Neuert (1987).
[58] Experience shows that profound planning and decision making processes are not possible within shorter time frames.

- the time required for the organization of the planning process (DTO) and for the decision cognition (DCOG) has to be at least 49.5 minutes[59].

Therefore, we formulate the following linear-optimisation-target-function:

$$Z=-6.25x_1+17.42x_2+22.97x_3-33.24x_4+50.83x_5+76.71 \quad \text{(F.2)}$$

$$Zmin!$$

Furthermore, we define the following constraints:

1) $0.3536 \leq x_1 \leq 1$ (F.3)
   $0.3768 \leq x_{\sim} \leq 1$
   $0.8127 \leq x_3 \leq 1$
   $0.6237 \leq x_{\sim} \leq 1$
   $0.2280 \leq x_{\sim} \leq 165$[60]

2) $+6.25x_1+17.42x_2+22.97x_3-33.24x_4+50.83x_5+76.71>90$

3) $+17{,}42x_{\sim}-33.24x_4+76.71>49.5$

4) $+6.25x_{\sim}+22.97x_3+50.83x_5 \leq 40.5$

By applying a Simplex algorithm we calculate the necessary manifestations of the rationality elements of the "degree of planning" and for the optimization of the LO-target-function under the given restrictions.

A:	-6.25	17.42	22.97	-33.24	50.83
	0.00	17.42	0.00	-33.24	0.00
	6.25	0.00	-22.97	0.00	50.83
	1.00	0.00	0.00	0.00	0.00
	0.00	1.00	0.00	0.00	0.00
	0.00	0.00	1.00	0.00	0.00
	0.00	0.00	0.00	1.00	0.00
	0.00	0.00	0.00	0.00	1.00
	-1.00	0.00	0.00	0.00	0.00
	0.00	-1.00	0.00	0.00	0.00
	0.00	0.00	-1.00	0.00	0.00
	0.00	0.00	0.00	-1.00	0.00
	0.00	0.00	0.00	0.00	-1.00
	-6.25	17.42	22.97	-33.24	50.83

B:	13.2900
	-27.2100
	-40.5000
	0.3536
	0.3768
	0.8127
	0.6237
	0.2280
	-1.0000
	-1.0000
	-1.0000
	-1.0000
	-1.0000

Optimum value:
90.000000

[59] The multiple regression analysis between the planning efficiency and the five degrees of planning rationality resulted in an accumulated impact factor (for DTO and DCOG) of 55%, which equals – in relation to the minimum decision making duration time – the time frame of 49.5 minutes.
[60] Average achieved values of the degrees of planning within the laboratory experiment.

Computed optimum values for x_i:
x_2=0.376800
x_7=12.453041
x_8=12.453041
x_1=0.353600
x_4=0.641420
x_{12}=0.017720
x_3=0.812700
x_5=0.228000
x_{14}=0.646400
x_{15}=0.623200
x_{16}=0.187300
x_{17}=0.358580
x_{18}=0.772000

Table 2: Simplex algorithm

The optimization algorithm results in the following optimum values, based on our previously defined targets and constraints:

- Degree of target orientation (DTO) = 0.3536,
- degree of process organization (DPO) = 0.3768,
- degree of information acquisition and evaluation (DINF) = 0.8127,
- degree of decision making cognition (DCOG) = 0.6414,
- and degree of reflection (DREF) = 0.2280.

This means i.e. for the DTO, that at least the profitability target and the liquidity target must constantly be considered. The DPO should at least include e.g. the decomposition of the overall problem into various sub-tasks and at least a “rudimental” delegation of tasks. The DINF should at least consider all available and accessible information. The DCOG should at least include the elements “definition of target criteria”, “development of alternative solutions”, “assessment of consequences” and “synchronization of decisions”. The DREF should at least result in a transparent documentation and review of the planning results.

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