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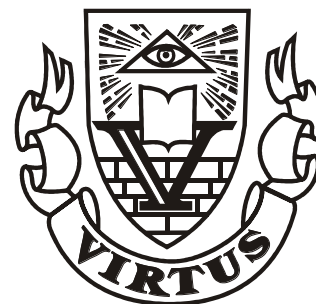
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IMPACT OF RECRUITMENT AND SELECTION ON ORGANIZATIONAL PRODUCTIVITY. EVIDENCE FROM STAFF OF A UNIVERSITY IN SOUTH AFRICA

Marta Kanyemba, Chux Gervase Iwu**, Charles O.K. Allen-Ile****

Abstract

The study aimed to understand the recruitment and selection-productivity fit within a tertiary institution in South Africa. Essentially, by examining this relationship, it will be easier to obtain a better understanding of the essential components of recruitment and selection that contribute to the productivity of a tertiary institution. The unit of analysis of this study comprised academic and non-academic staff of the institution. This study adopted a quantitative approach utilising a Likert scale questionnaire to serve as the primary source of data collection. A future study could emphasise the development of a theoretical framework that links specifically to the peculiarities of the tertiary education sector in South Africa. A further study could also unpack how the components of recruitment and selection can be better harnessed to attract the interest of young South Africans to academe. The paper addresses a matter of significance both to HR practice and scholarship. The paper concludes thus: Recruitment and selection processes impact productivity; hence management MUST adopt best practice for these crucial HR functions.

Keywords: Recruitment, Organizational Productivity, Selection, South Africa

JEL Code: J24, P42

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1 Introduction and background

Productivity can be enhanced by a suitable work environment. It can also be a product of effective recruitment and selection process (Catano et al., 2010). An effective recruitment and selection process can ensure that an institution hires the right candidate for a particular job or role. However, research has consistently indicated that human resource practitioners do not follow their institution's recruitment and selection processes in the appropriate manner (Aswathappa, 2007). Hence, institutions experience high labour turnover, high staff absenteeism, job reworks, high training expenses, labour unrest and low productivity (Robbins et al., 2009). This study, therefore, seeks to investigate staff perceptions of the relationship between recruitment and selection processes, and organisational productivity. The study was set in a tertiary institution in South Africa.

Tertiary institutions are amongst the most important institutions in any nation, as they play a significant role in the development of the country (Khalid, 2012). Countries that promote education become more developed, and they are able to formulate, implement and manage their own

development. Monama (2012) affirms that South Africa recognizes the importance of education. In June 2010, Khumalo (2010) reported that the president of the Republic of South Africa, Jacob Zuma, made a speech at the Sports for Peace Gala Dinner in Johannesburg, where he stated that education was a key weapon in the government's arsenal of strategies to halve poverty and unemployment by 2014. This is also evident in the government's expenditure in education, and the sum invested annually in universities, FET colleges and high schools (BuaNews, 2012).

This study focuses on a tertiary education institution in the Western Cape province of South Africa. Due to the position taken by the institution regarding privacy issues, the institution will be referred to as "institution X". Institution X offers competitive salaries and excellent benefit packages for the staff. Institution X also assists several communities in through donations to their charity projects. The institution is, therefore, an attractive proposition for prospective employees.

According to Schultz (2009), it is the responsibility of every manager to look after its human resource because they are the most important assets of any tertiary institution. In the past, the human

resources management function was not seen as important, and as a result many institutions did not place any premium on hiring people (Zhou, 2006). This obviously resulted in human resource managers' unhappiness with the quality of candidates, and long recruitment cycle times. Few institutions still hire staff the same way that they used to hire staff many years ago (Zhou, 2006). This is an indication that many human resources managers and officers still do not consider recruitment and selection as important tasks within the human resource department. Perhaps this is the reason why institutions complain that it is difficult to find a suitable candidate for job openings.

While there have been discussions as to the relevance of university qualifications, there is also a universal acceptance of the pivotal role of university education as a critical human development component. Universities have been recognized as providers of not only the high-level skills necessary for every labor market but also the training essential for teachers, doctors, nurses, civil servants, engineers, humanists, entrepreneurs, scientists, social scientists, and many other personnel (Educational Pathways International, nd). It is further argued that the knowledge generated by universities is the empowering mechanism for those who are trained in universities to develop the capacity and analytical skills that drive local economies, support civil society, teach children, lead effective governments, and make important decisions which affect entire societies. Within this context, it is therefore vital that universities (and in fact any other player in the education sector) considers the proper utilization of recruitment and selection processes in order to attain the right caliber of teaching and administrative team.

Given that the institution covered in this study plays within the education sector, it is imperative that they attract, recruit and retain the right candidates, especially considering the massive role of educational institutions in any economy. Using the incorrect type of recruitment and selection processes may impact the institution's efficiency in producing great talents. However, certain problems exist in recruitment and selection processes such as unclear job descriptions, unskilled personnel who conduct interviews, and many more. Such problems affect the productivity of the organisation. According to Vijay (2011), to avoid these kinds of problems, the human resource department should be familiar with the vacancy, and identify the best recruitment mechanism to attract and hire the best candidate who is available in the market.

Richardson (2011) states that as the job market becomes increasingly more competitive and the available skills become more diverse, recruiters should be more selective in their choices. This is because poor recruiting decisions can produce long-term negative effects. The effects are high training expenses to reduce poor performance and high turnover within the institution which in turn impacts on staff morale (Richardson, 2011). Consequently, this

process should be done properly so that organisational productivity can improve. Improving organizational productivity requires that appropriate recruitment and selection tools or techniques be utilized in order to hire suitable candidates for the job.

The main objective of this study therefore was to identify factors that impede or can be used to improve the recruitment and selection processes of productivity. In order to achieve the main objective of the study, we utilised the following research question: What are the perceptions of staff of the recruitment and selection processes of their institution?

2 Literature review

Syverson (2010) defines productivity simply as efficiency in production obtained from a given set of inputs. According to Syverson, productivity is primarily expressed as an output-input ratio. Several factors drive organisational productivity. These include staffing, structure, communications, and training and development. Others include sound objectives and supportive culture, planning, better control systems, focused strategy, and proper processes (Dechert-Hampe Consulting [DHC], nd). It is apparent that these drives are impacted by the human factor. In fact, most empirical studies have underscored the human element as a vital competitive advantage thus implying that proper staffing processes are a critical ingredient to an organisation's productivity.

Finding, attracting and keeping the best people can however be an arduous task, but with effective recruitment and selection processes, an organisation will be guaranteed the right calibre of people for the organisation's needs. However, this is not to say that effective recruitment and selection processes guarantee total success for an institution. Nel et al. (2008) support that there is no guarantee in making the correct selection decisions, but one can only attempt to make it as successful as possible by best utilising all the tools at one's disposal.

Brewster and Mayrhofer (2012) assert that recruitment and selection processes are crucial as they ensure that the right staff joins the organisation thereby helping the institution to meet its short-and long term objectives. Recruitment and selection are totally different from one another. According to Niles (2013), recruitment is an organisation's process of attracting applicants to jobs in an institution. Ofori and Aryeetey (2011) also define recruitment as the process of generating a pool of capable people to apply for employment in an institution. On the other hand, Rothwell (2010) defines selection as a related process, which involves management nominating for openings to see how equipped internal applicants are to meet current needs. For Marquis and Huston (2009), selection means a process of choosing from among applicants the best qualified individual or individuals

for a particular position. The aim of selection is to choose the right calibre applicant for the job.

Figure 1. Drivers of organisational productivity



Source: Dechert-Hampe Consulting

According to Cameron (2008), the cost of poor recruitment and selection processes can be significant. Therefore, recruitment and selection must be done properly, or else it may result in high labour turnover, high absenteeism, more errors, and high training expenses for the organisation and reduced or low productivity (Richardson, 2011). When the right people are hired, it is important that they work in a conducive work environment so that they are able to increase the productivity of the organisation. According to Gupta (2006), if workers are mentally assured that they are operating under safe working conditions, their morale will be high and they will work with more consideration and thus productivity will increase. Another way to increase productivity is when the staff is given a clear job description on the first day that he/she is hired. Stahl (2004) says that institutions can improve productivity by giving employees clear and specific descriptions of their job, roles, responsibilities, performance, performance expectation and job requirements. It will cost the institution high training expenses when selecting a wrong candidate as he/she will require lots of training in order for her/him to perform. Tertiary educational institutions should invest in training so that staff can improve productivity by doing their jobs more efficiently.

3 Research methodology

3.1 Research design

Research design is the blueprint for conducting a study. A good research design will assist the researcher in planning a study that will yield valid data pertinent to the research question. The research design of this study was planned and structured to investigate employee perceptions of the relationship between

recruitment and selection processes and organisational productivity at a university in the Western Cape province of South Africa. This study adopted a quantitative approach. According to Gravetter and Forzano (2009), quantitative research is based on measuring variables in order to obtain scores, usually numerical values that are submitted for statistical analysis, summary and interpretation therefore suggesting that the main purpose of quantitative research is to make the research valid by means of numbers. Kazadi (2011) holds the same view by stating that the purpose of quantitative research methodology is to evaluate data objectively by rendering numbers.

A Likert scale questionnaire was therefore developed to serve as the primary source of data collection. The reason for using a Likert scale questionnaire as the data collection instrument was that it allowed for degrees of opinion, ranging from strongly agree to strongly disagree. Questionnaires also curtail the time that would otherwise have been used in an interview. The Likert scale questionnaire, together with a covering letter, was e-mailed to respondents. The covering letter explained the purpose of the study and the importance of the questionnaire to this study. The Likert scale questionnaire was divided into two sections. Section A comprised questions on demographic data and section B comprised questions on recruitment and selection processes and organisational productivity.

The unit of analysis of this study comprised academic and non-academic staff of Institution X. Variables such as gender, race, age, marital status, management level, and years of experience were considered. The researchers also made use of secondary sources such as journals, the Internet, books and various publications to attain theoretical insight into the subject matter.

3.2 Instrument validity and reliability

It is essential to check that the survey instrument is both reliable and valid. A reliable instrument is consistent; a valid instrument is accurate and usually if an instrument is reliable it will be valid, and vice versa.

Validity is how an instrument measures what it is intended to measure. Kimberlin and Winterstein (2008) define validity as the extent to which an instrument measures what it purports to measure. Validity requires that an instrument is reliable, but an instrument can be reliable without being valid (Kimberlin and Winterstein, 2008). After receiving the completed questionnaires back from respondents, the researchers went through the questionnaire to check for validity of responses. A statistician from Institution X went through the questionnaire to double check. Responses that did not make sense were removed and ultimately the questionnaires were considered to contain valid data.

Reliability is the consistency of the measurement. Each respondent must answer the same questions. Instrument reliability refers to whether an instrument provides consistent results across items, raters, and time at the unit of analysis (i.e. item-instrument, and decision threshold level) (Lum and Kennedy, 2012). It is crucial for the reliability of the study that the instrument measures what it was intended to measure and even if one has to repeat the test on different people with similar characteristics. To ensure that the questionnaire was reliable, each questionnaire item was given a code value which was captured into a computer. Software used to produce statistical data was the Statistical Package for Social Science (SPSS).

3.3 Instrument administration

Instrument administration is how the questionnaires are handled. Permission was obtained from Institution X to proceed with the study. The researchers therefore requested and obtained the e-mail addresses of academic and non-academic staff members in the selected faculty. The Likert scale questionnaire, together with a covering letter which explained the questionnaire, was e-mailed these staff members. A total of 370 questionnaires were administered, but only 106 questionnaires were returned. An assistant researcher was utilised to give each questionnaire item a code value.

Respondents were given a week to complete the Likert scale questionnaire. This was deemed sufficient time, taking into consideration that they also have their own workload and deadlines. The assistant researcher reminded respondents three days before the due date to submit their questionnaires. Once a respondent completed the questionnaire, this was sent to the researchers via e-mail. Each received questionnaire (filled out properly) was assigned a code

value by using the SPSS. The respondents remained anonymous to allow them freedom of opinion. After receiving the completed questionnaires, there was no further personal contact between the researchers and the respondents.

3.4 Population

According to Wathington et al. (2012), a population consists of all individuals or things that the researcher wants to describe. In this study the population comprised only members of a particular faculty within Institution X. Institution X consists of five different faculties, namely Applied Sciences, Business and Management Sciences, Engineering, Education, Health and Wellness Sciences and Informatics and Design. According to Institution X's Equity Report (2013), the total population of the faculty was three hundred and seventy (N=370). The selected faculty is one of the biggest faculties in terms of student population and program offerings. The population consisted of both academic and non-academic staff members and were deemed able, based on their knowledge of and experience within Institution X, to give meaningful input in answering the question of whether there was a relationship between recruitment and selection processes, and organisational productivity

3.5 Sample frame

Denscombe (2007) defines sample frame as an objective list of the population from which the researcher can make a selection. Babbie (2010) also defines sample frame as the list or quasi list of units that make up a population from which a sample is selected. From the above definitions, the researchers believed that a sample frame is a complete list of the accessible population from which the researcher can select the sample. Therefore, the sample frame helps the researcher to reach his/her objectives in an appropriate manner. The sample frame for this study was composed according to the following information:

- The faculty's total population for this study is 370 staff of which 74 are temporary academic staff members, while 45 are temporary non-academic staff members. 186 are permanent academic staff members while 65 are permanent non-academic staff members. The staff comprises three levels:

- Junior level staff – junior lecturers and junior administrators;

- Middle level staff – senior lecturers and supervisors; and

- Senior level staff – associate professors, professors, heads of department and managers.

Variables such as gender, race, age, marital status, management level, and years of experience were considered. Staff received a questionnaire (in English) via e-mail, and were not forced to participate in the research study.

3.6 Sample size

A sample is a proportion, which is drawn from the targeted population (De Vos, Strydom et al., 2005). For this study the minimum anticipated sample size was 30% of the population. This was due to the counsel of Sekaran (2000) who argued that a response rate of 30 percent was acceptable for most research purposes. Unfortunately, the final actual sample size was 106 and not 111 as originally projected. This was due to some staff members not wishing to fill in the questionnaire. 106 participants were however deemed a suitable size sample to use because Ormrod and Paul (2010) believe that it is generally best to use the largest sample possible. A large sample is likely to be more representative of a population and yield more accurate data, when compared to a small sample. Essentially, a sample size is selected according to the size of the chosen population.

The sample included both academic and non-academic staff of the faculty in review at Institution X.

3.7 Sample technique

A systematic sampling technique was employed in this study. Systematic sampling is useful when the researcher uses a big sample size, and wants to reduce it to a smaller size for various reasons. Systematic sampling was deemed a suitable technique as its variances are most often smaller than alternative sampling techniques, and because it is simple, cheap and fast.

According to Johnson and Christensen (2012), a systematic sample is a sample that is obtained by determining the sampling interval k , selecting a random starting point between 1 and K and then selecting every k th element. In this study systematic sampling was used to discover whether there is a theoretical and empirical relationship between employee perceptions of recruitment and selection and organisational productivity. Therefore, every tenth name on the list that represents the population was selected. The reason for choosing every tenth name was to reduce the sample size to a manageable number.

3.8 Data collection

Data is the basic material with which researchers work (Terre Blanche et al., 2006). Data is used by the researcher to obtain relevant information, and to keep them on record for later reference. This study adopted the quantitative approach to acquire data using a Likert scale questionnaire. The researchers sent the Likert scale questionnaire to staff via e-mail. The Likert scale questionnaire was straightforward and easy to understand. However, in order for the researchers to receive the correct information and to achieve the goals of this study, participants were asked questions relating to recruitment, selection and organisational productivity. The aim of this was to

improve the recruitment and selection processes in order to improve the productivity of Institution X.

3.9 Ethical consideration

Before conducting any study, it is expected that the researcher familiarises himself or herself with guidelines of ethical research behaviour. This provides the researcher with the rules on how to conduct research in an appropriate manner so as to ensure the dignity and wellbeing of the research participants. In this study, we followed the ethical guidelines of Institution X, such as receiving compliance letter from the Ethics Review Committee, before e-mailing and distributing the questionnaire to the participants.

The following points were employed in this study for ethical consideration:

1) Informed consent: Permission to conduct the research was granted in a letter of consent from the HR department at Institution X. The purpose and instructions concerning the questionnaire were explained in the covering letter to make it easier for participants to understand how to complete them.

2) Confidentiality: The researchers assured participants that the information they shared would not be disclosed to any person. Strict confidentiality was maintained.

3) Voluntary participants: Participants were not forced to answer the questionnaire. It was voluntary.

4) Anonymity: All participants were guaranteed anonymity to afford freedom in answering to the questionnaire. After receiving the completed questionnaires, there was no further personal contact between the researchers and the respondents.

5) Avoid plagiarism: In this study the researchers avoided plagiarism and all sources of reference were duly acknowledged.

4 Analysis

Data analysis is a process, which brings order, structure and meaning to the mass of collected data (De Vos et al., 2005). Data for this study was gathered via the Likert scale questionnaire (primary source). Secondary data was collected from the literature review of books, journals and Internet sources. Since English is the official language at the institution, an English questionnaire was developed to ensure that all participants understood the questionnaires. The questionnaires were collected by the researchers and each questionnaire item was assigned a code value. The code value was entered and encoded into a computer to produce statistical data. SPSS software was used to produce the collected data in table form. The use of the SPSS helped the researchers to analyse the data in an appropriate manner. Nsabimawa (2010) states that the software examines the relationship among the variables and performs test of statistical significance based on the research questions, where possible. Thereafter, the results were presented in graphs, table and charts.

5 Findings

5.1 Sample representativeness and composition

The representativeness of a sample is the extent to which the characteristics of that sample are similar to

the characteristics of the universe (Anson et al., 2012). In other words, a sample is representative if it shows the same characteristics as the source population.

Table 1. Demographic characteristics of the respondents

Gender	Male	52.83%
	Female	47.17%
Age Bracket	20 or less	4.72%
	21-30	21.70%
	31-40	23.58%
	41-50	29.25%
	51-60	16.98%
	61+	3.77%
Marital Status	Married	54.81%
	Non-married	45.19%
Ethnicity	Black	36.79%
	Coloured	29.25%
	Indian or Asian	12.26%
	White	21.70%
Level of Management	Senior management	2.86%
	Middle management	43.81%
	Junior management	53.33%
Tenure	1-5 years	35.85%
	5-10 years	19.81%
	10-15 years	17.92%
	15 years and up	26.42%

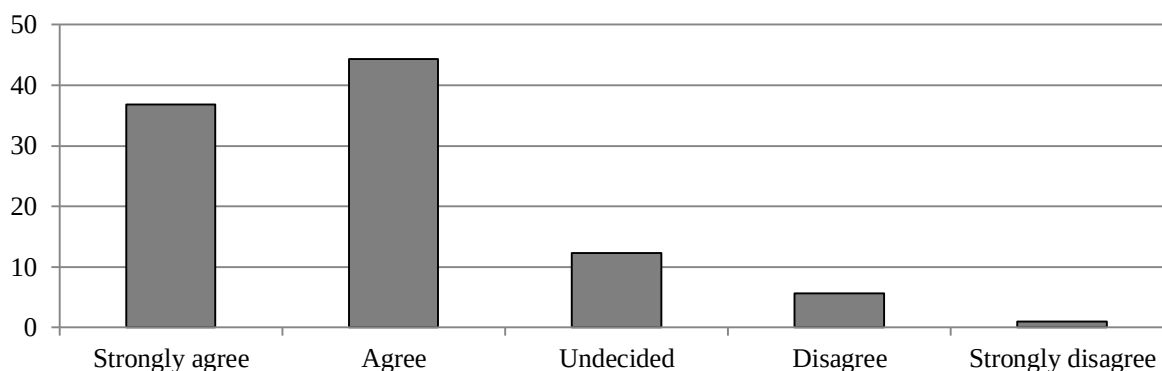
The study sample consisted of male and female staff who are employed in a particular faculty, of which 59 are academic and 47 are non-academic staff. Institution X has staff from diverse racial backgrounds, varying age groups, different levels of education and staff with varying length of service. These factors all contribute to a 'different' way of doing things. The diversity of the composition of this study sample should result in varying opinions regarding recruitment, selection and productivity. The education levels of the staff include Grade 12, diploma, baccalaureate degree(s) and post-graduate degree(s).

5.2 Discussion of results from questionnaire items

Recruitment and selection are seen as the most important processes within the institution and these processes have a great impact on organisational productivity. It is suggested that the institution should improve the recruitment and selection processes in order to increase productivity. Proper implementation of recruitment and selection processes can reduce high labour turnover, absenteeism and increase

performance (Richardson, 2011). When asked whether proper implementation of recruitment and selection process can reduce high labour turnover, 70.76% of respondents (Please see Figure 1 below) agreed with the statement. The literature reviewed support this finding.

Like any other tertiary education institution, a goal of Institution X is to be profitable. Profitability may be enhanced if the recruitment and selection team follows the right processes and hires the right person for the job. Hiring the right candidate for a position can increase productivity of the institution. According to Djabatey (2012) staff are hired based on their qualifications, work experience and communication or interpersonal skills. When staff are hired using the criteria mentioned it is likely that the staff will perform well and the productivity of the institution will increase. The hiring of unqualified, unsuitable staff could lead to a drop in productivity. It was significant that 77.4% of the respondents agreed that poor work performance decreases overall productivity. Staff performance needs to be monitored and productivity needs to be measured.

Figure 2. Recruitment and selection processes have a huge impact on organisational productivity**Table 2.** Poor employee performance decreases overall productivity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	48	45.3	45.3	45.3
	Agree	34	32.1	32.1	77.4
	Undecided	17	16.0	16.0	93.4
	Disagree	5	4.7	4.7	98.1
	Strongly Disagree	2	1.9	1.9	100.0
	Total	106	100.0	100.0	

There are various ways in which productivity can be measured. The result from the survey confirms that productivity of the institution can be measured by the pass rate of students and published peer-reviewed papers. The literature by Salerno (2003) supports that at higher education, examples of single-input and single-output productivity measure might include the number of students (educated) per faculty member or the number of journal articles published per researcher. It is clear that the research findings support the literature.

Increased productivity is likely to lead to profitability. Institution X rewards staff members with a token of appreciation when the institution makes a profit. When asked whether good performance is linked to bonuses, the majority of respondents agreed with the statement although 20.8% of the respondents were undecided and 18% of respondents disagreed.

When productivity is measured it shows how well or poorly the staff are performing and whether they have met the institution's performance targets. Staff performance should improve (actually get better) each day. Participants strongly believed that recruitment and selection processes have an impact on productivity.

When asked whether recruitment and selection processes have a huge impact on organisational productivity, a resounding 81.13% agree that recruitment and selection processes do have a huge impact on organisational productivity. 12.26% of the respondents remained undecided and 15.6% of respondents disagreed.

From the above findings it may be seen that employees do perceive that there is a relationship

between recruitment and selection processes, and productivity at the institution. Therefore, the researchers believe that it is important for the recruitment and selection team to be aware that organisational productivity can be affected by the calibre of staff that is hired. It is suggested by Stahl (2004) that giving employees clear job descriptions with clearly defined roles and responsibilities, can contribute to productivity.

6 Limitations and recommendations for future research

In the quest for perfection, often challenges arise which have to be faced and overcome. A major challenge faced by the researchers was that most of the staff members in the particular faculty of the selected institution were not interested in completing the questionnaire via e-mail. The researchers implemented a contingency plan which was to, in association with the research assistant, knock on staff doors and give them a hard copy of the questionnaire to complete.

Another challenge faced was that the research assistant was not always available due to other commitments. This made it difficult for the researchers to know which staff members had been given a questionnaire or not. Furthermore, it was also challenging for the researchers to get non-academic staff to complete the questionnaire. Non-academic staff do not appear to grasp the importance of research; they were tardy in completing the questionnaire and some of them even lost their questionnaires.

The biggest challenge encountered in the study was that the questionnaires were distributed at a time when the academic staff were preparing examination papers, marking assignments and tests and invigilating students writing examinations, while the non-academic staff had deadlines to meet that week. Hence, most of the staff was not available.

Aside from the above, this study notes a key methodological limitation namely the simplistic nature of data analysis. A future study would likely benefit from a much more rigorous deployment of complex statistical methodologies such as regression/correlation analysis (ANOVA, factor analysis, and so on). For instance, it will be interesting to see how staffing (recruitment and selection); structure (appropriate deployment), and communications (goal/role clarity) correlate to impact productivity. DCH (nd.) puts it succinctly thus:

‘In order to improve the standing of any organisation, the productivity drivers must work together. Therefore, it is necessary to understand how well these drivers work together and function as a whole. Effective Assessment involves understanding how each driver contributes to overall productivity. Changes to one driver might (and probably will) have an effect on others.’

A future study could also emphasise the development of a theoretical framework that links specifically to the peculiarities of the tertiary education sector in South Africa. This last suggestion is made against the backdrop of the dearth of empirical reports on the recruitment and selection-organisational productivity relationship. By examining this relationship, it will be easier to obtain a better understanding of the essential components of recruitment and selection that contribute to the productivity of a tertiary institution. For instance, recent studies (Jansen, 2003; Ramdass, 2009) have revealed that South African tertiary institutions are suffering from an ageing population; especially an ageing white population of South African science and scientific output. A further study could unpack how the components of recruitment and selection can be better harnessed to attract the interest of young South Africans to academe.

7 Conclusion

A major limitation of this study was finding information on recruitment and selection processes that focused at the selected institution thus suggesting that no previous studies on recruitment and selection processes had been conducted at this institution. The researchers had to rely on studies conducted elsewhere in order to gain an understanding of recruitment and selection processes and organisational productivity. Unfortunately, most available literature focused on human resources management and productivity and not specifically on recruitment and selection process. Many respondents ignored their e-mailed

questionnaires and this forced the researchers to utilise a door-to-door technique to distribute hard copies of the questionnaire.

Nevertheless, this study has relevance in that it has opened up the conversation around the relationship between recruitment and selection, and productivity at this institution. Beyond this, it also has significant practical implications. Firstly, the result has shown that there are significant positive returns in terms of increased productivity, lower labour turnover and profitability associated with proper recruitment and selection practice. For instance, majority of respondents are in agreement that appointing the right candidates to jobs increases productivity. The literature also indicates that selecting the best candidate for a job can increase productivity (BizAgi, 2011). The researchers conclude that this study can be used by organisations, tertiary institutions and non-profit organisations to improve their recruitment and selection processes in order to increase productivity. Management of tertiary institutions should therefore adopt best practice for these crucial HR functions.

Part of the best practice could be for management to ensure that the institution employs more modern recruitment methods (such as the use of social media) when hiring staff. It has been argued that the younger generation tend to use social media to search for job opportunities. All legislation and policies pertaining to recruitment and selection should also be made available to all staff members of the institution. This will increase the awareness of the legal appurtenances of recruitment and selection. The stakeholders of the institution should regularly report on the productivity of the institution so that the staff are aware of how well or poorly the institution is doing. It is equally important to regularly review incentive and reward systems for both academic and non-academic staff of tertiary institutions. There is no doubt that this study contributes to literature on organisational productivity, recruitment and selection and organisational behaviour.

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FROM EVOLUTIONARY GOVERNANCE TO EVOLUTIONARY STRATEGIES: STANDING ON THE EDGE OF CHAOS

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Abstract

The perspective of Evolutionary Governance that I have developed since 2012 is part of the emerging evolutionary perspective on the economy. I have proposed a new vision of governance as the function that optimizes the cognitive and behavioral collective intelligence of a firm to make decisions facing risks and uncertainty. The Board of Directors acts to anticipate variations of external conditions and internal routines, select the right orientations (decisions and routines which ensure the sustainability of the firm) and enhance co-evolution.

The term "evolutionary" refers to the process of endogenously developing variations, selection and retention on the one hand, and on the co-evolution phenomenon on the other hand. Once limited to paleoanthropology, it has been extended as an abstract process to conceptualize many domains, among which economics. The original process of variation/selection/retention has become a generic concept of evolution as novelty/emergence/dissemination.

Why is it necessary to introduce evolutionary concepts into governance research? To answer this question, I review in the first part the succession of influences over governance theories, and the pitfalls of the current framing compared to the objectives I assign to governance, as an internal mechanism of organizations to structure itself to face risks and uncertainty. In the second part, I review the breakthroughs of evolutionary concepts in various domains in close links with governance: strategy and political science and public administration. And in the last part, I explore the interesting properties of evolutionary governance and overview the impacts of this theory over strategy and economics.

Keywords: Evolutionary Governance, Evolutionary Strategies, Governance Theories

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1 The need to go beyond economics, law and psychology to frame governance

1.1 The Invisible and Visible hands of governance: evolution of concepts

Corporate governance theories relate to institutional analysis and have been influenced by macroeconomics. Corporate Governance theories history dates back to 1932 with Berle and Means¹ proposal reforms to overcome the separation of ownership from control of companies. They complained that ownership had become depersonalized: shareholders were bearing risks whereas managers were steering the companies with large latitude, and eventually their own interest. After the Berle and Means association of two Professors teaching at Columbia University, one in law and the other in economics, there has been an influence fight between lawyers and economists, as Professor

Douglas Branson² reminds us. Governance reforms followed another: federal chartering in the fifties and sixties; social responsibility in the seventies; the agency cost theory (Jensen and Meckling, 1976), opening a wide area of research in contractual science dedicated to incentive alignment disposals. In the early eighties, the Law and Economics Movement was inspired by Henry Manne³ and his market for corporate control theory, according to which market forces regulated corporate and managerial behavior much better than regulation, laws, or lawsuits ever could. Bad governance would result in a falling share price, then a bidder would succeed with a tender offer, or a takeover bid, replacing the bad governance with a good one. This was the invisible hand of governance through market law.

¹ Adolf A. Berle, J.R. & Gardiner C. Means, *The Modern Corporation and Private Property* 1932.

² Douglas M. Branson, *Proposals for Corporate Governance Reform : Six Decades of Ineptitude and Counting*, University of Pittsburg, Legal Studies Research Paper Series, Working Paper N°2013-16, May 2013 Douglas Branson was deeply involved in the ALI's reshaping of corporate governance laws.

³ Henry Manne, *Mergers and the Market for Corporate Control*: (1965) 73 J Pol Econ 110.

As a reaction to that movement, in the late eighties the American Law Institute (ALI) launched the Governance Project - the Good Governance. The ALI legitimately crafted fiduciary duties of the Board of Directors: duty of loyalty, duty of care and the business judgment rule, roles of directors and shareholders in control of transactions and tender offers; and shareholders' remedies. Other legal subjects were: interested directors' transactions, definitions of which opportunities are corporate opportunities, competition with the corporation by officers and directors. The ALI also crafted recommendations dealing with procedural aspects of governance: the structure of the Board (board composition and committees), supervisory role over the compensation of corporate officials.

The American Law Institute established from 1975 to 1994 new standards which spread out the worldwide governance culture, through institutions such as the OECD. This framework has been renewed, but not replaced, by institutional investors' activism in the nineties; regulation of gate-keepers at the beginning of the 21st century and lately by a focus on the independence of directors. These recommendations were either inserted in laws or in mandatory "comply or explain" rules with reference to national codes, according to the countries. They form the visible hand of governance. Variations have appeared with the stewardship theory, "agents watching agents", the theory of gatekeepers. The stewardship theory, launched by Donaldson and Davis⁴, contradicted the agency theory, claiming that the dominant motive for managers is to perform excellently in their job. It was largely based on the decision-making theory of Perez- Lopez⁵, who corrected the affirmation that managers could act in conflict with the interests of shareholders to favor their own interests and found that actors may have "transcendant" rather than mercantile motives. The so-called positive economy reintroduced ethics in the economic and organizational theories. In this wave, corporate social responsibility has got an increasing echo in the business world, without really impacting governance practices, with the exception of the "say on pay" procedures: too large discrepancies between corporate performance and managers' remuneration let shareholders of Citibank vote against the remuneration of the CEO in 2013. This was a significant move inside governance, not from the Board of Directors, but from the other governance organ: the Assembly of shareholders.

Whatever the theoretical streams about governance, the most significant influence of the contractual view of the business world is evidenced by the cost of transactions model within the institutional

economics, which Coase⁶ initiated in 1937 and was extended to governance theory by Williamson. Eventually, institutional economics joined the vision of corporation as a legal subject through the assumption that firms and economic structures themselves look for the most efficient transactions.

1.2 The dominant paradigm

1.2.1 Governance as a mechanism to reduce costs of transactions

Nowadays corporate governance is focused on fiduciary duties of Directors towards shareholders. In 1999, Hansmann & Kraakman published *The End of History of Corporate Law*⁷, as a parallel with the *End of History* and *The Last Man*, published by Francis Fukuyama in 1992. Governance is not contemplated as a function primarily dedicated to the sustainability of a company, but to the satisfaction of investors' interest. Under the pressure of large pension funds, looking for portfolio diversification, a convergence in corporate governance has been targeted to set up best practices standards in order to enhance stability, predictability and allowing further foreign direct investment. The fiduciary aspects of governance reduce uncertainty for stakeholders. But the focus and law and regulation emphasizes stability or small incremental changes, and does not help against radical uncertainty.

1.2.2 Uncertainty cannot be totally overcome through transactions as transactions themselves create uncertainty

Williamson criticized the view of economics as a theory of choice: "Choice has been developed in two parallel constructions: the theory of economic behavior, in which consumers maximize utility, and the theory of the firm as a production function, in which firms maximize profit"⁸. He is right when criticizing post neoclassical economics as a theory of equilibrium prices with agents maximizing their profit in perfectly efficient markets. Nevertheless, the imperfections of neoclassical economics, which are all too simplistic and static models, is not a reason to close the subject of choice, at least for governance. From an economic standpoint, the influence of institutions over economic performance is very important, and institutional economics bring powerful insights to the neoclassical conceptions of self-interested utility maximization equations. While Hayek had identified the issue of adaptation for autonomous economic actors as central, he believed

⁴ Donaldson L. and Davis. J.H., Stewardship theory or Agency Theory: CEO governance and shareholder, *Australian Journal of Management*, 16:49-65 returns.

⁵ Perez-Lopez J.A., *Teoría de la Acción Humana en las Organizaciones*, 1991, Madrid : Rialp.

⁶ Ronald Coase, 1937 *The Nature of the Firm* *Economica*, New Series, Vol. 4, No. 16 (November 1937), pp. 386-405.

⁷ *The End of History for Corporate Law* Discussion Paper N°280, http://www.law.harvard.edu/programs/olin_center.

⁸ Oliver E. Williamson *Theory of the Firm as Governance structure : from Choice to Contract*, University of California, Berkeley.

that market prices contain the whole information, deleting uncertainty. Firms might be the best governance structure, designed to minimize costs of transactions among various possibilities to structure production: markets, hybrids, firms, bureaus, (gathered as hierarchies by Williamson), which are considered as different forms of governance. The ultimate unit of activity is the transaction. Nevertheless, firms not only react to their present institutional environment, as to say to incomplete contracts, according to internal features: threats to firms arise not only due to breakdowns of contracts or cooperation agreements, they also have to anticipate future institutional schemes and environmental characteristics, with or without contractual agreements. And this capacity to organize adaptation and change in organizations is precisely corporate governance.

1.3 The necessity to introduce non-contractual choices under uncertainty

1.3.1 Former critics of the dominant paradigm

The contract theory assigns to governance the role to discipline managers (entailing the agency theory) and bring satisfying value for the shareholders and stakeholders instead of maximizing it. The ethical view developed in the positive economy explains that managers may be "moral", which is obviously the case, and that they had a strong incentive to be moral on the long term⁹. The repeated prisoners' dilemma gives an evidence to this assertion, as non-cooperative behaviors are badly performing on the long run. But this theory has two implicit assumptions: the first is that every unethical behavior would be easily visible, the second is that managers act for the long term. Without control, nobody can pretend that managers are moral by definition. It is sometimes possible, though generally difficult and costly to find evidence of illegal acts of managers. The accusation of "unethical" behavior is sometimes raised by citizens (in case of pollution, for example), but it is difficult to find an accusation of shareholders towards managers, that their behavior was immoral, if their financial performance was good. The control function is thus a necessity. Other critics were based on the necessity to strengthen strategic capacities of the firm: bring access to strategic resources, and enhance competencies. According to Teece, 2007, "the current wave of governance reforms in the United States -with its strong emphasis on accounting controls and systems integrity- may inadvertently lead to much "bigger" strategic performance failures by management". It has been proposed to diversify the origin of Directors and bring to the Board bankers, suppliers, etc...The Board would then become a cognitive instrument to create a learning organization. In our view, it does not answer

the principal mission of governance, which is to guide the firm through uncertainty.

1.3.2 Breakthroughs for choice under uncertainty

How neoclassical economics deal with the question of choice under uncertainty has dramatically been criticized through the integration of bounded rationality¹⁰, information asymmetry¹¹, through quality¹² and time dimension prospect theory¹³, learning organizations, subjective expected utility. Choice under uncertainty research now includes innovations stemming from findings on artificial markets, bounded rationality, bifurcations in a non-ergodic environment, technological as well as organizational innovations, including conventions, and a holistic view of firms. Human and social behavior studies in the context of decision-making under uncertainty and through history have been largely researched.

The conventions theory¹⁴ studies behaviors and decision-making under uncertainty. It is interesting to refer to this theory because it substitutes the notion of coordination and agreements to the notion of contract, which is legally binding, and to the notion of power. Not all actions are legally binding, and in certain cases, such as the interactions between Directors within a Board, a conventional approach may be more appropriate to fit the situation, whether conflictual or cooperative. Directors have expectations towards each other. Thévenot and Boltanski postulate that neither culture nor social rules fully explain the internal order of an organization. When individuals face complex situations whose issue is uncertain, without any probability assigned, they identify marks in the situation, whose aggregate is called "convention", to decide which behavior they adopt. Marks at the collective level influence individual decisions, reciprocally the sum of individual decisions influence the collective level. Marks could be:

1. Discourses: not only official discourses, which tend to present rational actions (for example, missions and values) but mainly justifications of their behaviors by individuals who try to present the rational behind their decisions
2. Behavior of key people (in terms of authority, seniority, complementarity, etc.),
3. Objects, necessary in the situation (for example, a report)
4. Space or time organization: for example, implicit or explicit geographical reach, short-term or long term orientation, etc.

¹⁰ Herbert Simon, Economics, Bounded Rationality and the Cognitive Revolution, Edward Elgar Publishing, 2008, ISBN-10: 1847208967.

¹¹ George A. Akerlof, The Market for "Lemons": Quality Uncertainty and the Market Mechanism, Vol.84, N°3, Aug 1970, PP.488-500.

¹² Ibid.

¹³ Kahnemann, Tversky, Choices, Values and Frames, Cambridge University Press, 2000, ISBN 0-521-62172-0.

¹⁴ Thévenot, Boltanski, De la Justification, Les Économies de la Grandeur, NRF essais Gallimard ISBN-10- 2070722546.

⁹ David Pastoriza, Miguel Arino, When Agents become Stewards: Introducing Learning in the Stewardship Theory.

Conventions differ through their principles. Each organization has a set of principles. Change creates new conventions, which stir suspicion, deconstructs the current convention, questioning frameworks of reference. Reactions may be to clarify the situation with a new interpretation, to criticize the old or the new principle, or a tentative of sustainable compromise.

For example, under the leadership of a new Chairman and CEO, a Mediterranean bank has shifted its values from a traditional family/hierarchy oriented reference to the opinion key value, where visibility, fashion, celebrity is the most important. The trade-off rules will be oriented so as to satisfy this principle: for example, the opinion of a person working for a large worldwide company will be more important than the opinion of a stand-alone expert, even if the expert is right, and the other person wrong. To analyze the governance of a company, this is an interesting tool. But this does not help to implement a governance that will drive the company to best adapt to the environment and win a competitive advantage.

Unfortunately, although these theories are really helpful to understand social interactions within the Board, they are not sufficient to palliate the theory of transactions with new decisional heuristics to enhance governance capabilities of organizations.

1.3.3 From bounded rationality to meta-preferences

Since Simon and March weakened the strong assumption of full rationality of decision-makers in a "bounded rationality", behavioral economics and social sciences on preferences ordering have investigated the domain of choice. The necessity for a collective decision-making is emphasized, as the means to deal with complex subjects, risks and uncertainty, to overcome cognitive limitations and irrational behaviors of one single decision-maker. This supports the necessity of a collective decision-making through a Board of Directors. But the procedural aspects of the votes inside the Board has an extreme importance to the decision. It is a fallacy to think that the simple aggregation of individual preferences lead to the final preference. When alternative options are introduced to the Board, each Director may have preferences for such or such outcome, which should drive to the selection of the option with the preferred outcome. Nevertheless this selection may be altered through the selection procedure. Meta-preferences concern the procedural aspects of the collective decision-making¹⁵. The term meta-preference is not used here in the Buchanan's sense of self-projection (how I want to behave), but as the processus handled to reach a decision at the Board. According to

Grofman and Uhlaner, the votes might be influenced by many factors, which I have applied to the case of Boards of Directors.

1. Procedural fairness: the way the Chairperson is handling debates (possibly using a practical veto to undesired oppositions) may influence voters' position (taking part into dominant or contrarian coalition)

2. Consensus: when the specific object of choice has less importance than maintaining the group cohesion or avoiding dissensions, some voters will change their preferences to fit those of the group

3. Decision costs: simplicity and timeliness could be preferred to in-depth debates

4. Universalism: feeling that all options will be equal in the long run

5. Civility norm: members of the board want to feel good and to be able to transact with one another in future occasions

6. Preferences for the final decision-maker's opinion, the Chairman or Chief Executive Officer, or the most influent member of the Board.

7. Restrictions on the set of feasible preference orderings: if there is a high probability of a clear majority winner, alignment to the predictable outcome of the vote

Difficulties to coordinate various perceptions and variability of perceptions according to the function you hold in a company had been evidenced by Simon, 1976.

1.3.4 Pernicious meta-preferences in the necessity of change and adaptation

Grofman and Uhlaner study suggests that the preference for certainty in the form of institutional maintenance drives to stability. Informal procedures are usually structured reflecting meta-preferences. This may occur in addition to cognitive biases, as the "proclivity of people to think in customary fashion" (Grofman- Uhlaner, 1985).

This impact is counterproductive when it is necessary for a Director to act on the basis of preferences, based on a clear presentation of plausible risks. If governance should aim at value creation, then it should optimize risk decisions, as risk appetite is the original source of value creation: according to Kenneth Arrow, risk taking is an option. Profit is the residual outcome of risk-taking and cannot be totally estimated *ex ante*. It is thus necessary to select risks to be taken. The decision will be based on the difference between the perceived risk and its preference for risk. In cognitive psychology, preferred risk is the level of optimal level of subjective risk, whereas in classical economy, risk aversion is the preference for the option whose expected value is linked to the highest probability. From the presentation, the directors will have to build their own perception of risk, resulting from the matching or not of the possibility of a negative occurrence on the one hand, and of the firm's avoidance and anticipation capacities. If the perceived

¹⁵ Bernard Grofman, Carole Uhlaner, Metapreferences and the Reasons for Stability in Social Choice : Thoughts on Broadening and Clarifying the Debate, School of Social Sciences, University of California, Theory and Decision 19 (1985) 31-50 0040-5833/85.10.

risk is superior to the preferred level of risk, then the Director should ask the reduction of risk exposure. Risk selection is not neutral. Risk triggers emotions. The degree of preferred risk is correlated to age and gender (Roberts, 1975, Wilde 1988) and to the level of expertise (Ewert and Hollenhorst, 1989). Meta-preferences may interfere with the own preferences of Directors.

1.3.5 Insufficient adaptive capacities under the cost of transactions theory

Cliometrics have revealed the path-dependence for change decisions. Douglass C. North affirms that "Change consists of marginal adjustments to the complex of rules, norms and enforcement that constitute the institutional framework. Technological change and institutional change are the basic keys to societal and economic evolution and both exhibit the characteristics of path-dependence"¹⁶. The cost of transactions theory introduces constraints to the change capacity of firms: it must be incremental. Deconstructing the formal contractual network would be a heavy process, which does not allow much flexibility, when discontinuities or bifurcations in a non-ergodic world appear.

In our view, the choice and contract conceptualizations of the firm should not be opposed. Rather, they complete each other. Nevertheless, this complementarity of concepts still does not answer the requirements to drive firms facing uncertainty. I assume that the key to all these characteristics is to be able to let the firm be adaptive: it is the real source of competitive advantage.

Governance is the regulation function that triggers the transformation of the firm taking into account a perception of what its ecosystem will be in the future. It must ensure the effective integration of a company in its ecosystem, including investors, financing actors, regulators, citizens, with a dynamic factor. Organizing the adaptive capabilities of the firm is a new aspect of governance.

2 Evolutionary theories in strategy and political science

2.1 Governance as emergence

Although Ulrich Witt¹⁷ tried to classify in 2008 the various interpretations of evolutionary economics along ontology and heuristic strategy between monist and dualistic ontological view, I think it is not necessary, when referring to microeconomics. In fact, the basis for emergence, which is another term for the evolutionary process, is the assumption of a

hierarchical realism. Evolution is a "processor", which is used in complexity theory, which in turn explains the characteristics of adaptive, emergent structures. An emergent system can be divided into hierarchical levels. The lower levels consist of the parts, and the upper level consists of the whole system. The two levels are connected either through micro-determinism, when the parts determine the whole system, or through macro-determination, when the upper level exerts downward-causation upon the parts. In the latter case, the system is emergent. Simon (1962) argues that entities which evolve under disruptive conditions are likely to be organized hierarchically¹⁸. To summarize properties of emergent systems, knowledge of the upper level cannot be deduced from the lower level, as the upper level organizes parts (structure, patterns) and their interactions (functions). Evolutionary theory is an emergence theory.

Evolutionary strategies are commonly used in robotics, neural networks, automatisms: evolutionary algorithms solve optimization problems. In that sense, it has been proposed to build risk-optimal portfolio using evolutionary strategies¹⁹.

Whereas the Cost of Transactions theory considers the transaction as its basic unit, evolutionary economics consider the operational routines as the primary piece for change of companies. At the upper level, routines are decisions.

2.2 From capabilities to dynamic capabilities

2.2.1 Strategy, internal capacities and adaptation

Strategic research has freed itself from institutional economics much earlier than governance research. In 1959, Penrose²⁰ imagined a growth strategy through resources and competences. The SWOT model of Andrews (1965) encompasses both internal and external analysis and a dynamic dimension with opportunities and threats. Following a long tradition in military strategy, since Sun Tsu, Ansoff²¹ recommended to manage strategic surprise, putting weight on timeliness of adaptation. Argyris²² compelled the need to challenge frameworks of reference, complaining that the change capacity of

¹⁶ Douglass C. North, *Institutions, Institutional change and Economic performance*, Cambridge University Press, 1990.

¹⁷ Ulrich Witt, *What is specific about Evolutionary Economics*, Max Planck Institute of Economics, Jena, Germany, JEL classification B15 B25 B41 B52 C73 O10 O30.

¹⁸ Markus Christen, Laura Rebecca Franklin, *The Concept of Emergence in Complexity Science: Finding Coherence between Theory and Practice*.

¹⁹ Piotr Lipinski, Katarzyna Winczura, Joanna Wojcik, *Building Risk-Optimal Portfolio using Evolutionary Strategies*, M. Giacobini et al.: *EvoWorkshops 2007*, LNCS 4448, pp208-217, 2007, Springer-Verlag.

²⁰ Edith Penrose, *The Theory of the Growth of the Firm*, Wiley, 1959.

²¹ Ansoff, *Managing Strategic Surprise by Response to Weak Signals*, *California Management Review*, n°18, P21- 33, 1975.

²² Argyris, *Double Loop Learning in Organizations*, *Harvard Business Review*, vol.55, N°5, p115-125, 1977 *Knowledge for Action: A Guide to Overcoming Barriers to Organizational Change*, Jossey-Bass Publishers, 1993.

firms was inhibited by defensive routines of actors and appealing a double loop learning feed-back. Chandler (The Visible Hand, 1977) complied with the institutional economics, with the substitution of market by the structures organization. Porter's Five Forces model²³ (1979) focused on the strategy as the result of external forces applying to the firm, and during more than ten years, he reigned over strategy. But the question of idiosyncratic and difficult-to-trade assets and competences came back with Rumelt²⁴, who gave the evidence that competencies gap within a sector could be higher than between sectors. At the same time, Barney highlighted "Firm Resources and Sustained Competitive Advantage". Eventually, in 1997, Eisenhardt²⁵ and Teece²⁶ dedicated their analyses to dynamic capabilities of the firms.

2.2.2 Teece and the dynamic capabilities, partially in the spirit of evolutionary theorizing

For Teece, to get a sustainable advantage requires more than the ownership of difficult to replicate assets. Capabilities represent the organization's ordinary ability to perform a set of activity, and are embedded in organizational routines/standard operating procedures. Dynamic capabilities are the ability to determine whether the organization is performing the right activities, and then effectuate necessary change and modify the resource base to align with requirements of and opportunities in the business environment. They may be embedded in routines, methodologies or in a few individuals/leaders. Teece describes three "dynamic capabilities" in the process of change:

- Sensing: identification and assessment of an opportunity through analytical systems, whether internal R&D, new technologies selection, suppliers or complementary innovators, even in exogenous sciences and technologies.
- Seizing: mobilization of resources through enterprise structure, procedures, designs, and incentives to address this opportunity and capture value. This encompasses delineating the customer solution and the business model, selecting decision-making protocols, enterprise boundaries to manage complements and "control" platform, and building loyalty and commitment.
- Managing threats/Transforming: through continued renewal, which is inherently difficult to

routinize, but relies upon governance, knowledge management, co-specialization, decentralization and "near decomposability" (Simon, 2002), which is the balance between autonomy and coordination.

Teece acknowledges that Dynamic Capabilities relate to high level activities: "Understanding how to enhance performance of the enterprise through sensing future needs, making quality, timely and unbiased investment decisions inside a well-designed business model, executing well on those decisions, effectuating productive combinations, promoting learning, reengineering systems that no longer work well, and implementing good governance remains enigmatic". In fact, as generally is the case in strategy literature, concepts of governance, management at executive level or leadership are not clearly delineated. For Teece, "top management leadership skills are required to sustain dynamic capabilities. An important managerial function is achieving semi-continuous asset orchestration and corporate renewal, including the redesign of routines". When he says "an important class of dynamic capabilities emerges around a manager's ability to override certain dysfunctional features of established decision rules and resource allocation processes", "the new and the radical will almost always appear threatening to some constituents", I think that it is typically the mission of evolutionary governance to fight the anti-innovation bias, even if it has an anti-cannibalization basis. Defining the risk appetite, including pooling of several options, to support investment choices, is a duty of the Board of Directors. Teece deplores that, in regimes of rapid technological innovation, investment choices skills are not ubiquitously represented among investors. I think that this is a duty of the Board to match investors understanding with their interest. Teece suggests to build "a small number of scenarios that can facilitate cognition, and then action, once uncertainty is resolved": this is what I help Boards to do and it is a very powerful instrument to explore the fields of uncertainty to make strategic allocation decisions. This is necessary to organize the right information process along the hierarchy, between the lower level and the governance level, to avoid information decay. Through the Teece framework, it appears that evolutionary strategies cannot be delivered without an evolutionary governance.

2.2.3 Eisenhardt: linking complexity theory and Time-Paced Evolution

Eisenhardt stands at the extreme opposite to David North, and institutionalists. David North insisted that "such discontinuous change has some features in common with discontinuous evolutionary changes", but "institutional change is overwhelmingly incremental". Eisenhardt, on the contrary, states that the punctuated equilibrium model of evolutionary theories, that is the alternance of long quasi-stability periods (with small incremental changes) with rapid

²³ Michael Porter, How Competitive Forces Shape Strategy, Harvard Business Review, vol 57, n°2, p137-145; 1979.

²⁴ Richard P. Rumelt, How Much does Industry Matter?, Strategic Management Journal, vol3, n°4, p359-425, 1982.

²⁵ Kathleen Eisenhardt, The Art of Continuous Change: Linking Complexity Theory and Time-Paced Evolution in Relentlessly Shifting Organizations, Administrative Science Quarterly, Vol 42, No1 (March 1997) pp1-34.

²⁶ David J. Teece, Explicating Dynamic Capabilities: The nature and Micro-foundations of (sustainable) enterprise performance, Strategic Management Journal, 28: 1319-1350 (2007).

brutal changes, is irrelevant in certain industries, because these industries compete by changing continuously. "Continuously changing organizations are likely to be complex adaptive systems with semi-structures that poise the organization on the edge of order and chaos". These organizations have three key properties: semi-structures that balance between order and disorder; links in time, that direct attention simultaneously to different time frames and sequenced steps (ill-defined priorities). In these structures, Eisenhardt says, the perspective contrasts with transaction costs economics, agency theory, where organizations are assumed to be stable.

2.3 Strategy: the CEO proposes, the board decides

In classical literature, strategy is activated by the CEO/general manager²⁷. As reported by Westphal and Fredrickson, classical research typically assumes that "rather than directing strategic decisions, outside directors are thought to support managers by co-opting financial institutions, helping to avoid hostile takeovers, and perhaps providing expertise (e.g. financial expertise) that aids in the implementation of management's strategy, without determining strategy itself". Behavioral perspectives on boards have been "virtually uniform" in their assumption that board of Directors are not involved in strategy formulation (Finkelstein and Hambrick, 1996). Outside of strategy research, economists have aligned to this view, and present change as a leadership and managerial issue. Westphal and Fredrickson think that "corporate strategy and performance may result from the influence on board preferences on both executive selection and strategic change and that board members may use their personal experience as a reference point of benchmark in formulating and evaluating strategic alternatives". Withdrawing the strategic orientation responsibility to the Board consequently withdraws emergence faculty to the firm, as the higher level is not capable of reorganizing the parts of lower level. According to legal systems, as in France, or more generally in the OECD code, the decision over strategy is the privilege of the Board²⁸. This is why evolutionary strategies have to be embedded in evolutionary governance.

2.4 The evolutionary governance theory

Complementary to our evolutionary corporate governance theory, Van Assche, Beunen and Duineveld have published an Evolutionary

Governance Theory²⁹ for politics and public administration in 2014.

They define governance as the coordination of collectively binding decisions for a community. Governance path has some space for path creation, despite path-dependency. Actor/institution and power/knowledge configurations are presented as the fundamental concepts of shaping the development of governance paths. Implementation of policies is understood as a process and policies are considered temporary constructs coordinating power/knowledge, continuously affected by other configurations of the same type.

3 Why is evolutionary governance a better governance?

3.1 A theoretical model embedded in practice

It seems that institutional economics do not solve the questions of risk-taking and change decision-making in uncertainty. The large crisis at banks and states rescuing banks in Western countries in 2008 and the 5 years following the crisis trigger has led to the general downgrade of their solvency, as revealed by the big rating agencies debt downgrades of banks and states.

The need to build a new theory emerged through our practice with Boards, especially when it became clear that Boards of financial institutions were not equipped with the understanding of the business, among others the off-balance sheet items, nor the economic environment, and had an aversion to foresee any unfavorable change in the environment, at least a sudden crisis, and *a fortiori*, to prepare the company to it. Since then, I have been working on changes to governance function to enhance strategic change capacities of firms, based on evolutionary economics, fuzzy logic, and complexity theories.

A flexible and adaptive organization is an "edge of chaos" institution. The complex adaptive theory studies how order emerges in complex, non-linear systems, such as galaxies, ecologies, markets, social systems and neural networks. Systems on the edge of chaos can be distinguished from rigidly ordered systems, as they migrate to a state of dynamic stability. They also can be distinguished from chaotic systems because they possess a deep underlying coherence that provides structure and continuity. These adaptive systems are self-organizing, as there is a spontaneous emergence of new forms of order, without any external agent that designs, constructs or maintains the system, but with the added capacity over auto-poietic systems to conserve and process high levels of information, the "learning capacity". These systems have enough stability to store information and enough fluidity for rapid and intense communication

²⁷ Who Directs Strategic Change? Director Experience, the Selection of New CEO's, and Change in Corporate Strategy, James D. Westphal and James W. Fredrickson, Strategic Management Journal, 22: 1113-1137 (2001).

²⁸ Code de Commerce art L225-35 modified by the law n°2003-706 August 1, 2003 : The Board of Directors determines the orientations of the activities of the company and monitors their implementation.

²⁹ Kristof Van Assche, Raoul Beunen, Martijn Duineveld, Evolutionary Governance Theory, An Introduction, Springer 2014.

to occur. Evolution can be understood as a phenomenon of complex adaptive systems which adjust their parameters that keep the systems on the edge of chaos. They must have sufficient sources of negative feedback. Intolerance to negative feedback can lead to self-destruction. Complex adaptive systems co-evolve with their environments, with rich exchanges of matter, energy and information. Structure in complex systems is emergent, as it arises out of the interactions within the system: parts of the systems use local rules to guide their interactions, these recurring relationships constitute the structure of the system.

To implement evolutionary governance, exchanges from the upper level to lower level can take the form of fuzzy commands. Fuzzy logics are an interesting tool to introduce flexibility based on beliefs, in the operational routines, while keeping order. The variables of the fuzzy function may be subjectively characterized. Where there is uncertainty, it is possible to find the patterns to quantify the credibility of possible outcomes. The outcome (or event) which the Directors believe, even a minima, is the focal element of the fuzzy function. The plausibility degree and the belief degree straddle the uncertain probability of the badly known event. It is possible to coordinate several goals. The command is simple and adaptable. It resists to perturbations. The synthesis of several experts is easily done. But the result is not fuzzy. For example, for an insurance company, strategic risk management may be handled as a fuzzy command. The command levers may be: asset allocation routines, tariffs elaboration, etc. Variables are: turbulences on the financial markets, climate turbulences.

To illustrate governance with biological analogy, I would represent the organization as a cell. The Board is the membrane, it allows ionic exchanges with its environment. The intracellular components utilize and produce a certain quantity of potassium or sodium. There are signals perceived by the membrane to change proportions: the Board re-orientates activity of the organization to fit its environment. It means that the hierarchical order should not be conceived as a vertical one, but as a protective envelop to the organization, analyzing outside phenomena and quickly sending stimuli to the internal components, to reconfigure in a new internal order.

Complexity theory transposed to governance delivers new rules:

1. Ask Feed-back to check the fitness of the organization to the landscape, including negative feedback (often hidden by executives);
2. Even if the Board stands as a hierarchy above all parts of the company, it should quickly decide to react once feedback is obtained;
3. Use symbolic feedback loops to build "learning organizations" and stimulate innovations;
4. Allow some degree of liberty ("stratified autonomy") to lower levels to interact with their

specific rules. Commands must be expressed in a fuzzy mode;

5. Accept complexity, as complexity can emerge from simple rules;

6. Understand key parameters of lower level routines and the dynamics they create;

7. Be prepared for the unpredictable through scenarios construction and ready to react very quickly, even the future is still uncertain, and send fuzzy commands;

8. Examine how to co-evolve with other actors of the environment;

9. Check whether the organization is able to self-reorganize before new regulations or competitors impose it;

10. Balance stability and fluidity.

3.2 Measuring the performance of governance

Although the disciplinary role of the Board can be objectively proven, there are difficulties to statistically test the various theories on independence and composition, the fact that they have a direct link with the performance of the Board or of the company³⁰. Boards are often composed by a mix of executives and directors. There is no communication on internal debates.

3.2.1 Which Key Performance Indicator's for Boards?

3.2.1.1 Number of resolutions and breakdown

When I analyze the governance process at the largest public bank of a Mediterranean country, which is complying with the legal framework, inspired by the ALI principles, I find the following results:

- Governance process represents 21% of resolutions. They consist in Shareholders meetings organizations, Committee creations, nominations at the executive level, delegations of powers, remuneration of Directors.

- The supervision activity is the most important, it represents 49% of resolutions. It covers financial statements control, chartered auditors nomination, approval of various committees' reports.

- Strategy represents 26% of resolutions. They deal with capital increase, share buy-backs programs, real estate transactions, annual budget approval. No discussion about risk scenarios, innovation, business model, structures (decentralization, regional coverage, international diversification).

- Sociology represents 4% of resolutions. In fact, they concern the nomination of the General Counsel and special counsellors for the CEO. No resolution about dynamic capabilities of the organization, such as

³⁰ Sanjai Bhagat, Bernard Black, 1999 http://papers.ssrn.com/papers;taf?abstract_id=11417.

loyalty, commitment, competencies (knowledge management), ethics, etc...

- Information systems and processes (operational routines) never stand on the agenda of the Board.

- Symbols: never discussed.

The systematic publication of the activity of the Board, even kept with this low level of disclosure would dramatically enhance the quality of governance, as it would oblige Boards to dig into matters which are often missed in current state.

3.2.1.2 KPI's chosen by the Board to govern the organization

Boards should have their own KPI's to monitor the implementation of the evolutionary strategy, different from the KPI of lower level. A majority of Boards are sticking to three or five years plans, and are extremely reluctant to change plans, even when signals appear that should trigger changes to strategy. A French insurance company had built a five-year "Strategic Operational Plan" with very ambitious expansion plans to stand among the ten largest European insurers. It has then acquired a lot of insurance companies to reach this goal, but accumulated strong goodwills, hence destroying capital reserves. With the crisis, its situation was jeopardized, but no one dared to rock the boat, until the regulator requested the replacement of the Chairman.

3.2.1.3 Scenarios construction

As Teece suggests, the construction of scenarios is extremely helpful in building knowledge of the industry for Directors, in enriching the dialogue between executives and Directors and on triggering imagination in the firm. In an insurance company, the Directors -even executive Directors- were unable to build prospective scenarios. Executives are confusing risks and stress tests with uncertainty and impact calculation of prospective scenarios. I build a set of 14 prospective (10 years) scenarios, asking the Directors to weigh their preferences. They decline to do this, so I chose 7 scenarios. I advised the insurance company to set aside capital reserves to protect the company. Among these 7 scenarios, at least three materialized in less than a year, leading the company to insolvency, without these reserves.

3.2.1.4 Incentives for innovation

The resistance to change and the difficulty to let managers admit that their vision of the world, once accurate, may become obsolete is extremely strong. The CEO of an insurance company had been promoted because his investment policy as Chief Investment Officer increased dramatically the wealth of the company. He had put in place an equity buy and hold strategy, which was fruitful in the times of continuous growth of markets. When he became CEO,

he followed the same policy which made his success. Unfortunately, he was not able to become contrarian before the crash, sell shares and buy high quality bonds. When the share prices dropped down, all capital reserves had disappeared, the wealth of the company was divided by two.

3.2.2 Directors' incentives

Much has been debated about the necessary control over managers' remuneration, the "say on pay", as a consequence of the principal-agent theory. But almost nothing about the incentive of Directors to perform, except their reputation risk, in the case their collusion with the managers would be revealed (Fama³¹), and the limitation of the number of their assignments.

I posit that there should be other incentives for Directors, both intangible and tangible.

- Getting the opportunity to share collective intelligence sessions with the appropriate frequency and freedom to speak. According to a McKinsey survey³² released in April 2014, efficient Directors should -according to their own appreciation- spend 45 days per assignment to be ill-acting on a Board. Obviously, getting insights on the industry, on possible scenarios for the main variables impacting the company, on benchmarking the company to its competitors, on imagining new business models, etc. takes time. Therefore having the possibility to spend enough time with other Directors to debate, with the Executives to understand how strategy is executed, on sites, to get a physical experience of operational routines and feel the corporate culture and social climate is essential.

- Standing in the knowledge/information loop

- Getting the right payment for high implication, knowledge and creativity. According to Fama, the cost of governance should be inferior to the reduction of value destruction the Board is ensuring, through its control over investments and spendings. With the aforementioned KPI's, it would be possible to align the global remuneration of the Board with their performance on KPI's.

4 Conclusion: governance cannot lag behind evolutionary dynamics

Evolutionary governance challenges classical theories on governance on the following points:

- Governance cannot be reduced to a fiduciary responsibility to shareholders or social responsibility, its primary function is to ensure sustainability of the firm.

³¹ Eugene Fama, Michael Jensen, Separation of Ownership and Control, *Journal of Law and Economics*, Vol 26, N°2. Corporations and Private Property, June 1983, pp301-325 (Chicago Journals).

³² McKinsey, High Performing Boards : What's on their agenda ?, April 2014.

- Sustainability requests the intelligence of co-evolution with the ecosystem, including those whom the firm is liable to (shareholders, creditors).

- Building sustainability and competitive advantage request the capacity to act and take risks within uncertainty.

- The firm must be emergent, to be able to change not as a reaction but as an anticipation, which leads to a competitive advantage.

- This capacity request the enhancement of adaptive capabilities of the firm.

- Strategy is embedded in governance.

- The Board should be evaluated on its evolutionary capacities and incentivized on this basis.

Evolutionary strategies have moved first to renew organizational theories. Now it is time for evolutionary governance to

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ASSESSING IT COMPETENCES OF BOARDS OF DIRECTORS: PERCEPTIONS OF MALAYSIAN CIOs

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Abstract

Information technology (IT) systems are becoming increasingly indispensable for organisations in their daily operations. Organisations therefore invest considerable capital in IT assets to support the IT needs of employees and other stakeholders. As the contemporary global business environment becomes increasingly reliant on IT, the need for IT to be governed effectively and efficiently grows. Boards play a critical role in the governance of organisations, yet despite the continued call for improved IT governance, there has been little research into how boards actually govern IT. Current research indicates boards appear to struggle to understand the state of IT within their companies and/or they lack appropriate IT skills in discussing IT issues.

This study therefore assesses IT competences of boards using a model developed from a review of IT competence frameworks in three domains, namely IT organisations/associations, professional accounting associations and academic research. The model is then tested, using Malaysia as a case study to evaluate the level of Board IT competence. Malaysia was chosen in light of the attention drawn to corporate governance in the 9th Malaysia Plan report.

A survey instrument extracted from the competences model lists 33 current critical IT issues facing boards. It then asked chief information officers (CIOs) of companies, to evaluate the importance of each issue and the level of competence their board has to deal with them. The results appear to show that there is a difference in the ranking of importance of issues and the level of IT competence boards currently hold based on what CIOs consider appropriate within a company. The findings will contribute to the research base on board IT competences from a Malaysian perspective thus highlighting areas for further improvement. If successful, the model can then be used to evaluate the state of IT governance in other international domains.

Keywords: IT competence, Boards of Directors, IT Governance, CIOs, Malaysia

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1 Introduction

Information technology (IT) systems are becoming increasingly indispensable for organisations in their daily operations (Parent & Reich, 2009). As a result, organisations invest considerable capital into IT assets to support the IT needs of their employees and other stakeholders. This results in spending on corporate information assets accounting for more than 50% of capital outlay (Nolan & McFarlan, 2005). With more and more business being transacted online via the internet, IT dependent business transactions and capital expenditure on IT software, hardware and infrastructure is expected to continue to grow rapidly. The contemporary global business environment is increasingly reliant on IT, which in turn needs to be governed effectively and efficiently.

Currently most business organisations are governed by a board of directors. The board of directors is seen as the ultimate decision making body of the organisation and is considered to be responsible for the major investment decisions, corporate governance and the strategic direction of the organisation (Psaros, 2009). Boards play a critical role in the governance of an organisation and enhance the overall health and wealth of the entity (Borth & Bradley, 2008). Corporate governance is described by Gay & Simnett (2010) as a system by which companies are directed and managed and covers the conduct of the directors, and the relationship between the board, management and shareholders. Information technology governance (ITG) is a subset of overall corporate governance focusing on IT systems, their performance and risk management.

The rising interest in IT governance is partly due to compliance initiatives, for instance the Sarbanes-Oxley legislation in the USA (2002) and the Basel II (2004) banking regulations in Europe. IT governance is also considered critical because of the need for greater accountability for decision-making around the use of IT, in the best interests of all stakeholders.

The International Standard for Corporate Governance ISO/IEC 38500 (2008) has helped clarify IT governance by describing it as the *management system* used by directors. In other words, IT governance is about the stewardship of IT resources on behalf of the stakeholders, who expect a return from their investment. The directors responsible for this stewardship look to management to implement the necessary systems and IT controls. Wagner (2011) amongst others notes the potential benefits that can be achieved by following best practice in all IT governance areas. It follows therefore that additional research in the area of IT governance should prove beneficial to all stakeholders. Yet, despite the continued call for improved IT governance there has been little research on how boards actually govern IT (Van Grembergen, De Haes and Guldentops, 2004). Many researchers have called for a specific focus on what boards do around IT governance, as they consider that overall corporate governance cannot be effectively discharged unless IT is governed properly (Musson and Jordan, 2005, Borth and Bradley, 2008 and Bhattacharya and Chang, 2008).

Further justification for additional research into IT governance can be found in the general area of research on corporate governance. According to the 2008 International Audit Committee Member Survey conducted by the Audit Committee Institute (ACI) of KPMG International (KPMG, 2008) nearly two-thirds of audit committees rate IT as one of the key non-financial risks over which they have oversight. The same study finds that IT is the fifth ranked overall challenge confronting audit committees, putting it ahead of regulatory and fraud concerns. To complicate matters further, many respondents to the survey believe that the information they receive about their IT risks is of a lower quality than the information received about their other risk and oversight responsibilities. Another survey conducted by the Audit Committee Institute of KPMG Australia in 2010 (KPMG, 2010) identified several significant developments which can potentially impinge on the work of audit committees. Two critical IT issues specifically identified are; the emergence of *Web 2.0* technologies and the expansion of cloud computing.

The above factors all combine to provide the motivation for the current study. A review was conducted of all the extant professional and academic literature in the area of IT governance with the expressed purpose of developing a model with which to evaluate the competences boards currently have in this area. The model was then tested within a public company environment in Malaysia, to evaluate its

effectiveness. The model was found to be a reasonably good indicator of IT competences with the directors of companies in the selected jurisdiction Malaysia deemed to be lacking the appropriate IT competences in certain critical areas of IT governance.

The remainder of the paper is organised as follows. A literature review section follows, from which the various IT competence sources are summarised and based on these, three research questions are raised. Section three then outlines the proposed IT competence model extracted from the literature. Section four outlines the research methodology utilised. Section five analyses the results. Finally section six concludes the paper and offers some future research possibilities.

2 Literature review

The literature review section is divided into three areas. Proposed sources of IT competences are extracted from three separate groups: IT associations, accountancy bodies and academic research.

2.1 IT associations

IT governance is defined by the the International Standard for Corporate Governance of IT (ISO/IEC 38500, p.3) as: *the system by which the current and future use of IT is directed and controlled. It involves evaluating and directing the plans for the use of IT to support the organisation and monitoring this use to achieve plans. It includes the strategy and policies for using IT within an organisation.*

The standard provides a model, vocabulary and six *Principles for Good Governance* of information and communication technology (ICT) as follows:

1. Establish Clearly Understood Responsibilities for ICT
2. Plan ICT to best support the organisation
3. Acquire ICT validly
4. Ensure that ICT performs well, whenever required
5. Ensure ICT conforms with formal rules, and
6. Ensure ICT respects human factors.

Another model from an IT association worth considering, when assessing the competency requirements of boards of directors, is the *Control Objectives for Information and Related Technology* (CobiT) model. CobiT is a framework created by the Information Systems Audit and Control Association (ISACA) for information technology (IT) management and IT governance. ISACA, which is an international professional association that deals with IT Governance, is an affiliate member of the International Federation of Accountants (IFAC). CobiT supports IT governance by providing a framework to ensure that:

1. IT is aligned with the business
2. IT enables the business and maximises benefits

3. IT resources are used responsibly, and
4. IT risks are managed appropriately.

These two definitive IT models are by definition very specific to IT experts. In order to equate them more specifically to the business environment it is beneficial to review what professional accounting bodies view as critical IT expertise needed by their members.

2.2 Accountancy bodies

The International Education Standard (IES 2, IFAC, 2003) for professional accountants notes the information technology component of accounting curricula should include the following subject areas and skills:

- General knowledge of IT;
- IT control knowledge;
- IT control competences;
- IT user competences; and
- One or a mixture of, the competences of the roles of manager; evaluator or designer of information systems (IFAC 2003:33).

Guidance in information technology knowledge and competences for professional accountants is further expanded upon in the *International Education Guideline 11: Information Technology for Professional Accountants* (IEG 11, 2003). Table 1 lists 22 skills and the level of attainment required for these items.

Table 1. Information Technology competences as required by IEG 11

	Information Technology Item	Skill Level
1	Computer-assisted audit techniques (to evaluate information system processing operations and controls and to analyse and evaluate monitoring processes and activities)	IT control & evaluator role skills
2	Operating systems	User role skills
3	Word processing (in a relevant accounting/business context)	User role skills
4	Spreadsheet software (in a relevant accounting/business context)	User role skills
5	Database software (in a relevant accounting/business context)	User role skills
6	Internet tools(Email, Web browser,FTP) (in a relevant accounting/business context)	User role skills
7	Professional research tools(in a relevant accounting/business context)	User role skills
8	Business presentation software (in a relevant accounting/business context)	User role skills
9	Anti-virus software and other security software (in a relevant accounting/business context)	User role skills
10	Utility software and other relevant software (in a relevant accounting/business context)	User role skills
11	Accounting packages	User role skills
12	E-business systems (ERP, CRM and business automation systems)	User role skills
13	Networks(LAN)	User role skills
14	Electronic commerce (B2C,B2B,encryption tools, digital signatures/certificates, key management)	User role skills
15	Back-up and recovery	User, Manager role
16	Outsourced services (Internet Service Providers, Application service providers)	Manager role skills
17	EDI and e-commerce activities	Manager role skills
18	Access controls (logical and electronic)	Manager role skills
19	Communication	Manager, Designer & evaluator role skills
20	Document design specification	Designer role skills
21	Testing of system	Designer, Manager role skills
22	Planning of system evaluation	Evaluator role skills

Similarly, a review of the competency requirements of various national accounting bodies in countries such as Australia, Canada, the UK, USA, South Africa, and Malaysia all reveal a requirement for competence/proficiency in the IT area.

2.3 Academic research

Many academic studies have looked at the IT skills needed in the business workplace and the extent to which business people possess them. Theuri and Gunn (1998) examined the way in which information systems courses have been designed and structured in

American universities and then related these practices to the systems skills expectations of the employers of accounting graduates. Hostrom and Hunton (1998) note how assurance services provided by the auditing profession are changing and that the fundamental issue now is that of control over information and related technology.

Coenenberg, Haller and Marten (1999) investigated the current state of accounting education for qualified auditors in Germany and identified challenges faced by that country due to changes in the accounting and auditing environment resulting from the increased use of IT in business applications. Howieson (2003) notes how IT advances will redefine

the relationship between clients and professional experts, because more powerful technology will empower clients to play a bigger role in managing their own affairs.

Greenstein and McKee (2004) conducted a literature review that resulted in the identification of 36 critical information technology skills. They then surveyed academics (in accounting information systems and auditing) and audit practitioners in America to determine their self-reported IT knowledge levels and perceptions about the best places to learn IT skills. Table 2 summarises some of the major skills required.

Table 2. List of critical IT skills from Greenstein & McKee

The director as a user of IT: Business Automation Skills	
Element	Capability
Word processing	Apply word processing software in a relevant accounting/business context
Spreadsheets	Apply spreadsheet software in a relevant accounting/business context
Presentation Software	Apply presentation software in a relevant accounting/business context
Internet tools	Apply Internet tools in a relevant accounting/business context
Research tools	Apply professional research tools in a relevant accounting/business context
Image processing software	Apply image processing software in a relevant accounting/business context
The director as a user of IT: Office Management Skills	
Element	Capability
Database search and retrieval	Ability to search and retrieve data from a database
Knowledge work systems	Ability to work with knowledge work systems to aid directors in the creation, integration and communication of knowledge
The director as a manager, designer and evaluator of IT	
Element	Capability
Electronic data interchange	Ability to perform EDI(traditional and web-based) transactions
Digital communications	Ability to understand digital communications(including wireless communications)
Network configurations	Ability to understand various network configurations(internal & external)
Internet service providers	Ability to understand the issues around the management of internet service providers
Encryption software	Ability to understand the use of encryption software to change data, using some type of encoding/decoding algorithm
Firewall software/hardware	Ability to understand the use of security technology to enforce an access control policy between networks
User authentication	Ability to understand the use of software and devices to identify system users
Intrusion detection and monitoring	Ability to understand the use of security technology to identify unauthorised requests for services

Trites (2004) states that information technology (IT) plays a serious role in any modern business system. Therefore IT considerations play an important part in the controls that are necessary to preserve and protect corporate assets from misappropriation, loss and misuse. He subsequently identified four critical categories within which IT governance could be assessed. These are discussed further in the next section. Finally, Delmond and Lebas (quoted in IFAC, 1998) note how recent developments in information technologies have increased the quantity of financial and non-financial data that can be accessed by

accountants, as well as the scope and speed of data analysis and transmission.

2.4 Research questions

The above literature review highlights three disparate bodies of work, all noting various IT competences within their own domain and for their own specific purpose. The IT groups developed standards to provide assistance to IT practitioners. The professional accountancy bodies developed frameworks to ensure members are capable enough in the specific area of IT. Academic research has developed frameworks to

evaluate among other things, how effective IT training is.

The stated objective of this paper is to develop a model with which to evaluate the competence of board members in relation to IT governance issues. Based upon the diverse range of sources utilised above, three research questions (RQ) are therefore raised.

RQ1: Can a framework for assessing the importance of IT issues be developed with indexes for the four critical sections identified in the literature?

RQ2: Can a framework for assessing Board IT competences be developed with indexes for the four critical areas of competence?

RQ3: Will a survey of Malaysian Chief Information Officers uncover any evidence of a knowledge gap as to the level of competence boards possess, in relation to IT governance issues?

3 Development of an IT competence model

A model with which to evaluate IT competence of directors needs to be framed in such a way as to be

understandable to boards, all members of which may not be at the same level of computer expertise. Directors are responsible for overall corporate governance and so it was decided to frame the model in terms of critical general corporate governance principles. Referring to Trites (2004) study mentioned previously four critical sections were therefore identified. These are:

1. strategic planning issues,
2. internal control issues,
3. business risk issues, and,
4. privacy and legal issues.

Each section was then taken and filled in with specific points, extracted from the three categories of sources identified in the literature review section. This resulted in 15 strategic planning competences, 9 internal control competences, 4 business risk competences and 5 privacy and legal competences. Tables 3 to 6 respectively list all individual competences.

Table 3. Strategic Planning Issues

1	The strategic value of IT to the company
2	The company's awareness of options for the effective, efficient and acceptable use of IT
3	Alignment between all IT activities and the company's objectives
4	Mechanisms are in place for monitoring information security risk
5	Awareness of technology-based competitive threats
6	Innovative use of IT to undertake new businesses and improve processes
7	Making use of the latest technologies for both scheduled and impromptu meetings
8	Making use of secure IT tools for all internal communication purposes
9	Making use of data analytics to support decision making at every level throughout the organisation
10	Ability to critically evaluate IT investment recommendations
11	Considering all stakeholder concerns and needs when making IT investment decisions
12	Ensuring appropriate human resource policies are in place
13	Ensuring ample resources are available to enable staff to leverage new technologies
14	Ensuring appropriate contractual agreements are in place with IT vendors/ suppliers
15	Awareness of the influence of company culture on the overall effectiveness of IT governance

Table 4. Internal Control Issues

1	Ensuring appropriate oversight of all IT related strategic and operational risks
2	Instituting appropriate IT governance mechanisms be it at board or at committee level
3	Ensuring standards for security and document retention are in place
4	Setting up IT fraud prevention/detection platforms throughout the organisation
5	Setting up mechanisms to ensure that the company gets value for money from all its IT investments
6	Ensuring that IT monitoring and measurement systems deliver expected results
7	Ensuring that plans and policies are implemented and effective
8	Conducting regular reviews of IT security and reliability measures
9	Ensuring appropriate IT project management systems are used

Table 5. Business Risk Issues

1	Being cognisant of developments in IT trends and emerging technologies for future business needs
2	Ensuring that all issues related to IT business continuity risk are identified and acted upon
3	Ensuring appropriate use of social media platforms to track and assess consumer sentiment
4	Ensuring relationships with third party IT service providers are sustainable

Table 6. Privacy and Legal Issues

1	Ensuring that all local legislative and regulatory requirements for protecting personal information as well as policy and procedures for compliance are adhered to
2	Ensuring compliance with all relevant local legislation pertaining to the use of software, hardware, service agreements and copyright laws
3	Ensuring compliance with any relevant overseas regulations such as Sarbanes-Oxley, HIPAA, Basel, etc.
4	Ensuring compliance with all professional standards, frameworks and methodologies affecting IT governance
5	Ensuring that the decommissioning or disposal of IT assets is done in accordance with environmental legislation and regulations

4 Research methodology

4.1 Survey instrument

The model was then incorporated into a survey instrument for testing. The survey instrument was in three parts. The first part listed five demographic questions about the respondent's company, his/her position (Chief Information Officer, Chief Executive Officer etc.) and years of experience. As regards the company, three questions identified the size of the company (by turnover); the industry sector it was in and which stock exchanges it was listed on.

Part two then listed the 33 issues in their four categories and asked the respondents to evaluate, in terms of importance, each IT issue facing their company today. Part three then re-listed the 33 items and respondents were asked to rank the level of competence they considered the board of their company possessed to deal with each issue. Appendix 1 lists an abridged version of the questionnaire showing the questioning relating to the four "business risk" issues.

4.2 Survey jurisdiction and respondents

It was decided to use a jurisdiction with an emerging market economy and a stock exchange with stringent corporate governance requirements to test the model. The model was then tested, using Malaysia as a case study to evaluate the level of Board IT competence. Malaysia was chosen in light of the attention drawn to corporate governance in the 9th Malaysia Plan Report prepared by the Economic Planning Unit of the Prime Minister's Office and the Finance Ministry of Malaysia in 2006 (EPU 2006).

The specific individual respondents surveyed were therefore the Chief Information Officers (CIOs) of Malaysian public listed companies. The list of companies surveyed was obtained from the website of the CIO Chapter National ICT Association Malaysia (PIKOM). The link to the survey instrument in electronic format together with a covering letter was sent to the Chairman CIO Chapter PIKOM via LinkedIn with a request that the link be sent out to their members who are mainly Chief Information Officers of public listed companies in Malaysia requesting their participation. Fifty seven useable

responses were received. This yielded a response rate of 7% which is deemed typical when surveying "time deficient" people such as the CIOs of public listed companies. A pilot study by Mohamad et al. (2014) of CIOs of Irish listed companies yielded a response rate of 10%. Similarly a survey of Malaysian senior management which included CIOs conducted by Yap et al. (2010) yielded a response rate of about 12%. The sample was therefore considered representative and valid as there is no reason to assume non-respondents would have had different views from those who took the time to respond.

5 Results

The results were analysed to evaluate and respond to the three research questions posed earlier. This was achieved by assessing the rankings of the CIOs in relation to (i) the importance of each particular issue and (ii) the perceived level of board competence to deal with each issue. Table 7 summarises the raw data. Firstly, reliability tests were run to check the validity of the data. Cronbach Alpha scores were calculated for all eight group evaluations as per Table 7 (i.e. importance and competence scores for each of the four groups of issues). The scores ranged from 0.818 to 0.962 indicating that 82% to 96% of the items are measuring the same construct. These percentages are considered acceptable as the reliability factor analyses provide satisfactory measures when compared to Nunnally and Bernstein's (1967) seminal benchmark figure of 0.70.

The *importance* of the issues was then tested, by reviewing respondents' answers to Part two of the survey instrument. On a scale of 1-5 the lowest score given to an item was 3.67 (approximately half way between neutral and important) and the highest was 4.68 (approximately half way between important and very important). All 33 items were ranked as important with the overall average rank at 4.29 (Table 8, row 6, column 2) which is more than 4.00, making each item "very important" on average. Critically, space was left in an open ended question at the end of the survey instrument for respondents to add any other issues they considered critical to IT governance which were not already in the 33 listed competences (refer Appendix 1). None were listed.

Table 7. Raw Data scores (Imp = importance, Comp = competence) for CIOs (n=57)

Strategic Planning Issues		Imp	Comp
1	The strategic value of IT to the company	4.316	3.895
2	The company's awareness of options for effective, efficient and acceptable use of IT	4.544	3.649
3	Alignment between all IT activities and the company's objectives	4.404	3.702
4	Mechanisms are in place for monitoring information security risk	4.526	3.649
5	Awareness of technology-based competitive threats	4.000	3.386
6	Innovative use of IT to undertake new businesses and improve processes	4.246	3.474
7	Making use of the latest technologies for both scheduled and impromptu meetings	3.667	3.211
8	Making use of secure IT tools for all internal communication purposes	4.246	3.386
9	Making use of data analytics to support decision making throughout the organisation	4.175	3.263
10	Ability to critically evaluate IT investment recommendations	4.579	3.667
11	Considering all stakeholder concerns and needs when making IT investment decisions	4.105	3.561
12	Ensuring appropriate human resource policies are in place	4.088	3.526
13	Ensuring ample resources are available to enable staff to leverage new technologies	4.000	3.509
14	Ensuring appropriate contractual agreements are in place with IT vendors/ suppliers	4.193	3.316
15	Awareness of influence of company culture on overall effectiveness of IT governance	4.035	3.333
Internal Control Issues			
1	Ensuring appropriate oversight of all IT related strategic and operational risks	4.526	3.597
2	Instituting appropriate IT governance mechanisms be it at board or at committee level	4.386	3.368
3	Ensuring standards for security and document retention are in place	4.404	3.579
4	Setting up IT fraud prevention/detection platforms throughout the organisation	4.246	3.333
5	Setting up mechanisms to ensure company gets value for money from IT investments	4.579	3.772
6	Ensuring that IT monitoring and measurement systems deliver expected results	4.526	3.544
7	Ensuring that plans and policies are implemented and effective	4.404	3.649
8	Conducting regular reviews of IT security and reliability measures	4.509	3.316
9	Ensuring appropriate IT project management systems are used	3.983	3.228
Business Risk Issues			
1	Being cognisant of developments in IT trends and emerging technologies for future business needs	4.421	3.386
2	Ensuring that issues related to IT business continuity risk are identified and acted upon	4.614	3.649
3	Ensuring appropriate use of social media platforms to track/assess consumer sentiment	3.754	2.983
4	Ensuring relationships with third party IT service providers are sustainable	4.053	3.281
Privacy and Legal Issues			
1	Ensuring that all local legislative and regulatory requirements for protecting personal information as well as policy and procedures for compliance are adhered to	4.684	3.649
2	Ensuring compliance with all relevant local legislation pertaining to the use of software, hardware, service agreements and copyright laws	4.632	3.561
3	Ensuring compliance with any relevant overseas regulations such as Sarbanes-Oxley, HIPAA, Basel, etc.	4.035	2.983
4	Ensuring compliance with all professional standards, frameworks and methodologies affecting IT governance	4.035	3.193
5	Ensuring that the decommissioning or disposal of IT assets is done in accordance with environmental legislation and regulations	4.246	3.088

Table 8. Group Mean Scores and Ranking of Issues and Competences by CIOs (n=57)

	Issues	Rank	Competences	Rank
Strategic Planning	4.21	3	3.50	1
Internal Controls	4.40	1	3.49	2
Business Risk	4.21	3	3.32	3
Privacy and Legal	4.33	2	3.29	4
Overall	4.29		3.40	

Table 8 summarises the means on a group basis for each batch of issues. Group means, as regards the importance of the groups of issues ranged from 4.21 to 4.40. This again tends to suggest the respondents

considered all items important and considered the group classification a reasonable methodology with which to evaluate overall IT importance.

RQ1 is therefore deemed to be answered in the affirmative, up to this point. This would appear to be a good basis with which to develop a model to evaluate how well or otherwise, boards are managing IT issues for their companies. The first task is to come up with a structured list of important items, and a scale with which to measure them. The current model appears to have achieved this. The respondents agreed all items were important and there was consensus among the respondents as to the items assessed. Finally, no items were identified which had been omitted from the lists.

Additional support for the evaluation of RQ1 and an assessment of RQ2 was then performed by reviewing respondents' answers to Part three of the survey instrument, the assessment of their board's *competence* to deal with the IT issues identified. Scores ranged from 2.98 to 3.90 with the overall average rank at 3.40 (Table 8, row 6, column 4) which approximates to 3.50. The group mean assessments of competence are summarised in Table 8 and range from 3.29 to 3.50. This tends to suggest respondents were able to use the model to evaluate how competent their boards were in relation to IT governance issues.

RQ1 can therefore be evaluated in the affirmative. Respondents considered the 33 issues as important, did not identify any omitted IT issues and were able to use the matrices to assess the performance of their boards as regards competence in the IT governance area.

Further support for the veracity of the model is derived from a review of Table 8 rankings of the groups of issues. In terms of importance, Internal Control issues were ranked most important followed by Privacy and Legal Issues. Strategic Planning and Business Risk issues were then jointly ranked third. When competence to deal with these issues was then evaluated, a slightly different ranking order emerged. Strategic Planning issues were ranked first, followed by Internal Controls, Business Risk then Privacy and Legal issues in that order. This suggests that although respondents recognised the importance of the issues however they evaluated their board competence to deal with these same issues differently, thus resulting in a slightly different ranking pattern.

RQ2 is also answered in the affirmative. Management of the evaluated companies considered overall that their boards of directors were reasonably competent in dealing with current IT issues.

Finally in relation to RQ3 about a knowledge gap differences were noted when it came to the evaluation of the importance of issues versus the corresponding board competence to deal with it. Table 7 lists mean scores both for the importance of the 33 IT governance issues as well as the competence of directors in relation to their oversight responsibilities for those same issues as scored by the CIOs. For the importance of issues the mean scores ranged from a minimum of 3.667 to a maximum of 4.684 with an

overall average of 4.29 (Table 8, row 6, column 2). Meanwhile for the competence of directors the mean scores ranged from a minimum of 2.983 to a maximum of 3.895 with an overall average of 3.40 (Table 8, row 6, column 4). It appears that across the board for all 33 issues and competences surveyed the CIOs scored the competence of directors lower than they scored the importance of the corresponding issue.

This is indicative of possible issues with IT governance which need to be reviewed. Thus it appears as if CIOs of Malaysian companies consider their boards presently to be not fully on top of some current critical IT governance issues. This might be expected in an emerging market economy with a reasonably well developed stock exchange system, which Malaysia currently enjoys.

6 Summary and conclusions

The importance of IT governance has undoubtedly escalated over the last decade but as Van Grembergen and De Haes (2010) observe, boards sometimes appear to be struggling to understand the state of IT within their companies. On occasion they do not have sufficient information to govern IT effectively, with many board members displaying a lack of IT skills and interest in discussing IT at board meetings. Company boards are ultimately responsible for IT governance. Chalaris *et al.* (2005) summarise these responsibilities as: the realization of promised benefits as a result of IT's alignment with that of the organization; the exploitation of opportunities and maximization of benefits from IT enabling the organization; the responsible use of IT resources; and the appropriate management of IT-related risks. Hence, some assistance as to the specific necessary competences boards should have in the IT area appears critical. These also need to be framed in a model directors can understand, as all directors do not have the same level of IT skills and training.

This research study therefore attempts to address a perceived gap in the IT governance literature, by providing an actual model with which to evaluate the level of IT competence boards actually possess. A model of 33 specific competences from 4 overall categories of IT governance issues was therefore developed from three separate sources. These are: IT bodies, professional accounting bodies and academic research. The model was then tested in Malaysia, using public companies listed on Bursa Malaysia the local stock exchange. Results suggest the model is an effective tool to evaluate board IT competence levels. However, in this particular jurisdiction, board competences were assessed by company management to be still lacking in some areas of IT governance. This was not entirely surprising for a jurisdiction with an emerging market economy and a fairly sophisticated stock exchange system with the observance of corporate governance regulations mandatory as a pre-condition for membership.

Past literature on IT governance has focused on the domains of IT strategic alignment, IT resource management, risk management, performance measurement, and IT value delivery. These five domains have gained global recognition as accepted relevant domains of IT governance (Johnson, 2005). But the IT environment is dynamic and the increased reliance on outsourcing these days by major corporations and advances in cloud computing will only expand the areas of IT governance. This in turn will expand company boards' needs for IT competences. A model to evaluate such competence levels therefore appears important. This highlights the significance of the current research.

The model can now be used to evaluate IT competence levels in other jurisdictions. The level of competence could then be compared from one jurisdiction to the next. It can also be used to evaluate whether the competence of company boards as regards IT issues, varies with the level of (i) corporate legislative controls (ii) stock exchange requirements and (iii) corporate governance codes. Critically, the current study has requested *management* (via CIOs) to evaluate board level competences. Future research could get boards to self-evaluate their competence and then get management to evaluate board competence and compare the two to see if any competence "gaps" appear. The results of such future research may assist boards to better understand the governance of IT and allow them to consider the impact of IT structure on board IT governance processes.

7 Limitations

As with any study of this ilk, results and analysis are dependent upon the responses received from participants. Whether the responses they provide are an accurate reflection of their true thoughts on the matter, or have been adjusted (to provide responses which would appear more appropriate) is a matter the research cannot determine. For example CIOs may have been afraid to be too critical of the boards of their company for fear of reprisal. The small sample size (only representing 7% of the population) is also acknowledged, but as explained previously, a manageable total population with appropriately satisfactory governance characteristics was considered critical to an effective evaluation of the model's capabilities and limitations. The participants in this particular jurisdiction did not identify any shortcomings in the model, such as other critical IT issues not considered. Testing in a different environment may have uncovered such items. Future research may shed some light on this possible limitation.

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Appendix A. Abridged version of Survey Instrument

Part 1: Demographic profile

Please tick 1 box to answer each of the following questions.

1. What is your company's industry sector?

Manufacturing ☐ Finance ☐ Service ☐ Retail ☐ Media ☐
 Plantation ☐ Tourism ☐ Mining ☐ Agriculture ☐ Other ☐ _____

Table A.1. Part 2: Importance of it issues

3. Business Risk Issues						
Please rank your assessment of the <u>IMPORTANCE</u> of the following IT issues to your company, by marking one box on the scale provided						
#	Issues	Very	Fairly	Neither Unimportant Nor Important	Fairly	Very
		Unimportant			Important	
1	Being cognisant of developments in IT trends and emerging technologies for future business needs					
2	Ensuring that all issues related to IT business continuity risk are identified and acted upon					
3	Ensuring appropriate use of social media platforms to track and assess consumer sentiment					
4	Ensuring relationships with third party IT service providers are sustainable					

Table A.2. Part 3: Board it competency

3. Business Risk Competences						
Please rank the level of <u>COMPETENCE</u> your board currently has to deal with these issues by marking one box on the scale provided						
#	Competences	Lacking Significant	Lacking Some	Neither Competent nor Incompetent	Fairly	Very
		Competence			Competent	
1	Being cognisant of developments in IT trends and emerging technologies for future business needs					
2	Ensuring that all issues related to IT business continuity risk are identified and acted upon					
3	Ensuring appropriate use of social media platforms to track and assess consumer sentiment					
4	Ensuring relationships with third party IT service providers are sustainable					

Finally, please list any other IT issues you consider important, which have not been included above:

HOW CAN EFFECTIVE GOVERNANCE BUILD BUSINESS OPPORTUNITIES BETWEEN AUSTRALIA AND THE VISEGRÁD COUNTRIES?

Áron Perényi*, Alexis S. Esposto**

Abstract

Australia's economic ties to Europe relatively weakened over the past decades, the Asian Century opened up new opportunities, and diverted attention from a Euro-centric political and economic view. This paper does not challenge the merit of Australia's current global orientation. However, it does take the opportunity to a possibility for diversification, using effective leadership in raising business opportunities with the emerging region of Europe: the Visegrád Countries. This group of nations have been earmarked as the best performing, latest additions to the EU. Outcomes of a round table discussion with key stakeholders of the Australia – Central Europe business relations are documented and cross-referenced with extant literature to highlight the main areas in which effective leadership can build business opportunities***.

Keywords: Business Opportunities, Corporate Governance, Emerging Markets, Leadership

JEL Code: G34

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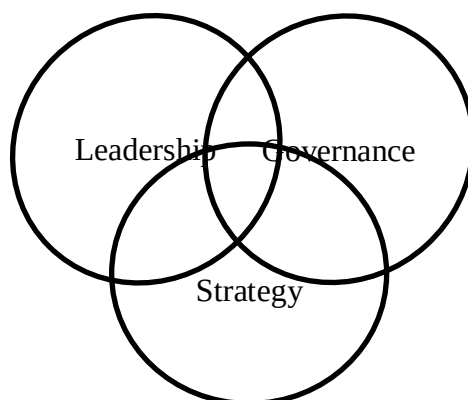
1 Introduction

Leadership – as defined by the current body of literature – is a multi-faceted societal, political and organisational phenomenon that exists on several levels of analysis (Dionne et al. 2014). Individual, group and organisational levels are addressed in the trait, behavioural and contingency leadership paradigms (Lussier & Achua 2013). Hernandez et al. (2011) define leadership in a complex and holistic manner that is capable of addressing challenges faced by society. Integrative leadership is an emerging paradigm, which has been brought about by the necessity to understand leadership in its complexity (Burns 2003), in particular within the context of facilitating the organisation of international communities (Crosby & Bryson 2005). Such international, political, public and community leadership is in focus when exploring the development of international economic relations.

Dionne et al. (2014) identify political and public leadership as one of the many domains of leadership research, which focusses on investigating leadership of political figures and leadership in communities. This definition is in contrast to the political leadership definition of Ammeter et al. (2004), who focus on the

aspects of organisational politics. Political leadership in this context describes the level of leadership, that can influence individual actors and communities in the public (Elcock & Fenwick 2012) and private sector (Day et al. 2014) to develop opportunities for a broad range of stakeholders.

When compared to the above outlined definitions of the domain of leadership, governance addresses the configuration of the technical, organisational framework facilitating effective leadership (Levy & McKiernan 2009) in the business (Albert-Roulhac & Breen 2005; Heidrick & Struggles 2013), public (Acuto 2013) and NGO (Chait et al. 2004) sector organisations. By addressing leadership issues, practical recommendations can be derived to develop governance frameworks. Leadership is both broader and narrower in its scope, compared to governance, and strategy is often identified as a facilitator (see Figure 1). This paper focuses on how leadership can influence governance at different levels to facilitate achieving objectives. Empirical evidence underpins this approach, particularly as organisational leadership and performance are proven to be related (Rashid & Islam 2011).

Figure 1. The leadership, governance and strategy conceptual triangle

Source: based on Leavy and McKiernan (2009)

An inherent aspect of leadership is the process of influencing people through change in order to achieve a specific goal or goals (Lussier & Achua, 2013). The path to achieving goals is often paved by hindrances and challenges, which need to be overcome to reach the desired outcomes. Barriers to achieving goals can be viewed as limitations of hard reality, or perceptions and beliefs often manifesting as misguided perceptions that inhibit achievement of goals.

Central and Eastern Europe has become a point of interest several times during the 19th, 20th and 21st centuries, and Australia has a long history of engagement and exchange with the region. 19th century was earmarked by sporadic migration to Australia from the Central European region (Jupp 2001), with examples of remarkable migrant contributions to building early Australian community (Victorian Collections 2014). Waves of migration from Central Europe into Australia was closely related to political events of global magnitude, such as the World Wars, revolutions (Hungary 1956, Czechoslovakia 1968), and civil strife (Yugoslav wars 1991-1999), which triggered peaking migrant influx into Australia (Colic-Peisker 2009; Lidicky 2008; DIMA 2001, DIAC 2014a; 2014b; 2014c; 2014d). Enhanced economic exchange characterised the relationship between Australia and Central Europe since before the fall of the Iron Curtain in Europe (Joint Standing Committee on Foreign Affairs Defence and Trade 2003), with enhanced education and political connections developing after the political changes and EU accession took effect in Central Europe. The Australian Program of Training for Eastern Europe (APTEE) was a training program specifically tailored to providing business education to hundreds of people from Central and Eastern Europe (Australian International Development Assistance Bureau 1990), and the intensive student exchange was followed by ongoing networking and collaboration in the form of regular conference meetings of the APTEE alumni.

After such a substantial history of interaction and cooperation between the regions, it has been

highlighted in the recent years, that Central Europe is one of the strategic growth areas of the European economy (Labaye et al. 2013). After the recession starting in 2007, sluggish growth has enduringly characterised Central Europe, but the prognoses of development in manufacturing sectors (Joint Standing Committee on Foreign Affairs Defence and Trade 2003) have manifested in the development of substantial export capacities (Jedlička et al. 2014).

In light of the emergence of the Asian Century (Commonwealth of Australia 2012), engagement opportunities for the Australian economy with Europe may seem of relatively small importance and value. This was already identified as a point of concern a decade earlier, nevertheless arguments are here presented that diversified engagement presents value for Australia in terms of stability, continuity and seeking active engagement with a diverse portfolio of geographical regions is highly beneficial (Joint Standing Committee on Foreign Affairs Defence and Trade 2003).

This paper seeks to explore the role of international, political, public and community leadership in building and re-building relationships between Australia and Central Europe, by examining the case of the Central European Visegrád Countries, based on historical information relating to population, cultural and economic exchange, and notes taken at a panel discussion facilitated involving a wide range of stakeholders (public officials from Australia and Central Europe, business representatives and academics) in November 2014 in Melbourne. The aim of our paper is to develop and apply an analytical tool: the leadership and engagement matrix. Its objective is to make recommendations for private and public sector stakeholders in how to create and use effective leadership to enhance economic and social exchange between the global regions. This is relevant in making recommendations for governance both at national, international, policy business and government levels.

Accordingly, the paper consists of three sections to follow. Section 2 provides an overview of secondary data in relation to migration, cultural and

education exchange and trade and investment. This is concluded by discussing projections in relation to the future potential of economic exchange between Australia and the Visegrád countries. The authors do this to validate the potential for developing international relations between Australia and Central Europe, and to provide a basis for analysis using the leadership and engagement matrix framework. Section 3 provides a brief review of the literature on integrative leadership and the different levels of governance and develops the leadership and engagement matrix framework. Section 4 provides a detailed analysis of the challenges and possibilities within this space using the leadership and engagement matrix. Finally, section 5 of the paper concludes with a summary of findings and recommendations in relation to the leadership challenges described above, reflections on the use of the leadership and engagement matrix, highlighting avenues for future research.

2 Australia's relations to Central Europe

This section provides an overview of secondary information in relation to population, cultural and economic exchange between Australia and the Visegrád countries. As highlighted in the parliamentary debate in relation to the 2013 closure of the Australian embassy in Budapest (Open Australia 2013), there has been a long history of migration, and political cooperation between the two countries. With current (2015) Australian diplomatic and economic representation³³ focussing on Central Europe, and all Visegrád countries having diplomatic representation (it is argued, that there is existing high level infrastructure present to build on the foundations laid in the past).

2.1 Population movement

A rich history of migration typifies Australia's interaction with Central Europe and the Visegrád countries throughout the 19th and 20th centuries. 19th century migration was characterised by formative characters of early colonial Australian history, such as Ernest Leviny (Victorian Collections 2014) and continued in the early 20th century in a similar, sporadic manner, earmarked by migration of a predominantly political and humanitarian nature for the majority of the century (Rasmussen 2006, Colic-Peisker 2009; Lidicky 2008; DIMA 2001). Table 1 shows some key figures of foreign born population in Australia, by number of people and country of origin. Gradually, the share of the Visegrád community out of Australia's total population decreased from

approximately 1% to around 0.4% recently, with overseas born community numbers on record peaking at around 1996. Not surprisingly, migration in the opposite direction has not been substantial, only showing a few hundred people leaving Australia to move to Central Europe.

These numbers may not necessarily accurately reflect the size of communities, and other sources quote larger ethnic population sizes (Open Australia 2013), which probably include members of the communities born in Australia (2nd, 3rd generations), or immigrants from other countries. This further augments the potential Australia can utilise building relations with the Central European Visegrád nations.

2.2 Culture and education

Cultural exchange with Central Europe was strongly related to migration for an extended period of time. Migrants have brought with them their national culture (Jupp 2001) and their legacies are to be found Australia wide. Given the minimal flow of migrants in the opposite direction, the distance and cost of travelling, and political issues sparking up during the 20th century have also left a mark on the relationship between the regions.

With the opening up of Central and Eastern Europe in 1989, educational exchanges have caught momentum. The Australian Program of Training for Eastern Europe (APTEE 1990) later renamed and extended in geographical scope as Australian Program of Training for Eur-Asia (APTEA 1994) is an example of existing and growing cooperation. The training program provided an opportunity for incoming students from the transitional countries of Central and Eastern Europe, and later Western Asia as well to complete a Graduate Certificate of Business Administration course. The key objectives of the programme included:

- Assisting the development of commercial relationships;
- Contribute to Eastern Europe's movement towards a market economy;
- Provide students with competitive business skills.

Records show, that between 1991 and 1993, 160 fellows have taken part in the exchange (APTEE 1993), and throughout the life of the programme until its conclusion in 1997, there have been some 424 participants who arrived in 22 groups recorded of whom in total 27 participants were Czech, 42 Hungarians, 48 Polish and 20 Slovak, constituting a total of 137 participants from the Visegrád countries (Makmakas n.d.). The enduring impact of the initiative is signified by the alumni community, which has held eleven, bi-annual congresses between 1994 and 2014.

³³ Australia currently has an embassy in Warsaw and Vienna; an Austrade regional office in Warsaw; and has diplomatic representations of Visegrád embassies in Canberra, and consulates, and honorary consuls and trade and investment offices in Melbourne and Sydney.

Table 1. Australian immigration from the Visegrád countries

	1921	1947	1954	1961	1971	1981
Czech Republic	-	-	-	12,132*	16,602*	16,152*
Hungary	148	1,227	14,602	30,533	29,160	27,987
Poland	1,780	6,573	56,594	60,049	59,700	68,496
Slovak Republic	-	-	-	12,132*	16,602*	16,152*
TOTAL	1,928	7,800	71,196	90,582	88,860	96,483

	1991	1996	2001	2006	2011	2013
Czech Republic	17,648*	13,720	13,070	13,940	13,450	13,590
Hungary	25,301	27,770	25,660	24,070	22,440	21,930
Poland	65,119	72,420	65,540	62,920	57,920	56,750
Slovak Republic	17,648*	5,860	6,430	5,990	6,050	6,320
TOTAL	90,420	119,770	110,700	106,920	99,860	98,590

* Figures from 1961 to 1991 are for Czechoslovakia.

Sources: ABS (2015), DIMA (2001)

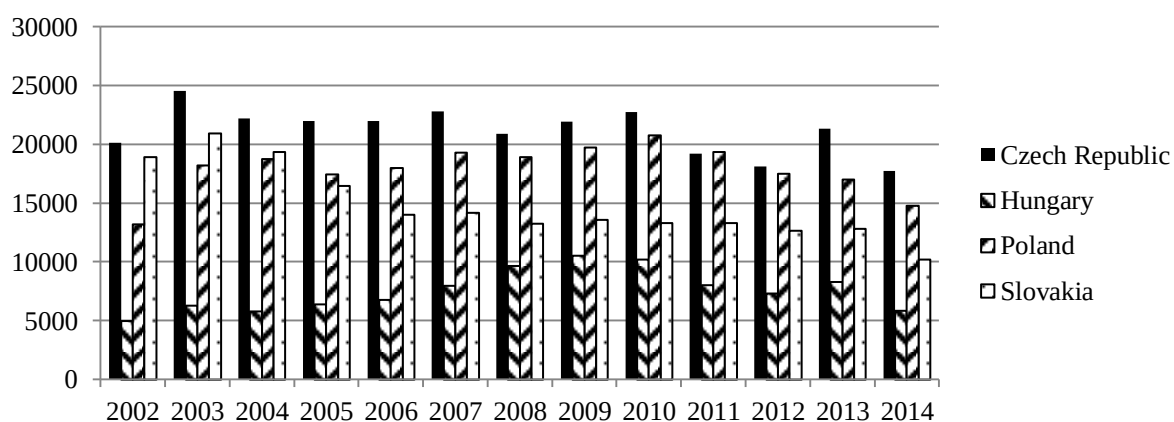
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- Assisting the development of commercial relationships;
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- Provide students with competitive business skills.

Figure 2. Stock of international students in Australia, by country

Source: Department of Education (2014)

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its conclusion in 1997, there have been some 424 participants who arrived in 22 groups recorded of whom in total 27 participants were Czech, 42

Hungarians, 48 Polish and 20 Slovak, constituting a total of 137 participants from the Visegrád countries (Makmakas n.d.). The enduring impact of the initiative is signified by the alumni community, which has held eleven, bi-annual congresses between 1994 and 2014.

With the expansion of the export of Australian education abroad, the number of international students rapidly expanded. Figure 2 provides details of incoming students to Australia from the four Visegrád countries. Total international student numbers peaked at 70,000 in 2003, and have settled at around 48,000 in 2014. With English being the commonly most spoken foreign language across the four countries (Mejer et al. 2010), potential of further cultural and educational exchange is holds many opportunities. According to survey results, in 2007, 33.4% of Czech, 14.5% of Hungarian, 25% of Polish and 30% of Slovak respondents between the ages of 24-65 indicated being proficient in English, although English literacy rates are well below Western European levels of approximately 50%³⁴ (Mejer et al. 2010). There is substantial language skill still existing in the Australian communities as well. 56.8% of Czech, 59.2% of Hungarian, 71% of Polish and 61.7% of Slovak households in Australia indicated that they speak the respective national languages at home, demonstrating potential ability for business communication and interest in consumption of cultural goods and services as well (DIAC 2014a; b; c; d).

3.3 The evolution of trade

Foreign trade has always contributed substantially to Australia's GDP. In the first half of the 19th century, exports made up approximately 10% of Australia's GDP, with a peak of 40% at around the gold rush years of the 1850s. In the first half of the 20th century, exports stabilised at around 20% of the GDP (Pinkstone & Meredith 1992), which is still the case today. Prior to Federation, 70 per cent of Australia's exports were directed at the UK and volumes remained relatively stable until prior to WWII, but trade patterns began to change considerably shortly afterwards.

Table 2 shows Australia's direction of trade during the 20th century. The UK's influence on Australian trade fell considerably in 1938/39 and by 1975/79, merely constituted 4.2 per cent of Australia's exports. Central and Eastern Europe did not contribute considerably to either Australia's exports, or imports in this time frame. The establishment of the European Community, and UK's accession into it (in 1973) only weakened Australia's trade position towards Europe (Abbott 2006). Since then Australia began to diversify its trade, placing particular attention to the Asian region – 'the Asian Century' (Commonwealth of Australia 2012) resulting, mainly from the fact that the

UK found other commercial partners and that world trade conditions changed considerably.

Table 3 highlights the major shift in Australian trade towards its newly found partners in Asia. Of the top 5 trading partners 4 are from the Asian region, while the other one is the United States of America. In terms of exports, in a period of less than 20 years China became Australia's foremost trading partner, followed by Japan and the Republic of Korea. A similar pattern of trade can be seen in terms of imports. Together these three nations' two way trade adds up to nearly half of Australia's total trade with the rest of the world. Asia's importance therefore is clear and significant. This concentration in terms of trade further highlights the potential of and necessity for diversification, which brings about stability and resilience for the Australian economy.

The pace and scale of change in the region have been staggering ... the past 20 years, China and India have almost tripled their share of the global economy and increased their absolute economic size almost six times over. By 2025, the region as a whole will account for almost half the world's output. Many millions of people will have been lifted out of poverty. They will live longer and be better connected to the world (Commonwealth of Australia, 2012, p. 6).

Further detailed review of annual data highlights substantial yearly fluctuation of export and import volumes between Australia and the Visegrád countries. That, despite the substantial total growth of exports (+526%) and imports (+1838%), demonstrates a lack of stability of the economic relationship. Furthermore, the deficit in merchandise trade between the two regions for Australia needs to be addressed.

3.4 A snapshot of foreign investment

Whilst Australia has traditionally been a recipient of investment and foreign capital, particularly from Europe, the Central and Eastern Europe – due to capital scarcity and lower income levels – has never been in a position to supply investment into Australia. This presents a similar relationship when compared to the surplus of merchandise trade realised by the Visegrád countries. Foreign investment consists of portfolio and foreign direct investments.

Foreign direct investment is the practice exercised by multinational enterprises involving the direct purchase of existing enterprises, real assets such as plants, buildings and land, in a foreign country. FDI also involves the acquisition of foreign firms, joint ventures and the formation of newly established foreign subsidiaries (e.g. Madura, 2012 and Eiteman, et.al. 2012). FDI is of growing importance to the economic development of nations and is of particular benefit, not only to Australia, but to emerging Central European the Visegrád countries as well.

³⁴ Interestingly, German is equally widely spoken in these countries.

Table 2. Directions of Australian trade, 1938/9 – 1975/6

Exports								
Country	1938/39		1946/47		1955/56		1975/76	
	£m	%	£m	%	£m	%	\$m	%
UK	66.7	54.4	89.6	29.0	257.9	33.1	402.5	4.2
Canada	2.0	1.6	5.3	1.7	10.9	1.4	243.9	2.6
New Zealand	6.7	5.4	12.9	2.3	41.1	5.3	455.2	4.8
India	2.0	1.6	13.0	4.2	12.2	1.6	71.5	0.8
Belgium	5.5	4.5	19.1	6.2	26.3	3.4	118.8	1.2
France	9.4	7.7	20.7	6.7	67.4	8.7	206.5	2.2
Germany	2.7	2.2	1.4	0.5	36.5	4.7	292.5	3.1
Italy	1.2	1.0	13.2	4.3	34.6	4.5	206.7	2.2
Japan	4.9	4.0	5.6	1.8	86.8	11.2	3112.9	32.6
USA	3.6	3.0	47.6	15.4	55.2	7.1	969.0	10.1
Other	17.8	14.6	80.6	27.9	147.0	19.0	3476.3	36.2
Total	122.5	100.0	309.0	100.0	775.9	100.0	9555.8	100.0
Imports								
Country	1938/9		1946/7		1955/6		1975/6	
	£m	%	£m	%	£m	%	\$m	%
UK	46.1	40.7	74.6	35.8	355.9	43.5	1108.7	13.4
Canada	8.8	7.8	16.7	8.0	23.4	2.9	203.9	2.5
New Zealand	1.6	1.4	2.9	1.4	8.3	1.0	251.3	3.1
India	3.3	2.9	17.4	8.4	23.4	2.9	50.1	0.6
Belgium	1.1	1.0	1.6	0.8	9.3	1.1	70.0	0.9
France	1.2	1.0	1.7	0.8	15.6	1.9	138.8	1.7
Germany	4.7	4.2	0.1	0.1	35.0	4.3	543.6	6.6
Italy	0.8	0.7	2.8	1.3	11.8	1.4	192.1	2.3
Japan	4.7	4.1	0.7	0.3	22.6	2.7	1609.5	19.5
USA	16.7	14.7	39.8	19.1	98.7	12.1	1655.6	20.1
Other	24.3	21.5	50.1	24.0	214.3	26.2	2416.7	29.3
Total	113.3	100.0	208.4	100.0	818.3	100.0	8240.3	100.0

Source: NNAE (1974, p. 130)

Worldwide flows of FDI have increased significantly since the 1990s. In spite of this persistent growth, these growth rates have been quite uneven, favouring primarily developed nations in the OECD. Nevertheless, the proportion of FDI inflows going to emerging economies has increased considerably between 1985 and 2012, with China being a main beneficiary of these investments (see Krugman, et.al. 2012).

FDI has played a substantial role in the transformation of the Central and Eastern European economies, in particular as privatization facilitated the influx of FDI into these economies from the more developed, market economies (Gros & Steinherr 2004, Berend 2009). In mind with the substantial Australian involvement of early education exchange post transition, it can be expected that despite the geographical distance (Blainey 1982), substantial Australian interest in developing economic relations through FDI has manifested in outward FDI from Australia to the Visegrád countries. Table 4 provides some information on investment flows between Australia and the Visegrád economies. Availability of investment data between the regions – due to the

relatively low amounts – is scarce both in Australian sources, both in the OECD Statistics database.

In fact, these amounts sound minimal, when compared to the top players in Australian investment. The largest investor in Australia was the USA in 2012 (23.9%), followed by the UK (14.4%), Japan (11.1%), the Netherlands (5.9%) and Singapore (4.3%), and the stock of FDI mounted up to A\$ 549.6 Bn. In terms of investment flows, the largest investors in Australia in order of importance both in 2012 and 2013 were the US, UK, Singapore, Japan and China, with total FDI inflows for both years mounting up to A\$ 114 Bn. In relation to this, investment transactions with Central Europe sound insubstantial, providing lots of room for improvement. Avenues for this improvement require a systematic approach to shaping the institutional environment, as firm investment behaviour has been demonstrated to be significantly influenced by the context of the firms (Majocchi et al. 2013).

Table 3. Directions of Australian trade, top 10 trading partners, 1993-2013

Exports (millions, \$A)	Partner Country	1993	Share (%)	1998	Share (%)	2003	Share (%)	2008	Share (%)	2013	Share (%)
	1. China	2,268	4	3,872	4	8,803	8	27,034	12	77,973	30
	2. Japan	15,206	24	17,580	20	21,727	20	34,967	16	46,481	18
	3. Republic of Korea	3,970	6	6,397	7	9,116	8	14,240	6	19,116	7
	4. India	889	1	1,852	2	2,576	2	9,328	4	11,418	4
	5. United States	4,940	8	7,794	9	10,365	10	10,602	5	9,022	3
	6. Czech Republic	19	0.03	63	0.07	69	0.06	82	0.04	113	0.04
	7. Hungary	4	0.01	13	0.01	25	0.02	17	0.01	18	0.01
	8. Poland	18	0.03	30	0.03	19	0.02	40	0.02	130	0.05
	9. Slovak Republic	1	0.00	5	0.01	9	0.01	7	0.00	1	0.00
	10. Visegrád countries	42	0.07	110	0.12	122	0.11	145	0.07	263	0.10
	11. Rest of the world	35,423	56	51,379	58	55,247	51	126,024	57	97,687	37
	TOTAL (World)	62,738	100	88,985	100	107,956	100	222,341	100	261,959	100
Imports (millions, \$A)	1. China	2,557	4	5,303	5	13,789	11	30,994	14	44,478	18
	2. United States	13,004	21	19,834	20	22,494	17	24,325	11	27,980	12
	3. Japan	11,139	18	12,660	13	16,337	13	19,679	9	18,346	8
	4. Singapore	1,509	2	2,643	3	4,370	3	13,685	6	14,329	6
	5. Thailand	756	1	1,480	2	3,471	3	8,846	4	11,129	5
	6. Czech Republic	40	0.06	55	0.06	121	0.09	373	0.17	641	0.27
	7. Hungary	30	0.05	67	0.07	136	0.10	417	0.18	308	0.13
	8. Poland	22	0.04	40	0.04	99	0.08	374	0.17	565	0.23
	9. Slovak Republic	2	0.00	6	0.01	19	0.01	211	0.09	328	0.14
	10. Visegrád countries	95	0.15	167	0.17	374	0.29	1,375	0.61	1,841	0.77
	11. Rest of the world	33,343	53	54,685	57	69,057	53	127,042	56	122,436	51
	TOTAL (World)	62,402	100	96,773	100	129,893	100	225,946	100	240,540	100

Source: DFAT (2014a)

Table 4. FDI transactions between Australia and the Visegrád countries in 2013

(A\$ million)	Investment from Australia		Investment into Australia	
	total	FDI	total	FDI
Czech Republic	256	69	30	np
Hungary	353	np	19	np
Poland	1460	np	np	np
Slovak Republic	11	np	0	0

np: data not published

Sources: DFAT (2015a; b; c; d)

3.5 The future of trade and economic prospects

Future prospects can be understood based on past trends and current economic figures. Table 5 summarises key features of the economies investigated. Whilst Australia is larger in the absolute

extent of the economy, and land mass, the Visegrád countries display a higher population, greater relative importance and growth of industrial output. Magnitude of education expenditures are similar across the regions.

Table 5. Market size and other economic characteristics of Australia and the Visegrád countries

Australia GDP (2012): US\$ 1,564 Bn Population (2012): 23.1 million Land area: 7,692,000 km ² Industry employment (2010): 21.1% Export (2012): China, Japan, ROK Import (2012): China, US, Japan Gov. education exp. / GDP (2006-12): 5.6% Industrial prod. ind. (2012/2005): 118	Visegrád four total * GDP (2012): US\$ 904 Bn Population (2012): 64.3 million Land area: 532,816 km ² Industry employment (2012): 32.2% Export (2012): Germany, Visegrád countries Import (2012): Germany, Russia, China Gov. education exp. / GDP (2006-12): 4.4% Industrial prod. ind. (2012/2005): 134
Czech Republic GDP (2012): US\$ 196 Bn Population (2012): 10.66 million Land area: 78,866 km ² Industry employment (2012): 38% Export (2012): Germany, Slovakia, Poland Import (2012): Germany, China, Poland Gov. education exp. / GDP (2006-12): 4.3% Industrial prod. ind. (2012/2005): 116	Hungary GDP (2012): US\$ 125 Bn Population (2012): 9.98 million Land area: 93,026 km ² Industry employment (2012): 30% Export (2012): Germany, Romania, Slovakia Import (2012): Germany, Russia, Austria Gov. education exp. / GDP (2006-12): 4.9% Industrial prod. ind. (2012/2005): 112
Slovakia GDP (2012): US\$ 93 Bn Population (2012): 5.45 million Land area: 49,036 km ² Industry employment (2012): 37.5% Exp. (2012): Germany, Czech Rep., Poland Import (2012): Germany, EU, Russia Gov. education exp. / GDP (2006-12): 4.2% Industrial prod. ind. (2012/2005): 145	Poland GDP (2012): US\$ 490 Bn Population (2012): 38.21 million Land area: 311,888 km ² Industry employment (2012): 30.4% Export (2012): Germany, UK, Czech Rep. Import (2012): Germany, Russia, China Gov. education exp. / GDP (2006-12): 4.3% Industrial prod. ind. (2012/2005): 145

* Aggregation based on authors' own calculations
Source: UN (2014)

The growth of two way trade outgrew both economies on an annual basis. Table 6 shows results of calculations regarding the average annual growth of GDP based on the TRIEC data (DFAT 2014a) and World Bank (2015) GDP growth indicators. The average annual growth rate of two way trade far exceeded the average annual GDP growth rates for all four Visegrád countries, and also Australia's

considerable economic growth over the examined 21 year time period.

What's even more surprising is that Australia's total two way trade grew at exactly the same average annual rate as Australia's trade with the Visegrád countries. It is also visible from the data that higher economic growth rates in the partner country attract higher trade growth figures. However, noting that Australia has a trade deficit with countries of the

Visegrád group, and that export and import figures are subject to substantial fluctuation on an annual basis,

these trends may not truly project future trade opportunities.

Table 6. Two way trade between Australia and the Visegrád countries 1993-2013

Two way trade (A\$000)	1993	2013	Annual trade growth	Annual GDP growth
Czech Republic	59,902	753,670	12.82%	2.38%
Hungary	34,521	325,593	11.28%	1.94%
Poland	39,680	695,360	14.61%	4.26%
Slovak Republic	3,420	329,400	24.30%	4.07%
Visegrád total	137,522	2,104,024	13.87%	-
Australia total	125,141,049	502,499,528	13.87%	3.43%

Sources: DFAT (2014a) and World Bank (2015)

3 The leadership and engagement matrix

The purpose of this section is to develop an analytical tool within the framework of integrative leadership theory, to highlight challenges faced when considering the development of relationships and exchange between Australia and the Visegrád countries. The objective of this paper is to use this analytical tool (leadership and engagement matrix) to devise strategies and inform governance for private and public sector use.

This firstly requires a review of the literature of integrative leadership theory and its relationship to corporate governance. The section continues with the development of the analytical tool (leadership and engagement matrix) to be used to fulfil the research objectives.

3.1 Review of literature leadership and governance

Leadership that is appropriate at the international community level, for raising awareness, building strategy and managing shared interest of communities requires a complexity approach (Hazy et al. 2007). A comprehensive and integrative approach within the mechanisms and locus of leadership places leadership complexity theory primarily into the domain of cognition (what people think), linking the investigation of leaders and their contexts (Hernandez et al. 2011). This demonstrates a particular overlap between political (Heidrick & Struggles 2013) and business (Leavy & McKiernan 2009) leadership.

Political leadership is often defined as a problem-driven approach to leadership, in a context where globalisation creates new forms of international and transnational leadership of organisations and communities (Knight et al. 2009). A political leader is most often an elected representative, whose task is to manage the relationships between the communities involved. Political leaders can be pragmatic and work in a particular context to solve problems, but can also be ideological in governing their context into recognising certain problems and following certain principles, or charismatic, setting objectives to their communities (Larsen 2011). Leadership at an

international level needs to encompass all three types of political leadership.

Business leaders set strategies for organisations to follow when pursuing their objectives (Leavy & McKiernan 2009), and shape governance of businesses by their characteristics and traits (Albert-Rouilhac & Breen 2005). Complexity leadership theory in business leadership emphasises, that leadership can be implemented through any interaction within an organisation (Hazy et al. 2007).

Tihanyi et al. (2014) emphasise, that governance in management research needs rethinking. Corporate governance is defined as a “system by which companies are directed and controlled” (p. 1535). Governance research has traditionally taken the finance perspective, and management research has focussed on well-defined research problems, such as management decision making, policy and CEO compensation – a lot to do with agency-conflict theory, which is ultimately an insufficient conceptual background for formulating validated policy implications (Dühnfort et al. 2008). A growing stream of studies examines governance in a broader context, relating to the external environment. Steger and Hartz (2005) provide a review of corporate governance in the German context, which has traditionally strongly influenced other Central European countries, to find a substantial stakeholder orientation. Klettner et al. (2014) provide empirical evidence for linking leadership, corporate governance and strategic outcomes.

Based on the above literature reviewed, it is consistent within both political and business leadership research, that governance is predominantly the means of setting objectives identified by leadership into action. Thus, the leadership and engagement matrix is developed by integrating the perspectives of complex leadership theory into an international context. This is done by combining the former with concepts developed in the sphere of corporate governance.

3.2 Development of the leadership and engagement matrix

In order to identify and build strategies around international community goals, a systematic analytical method is necessary that encompasses leadership and governance. Elcock and Fenwick (2012) provide the

foundations of a matrix based leadership analytical tool that integrates institutional, individual and informal perspectives of leadership in government and public governance. Extending from this basis, the leadership and engagement matrix framework was created (see Table 7.)

Table 7. Leadership and engagement matrix template

Conceptual areas	Facts / perceptions	Opportunities	Objectives	Strategies	Governance

Conceptual areas need to be identified with regard to the interest of stakeholders and theoretical considerations in terms of developing international business relations and exchange. Facts and perceptions are secondary data based analysis and stakeholder views that provide specific foundations to the potential opportunities identified. Objective setting is a function of facts, perceptions and opportunities, and strategies are possible means of addressing the gap identified by the objectives. Governance is the final component of the leadership and engagement matrix, specifying the framework in which the strategies are implemented within the international context, in the political and business sphere.

4 Leadership and engagement in the Australia – Central Europe relationship

The previous sections outlined the background and context of cooperation between the region, and provided a conceptual foundation and an analytical tool to pinpoint and address the challenges needed for successful international relationship development.

Besides secondary information, it has been almost unanimously highlighted by authors of leadership and governance both in public and the private sector that stakeholder engagement and involvement in this shared thinking and evaluation process is essential. In order to cover the widest possible range of stakeholders, a round table discussion was organised on the 27 November 2014, in Melbourne, Australia, with the participation of Australian and Visegrád country government representatives, members of the academia, and industry. The objectives of this workshop were generally aligned to the original objective statement of the APTEE program, namely:

- Generate public interest and exposure of the potential in business, government and academic collaboration between Australia and Central-Eastern Europe;
- Develop strategies to facilitate enhanced exposure, information flow and stakeholder engagement of Central-Eastern European Business in Australia;
- Provide a platform for stakeholder involvement;

- Organise activities and events supporting achievement of the above objectives.

For these objectives to be achieved, and further trade, investment, education and other exchange possibilities to be realised, the leadership and engagement matrix focuses on six key areas: (1) trade, (2) investment, (3) language & education, (4) business practices, (5) economy of scale & distance, and (6) information & engagement (see Table 8).

4.1 Building trade

The growth of two way trade has far exceeded economic growth. As the combined market size of the two economic regions can be considered similar, and past growth potential has been demonstrated, there is a pronounced opportunity for further growth. As the Visegrád countries display higher industrial growth levels than Australia, it is likely to provide an opportunity of resource demand driven growth, contributing to balancing out trade between the regions.

As mentioned at the round table discussion, services, such as market information provision and increased collaboration between the public and private sectors involving all five countries can yield progressive results.

4.2 Facilitating investment

The magnitude of investment, and in particular FDI, is not substantial between the regions. Historically, both regions can be considered net recipients of foreign investment, and in particular since the opening up of the Eastern bloc countries. The Visegrád four have been attracting significant levels of FDI on a global scale. Investment can be an effective tool for Australia to strengthen its economic ties with Central Europe, and thus become a vehicle for closing the trade deficit gap.

Table 8. Leadership and engagement matrix between Australia and the Visegrád countries

Conceptual areas	Facts / perceptions	Opportunities	Objectives	Strategies & governance
Trade	20 years of fast growth of two way trade, with Australian deficit.	• Visegrád countries market size and growth comparable to Australia • Australian export can grow into Visegrád countries • Think about services, not just goods	• Grow trade • Improve trade balance • Grow service trade	• Market info. provision • Public-private cooperation • Industry specificity *
Investment	Low involvement, predominantly outward FDI from Australia, manufacturing opportunities	• Growth of investment, thereby integrating supply chains and establishing market access • Australian investment could grow into Visegrád countries	• Facilitate FDI • Strengthen economic ties • Reduce risk	• Venture capital • Financial sector enhancement (banks) • Guarantees
Language & Education	Existing basis of English speakers in Visegrád countries with room for improvement	• Potential for language up-skilling of Visegrád countries and community language education in Australia	• Language education • Student exchange • Arts and culture exchange *	• Curriculum design • Multicultural education • Student exchange
Business practices	Fundamental differences in business cultures *	• Consulting firms can provide transactional advice * • Education providers can inform business practice * • Facilitation and support – private and public	• Harmonisation • Awareness • Risk elimination	• Government agreements • Executive education
Economy of scale & distance	Due to distance, small scale exporters struggle to gain economical access *	• Organise cooperation for market access and transport * • Facilitate integration of small businesses* • Work with multinationals operating in both regions	• Build volume • Coordinate cooperation * • Activate NGOs *	• Transport platform sharing * • Government agreements
Information & engagement	Information often fragmented, Visegrád countries lack cooperation, Australian businesses lack information *	• Share and disseminate market and business opportunity specific information • Provide networking opportunities for businessmen * • Open up engagement for small businesses • Provide web based solutions *	• Information service provision • Raise awareness • Platform for connections and networking	• Information web page * • Database and matchmaking platform • Networking events * • Trade missions

* Items specifically identified in the round table discussion

Considerable options are to reduce risk (perceptions) with regard to the region, and provide institutional support facilitating FDI, in particular in ways that are successful in Western Europe but are scarce in Central and Eastern Europe (such as venture capital or investment related guarantees). Provided the gap in GDP levels in favour of Australia, prices of industrial assets and IP may favour Australian investors, especially during the reign of a strong Australian dollar³⁵. It would also be interesting to explore possibilities for the Australian financial institutions in the regions.

4.3 Building on language and education

Levels of English knowledge in the Visegrád countries, as well as the substantial presence of foreign language speaking communities in Australia provide a platform for enhancing cooperation between the regions. Based on Australia's traditional linkage to education and transition in Central Europe (with reference to the APTEE and APTEA programs), there is certainly obvious demand and opportunity for enhancing educational ties, and building trade in services. Augmented cultural and language exposure can lead to reduction of communication barriers and building cross-cultural understanding of consumers as well, laying a foundation of enhanced cultural exchange and services trade (such as tourism, art and fashion).

4.4 Bringing closer business practices

This particular issue has been identified by business practitioners during the panel discussion. It was suggested, that for example the nature (specifications, depth and details) of public tendering are so different between the two regions, that companies either get discouraged prior to even engaging, or experience substantial difficulties during implementation. The Visegrád countries have undergone harmonisation of their legal systems governing businesses with EU standards over the past decades. Nevertheless, there are differences between the two regions, which can be bridged with properly facilitated arbitration, potentially supported by government involvement. More specifically, considering the individual component pertaining to doing business, nature of servicing culture, detail and process of negotiation can converge through increased exposure and cross cultural learning.

4.5 Tackling size and distance

Assertions made at the round table discussion reinforced the conclusions made on the magnitude of trade between the regions. Transportation of goods – particularly at the individual business level – can

become either expensive or slow due to the small size of transactions. This particularly disadvantages small businesses in Australia and the Visegrád countries.

In order to tackle this issue, enhanced, cross country cooperation between business actors can provide solutions, especially if encouraged and aided by the government through communication facilitation and providing favourable transportation deals.

4.6 Providing information and enhancing engagement

Stakeholders represented at the round table discussion articulated that business needs to be done by business people, and they can only do business when they meet. In fact, one of the most important avenues of enhancing business opportunities is the facilitation of business networking, and creating connections between individual business people between the two regions. Government representatives have articulated that there are substantial, industry focussed initiatives already in place, which lead the forum to conclude that enhanced multilateral collaboration and information provision may lead to increased engagement and emergence of business opportunities in both directions.

5 Conclusions and implications

The leadership and engagement matrix developed by the authors was used to summarise the information in relation to enhancing relationships and exchange between Australia and the Visegrád countries. A review of secondary data and a round table discussion informed researchers of the current situation and future prospects of doing business and conducting other areas of exchange between the regions. This lead to developing strategic and governance recommendations for the stakeholders. In this section, summarises the experiences using the leadership and engagement matrix framework, provides a comprehensive summary of the analysis outcomes and highlights recommendations for future research based on the limitations encountered.

5.1 Conclusions on the use of the leadership and engagement matrix

The leadership and engagement matrix – based on the conceptual foundations of integrated leadership theory, public and business leadership and governance – has proven to be an effective tool for aggregating information from various sources in one comprehensive framework.

The challenge experienced by the researchers when using the tool is the validation of recommendations. In fact, the leadership and engagement matrix can provide a structured view of secondary information and stakeholder views, but its inherent limitation is the ability to provide an

³⁵ This might impact the other way round when the Australian dollar falls significantly.

unquestionable evidence base for the recommendations. This however is not surprising, as the tool is of a qualitative nature, and qualitative instruments are more suited to developing options or alternatives, as opposed to validating certain outcomes.

In terms of the governance related recommendations, this has provided a further challenge. Upon articulating options and alternatives for objectives to pursue, specific recommendations for policy makers and businesses on how to realise these outcomes are questionable, until the objectives are validated. Nevertheless, the framework was suitable to articulate some direction for the stakeholders to move forward.

5.2 Recommendations for development of relationships

Recommendations for public and private sector governance are summarised in conclusion of this paper. There have been a number of barriers identified for businesses that inhibit growth of their relationships across the regions. For merchandise trade, distance is identified as a primary inhibitor of the growth of transactions. Further to this, transportation costs and volumes, and differences in business and customer service culture are highlighted.

The two main issues need to be addressed in different ways. Costs related to transportation and distance can be bridged by businesses by collaborating on managing logistics. However, business and customer service cultural and legal differences require a different adjustment from the participating businesses. Familiarisation, learning and exposure are essential for businesses to bridge this gap, and these require additional resources, which tend to bite into profit margins.

Government involvement can be crucial in eliminating excessive transactional costs in order to facilitate more efficient collaboration of business actors. Trade missions, networking interfaces and opportunities and ongoing education programmes can contribute to bridging this gap.

Government related stakeholders may face further challenges in terms of harmonising business related regulations, and augmenting frameworks for enhancing communication and exchange. A reduced perception of risk can also contribute to enhanced investment exchange, and an augmented potential for services exchange (such as arts, culture, fashion, tourism and education).

An important aspect of facilitating this collaboration is establishing forums of collaboration. The Visegrád nations have a forum for collaboration, but government initiatives are potentially augmented by cross country collaboration both at the Central European level and also across the equator.

Government programmes aimed at SMEs – more sensitive to transaction costs – can potentially trigger

more robust results, as entrepreneurs are also more flexible and are expected to learn how to adjust to the new business environments more quickly. Existing language skills in Central Europe, and community groups in Australia can also provide a foundation to developing connections at an individual level.

And whilst the governments – and in particular Austrade – is heavily engaging in information provision to the stakeholders and businesses in particular, building an interface that acts as a one-stop-shop from both sides may develop potential for improving the dissemination of information.

5.3 Limitations and further research

As highlighted in relation to the leadership and engagement matrix itself, validation of the recommendations is essential. The data reviewed – especially on investment exchange – was of poor availability and detail, and more accurate time series of information would enable recognition of patterns more effectively.

Further to historical, secondary data, the paper did not go into exploring in detail the already existing institutional frameworks and treaties. This component of the analysis will create further insights to be incorporated into the leadership and engagement matrix.

Additional detail in terms of doing business issues, governance, corruption and innovativeness can also be incorporated in a more detailed analysis, as part of the review of secondary data, to highlight specific issues of business level compatibilities and mismatches.

Further research needs to expand the leadership and engagement matrix with the above listed components. Further research also needs to address the obstacle of validating the recommendations concluded from the leadership and engagement matrix, which will require the inclusion of a larger sample of stakeholders. This will provide new challenges for researchers into the future.

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MEGA-SPORTING EVENTS: THE IMPACT ON HOST STOCK MARKETS AND INVESTMENT PROSPECTS

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Abstract

The success of mega-sporting events such as the Summer Olympics and the FIFA World Cup brings pride and a focus to their host nations. This paper aims to find the effects of the announcement and the actual event on the host stock market. It then recommends an investment strategy. The paper finds that the announcement of the Olympics and World Cup creates statistically significant abnormal returns and the actual sporting event has little effect on the stock market. By factoring size of the economy, it is found that smaller economies tend to have larger abnormal returns than bigger economies. We then provide recommendation on investment strategies in order to exploit the significant abnormal return on the day of the World Cup announcement.

Keywords: Mega-sporting Events, Stock Markets, Investment Prospects

JEL Code: G31, R53

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1 Introduction

The FIFA World Cup and the Summer Olympics are both mega-sporting events that draw a worldwide audience as well as an influx of investment to bring the event to that host nation. Historical returns during the period of the FIFA World Cup and Summer Olympics are analysed and used to determine whether investors should invest in the host countries' stock market. This paper would benefit investors by improving their investment strategies and will allow them to exploit the markets during these investment periods.

There are a number of classifications of sporting events. These sporting events can be categorised by their scale into four groups, mega events, hallmark events, special events and community events (Roche, 2000). The FIFA World Cup and Summer Olympic games are classified as mega-events and as such this paper will focus on these two mega events.

Mega-sporting events attract many spectators and media attention to the host nations. There is an inflow of investments, during the preparation and for the duration of the event, that can filter into the stock markets. Therefore, when the host country is announced, a positive reaction is expected on the stock market of the host country. The 2010 FIFA World Cup alone had an average of over two billion viewers watching over 20 minutes of a match (FIFA, 2010). The host cities for events of this magnitude spend billions on infrastructure and stadia to prepare for these events.

There are a limited number of papers that have documented major sporting events and their effects on stock market returns. Research has focused on the

association between stock returns and outcomes of specific football games. The majority of studies have focused on the markets' reaction to the host country's announcement as well as the effect of mega events from an economic perspective. However, this paper aims to explore historical returns to evaluate abnormal returns to the stock market due to mega-sporting events.

This paper aims to use past returns of the FIFA World Cups (henceforth referred to as the World Cup) and the Summer Olympics Games (henceforth referred to as the Olympics) to recommend a strategy for investors. An event study will be used to examine abnormal and cumulative abnormal returns over the event period and at the announcement date to determine if historical returns are significant. This will be done using a sample consisting of 14 countries that have hosted the Olympics and World Cups between 1974 and 2014. The paper will test hypotheses regarding economy sizes and abnormal returns in order to make an investment recommendation with reference to specific trading days. Investors would be able to use these findings to improve strategies and increase returns.

The rest of the paper is structured as follows: Section 2 contains the literature review, Section 3 contains research methods, Section 4 outlines the results and Section 5 concludes.

2 Literature review

The inflow of funds and media attention due to mega-sporting events is hypothesised to filter into the stock market. The literature available focuses on the association between stock returns and outcomes of World Cup games; as well as the economic impact these mega events can have on a nation in the short term and the long term (Bohlmann & van Heerden, 2005; 2008; Jones, 2001; Rose & Spiegel, 2009). There are few papers that investigate the effects of the events as a whole on their host stock markets. This review reports on the inconsistencies between several studies regarding returns at various stages of the World Cups and Olympics.

Floros (2010) examined the effect of the 2004 Athens Olympic Games on the Athens Stock Exchange (ASE) using the General Autoregressive Conditional Heteroskedasticity (GARCH) model. The paper found that there was no significant effect on the ASE index. However, there was a positive effect on the price of two of the national sponsors of the event. Floros went on to urge national companies to sponsor major sporting events. Additionally the paper found that there was a positive effect on the prices of the national sponsors' stock when Greek Olympians won medals. Similarly, Samitas, Kenourgios & Zounisc (2008) focused on the sponsors of the 2004 Athens Olympics Games and their returns in the market. The paper uses a different approach in the form of an event study methodology and a bootstrapping technique. A small positive effect was found on both national and international sponsors' stock. Their paper also reveals that the returns were more significant for smaller firms which Floros (2010) does not. This study only looks at the announcement date and the opening ceremony. The paper excludes the effects during the games and when they ended.

Ashton, Gerrard & Hudson (2003) provide evidence of the significant impact of sporting success on the London Stock Exchange by investigating the reaction of the stock market to nationwide sporting success. The paper uses an event study methodology. The London Stock Exchange movements, using the FTSE 100 as a proxy, were tracked based on England's international matches. A regression model was built based on winning or losing matches to explain variation in the FTSE. Amplified commercial importance had been placed on international matches. Stock markets revised their expectations of possible gains which may have resulted from England's national team match results. Additionally, the success of a sports team has a certain "feel good" aspect, thus producing increased confidence about future performances and match results which filters to investors.

Berman, Brooks & Davidson (2000) investigated the impact of the announcement of the 2000 Olympic Games on the stock market. Their study found that there was no significant impact on the overall stock

market and only a few industry portfolios exhibited a positive effect as a result of the announcement. In addition, the positive effect was limited to the host state of New South Wales. A similar but more detailed analysis is conducted by Mirman & Sharma (2010). Their paper investigated stock market outcomes of countries which are in competition to host the Olympic Games at the time of the announcement being made. The paper examines indexes for abnormal and regular returns from the announcements between 1990 and 2006. Their results show a substantial negative reaction in the stock market for countries that host the Winter Olympics and a negligible positive reaction for countries that host the Summer Olympics.

Similar findings have been made by Li (2007) which support this fact. Li studied the effect of major sporting events on the stock markets of host countries. By investigating the stock markets reactions to the actual mega event and the news of its announcement, one would expect to see positive movements in the stock market. However, through event study methodology and three abnormal returns models, no announcement date effect is found on returns to the stock market. The paper discovered that various events had performed well in the event year. It was found that 15 out of 27 events studied had annual returns that were significantly different from the mean. Of the 27 events tested, eight have significantly higher annual returns than the mean. However, the paper states that the mega events have no impact in the stock market which is odd, given this evidence.

Li separates the host countries into developed and developing countries, as well as by market capitalisation and does not find any returns of significance in any market. In addition to these findings; the consumer goods, beverages, heavy construction, industrial goods and construction materials sectors performed better than the rest of the market. This would be expected due to the large undertaking of construction and the fact that thousands of people travel to the host nation. The paper emphasises the fact that some countries tend to prosper up to three years after the Summer Olympic Games. There is no definitive research as to how the mega events affect the country thereafter.

Obi, Surujlal & Okubena (2009) discovered that there were steadily increasing returns after the announcement date for South Africa's hosting of the World Cup, opposing the view of Li (2007). The reason for this could be the doubtful consensus over South Africa's ability to host an event of this magnitude. Over time, the change in sentiment is displayed in the increasing stock returns. However, South Africa is one country, and this finding cannot be stated for all potential hosts. The mean adjusted model was used in this event study. The use of monthly returns as opposed to daily returns may have skewed their results when looking at news events such as an announcement date.

An event study on abnormal returns to companies share prices based on black empowerment deals that affect ownership has been established by Ward & Muller (2009). This paper uses a chart to illustrate movements of abnormal and cumulative returns over the event period. The paper uses a bootstrapping technique to find the significance of each day's abnormal return and cumulative abnormal return in the event periods. This is useful when recommending investment strategies.

Most of the literature available uses an event study methodology approach but employs different methods of calculating the effects of the events on the stock markets. The mean adjusted model is the most comprehensive model used. This paper will use an updated data set and in contrast to previous studies will use daily returns. The impact of the World Cup and Olympics on the stock markets as a whole will be investigated. The methods by Ward & Muller (2009) will be adjusted to suit this paper. This paper aims to find abnormal returns and recommend a strategy to exploit these returns in the mega events. The next section describes the research methods, which includes the data used in this paper.

3 Methodology

3.1 Data

The data covers the announcement and event dates for the World Cups and Olympics from 1974 until 2013. The announcement of the host country usually takes place six to seven years prior to the event. Major stock indexes of host countries are used as proxies for market returns as seen in Appendix A. The event is approximately 30 days, although the number of trading days varies by country. Where two countries hosted the event together, the returns calculated from each index were treated as two separate events. The Olympics and World cup data consists of 20 events. Stock market data is limited due to the lack of index level data prior to 1974. The Bloomberg stock market database was used to obtain last price data. Daily returns, as opposed to monthly returns, were used as it is more appropriate given that the event occurs over a month period (Brown & Warner, 1985). The Gross Domestic Product (GDP) in current prices, was taken from the latest World Bank (2014) findings, and used as a proxy for the size of the economy.

3.2 Methods

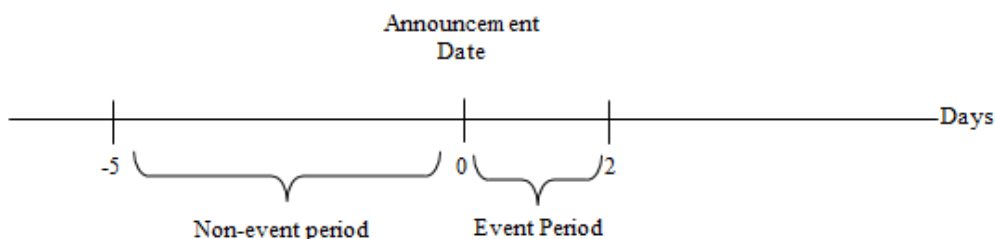
This section focuses on explaining the methods used, such as event studies and abnormal returns calculations. The event study methods used will be explored first, with an explanation of the event timeline and the non-event timeline. The abnormal returns calculation is then introduced with its significance tests. A regression is introduced to find a relationship between GDP and abnormal returns.

The question at hand is whether mega events have a significant effect on the stock markets. The most used method of measuring impacts on the stock market is that of event studies. This paper largely resembles that of a "market efficiency test study", similar to that of Fama, Fisher, Jensen & Roll (1969). These are studies which gauge how effectively the market reflects "new" information. This paper considers the new information to be the announcement date and the tournament dates. From the event study, this paper will determine whether or not abnormal returns are present.

This paper defines a "non-event" period as one in which no event or news is present and is what is used as a basis for the expectations of the market. In this case, the non-event period includes days leading up to an announcement or the days leading up to the actual sporting event. An event period is one in which news takes place. In this case, the event period would be the result of the stock market from the announcement date or the tournament dates. The following section explains these dates in more detail.

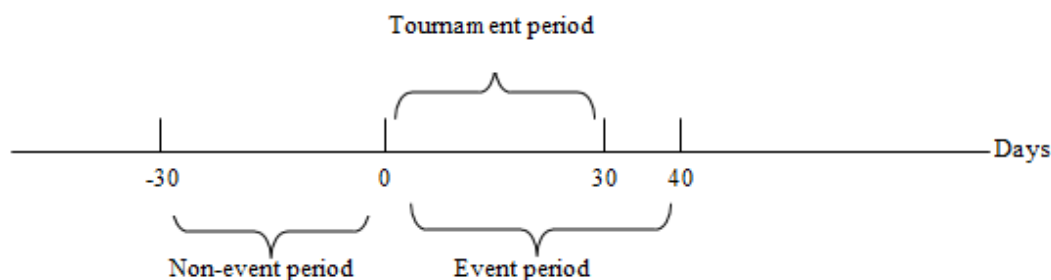
The announcement date is the date in which either the International Olympic Committee (IOC) or FIFA announce who has won the right to host the event. The effect of the announcement on the local stock market will be captured by the days leading up to, and after the announcement date. The non-event window period is captured by the five trading days leading up to the announcement date. This will represent the expected returns of the index. The event window period is between the announcement date and the next two trading days following the announcement. This is done to capture the full effect of the announcement on the index. This method is used for both the Olympics and World Cup announcements.

Figure 1. Announcement date



The effect of the Olympics is captured by the month before the tournament, the period of the tournament and five trading days after the tournament.

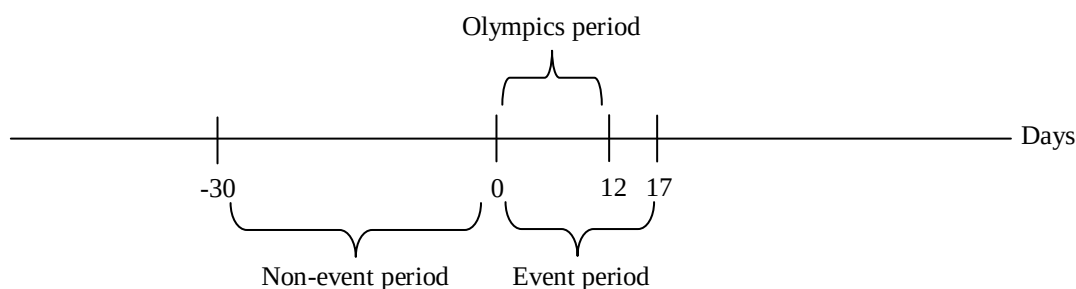
Figure 2. Tournament period



The non-event period is represented by the month before the tournament. This will represent the expected returns of the index. The event window period is the period of the actual World Cup tournament and the ten trading days following the end of the tournament.

The effect of the Olympics is captured by the month before the tournament, the period of the tournament and five trading days after the tournament.

Figure 3. Olympics period



The non-event period is represented by the month before the tournament. This will represent the expected returns of the index. The event window period is the 12 trading days of the Olympics and the five trading days following the end of the Olympics. The non-event periods chosen are used in order to minimise other factors that may skew the results. Therefore these periods are chosen to represent the state of the market returns at that time. This is germane to the abnormal returns calculation.

To calculate abnormal returns, this paper uses a standard method of log returns. Normal returns from non-event periods are used as expected returns in conjunction with the actual returns during the event periods to calculate abnormal returns.

The data collected from Bloomberg is that of daily index values. These have to be altered into returns to the index using the continuously compounded method, which follows (Chen, 2005):

$$R_{i,t} = \ln \left(\frac{P_{i,t}}{P_{i,t-1}} \right), \quad (1)$$

where

$R_{i,t}$ is the continuously compounded return on index i for the period t ,

$P_{i,t}$ is the index value i for the period t ,

$P_{i,t-1}$ is the index value i for the period $t-1$ and

$\ln$ is the natural log function.

Once the index values have been transformed into returns to the indexes, the abnormal returns are calculated. The average of the non-event returns is assumed to be the expected returns. These values are achieved using the methods explained previously. The average is calculated as follows:

$$E(R_i) = \frac{1}{T} \sum_{t=1}^T R_{i,t}, \quad (2)$$

where:

$E(R_i)$ is the expected returns of an index i ,
 T is the total number of non-event trading days used and

$R_{i,t}$ is the returns of an index i on day t (over non-event trading days).

The abnormal returns are then calculated as the difference between the actual returns during the event periods and the expected returns previously calculated:

$$AR_{i,t} = R_{i,t} - E(R_i), \quad (3)$$

where:

$AR_{i,t}$ is the abnormal returns from index i of the event for day t ,

$R_{i,t}$ is the returns of an index i in the event day t and

$E(R_i)$ is the expected returns of an index i .

These event periods are both the Olympic and World Cup announcement dates and event tournament or games dates as previously explained.

In order to perform accurate significance tests, the data has to be tested for normality. A histogram of the abnormal returns is inconclusive, but a Shapiro Wilks test indicated with 95% confidence that the results do not follow a normal distribution and therefore have to be standardised. (Appendix B)

In order to standardise the data the mean and standard deviation of the abnormal returns need to be calculated. The average of the abnormal returns is calculated as follows:

$$AAR_t = \frac{1}{N} \sum_{n=1}^N AR_{i,t}, \quad (4)$$

where:

AAR_t is the average of the abnormal returns from indexes for the period t ,

$AR_{i,t}$ is the abnormal returns from index i of the event for day t and

N is the number of abnormal returns calculated.

These values along with the standard deviation are then used to standardise the abnormal returns:

$$SAR_{i,t} = \frac{AR_{i,t}}{\sigma}, \quad (5)$$

where:

$SAR_{i,t}$ is the standardised abnormal returns for index n on day t ,

$AR_{i,t}$ is the abnormal returns from index i of the event for day t ,

AAR_t is the average of the abnormal returns from indexes and

σ is the standard deviation of the abnormal returns from n indexes.

Cumulative abnormal returns can be used as a more comprehensive representation of abnormal returns. It cumulates the effect of the days following the event period to include the effects that roll over

into the next few days. This is useful to see the entire effect of the event over a period.

The cumulative abnormal returns calculation is shown as follows:

$$CAR_t = \sum_{t=t_1}^{t_2} AR_t, \quad (6)$$

where:

CAR_t is the cumulative abnormal returns from indexes over period t_1 to t_2 and

AR_t is the abnormal returns from indexes.

A student's t -test is performed to test the significance of the abnormal returns across the event periods. These indicate significance to the announcement period which is explained in more detail under Empirical Results and Discussion. Daily abnormal returns are analysed by testing their significance over the period of the announcement. In order to make a recommendation, a chart (Figure 1) is used to illustrate the movements of abnormal and cumulative abnormal returns. These daily returns are tested for significance. This method has its limitations in that it does not take other news events into consideration, which may skew the data at hand.

Past papers such as Li (2007) have tried to explain the phenomenon of abnormal returns to certain countries by level of development but found no significant results. However, this paper uses a related method to explain abnormal returns. Research has shown that a country's degree of development does not factor in the effect of a mega event. This paper hypothesises that countries that have similar sized economies should experience similar abnormal returns. By using log of Gross Domestic Product (GDP) as a proxy for the size of the economy, an Ordinary Least Squares (OLS) regression is created to investigate whether the size of an economy has an effect on abnormal returns. The following equation attempts to test the hypothesis:

$$AAR_t = \beta_0 + \beta_1 \text{GDP} + \varepsilon_i, \quad (7)$$

where:

AAR_t is the average abnormal returns from indexes over the three day announcement period,

GDP is the log of GDP for the winning host country in the year of the announcement,

β_0 the intercept of the regression output,

β_1 is the coefficient of the log GDP variable and

ε_i is the error term for the regression output.

This regression suggests that the size of a country's economy is negatively related to abnormal returns. However, this relationship could be said for any year, regardless of whether there has been an

announcement or not. In order to rectify this, an indicator variable is introduced. This will indicate whether a year's abnormal returns appeared in an announcement year or not. The regression equation follows:

$$R = \beta_0 + \beta_1 \text{Indicator} + \beta_2 \text{GDP} + \varepsilon_i, \quad (8)$$

where:

R is the average abnormal returns from indexes over the three day announcement period, and the average returns from the year before,

Indicator is a dummy variable indicating whether the returns occur in an announcement year or not,

GDP is the GDP for the winning host country in the year of the announcement of the year before,

β_0 the intercept of the regression output,

β_1 is the coefficient of the indicator variable,

β_2 is the coefficient of the log GDP variable and

ε_i is the error term for the regression output.

This regression does show the significance of the announcement year (through the indicator variable) and the size of a country's GDP. However, these values are not comparable. An abnormal return over three days cannot be accurately compared to an average for the year before.

To correct for this, a new equation is developed. The dependent variable is the three day abnormal returns for the announcement period and a comparable three day period the year before. This is to provide a more comparable analysis. An announcement indicator variable will be used to see if the announcement has a significant effect on the returns. The regression equation follows:

$$\text{AAR} = \beta_0 + \beta_1 \text{Indicator} + \varepsilon_i, \quad (9)$$

where:

AAR is the average abnormal returns from indexes over the three day announcement period, and a comparable period the year before,

Indicator is a dummy variable indicating whether the returns occur in an announcement year or not,

β_0 the intercept of the regression output,

β_1 is the coefficient of the indicator variable and

ε_i is the error term for the regression output.

Given that this factor is significant, the relationship found in equation (1) between GDP and abnormal returns holds true. The Empirical Results and Discussion section that follows, discusses the implications of this.

4 Results

In this section, the results of the event study will be analysed and discussed. The descriptive statistics can be found in Appendix C. The abnormal returns are separated by announcement date and sport event. On average the abnormal returns at the announcement date exceeds the abnormal returns over the sporting event period. The abnormal returns at the announcement date for the World Cup and the Olympics are analogous. However, in terms of the sporting event the Olympics produces slightly larger abnormal returns.

On average, the standard deviations for each mega event were at least similar or larger than the mean of the abnormal returns. The announcement that Greece would be hosting the 2004 Olympics resulted in the highest average abnormal return. This could be due to it marking the return of the Olympics to the city where it started. The announcement that South Africa would be hosting the 2010 World Cup resulted in the second highest average abnormal return. A possible reason for this could be that this was the first mega sporting event to be hosted on the African continent. The average abnormal return at the announcement date for the Brazil World Cup was the most negative. This is interesting because there was a large amount of doubt as whether Brazil would be able to stage a major sporting event due their lack of infrastructure (Downie, 2007).

The cumulative abnormal returns (Appendix D) appear to be mostly positive. The returns over the sporting event period ranges from approximately -14% to 23% whilst the returns over the announcement period ranges from approximately -3% to 9%. The difference in the size between the ranges is as a result of the sporting event period being longer than the announcement period. The next section will look at the statistical significance of the abnormal returns and cumulative abnormal returns.

Table 1. Student's t-test on the abnormal returns

	Test Statistic
All Abnormal Returns	2.2352**
Announcement	2.2835**
Sport Event	1.3313

Note: * significant at 1% level, **significant at 5% level, ***significant at 10% level

From Table 1, it can be seen that the abnormal returns are significantly different from zero at the 5% level of significance. Interestingly, when the abnormal returns were separated by announcement date and

sport event, it was found that only the abnormal returns associated with the announcement date was significantly different from zero at the 5% level.

Table 2. Sign test on abnormal returns

P- values		One-sided tests	
		> 0	< 0
Test 1: A=0		0.0063**	0.9952
Test 2: S=0		0.0407	0.9675
Test 3: ANN=0		0.0099**	0.9955

Note: A is sport event and announcement, S is sport event and ANN is announcement

* significant at 1% level, **significant at 5% level, ***significant at 10% level

The sign test illustrates whether the abnormal returns were significantly positive or negative. The announcement date has positive abnormal returns at the one-tailed 2.5% level of significance. Together, the sporting event and announcement date have significantly positive abnormal returns. However, this could be due to the strength of the announcement dates' significance.

The sign test was then used to test whether the cumulative abnormal returns were significantly different from zero with the results displayed in Table 3. It was found that the cumulative abnormal returns across all events were not significantly different from zero.

Table 3. Sign test on cumulative abnormal returns

P- values		One-sided tests	
		> 0	< 0
Test 1: A=0		0.1147	0.9393
Test 2: S=0		0.2272	0.8949
Test 3: ANN=0		0.2403	0.8811

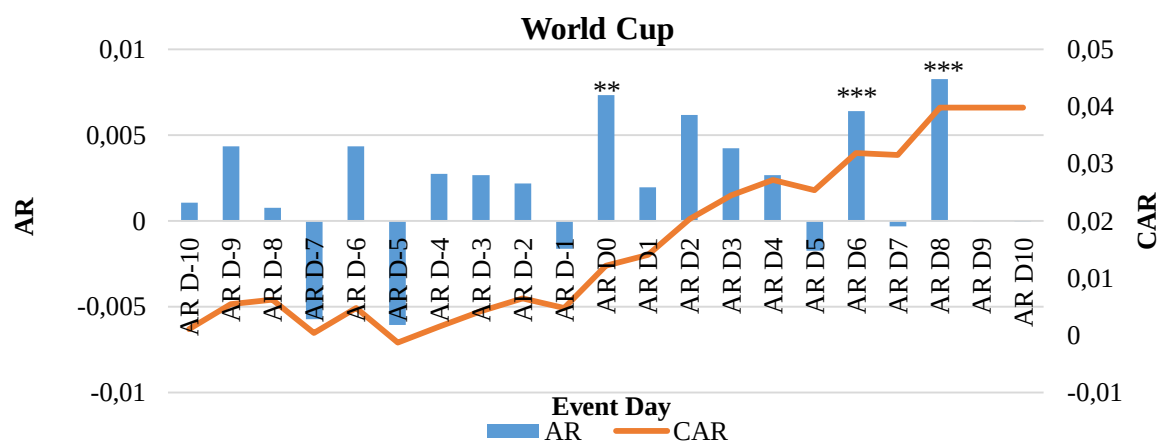
Note: A is sport event and announcement, S is sport event and ANN is announcement

* significant at 1% level, **significant at 5% level, ***significant at 10% level

This paper uses a method similar to that of Ward and Muller (2010) to illustrate how the abnormal and cumulative abnormal returns changed over the period surrounding the announcement. A t-test was used to

test whether the returns for each day were significantly different from zero. The significance of daily abnormal returns is advantageous in that it assists in the investment decision.

Figure 4. Abnormal and cumulative returns for the world cup events over the announcement period

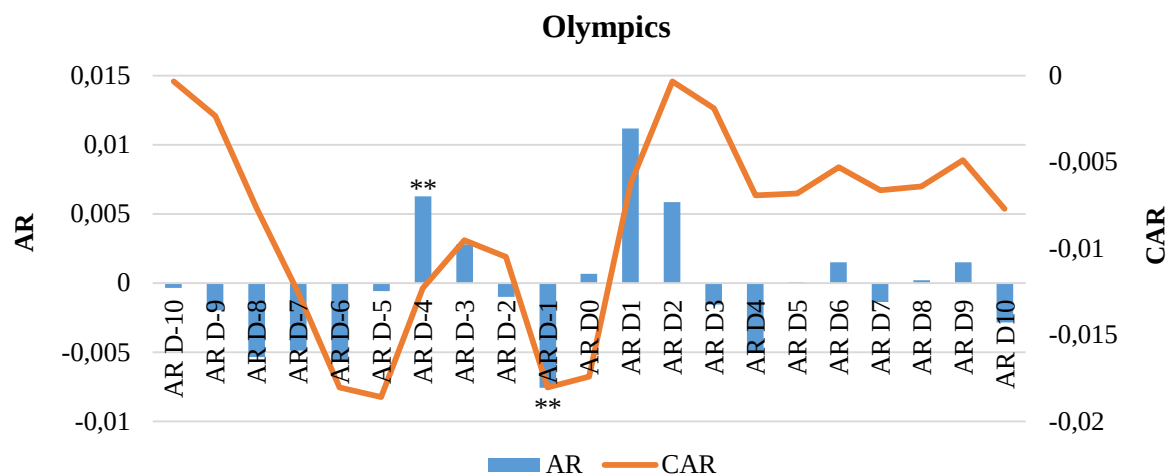


Note: * significant at 1% level, **significant at 5% level, ***significant at 10% level

Figure 4 shows that for the World Cup, the returns are highest on day zero (D0) and day eight (D8) on average. Only the announcement day (D0), day six (D6) and day eight (D8) were significantly

different from zero. Cumulative abnormal returns is shown to increase from the announcement date until day four.

Figure 5. Abnormal and cumulative returns for the Olympics over the announcement period



Note: * significant at 1% level, **significant at 5% level, ***significant at 10% level

Figure 5 shows that the highest abnormal return occurs on day one. The day before (D-1) and four days before (D-4) are significantly different from zero. The cumulative abnormal returns are negative throughout the period. For a chart that combines all major sport events see Appendix E.

Given that the positive abnormal returns around the announcement date are statistically significant, this paper recommends that investors invest over the

announcement date period. It is never certain which country or city will win the bid; however, there are always favourites in the race leading up to the announcement.

It was hypothesised that the size of the economy could be a factor in the size of the abnormal returns. In order to test this, the natural logarithm of GDP for each host country was regressed on the average abnormal returns of each host country.

Table 4. The relationship between GDP and abnormal returns at the announcement

		Number of obs		18.0000		
		F(1, 14)		7.7300		
		Prob > F		0.0134		
		R-squared		0.3242		
		Root MSE		0.0085		
Abnormal returns	Coefficient	Standard Error	t statistic	P>t	95% Confidence Interval	
In of GDP	-0.0041	0.0015	-2.7800	0.0130	-0.0073	0.0010
Constant	0.1203	0.0417	2.8800	0.0110	-0.0319	0.2087

From the regression in Table 4, it can be seen that there is an inverse relationship between the size of the economy and the abnormal returns. One explanation for this could be that smaller economies that are selected as hosts often see huge inflows of funds in the form of an increase in infrastructure. Bigger and already developed countries tend have the infrastructure in place. However, it could be that the relationship between abnormal returns and GDP holds

true regardless of the announcement date. The indicator variable that was added to the regression equation (2) to counters this problem. (Appendix F)

GDP and the announcement indicator were then regressed on both abnormal and expected returns. However, this was not comparable as discussed in Section 3.2. After regressing comparable abnormal return data on the indicator alone as in equation (3) the following results is found.

Table 5. Testing if the announcement year is significant

					Number of obs	34.0000
					F(1,32)	4.0700
					Prob > F	0.0522
					R-squared	0.1128
					Adj R-squared	0.0851
					Root MSE	0.0143

Abnormal Returns	Coefficient	Standard Error	t statistic	P > t 	95% confidence interval	
Indicator	0.0099	0.0049	2.0200	0.0520	-0.0001	0.0199
Constant	-0.0032	0.0035	-0.9200	0.3640	-0.0103	0.0039

From Table 5 it can be seen that the announcement year is significantly different from the non-event year at the 5.2% level. Given that the announcement year is significantly different, it can be said that the inverse relationship between GDP and abnormal returns is true for the announcement year.

The results are restricted in that we were unable to produce a model that could be used to predict future abnormal returns. This could be an area for future research. Whilst our sample of data is larger than that of previous studies, it would be more advantageous to have a bigger sample.

This paper recommends that investors ignore the actual sporting event as the returns are statistically insignificant, and focus on the announcement date instead. Given that indices are not investible, a recommendation is to use exchange-traded funds (ETF) that track the all-share index of that country as shown in Appendix G. It is evident that the World Cup announcement day (D0) has the most significant abnormal return. If investors have an appetite for risk, they could pick a country to invest in based on research and invest the day before the announcement to gain the significant abnormal return on day zero (D0). It is also suggested that for the Olympics announcement, investors invest for the period between the day before the announcement (D-1) and two days after the announcement to benefit from the cumulative abnormal returns over that period. It is advisable to invest in relatively smaller economies to benefit from the, on average, larger abnormal return.

5 Conclusion

Research shows that mega-events can be beneficial to economies and event sponsors. It does not tell us how these events may affect investors in the host markets. This paper investigates the effect of the mega-events on the local stock markets and finds that the actual sporting event provides no abnormal returns to the market. However, the announcement brings about statistically significant abnormal returns to the market. It is also clear in this paper's investigation, that there is an inverse relationship between the size of a country's economy (GDP as a proxy) and the abnormal returns received due to the announcement date. This means that the smaller the country's

economy, the larger its returns to the market for a mega-event announcement. Due to this inverse relationship, a recommendation to invest in all-share ETFs of smaller countries is given. It is advised to invest the day before (D-1) the World Cup announcement to gain the significant abnormal return on day zero (D0) and from the day before (D-1) the announcement of the Olympics to day two (D2).

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Appendix A

Table A.1. Indices used as proxies for market returns

Host Country	Index	Ticker
Australia	FTSE All-Share Index	ASX
Brazil	Ibovespa Brasil Sao Paulo Stock Exchange Ind	IBOV
China	Shanghai Stock Exchange Composite Index	SHCOMP
England	FTSE 100 Index	UKX
France	CAC 40 Index	CAC
Germany	Deutsche Boerse AG German Stock Index	DAX
Greece	Athens Stock Exchange General Index	ASE
Japan	Nikkei 225	NKY
Qatar	Qatar Exchange Index	DSM
Russia	Russian Trading System Cash Index	RTSI\$
South Africa	FTSE/JSE Africa All Share Index	JALSH
South Korea	Korea Stock Exchange KOSPI Index	KOSPI
Spain	IBEX 35 Index	IBEX
United States of America	Standard and Poor's 500 Index	SPX

Appendix B

Figure B.1. Histogram testing normality of the Abnormal returns

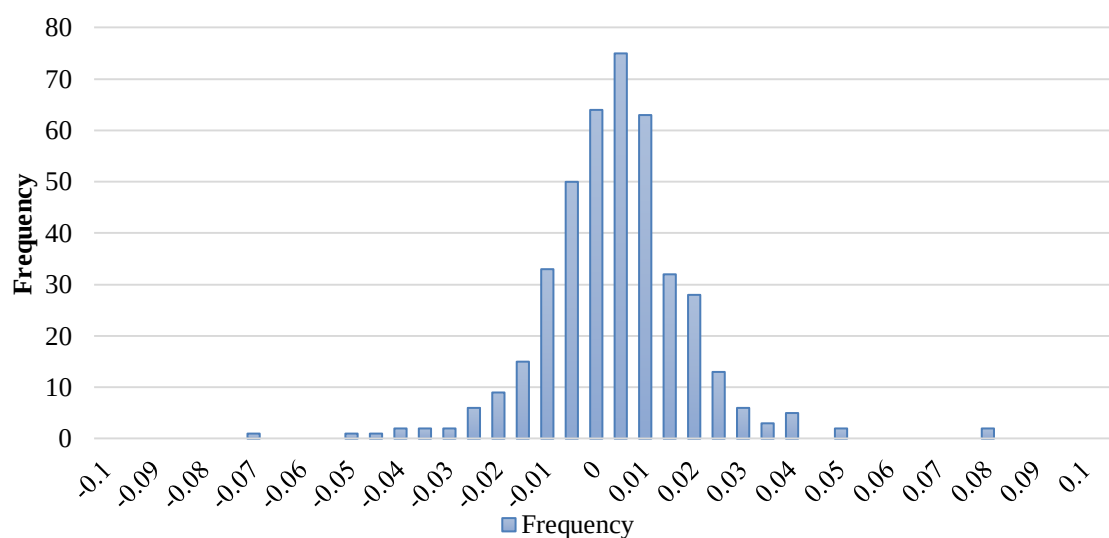


Table B.1. Shapiro-Wilks test

Variable	Observations	W	V	Z	Prob>z
Abnormal returns	415.0000	0.9438	6.0060	6.6090	0.0000

Appendix C

Table C.1. Descriptive Statistics of abnormal returns for the Olympics

	Announcements					Sporting Event				
	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
Japan	3	0.0064	0.0123	-0.0068	0.0176	-	-	-	-	-
Brazil	3	0.0106	0.0073	0.0034	0.0180	-	-	-	-	-
England	3	-0.0012	0.0146	-0.0176	0.0103	17	0.0039	0.0083	-0.0090	0.0232
China	3	-0.0023	0.0028	-0.0055	-0.0004	17	-0.0058	0.0312	-0.0513	0.0770
Greece	3	0.0324	0.0396	0.0038	0.0776	17	0.0016	0.0076	-0.0135	0.0126
Australia	3	0.0009	0.0034	-0.0020	0.0046	17	-0.0026	0.0090	-0.0185	0.0093
USA 1996	3	-0.0042	0.0095	-0.0139	0.0050	17	0.0061	0.0083	-0.0069	0.0231
Spain	-	-	-	-	-	16	0.0096	0.0120	-0.0114	0.0356
South Korea	3	0.0198	0.0299	-0.0147	0.0380	16	0.0013	0.0107	-0.0124	0.0320
USA 1984	3	-0.0092	0.0103	-0.0174	0.0023	16	0.0047	0.0122	-0.0106	0.0265

Table C.2. Descriptive Statistics of abnormal returns for the World Cup

	Announcements					Sporting Event				
	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
Qatar	3	0.0165	0.0165	0.0067	0.0356	-	-	-	-	-
Russia	3	0.0114	0.0034	0.0088	0.0153	-	-	-	-	-
Brazil	3	-0.0128	0.0190	-0.0249	0.0091	31	0.0005	0.0096	-0.0165	0.0238
South Africa	3	0.0236	0.0211	0.0066	0.0473	31	0.0034	0.0105	-0.0201	0.0238
Germany	3	0.0079	0.0083	0.0012	0.0171	33	0.0070	0.0132	-0.0138	0.0320
South Korea	3	0.0038	0.0099	-0.0076	0.0097	30	0.0008	0.0238	-0.0715	0.0471
Japan	3	-0.0019	0.0150	-0.0184	0.0109	32	-0.0044	0.0181	-0.0415	0.0340
France	3	-0.0035	0.0079	-0.0109	0.0049	34	-0.0038	0.0116	-0.0272	0.0171
USA	3	0.0015	0.0143	-0.0124	0.0162	31	-0.0008	0.0059	-0.0161	0.0096
West Germany	-	-	-	-	-	26	-0.0005	0.0096	-0.0276	0.0173

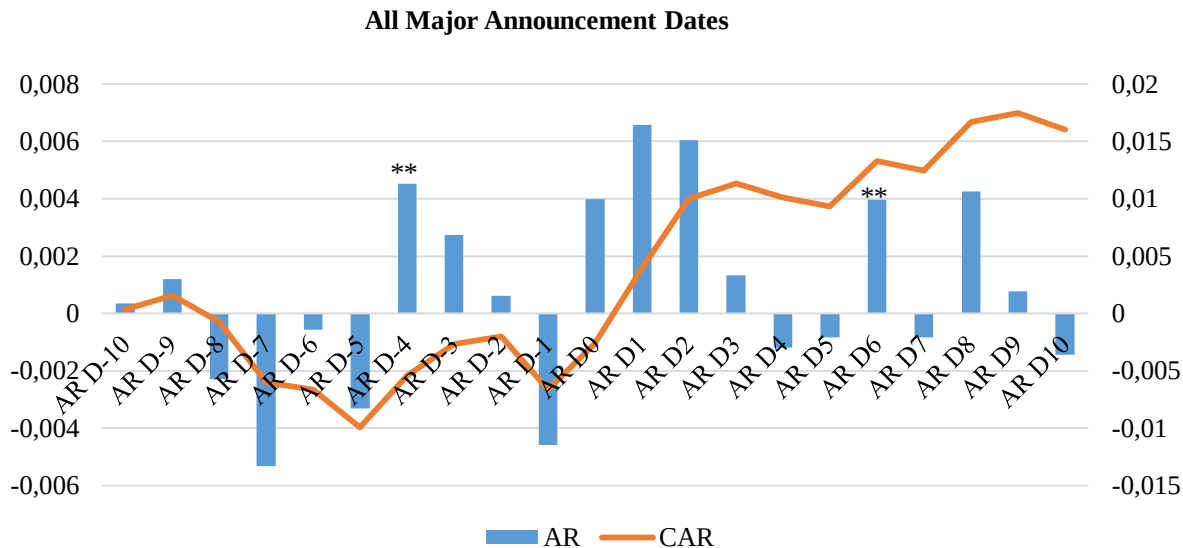
Appendix D

Table D.1. Cumulative Abnormal Returns for the Sporting Event and Announcement

Sporting Event	CAR	Announcement	CAR
Germany '74	-0.0133	USA '84	-0.0277
USA '84	0.0758	South Korea '88	0.0594
South Korea '88	0.0212	USA '94	0.0044
Spain '92	0.1542	USA '96	-0.0127
USA '94	-0.0251	France '98	-0.0105
USA '96	0.1033	Australia '00	0.0028
France '98	-0.1276	Japan '02	-0.0058
Australia '00	-0.0439	South Korea '02	0.0114
Japan '02	-0.1412	Greece '04	0.0972
South Korea '02	0.0236	Germany '06	0.0236
Greece '04	0.0265	China '08	-0.0069
Germany '06	0.2308	South Africa '10	0.0708
China '08	-0.0994	England '12	-0.0036
South Africa '10	0.1048	Brazil '14	-0.0383
England '12	0.067	Brazil '16	0.0318
Brazil '14	0.0164	Russia '18	0.0342
		Japan '20	0.0191
		Qatar '22	0.0495

Appendix E

Figure E.1. The abnormal and cumulative abnormal returns for all major sporting events



Appendix F

Table F.1. Regression with indicator and GDP (Equation 2)

Number of obs	34.0000
F(1,32)	6.1500
Prob > F	0.0056
R-squared	0.3833
Root MSE	0.0069

Abnormal Returns	Coefficient	Standard Error	t statistic	P > t 	95% confidence interval	
GDP	-0.0028	0.0010	-2.9300	0.0060	-0.0048	-0.0009
Indicator	0.0070	0.0024	2.9300	0.0060	0.0021	0.0118
Constant	0.0772	0.0265	2.9100	0.0070	0.0231	0.1312

Appendix G

Table G.1. List of ETFs that track major all share indices

Host Country	Index	ETF
Australia	FTSE All-Share Index	iShares MSCI Australia Index Fund
Brazil	Ibovespa Brasil Sao Paulo Stock Exchange Index	iShares MSCI Brazil Index Fund
China	Shanghai Stock Exchange Composite Index	iShares FTSE/Xinhua China 25 Index Fund
England	FTSE 100 Index	iShares MSCI United Kingdom Index Fund
France	CAC 40 Index	Lyxor UCITS ETF CAC 40 DR
Germany	Deutsche Boerse AG German Stock Index	iShares MSCI Germany Index Fund
Greece	Athens Stock Exchange General Index	Global X FTSE Greece 20 ETF
Japan	Nikkei 225	MAXIS Nikkei 225 Index ETF
Qatar	Qatar Exchange Index	iShares MSCI Qatar Capped ETF
Russia	Russian Trading System Cash Index	MSCI Russia Capped Index Fund
South Africa	FTSE/JSE Africa All Share Index	iShares MSCI South Africa Index Fund
South Korea	Korea Stock Exchange KOSPI Index	Horizons Korea KOSPI 200 Exchange Traded Fund
Spain	IBEX 35 Index	db x-trackers IBEX 35 Index UCITS ETF
United States of America	Standard and Poor's 500 Index	SPDR S&P 500 ETF

SIMULTANEOUS MODELS FOR ACCOUNTING POLICY OPTIMIZATION OF STOCK CORPORATIONS ACCORDING TO GERMAN COMMERCIAL LAW

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Abstract

The paper presents simultaneous models for accounting policy optimization of stock corporations according to German commercial law. In particular, we illustrate the integration into the optimization models of the effective income tax, the concept of deferred taxes, remuneration principles for members of management boards and supervisory boards under stock corporation law, parameters for the distribution of profits, and key indicators of the annual financial statements. The models are useful to design optimal financial statements in line with the targets of the company**.

Keywords: Accounting Policy, Accounting Policy Optimization, Simultaneous Optimization Model

JEL Code: M41, K22

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1 Introduction

According to prevailing academic opinion, the accounting policy of a company is used to affect the behavior of its addressees (e.g., shareholders, investors, suppliers, creditors, employees, tax authorities, analysts, public opinion, etc.) in line with the targets of the company by means of conscientious, admissible design and planning of the accounting instruments (e.g., annual financial statements). Since the mid-1980s, intensive work has been carried out to design IT-based decision-making models for the purpose of simultaneous planning of the annual financial statement. In recent decades, a variety of new concepts and modifications to meet the changing basic legal and economic conditions has contributed to an extension of the optimization models (Freidank 1990; Freidank 2001, p. 1–24; Freidank and Buchholz 2008, p. 109–133; Freidank and Reibis 2007, p. 295–314; Freidank and Velte 2013, p. 883–930; Freidank, Bauer, and Sassen 2014; Hahn and Schneider 1998, p. 333–405; Jöhannngen-Holthoff 1985; Kloock 1989, p. 141–158; Krog 1998, p. 273–331; Lachnit and Freidank 1990, p. 29–39; Reibis 2005; Schäfer 1999; Seelbach and Fischer 1998, p. 231–271).

The purpose of this paper is to illustrate simultaneous models for accounting policy optimization of stock corporations according to German commercial law. Therefore, we will show how the above mentioned models have to be adapted to the provisions of the current German commercial and tax law (in particular the German Körperschaftsteuergesetz [KStG, Corporate Tax Act],

Solidaritätszuschlagsgesetz [SolZG, Solidarity Surcharge Act], Gewerbesteuergezet [GewStG, Trade Tax Act], and the Handelsgesetzbuch [HGB, Commercial Code]) and how they have to be modified from a decision-oriented perspective in regard to stock corporations. We will focus in particular on the integration into the optimization models of the effective income tax; the concept of deferred taxes, which was comprehensively modified in 2009 by the German Accounting Modernization Act (Bilanzrechtsmodernisierungsgesetz [BilMoG]); remuneration principles for members of management boards and supervisory boards under stock corporation law; parameters for the distribution of profits; and key indicators of the annual financial statements.

The remainder of this paper is organized as follows. Section 2 contains model extensions regarding the planning of annual financial statements. It starts with a general systematization, the determination of the target function, and the definition of the restrictions. This subsection analyzes the reporting of effective income tax effects, the inclusion of deferred tax effects, the recognition of bonuses for management board and supervisory board members, the restrictions relating action parameters to the impact on the result, the restrictions on noncompliant options regarding the German generally accepted accounting principles, the restrictions relating to the action parameters that draw on the results, and the restrictions relating to selected annual financial statement indicators. Section 3 contains examples that explain the models. Finally, results are presented in a summary in Section 4.

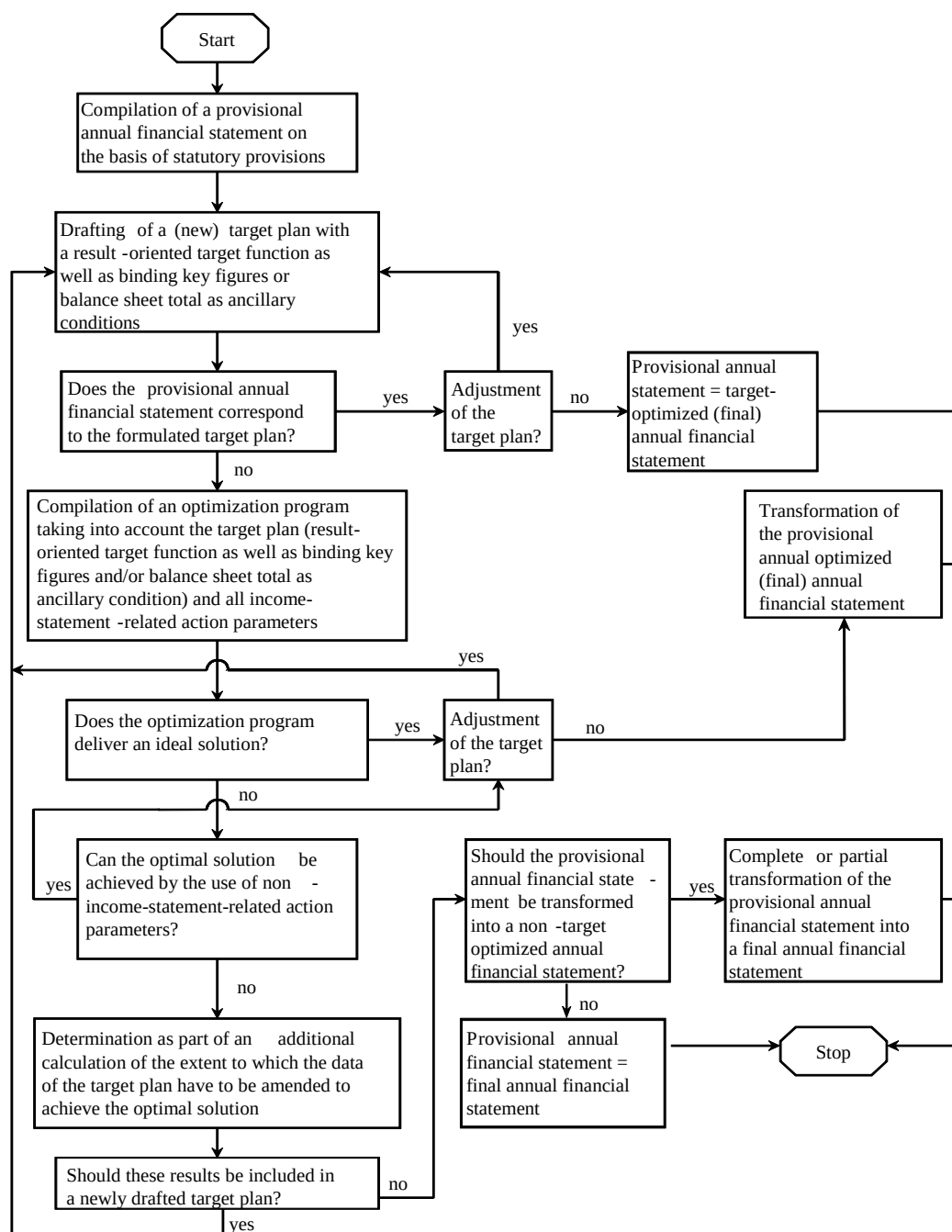
2 Model extensions regarding the planning of annual financial statements

2.1 General systematization

A provisional annual statement compiled on the basis of the commercial law provisions forms the starting point for the optimization approaches in the models for the result- or dividend-related accounting policy (Fig. 1). This provisional annual statement has to be transformed simultaneously in consideration of a target (i.e., target function and certain binding restrictions) through the use of the available result-

effective action parameters into a target-optimal annual financial statement. If a target-adequate, optimal solution cannot be achieved after this process, it must be analyzed whether the solution can be achieved through the additional use of result-ineffective action parameters. If the program then still fails to devise an optimal solution, there is the option to use an additional calculation of how the target plan must be amended to ensure that the models nevertheless result in an optimal solution. Otherwise, the provisional annual financial statement is adopted as the final statement.

Figure 1. Flowchart to determine the target-optimized annual financial statement



Source: Freidank and Velte 2013, p. 900

Regarding these reactive effects, the models also have sequential features. Decision-makers can express the target function either by way of extremization (maximization or minimization) or by determining a fixed annual net profit. The following restrictions are taken into account as secondary targets in the form of binding ancillary conditions:

- statutory options and the scope of discretion regarding recognition and valuation in the balance sheet of each individual action parameter as well as certain profit allocation options with their upper and bottom limits (maneuvering funds);

- certain key figure levels that have to be considered from a corporate policy perspective;

- limits regarding the recording of effective and deferred income taxes;

- limits regarding the consideration of annual financial statement-related remuneration concepts for the management and supervisory boards;

upper limits regarding the balance sheet total, because exceeding these limits might trigger certain publicity and audit obligations according to sec. 267 of the German Commercial Code.

For reasons of transparency, the following concepts only include selected business administration-related key figures as well as - by way of example - the most important balance sheet and tax-law-related individual provisions. However, the

models can generally be extended. The solution of the approaches can be achieved with the help of mathematical optimization programs, which are offered by various software vendors. In order to determine the input values required for the optimization calculations and the subsequent transformation of the provisional target-optimized annual financial statement, the use of spreadsheet calculation software is recommended.

2.2 Determination of the target function

If the provisional annual result before result-related revenues (e.g., corporate tax, trade tax, deferred taxes, and bonuses) and before use of maneuvering income is designated as $vJvor$, and if the positive and negative income statement-related action parameters (maneuvering funds) regarding the values of the individual preliminary balance sheet items of the fixed and current assets, of the accruals and deferrals, as well as long-term and short-term debts are designated as x_A , X_A , $x_{A\ddot{u}}$, $X_{A\ddot{u}}$, x_a , X_a , $x_{a\ddot{u}}$, $X_{a\ddot{u}}$, x_U , X_U , $x_{U\ddot{u}}$, $X_{U\ddot{u}}$, x_u , X_u , $x_{u\ddot{u}}$, $X_{u\ddot{u}}$, x_{Fl} , X_{Fl} , x_{Fk} , X_{Fk} , x_{fl} , X_{fl} , x_{fk} , X_{fk} , x_{Ra} , X_{Ra} , x_{ra} , X_{ra} , then an intended target annual result of the commercial annual financial statement ($sJnach$) can be determined according to result-related income and according to maneuvering fund use as shown generally in Equation (1):

$$sJnach - vJvor = -XKSt - XGewSt - XLS - xTAvor - xTAAuf + x_A + X_A + x_{A\ddot{u}} + X_{A\ddot{u}} - x_a - X_a - x_{a\ddot{u}} - X_{a\ddot{u}} + x_U + X_U + x_{U\ddot{u}} + X_{U\ddot{u}} - x_u - X_u - x_{u\ddot{u}} - X_{u\ddot{u}} + x_{Fl} + X_{Fl} + x_{Fk} + X_{Fk} - x_{fl} - X_{fl} - x_{fk} - X_{fk} + x_{Ra} + X_{Ra} - x_{ra} - X_{ra} \quad (1)$$

In this case, the subscriptions of the variables (X , x) mean:

A, a = fixed assets

$A\ddot{u}, a\ddot{u}$ = other fixed assets

Fk, fk = short-term debts

Fl, fl = long-term debts

$GewSt$ = trade tax

KSt = corporate tax

LS = deferred income taxes

Ra, ra = accruals and deferrals

U, u = inventories

$U\ddot{u}, u\ddot{u}$ = other current assets

$TAAuf$ = supervisory board bonuses

$TAvor$ = management board bonuses

Receivables and other assets as well as current financial assets (sec. 266(2) HGB) are classified as other current assets. Asset items in uppercase signify an increase and those in lowercase signify a decrease. The reverse is true for debt items: positive parameters lead to an increase in the annual result and negative parameters to a decrease. This means, for example, that if variable X_u (the value of the action parameters that reduce the inventory assets) refers to the possibility of an additional set off of expenditure when using the "last-in, first-out" method relative to the average valuation undertaken in the provisional annual financial statement, the use of this option will have a

negative impact on the target annual result ($sJnach$). By contrast, the write-up of investment securities held as fixed assets in the form of variable $X_{A\ddot{u}}$ (the value of those action parameters that increase the amount of the value of the other fixed assets) leads to an increase in the target annual result ($sJnach$).

Due to the amendment of the German authoritative principle that tax accounting should be based on commercial accounting by the German Accounting Modernization Act (Bilanzrechtsmodernisierungsgesetz [BilMoG]) in sec. 5(1) EStG (Freidank/Velte 2010, pp. 185–194), all

action parameters that modify the annual result must be classified into the following groups.

Group I: These include only options permitted by commercial law, which may not be taken into consideration for the purposes of calculating income tax due to violating the aforementioned authoritative principle.

Group II: These include the commercial and tax law options that are compliant with the German generally accepted accounting principles and are taken into consideration for the purposes of the commercial annual financial statement as well as for the calculation of income tax. However, their tax-related impact is dependent on similar use in the commercial annual financial statements in accordance with the aforementioned authoritative principle. Some German scholars have pointed out that an autonomous use of options compliant with the German generally accepted accounting principles in the commercial annual financial statement as well as for income tax calculation purposes is admissible. This view is dismissed for the present purposes (for reasons, see Freidank and Velte 2010, p. 189–191).

Group III: These include the options that are not compliant with the German generally accepted accounting principles and remain relevant only for the purpose of calculating income tax due to the scrapping of the reverse authoritative principle. These options have no impact on the target function of the commercial annual result. As we will show, however, the use of noncompliant options for the purposes of calculating income tax has, in consideration of deferred taxes in the commercial balance sheet, an

indirect impact on the commercial annual financial statement.

Whereas the action parameters of group I are marked with a lowercase *x*, the action parameters marked with an uppercase *X* refer to the options of group II. As Equation (1) shows, the action parameter of the options of groups I and II may directly lead to a change in the target annual result. For the sake of simplicity, the options of group II are represented in the following through the symbol *XM* [all net-income-increasing action parameters in consideration of effective income-tax impact (*XA*, *XAü*, *XU*, *XUü*, *XFL*, *XFK*, *XRA*)] and through the symbol *Xm* [all net-income-lowering action parameters in consideration of effective income-tax impact (*Xa*, *Xaü*, *Xu*, *Xuü*, *Xfl*, *Xfk*, *Xra*)]. Furthermore, with respect to group III, all noncompliant (tax-related) options are expressed by the symbol *XI* (total value of those profit-/loss-effective action parameters that lead to an increase in the income-tax-related assessment bases without having a direct impact on the commercial net annual profit) or by the symbol *Xi* (total value of those profit-/loss-effective action parameters that lead to a reduction in the income tax-related assessment bases without having a direct impact on the commercial annual result).

If, however, the target balance sheet result (*sBI*) is to be expressed as a maximized, minimized, or fixed value, then Equation (1) must be modified as follows in consideration of a potential result carried forward and changes in reserves in the sense of sec. 158(1) AktG (see Section 2.3.7):

$$\begin{aligned} sBI - vJvor = & -XKSt - XGewSt - XLS - xTAvor - xTAauf + xA + XA + xAü + XAü - xa - Xa - xaü \\ & - Xaü + xU + XU + xUü + XUü - xu - Xu - xuü - Xuü + xFl + XFl + xFk + XFk - xfl - Xfl - xfk - \\ & Xfk + xRa + XRa - xra - Xra + xGV - xvv + xRENTK + xRENTG + xRENTS + xRENTAG - xreing \\ & - xreins - xreina - xreinü \end{aligned} \quad (2)$$

2.3 Definition of the restrictions

2.3.1 Basic considerations

If the available maneuvering funds are adequately used for the purpose of realizing specific accounting policy objectives, the provisional annual result (*vJvor*) and the provisional balance sheet result are figures that can be inherently influenced by accounting policy. If an annual result or a balance sheet result shall be published at a determined amount, then the responsible persons must know to which extent the provisional annual result must be amended in consideration of the profit-/loss-related results in order to accurately reflect the target annual result (*sJnach*) or the target balance sheet result (*sBI*) and other desired annual financial statement figures. Owing to

the quantitative recording of the linear correlations between the annual result, the balance sheet result, profit-/loss-dependent results, and the positive and/or negative use of maneuvering funds, it is possible to integrate the impact of structuring the accounting policy options in regard to profits and losses on the expenditure for corporation and trade taxes and bonuses, deferred income taxes, and other financial statement figures into a decision-making model.

2.3.2 Reporting of effective income tax effects

On the basis of the assumption that the tax base for corporation tax purposes (*zvE*) is subject to definitive taxation through corporation tax (*sd*) (sec. 23(1) KStG), the following applies:

$$XKSt = sd \cdot zvE \quad (3)$$

If the solidarity surcharge rate (soli) (sec. 2, no. 3; sec. 3(1), nos. 1 and 2; sec. 4 SolZG) is included,

the Equation above can be expressed as follows (with $sk = (1 + soli) \cdot sd$):

$$XKSt = sk \cdot zvE \quad (4)$$

Due to various violations of the aforementioned authoritative principle as well as the income and corporation tax-related modifications that have to be taken into consideration, the commercial target annual result (sJnach) and the tax base for corporation tax purposes (zvE) are not identical. These deviations have been identified in Table 1 with the symbol ka . It

should be noted that ka may be a positive or a negative value. This depends both on the differences between the commercial balance sheet and income tax balance sheet as well as on the income and corporation tax-related modifications of the tax balance sheet result, and on the deduction of losses, subject to the latter being adjusted outside the tax balance sheet.

Table 1. Calculation of the tax base for corporation tax purposes

±	Annual result under commercial law (Jnach)	} ka
	Deviations between the commercial and tax balance sheet	
=	Annual result under tax law	
±	Result correction due to income and corporate tax-law provisions (sec. 8, para. 1 KStG in conjunction with sec. 3; sec. 4, para. 5; sec. 4h EStG; e.g., deferred tax revenue)	
+	Non-deductible tax expenses (e.g., corporate tax [sec. 10, no. 2 KStG], trade tax [sec. 4, para. 5b EStG] or deferred tax expenses)	
+	Other non-deductible expenses (sec. 9 para. 1, no. 2; sec. 10, no. 1, 3, 4 KStG)	
+	Concealed profit distributions (sec. 8, para. 3 KStG)	
–	Concealed contributions	
–	Share in profits and manager compensation of the personally liable shareholder of a partnership limited by shares (sec. 9, para. 1, no. 1 KStG)	
=	Corrected annual result under tax law	
–	Loss deduction under corporate tax law (sec. 8, para. 1 KStG in conjunction with sec. 10d EStG) (Vk)	
=	Tax base for corporation tax purposes (zvE)	

With regard to the change factor ka , this then results in:

$$XKSt = sk \cdot (sJnach \pm ka) \quad (5)$$

Here, the condition $(sJnach \pm ka) \geq 0$ must apply since otherwise KSt would take a negative value. Table 1 shows that ka includes the expenditure for corporation tax, trade tax, the deferred tax result (XLS), and half of the supervisory board bonuses (sec.

10, no. 4 KStG) (xTAauf). These figures have a mutable character in the interdependent equation system. If these variables are deducted from the value ka , the following constant Equation results:

$$ka^* = \pm ka - (XKSt + XGewSt \pm XLS + 0.5 \cdot xTAauf) \quad (6)$$

Equation (6) covers those deviations between the commercial annual result and the tax base for corporation tax purposes that do not relate to the effective corporation and trade tax expenditure, the

deferred tax result, and half of the supervisory board bonuses. Due to these modifications, this means for Equation (5):

$$XKSt = sk \cdot (sJnach \pm ka^* + XKSt + XGewSt \pm XLS + 0.5 \cdot xTAauf) \quad (7)$$

Here, the condition ≥ 0 must apply to the term in brackets since otherwise XKSt would take a negative value.

In order to calculate the tax base for trade tax purposes (i.e., the trade income [GE] [sec. 7 GewSt]), the tax base for corporation tax purposes before loss

deduction must still be adjusted by certain trade-tax-related modifications as well as by the deduction of trade losses carried forward (ga). This procedure is shown in Table 2 (Vk = loss deduction under corporate tax law [sec. 8, para. 1 KStG in conjunction with sec. 10d EStG]).

Table 2. Calculation of the tax base for trade tax purposes

	Tax base for corporation tax purposes before loss deduction (zvE + Vk)
+/-	Modifications under trade tax law (sec. 8, sec. 9 GewStG)
-	Loss deduction under trade tax law (Vg) (sec. 10a GewStG)
=	Tax base for trade tax purposes (trade earnings) (GE)

The following applies to trade tax (GewSt), which is assessed on the basis of the trade earnings (he = rate of assessment of the municipality in % : 100, me = trade tax index number in % : 100):

$$\text{GewSt} = \text{me} \cdot \text{he} \cdot \text{GE} \quad (8)$$

and including the Equations developed above (with $\text{sg} = \text{me} \cdot \text{he}$):

$$\text{GewSt} = \text{sg} \cdot (\text{sJnach} \pm \text{ka}^* + \text{XKSt} + \text{XGewSt} \pm \text{XLS} + 0.5 \cdot \text{TAauf} \pm \text{ga} + \text{Vk}) \quad (9)$$

Here, the condition ≥ 0 must apply for the term in brackets since otherwise GewSt would take a negative value.

The above Equations can now be transformed to make them usable for accounting policy optimization:

$$\text{XKSt} + \text{sk} \cdot \text{xTAvor} + \text{sk} \cdot 0.5 \cdot \text{TAauf} - \text{sk} \cdot \text{XM} + \text{sk} \cdot \text{Xm} - \text{sk} \cdot \text{XI} + \text{sk} \cdot \text{Xi} = \text{sk} \cdot (\text{vJvor} \pm \text{ka}^*) \quad (10)$$

$$-\text{sg} \cdot \text{vJvor} + \text{XGewSt} + \text{sg} \cdot \text{xTAvor} + \text{sg} \cdot 0.5 \cdot \text{TAauf} - \text{sg} \cdot \text{XM} + \text{sg} \cdot \text{Xm} - \text{sg} \cdot \text{XI} + \text{sg} \cdot \text{Xi} = \text{sg} \cdot (\text{vJvor} \pm \text{ka}^* + \text{Vk} \pm \text{ga}) \quad (11)$$

2.3.3 Inclusion of deferred tax effects

2.3.3.1 Commercial code requirements

The differences in recognition and measurement that have to be considered in accordance with sec. 274 HGB arise due to exceptions to the aforementioned authoritative principle, which states that certain commercial recognition and measurement provisions do not apply to the determination of the tax result (e.g., sec. 5(6) EStG). In addition to temporary and quasi-permanent differences between the commercial and tax balance sheet, tax-related losses carried forward pursuant to sec. 274(1), sent. 4 HGB may also lead to deferred tax assets, as these present a (future) economic benefit to the company (Herzig and Briesemeister 2012, p. 169–221).

However, the differences between the commercial and tax balance sheet items do not always have an impact on the result. These differences have to be recognized according to the temporary concept. They occur in connection with acquisition processes, whereby differences between the commercial value and the relevant taxation value arise. Examples of this include the acquisition of fixed assets subject to a fiscal subsidy that is reported differently in the commercial and tax balance sheets or a contribution in kind that is reported at different values in the commercial and tax balance sheets (Bertram 2012, note 118 on sec. 274). If the recognition of deferred taxes has an impact on the result (as is usually the case), the expenses or earnings from the change in reported deferred taxes must be indicated separately under the "taxes on income and earnings" item

according to sec. 274(2), sent. 3 HGB. In the case of deviations without an impact on the results, the relevant changes to reported deferred taxes must be reflected in the equity (e.g., in other retained earnings). The following models are based on the standard case in which the deferred taxes have an impact on the result.

It should be noted that for corporations like the German stock corporation or the German limited liability corporation and companies assimilated within them by law, the balance between deferred income tax assets and liabilities can be reported in accordance with the overall difference approach (net method) or the gross method that reflects the deferred tax burden or relief separately in a liability or asset item (sec. 274(1), sent. 3 HGB) (Kozikowski and Fischer 2012, note 15 on sec. 274). The following company-specific income tax rates for the reporting of the deferred tax burden or relief at the time of the reversal of the differences in accordance with sec. 274(2), sent. 1 HGB are relevant to the calculation of the deferred tax assets and liabilities (Kozikowski and Fischer 2012, notes 60–63 on sec. 274 HGB and further references):

- in the case of trade tax, a tax rate in consideration of the rate of assessment of the municipality, the trade tax index number, and the prohibition of the deduction of trade tax from its tax base (sg);

- in the case of corporation tax, the definitive tax burden rate in consideration of the solidarity surcharge, and the prohibition of the deduction of corporation tax from its tax base (sk).

The amount recognized as the deferred tax asset or liability per accounting period is the result of the

multiplication of the consolidated company-specific income tax rate ($s = sg + sk$) with the identified asset or liability differences from temporary tax deferrals and benefits from losses carried forward that can be set off (Fuhrmann and Gellrich 2012, p. 121–122; Kozikowski and Fischer (2012), note 61 on sec. 274). The following model formulations are based on the assumption that in the case of tax deferrals or accruals a future constant income tax rate will be applied at the time of the reversal of the differences.

2.3.3.2 Model integration of deferred taxes

Taking into account the basic commercial conditions shown above, it is now possible to integrate the deferred income tax into the model in accordance with the individual difference approach. Due to the unbalanced reporting of deferred tax assets and liabilities, the addressees of the annual financial statement obtain a more transparent overview of the financial situation of the corporation in regard to the reported tax deferrals pursuant to sec. 274(1), sent. 3 HBG if they select the individual difference approach than if they opt for the net method. This corresponds

in principle to the International Financial Reporting Standards (IFRS) rules contained in IAS 12.74 and DRS 18 (2012), 18.56 to 18.58. Furthermore, by using the gross method, the deferred asset and liability items as well as the deferred tax earnings and expenditures can be calculated separately and simultaneously in the following models. If the corporation maintains a corresponding register of differences (Freidank and Velte 2013, p. 809–811; Fuhrmann and Gellrich 2012, p. 119), the respective temporary and quasi-permanent differences that result from a comparison of the commercial and tax balance sheet values can be taken from this register. Finally, analogously to international provisions (IAS 12.24), we are assuming an obligation to recognize deferred tax assets.

Table 3 shows the components of the assessment basis of deferred tax assets that will lead to the "total of the deferred taxes asset" item in the annual statement under commercial law when multiplying by the indicated tax factors. In the following, we assume that a positive result occurs in the reference period for the values zvE and GE (for all other constellations, see Freidank/Bauer/Sassen 2014).

Table 3. Determination of the deferred tax asset item

Components of the assessment basis	Tax factor
Temporary differences that lead to the recognition of deferred tax assets (ADt)	
+ Quasi-permanent differences that lead to the recognition of deferred tax assets (ADqp)	
= Total of those differences that lead to deferred tax assets (AD)	s
+ Loss carried forward from the previous years under corporate tax law, which may be used within the next five years ($\Sigma KVvor5$)	sk
+ Loss of the period under corporate tax law that can be carried forward (KVvor) and that arises from a negative tax base for corporation tax purposes ($-zvE$)	sk
+ Loss carried forward from the previous years under trade tax law, which may be used within the next five years ($\Sigma GVvor5$)	sg
+ Loss of the period under trade tax law that can be carried forward (GVvor) and that arises from a negative tax base for trade tax purposes (trade earnings) ($-GE$)	sg
= Amount of the deferred taxes asset item (XLESTA)	

The temporary and quasi-permanent balance sheet deviations (AD) as well as the losses carried forward from the previous year have to be valued at

the respective tax rates to determine the deferred asset item (XLESTA).

$$XLESTA = AD \cdot s + \Sigma KVvor5 \cdot sk + \Sigma GVvor5 \cdot sg \quad (12)$$

The change in the amount of the deferred asset item compared to the previous year ($\Delta LESTA$) must be calculated to determine the amount of deferred tax

result. The amount of the deferred asset item of the previous period is expressed in the Equation below as $LESTA_{vor}$.

$$\Delta LESTA = XLESTA - LESTA_{vor} \quad (13)$$

If $\Delta LESTA < 0$, the "deferred tax assets" item in the balance sheet decreases and leads to a deferred tax expense in the amount of $\Delta LESTA$ in the commercial income statement. If $\Delta LESTA > 0$, the "deferred tax

assets" item in the balance sheet increases and leads to a deferred tax income to the extent of $\Delta LESTA$.

Table 4 shows the components of the assessment basis for deferred tax liabilities that will lead to the

"deferred tax liabilities" item in the annual statement under commercial law when multiplied by the indicated tax rate (s).

Table 4. Determination of the deferred tax liability item

Components of the assessment basis	Tax rate
Temporary differences that lead to the recognition of deferred tax liabilities (PDt)	s
+ Quasi-permanent differences that lead to the recognition of deferred tax liabilities (PDqp)	s
= Total of those differences that lead to deferred tax liabilities (PD)	s
= Amount of the deferred taxes liabilities item (LESTP)	

The sum of the temporary and quasi-permanent differences (PD) has to be multiplied by the tax rate (s) to receive the deferred tax liabilities.

$$XLESTP = PD \cdot s \quad (14)$$

The change in the deferred liability item relative to the previous year ($\Delta LESTP$) has to be determined for the calculation of the deferred tax result. The

deferred tax liabilities of the previous period is expressed in the Equation below as $LESTP_{vor}$.

$$\Delta LESTP = XLESTP - LESTP_{vor} \quad (15)$$

If $\Delta LESTP < 0$, the "deferred tax liabilities" item in the balance sheet decreases and leads to deferred tax earnings in the amount of $\Delta LESTP$. If $\Delta LESTP > 0$, the "deferred tax liabilities" item increases and leads to deferred tax expenses in the amount of $\Delta LESTP$.

The deferred tax result of the period (XLS) is calculated using the Equation below. The size of XLS

arises from the change in deferred tax assets and liabilities in the balance sheet as a result of their formation and resolution. If $XLS > 0$, this leads to deferred tax expenses in the income statement, which reduces the net annual result. In the case of $XLS < 0$, this leads to deferred tax earnings, which increases the net annual result.

$$\pm XLS + XLESTA - XLESTP = -LESTP_{vor} + LESTA_{vor} \quad (16)$$

The equations $XLESTA$ and $XLESTP$ have to be modified for simultaneous consideration of the effects of the use of options in groups I and III (see Sec. 2.2) on deferred taxes. The accounting options of group II (X_M , x_m) have no relevance in this context since they alter the commercial and tax balance sheet amounts to the same extent. Thus, these accounting options have no impact on deferred taxes. The accounting options of groups I and II may affect the differences provisionally formed between the commercial and tax balance sheet items. This circumstance may lead to a

change in deferred tax assets (AD) or deferred tax liabilities (PD). With regard to the "deferred tax assets" balance sheet item, this means that, for reasons of simplification, action parameters without an effective income tax impact that increase the net annual result (x_A , $x_{Aü}$, x_U , $x_{Uü}$, x_{Fl} , x_{Fk} , x_{Ra}) are reflected by the symbol x_M , and all action parameters without an effective income tax impact that reduce the net annual profit (x_a , $x_{aü}$, x_u , $x_{uü}$, x_{fl} , x_{fk} , x_{ra}) are reflected by the symbol x_m :

$$XLESTA + s \cdot x_M (AD) - s \cdot x_m (AD) + s \cdot XI (AD) - s \cdot x_i (AD) = s \cdot AD + \sum KV_{vor} \cdot s_k + \sum GV_{vor} \cdot s_g \quad (17)$$

The Equation for the "deferred tax liabilities" balance sheet item is expressed as follows:

$$XLESTP - s \cdot x_M (PD) + s \cdot x_m (PD) + s \cdot XI (PD) + s \cdot x_i (PD) = s \cdot PD \quad (18)$$

Thus, the relevant action parameters of the accounting options of groups I and III must be inserted in each case in Equations (17) or (18). Their allocation depends on the potential changes of the provisionally

formed differences between commercial and tax balance sheet items. If the company decides, for example, to form tax-free reserves (group X_i [PD]), the exercise of this accounting option will lead to an

increase in the variable XLESTP. If the company decides, for instance, to recognize self-created immaterial assets as part of the fixed assets pursuant to sec. 248(2), sent. 2 HG (group xM [PD]), this will lead to an increase in the variable XLESTP. Had the decision-makers opted for the exercise of one of these two options for the purpose of compiling the provisional annual financial statement, their impact on the deferred tax liabilities would already be included in the value of PD. Provided that the options are to be counted towards the available maneuvering funds, they would have to be assigned to the variables Xi (PD) and xm (PD) in Equation (18).

2.3.4 Recognition of bonuses for management board and supervisory board members

Companies can use specific variable assessment bases for bonuses for management and supervisory board

members pursuant to sec. 87(1) AktG in conjunction with sec. 113(3) AktG (Seibt 2010, note 12 on sec. 87 AktG; Drygala 2010, note 25–27 on sec. 113 AktG.), which have to be taken into consideration for the purposes of planning the annual financial statement. In this case the extensions described below must be included in the optimization models. If a profit participation for the management board consists of a portion of the net result, the bonus (xTAavor) will be calculated as shown in Equation (19). The annual result is reduce beforehand by specific mandatory components [avor = rate of the management board according to the corrected annual result; xreings = total value of legal or statutory reserves setting (this does not include any setting of the equity reserve in accordance with sec. 58(2a) AktG since these settings are always made on a voluntary basis); xvv = total value of the commercial loss carried forward from the previous year].

$$xTAavor = avor \cdot (sJnach - xvv - xreings) \text{ with } 0 \leq avor \leq 1 \quad (19)$$

The reserve setting xreings can be split into a legal part (xreing) and a statutory part (xreins). Accordingly, Equation (20) applies:

$$xreings = xreing + xreins \quad (20)$$

Sec. 150(2) AktG requires that 5% of the net annual profit reduced by the loss carried forward from the previous year must be transferred to the statutory reserve unless the funding level required by law or articles of association can also be achieved by a lower transfer to the reserve. Based on the standard case of an adoption of the annual financial statement by the

management board and the supervisory board (see sec. 58(1), sent. 1 AktG for an exceptional case), the transfer to reserves can be described as shown in Equation (21) (reinn = lower reserve transfer pursuant to sec. 150(2) AktG; r = rate for the setting of the legal reserve):

$$xreings = r \cdot 0.05 \cdot (sJnach - xvv) + (1 - r) \cdot reinn + reins \text{ with } r = 1 \text{ in the case of } 0.05 \cdot (sJnach - xvv) < reinn \text{ and } r = 0 \text{ in the case of } 0.05 \cdot (sJnach - xvv) \geq reinn \quad (21)$$

If Equation (21) is inserted into Equation (19), then the following term results after some

modifications for the calculation of management board bonuses:

$$-(1 - 0.05 \cdot r) \cdot avor \cdot (XKSt - XGewSt \pm XLS - xTAauf + xM - xm + XM - Xm) + [1 + (1 - 0.05 \cdot r) \cdot avor] \cdot xTAavor - (0.05 \cdot r - 1) \cdot avor \cdot xvv + avor \cdot xreins = (1 - 0.05 \cdot r) \cdot avor \cdot vJvor + (r - 1) \cdot avor \cdot reinn \quad (22)$$

In contrast to the calculation of the bonuses for the management board, the bonuses for supervisory board members pursuant to sec. 113(3), sent. 1 AktG are calculated by applying a constant rate (aauf) of the balance sheet result, which has to be reduced beforehand by an amount of at least 4% of the contributions paid on the lowest issue price of the shares (Aus) (aauf = rate of the supervisory board according to the adjusted balance sheet result; xGV =

profit carried forward from the previous year; xRENTK = withdrawal from capital reserve; xRENTG = withdrawal from the legal reserve; xRENTS = withdrawal from the statutory reserve; xRENTAG = withdrawal from other retained earnings; xreina = transfer to other retained earnings pursuant to sec. 58(2) AktG; xreinü = other transfers to other retained earnings pursuant to sec. 58(2a) AktG).

$$TAauf = auf \cdot (sJnach + xGV - xvv + xRENTK + xRENTG + xRENTS + XRENTAG - xreing - xreins - xreina - xreinü - 0.04 \cdot Aus) \quad (23)$$

Here, the condition ≥ 0 must apply for the term in brackets since otherwise TAAuf would take a negative value.

The variable xreina can be specified per sec. 58(2) AktG in the case that the management and supervisory board adopt the annual financial statements. Since, on the one hand, a maximum of 50% of the difference between the annual result and the loss carried forward, and, on the other hand, the write-ups to the legal reserve may be transferred to the other retained earnings in this case, Equation (24)

$$\text{xreina} = \text{dm} \cdot [\text{sJnach} - \text{xvv}] + (1 - r) \cdot \text{reinn} - \text{xvv} \text{ with } 0 \leq \text{dm} \leq 0.5 \quad (24)$$

If Equation (24) is integrated into Equation (23), after some modifications the following results:

$$\begin{aligned} &-(1 - \text{dm}) \cdot (1 - 0.05 \cdot r) \cdot \text{aauf} \cdot (-\text{XKSt} - \text{xGewSt} \pm \text{XLS} - \text{xTAavor} + \text{xM} - \text{xm} + \text{XM} - \text{Xm}) + [1 + \\ &(1 - 0.05 \cdot r) \cdot \text{aauf}] \cdot \text{xTAauf} - \text{aauf} \cdot [(1 - \text{dm}) \cdot (0.05 \cdot r - 1) \cdot \text{xvv} + \text{xGV} + \text{xRENTK} + \text{xRENG} + \\ &\text{xRENTS} + \text{xRENTG} - \text{xreins} - \text{xreinü}] = (1 - \text{dm}) \cdot (1 - 0.05 \cdot r) \cdot \text{aauf} \cdot \text{vJvor} + [(\text{dm} - 1) \cdot (1 - r) \cdot \\ &\text{reinn} - 0.04 \cdot \text{Aus}] \cdot \text{aauf} \end{aligned} \quad (25)$$

2.3.5 Restrictions on action parameters with an impact on the result

With regard to the determination of action parameters that have an impact on the result and their upper and lower limits as $\leq$ conditions, there is the problem that the values of the existing accounting option cannot be divided infinitely. Hence, a determined optimal solution of the optimization model cannot be realized because the calculated value does not correlate with the commercial and tax provisions. For this reason, the optimization of the target function must be based on a mixed-integer approach (Corsten, Corsten, and Sartor 2005, p. 125–178; Müller-Merbach 1973, p. 366–414), which ensures that the action parameters can be included in the optimal solution with every possible intermediate value or only with their upper and lower limits. For example, certain overhead cost components as part of the production costs can only be recognized in the amount of 0 or to the maximum amount.

If the action parameters are initially formulated as $\leq$ restrictions, then the following Equations (26) to

applies (dm = rate available for disposal by the management). As only part of the net annual profit that is actually available to fund the reserve may be used according to sec. 58(2) AktG, the transfers to the legal reserves as well as the reversal of a loss carried forward must first be deducted from the net annual profit (sec. 58(2), sent. 4 AktG). This does not apply to a transfer to the capital reserve because this reserve is neither funded by the net annual profit nor serves to fund the latter (ADS 1997, note 16 on sec. 58, p. 296).

(53) result. Here, all result-increasing action parameters (xA, Xa, xAü, XAü, xU, XU, xUü, XUü, XFL, XFL, XFK, XFK, XRA, XRA) and all result-decreasing action parameters (xa, Xa, xaü, Xaü, xu, Xu, xuü, Xuü, xfl, Xfl, xfk, Xfk, xra, Xra) are listed individually. Certain accounting options apply in the following optimization models for cumulative groups of assets or liabilities. Nevertheless, for each accounting option it is possible to define a separate variable and formulate a separate restriction. However, the complexity of the optimization model would significantly increase as a result. For example, the assessment scope in Equation (35), $\text{XU} \leq \text{oUv}$ ($\text{XU} - \text{vUv}$), contains the value of all action parameters that increase the amount of inventories when considering effective income tax effects. The condition $\text{oUv} (\text{XU}) \geq \text{vUv}$ describes the range of the value of the inventories between the value in the interim financial statements (vUv) and the upper limit of the value of the inventories. The maximum can be exercised by using all the action parameters of the options group XU.

$$\text{xA} \leq \text{oAs} (\text{xA}) - \text{vAs} \quad \text{with } \text{oAs} (\text{xA}) \geq \text{vAs} \quad (26)$$

$$\text{XA} \leq \text{oAs} (\text{XA}) - \text{vAs} \quad \text{with } \text{oAs} (\text{XA}) \geq \text{vAs} \quad (27)$$

$$\text{xAü} \leq \text{oAü} (\text{xAü}) - \text{vAü} \quad \text{with } \text{oAü} (\text{xAü}) \geq \text{vAü} \quad (28)$$

$$\text{XAü} \leq \text{oAü} (\text{XAü}) - \text{vAü} \quad \text{with } \text{oAü} (\text{XAü}) \geq \text{vAü} \quad (29)$$

$$\text{xa} \leq \text{vAs} - \text{uAs} (\text{xa}) \quad \text{with } \text{vAs} \geq \text{uAs} (\text{xa}) \quad (30)$$

$$\text{Xa} \leq \text{vAs} - \text{uAs} (\text{Xa}) \quad \text{with } \text{vAs} \geq \text{uAs} (\text{Xa}) \quad (31)$$

$$\text{xaü} \leq \text{vAü} - \text{uAü} (\text{xaü}) \quad \text{with } \text{vAü} \geq \text{uAü} (\text{xaü}) \quad (32)$$

$$x_{A\ddot{u}} \leq v_{A\ddot{u}} - u_{A\ddot{u}} (x_{A\ddot{u}}) \quad \text{with } v_{A\ddot{u}} \geq u_{A\ddot{u}} (x_{A\ddot{u}}) \quad (33)$$

$$x_U \leq o_U v (x_U) - v_U v \quad \text{with } o_U v (x_U) \geq v_U v \quad (34)$$

$$X_U \leq o_U v (X_U) - v_U v \quad \text{with } o_U v (X_U) \geq v_U v \quad (35)$$

$$x_{U\ddot{u}} \leq o_{U\ddot{u}} (x_{U\ddot{u}}) - v_{U\ddot{u}} \quad \text{with } o_{U\ddot{u}} (x_{U\ddot{u}}) \geq v_{U\ddot{u}} \quad (36)$$

$$X_{U\ddot{u}} \leq o_{U\ddot{u}} (X_{U\ddot{u}}) - v_{U\ddot{u}} \quad \text{with } o_{U\ddot{u}} (X_{U\ddot{u}}) \geq v_{U\ddot{u}} \quad (37)$$

$$x_u \leq v_U v - u_U v (x_u) \quad \text{with } v_U v \geq u_U v (x_u) \quad (38)$$

$$X_u \leq v_U v - u_U v (X_u) \quad \text{with } v_U v \geq u_U v (X_u) \quad (39)$$

$$x_{u\ddot{u}} \leq v_{U\ddot{u}} - u_{U\ddot{u}} (x_{u\ddot{u}}) \quad \text{with } v_{U\ddot{u}} \geq u_{U\ddot{u}} (x_{u\ddot{u}}) \quad (40)$$

$$X_{u\ddot{u}} \leq v_{U\ddot{u}} - u_{U\ddot{u}} (X_{u\ddot{u}}) \quad \text{with } v_{U\ddot{u}} \geq u_{U\ddot{u}} (X_{u\ddot{u}}) \quad (41)$$

$$x_{F\dot{l}} \leq v_{F\dot{l}} - u_{F\dot{l}} (x_{F\dot{l}}) \quad \text{with } v_{F\dot{l}} \geq u_{F\dot{l}} (x_{F\dot{l}}) \quad (42)$$

$$X_{F\dot{l}} \leq v_{F\dot{l}} - u_{F\dot{l}} (X_{F\dot{l}}) \quad \text{with } v_{F\dot{l}} \geq u_{F\dot{l}} (X_{F\dot{l}}) \quad (43)$$

$$x_{F\dot{k}} \leq v_{F\dot{k}} - u_{F\dot{k}} (x_{F\dot{k}}) \quad \text{with } v_{F\dot{k}} \geq u_{F\dot{k}} (x_{F\dot{k}}) \quad (44)$$

$$X_{F\dot{k}} \leq v_{F\dot{k}} - u_{F\dot{k}} (X_{F\dot{k}}) \quad \text{with } v_{F\dot{k}} \geq u_{F\dot{k}} (X_{F\dot{k}}) \quad (45)$$

$$x_{f\dot{l}} \leq o_{f\dot{l}} (x_{f\dot{l}}) - v_{f\dot{l}} \quad \text{with } o_{f\dot{l}} (x_{f\dot{l}}) \geq v_{f\dot{l}} \quad (46)$$

$$X_{f\dot{l}} \leq o_{f\dot{l}} (X_{f\dot{l}}) - v_{f\dot{l}} \quad \text{with } o_{f\dot{l}} (X_{f\dot{l}}) \geq v_{f\dot{l}} \quad (47)$$

$$x_{f\dot{k}} \leq o_{f\dot{k}} (x_{f\dot{k}}) - v_{f\dot{k}} \quad \text{with } o_{f\dot{k}} (x_{f\dot{k}}) \geq v_{f\dot{k}} \quad (48)$$

$$X_{f\dot{k}} \leq o_{f\dot{k}} (X_{f\dot{k}}) - v_{f\dot{k}} \quad \text{with } o_{f\dot{k}} (X_{f\dot{k}}) \geq v_{f\dot{k}} \quad (49)$$

$$x_{R\dot{a}} \leq o_{R\dot{a}} (x_{R\dot{a}}) - v_{R\dot{a}} \quad \text{with } o_{R\dot{a}} (x_{R\dot{a}}) \geq v_{R\dot{a}} \quad (50)$$

$$X_{R\dot{a}} \leq o_{R\dot{a}} (X_{R\dot{a}}) - v_{R\dot{a}} \quad \text{with } o_{R\dot{a}} (X_{R\dot{a}}) \geq v_{R\dot{a}} \quad (51)$$

$$x_{r\dot{a}} \leq v_{R\dot{a}} - u_{R\dot{a}} (x_{r\dot{a}}) \quad \text{with } v_{R\dot{a}} \geq u_{R\dot{a}} (x_{r\dot{a}}) \quad (52)$$

$$X_{r\dot{a}} \leq v_{R\dot{a}} - u_{R\dot{a}} (X_{r\dot{a}}) \quad \text{with } v_{R\dot{a}} \geq u_{R\dot{a}} (X_{r\dot{a}}) \quad (53)$$

If the commercial and tax accounting rules permit the recognition of any number of intermediate values, the above restrictions can be included in their present form in the optimization model. However, some accounting option groups are relevant only to the extent of their maximum value or in the amount of

0. This circumstance requires a modification of the restriction. This issue is particularly relevant to those accounting options that include the "recognition" or "no recognition" option. The solution of this problem is exemplified in the following by reference to the option group $x_{A\ddot{u}}$ in Equation (28):

$$[o_{A\ddot{u}} (x_{A\ddot{u}}) - v_{A\ddot{u}}] \cdot x_{A\ddot{u}} \leq o_{A\ddot{u}} (x_{A\ddot{u}}) - v_{A\ddot{u}} \quad \text{with} \quad (54)$$

$$x_{A\ddot{u}} \leq 1 \text{ (integer)} \quad (55)$$

The variable $x_{A\ddot{u}}$ is subject to the condition of being an integer. The variable $x_{A\ddot{u}}$ is also assigned to the coefficients of $o_{A\ddot{u}} (x_{A\ddot{u}}) - v_{A\ddot{u}}$ in the target function line and the other restriction lines of the simplex table. Therefore, there is only the option to

allocate the values of 0 or 1. This procedure ensures that the optimal solution under $x_{A\ddot{u}}$ can only take the values of 0 or 1. In the case of $x_{A\ddot{u}} = 1$, the amount of $o_{A\ddot{u}} (x_{A\ddot{u}})$ is fully result-effective. If there are also other option groups with similar restrictions, the

restriction approaches have to be modified analogously.

Now the decision-makers can use the available result-altering accounting options on the basis of the preliminary balance sheet values by using the formulated action parameter restrictions for the purpose of target-appropriate transformation of the financial statements. It is irrelevant in this context whether the decision-makers have already used accounting options to prepare the preliminary balance sheet because the impact of these decisions in the optimization models will either be retained or (partly) undone. However, the decision-makers need to know the legally permissible upper and lower commercial and tax limits to integrate them precisely into the optimization approaches. This approach could be supported by the integration of optimization models in accounting policy expert systems, which then assist

the users in their databases with commercial and tax legal commentaries (Freidank 1993, p. 312–323).

For example, there is the option to write off certain fixed assets on the basis of the straight-line method or on the basis of the depreciation method according to the expected use of the assets. In this case, the amount of the difference between the value already calculated in the preliminary financial statements with respect to the straight-line method and the higher expenses for using the depreciation method according to expected use of the assets is to include an option (Xa, Equation [31]) in the optimization models. If for the option group Xa there is only the option to choose between these two methods, then the relevant restrictions have to be formulated as indicated below. Here, $vAs - uAs (Xa)$ represents the higher possible volume of depreciation. This value must be determined by the decision-makers and recognized in the optimization calculations:

$$[vAs - uAs (Xa)] \cdot Xa \leq vAs - uAs (Xa) \text{ with} \quad (56)$$

$$Xa \leq 1 \text{ (integer)} \quad (57)$$

However, if for the option group Xa (Equation [31]) there is a further assessment alternative by which the lower limit of the fixed assets can be further reduced (e.g., even by a depreciation that is

permissible under commercial law), which allows for any number of intermediate values, then Xa is to divide into two subgroups ($GA = \text{integer values}$; $ZW = \text{intermediate values}$):

$$[vAs - uAs (XaGA)] \cdot Xa (GA) \leq vAs (XaGA) \text{ with} \quad (58)$$

$$Xa (GA) \leq 1 \text{ (integer)} \quad (59)$$

$$[vAs - uAs (XaZW)] \leq vAs - uAs (XaZW) \text{ with} \quad (60)$$

$$Xa = Xa (GA) + Xa (ZW) \quad (61)$$

In this case, the decision-makers have to recognize the maximum possible amount for the write-off ($XaZW$) as the input size in the optimization model. If there are also further individual options in this group or if there are other option groups with similar restrictions, the restriction approaches have to be modified analogously.

The determined accounting options regarding recognition, valuation, and discretion were allocated clearly to the variables of the target function. This procedure prevents interdependencies between the action parameters and allows one to separate the potential accounting option value into separate option groups. The structural variables of the optimization model show the necessary value of the maneuvering fund to reach the target-optimal financial statement. The slack variables of the optimal solution show the non-required value of the maneuvering fund regarding the action parameters employed as well as the latent reserves of the other restrictions included in the planning approach (e.g., key figures and balance sheet total).

Table 5 shows the complete formulated model approach with the balance sheet result as a target value. Here, the indices of the individual option groups are substituted by sequential numbering with $xA = x8$, $XA = x9$, ..., $xreinü = x47$ to adjust the structural variables to the data of the computational model. A similar approach is used for the restrictions, which were also provided from Y1 to Y64 with serial numbers. Conditions Y1 to Y7 contain restrictions required to recognize effective and deferred tax effects as well as management and supervisory board bonuses. Conditions Y8 to Y43 characterize the maneuvering fund, which is based on the individual accounting option groups. Conditions Y44 to Y64 contain the options regarding the appropriation of the result as well as the restriction on key figures or the balance sheet total (see below). The individual accounting option groups differ only in terms of the alternatives for which any number of intermediate values exist. If there are also option groups that find their optimal solution only in the maximum value or in the amount of 0, then the planning approaches have to

be modified as shown above. In this case, an option group includes at least two structural variables. Whereas the second variable is to be used for alternatives that may become part of the optimal solution at any intermediate value, the first variable of each group applies to the options that require an integer solution. The complete mixed-integer formulation is shown in its general form in Table 6 on the basis of the option groups xA (Equation [26]) and XA (Equation [27]), each of which involves two structural variables per group.

2.3.6 Restrictions on noncompliant options regarding the German generally accepted accounting principles

For the action parameters of group III (noncompliant options regarding the German generally accepted accounting principles), a cumulative determination of the available discretion margins is sufficient since they have no direct impact on the annual result and the structure of the annual financial statement. If tax-accounting options are only relevant to decision-making at their maximum value or at the value of 0, a modification of the restriction approach (IM [XI], im [Xi] = maximum increasing or decreasing opportunity for taxation purposes) is also required for these noncompliant options regarding the German generally accepted accounting principles.

$$XI \cdot IM(XI) \leq IM(XI) \text{ with} \quad (62)$$

$$XI \leq 1 \text{ (integer) and} \quad (63)$$

$$Xi \cdot im(Xi) \leq in(Xi) \text{ with} \quad (64)$$

$$Xi \leq 1 \text{ (integer)} \quad (65)$$

However, if there are additional alternatives for the two action parameters XI and Xi that permit any number of intermediate values, then the parameters XI and Xi or the maximum possible use of the tax

maneuvering funds must be split into two subgroups analogously to the commercial procedures described above in Sec. 2.3.5 (GA = integer values, ZW = intermediate values):

$$XI(GA) \cdot IM(XIGA) \leq IM(XIGA) \text{ with} \quad (66)$$

$$XI(GA) \leq 1 \text{ (integer) and} \quad (67)$$

$$XI(ZW) \leq IM(XIZW) \text{ in which case} \quad (68)$$

$$XI = XI(GA) + XI(ZW) \text{ applies and} \quad (69)$$

$$Xi(GA) \cdot in(XiGA) \leq in(XiGA) \text{ with} \quad (70)$$

$$Xi(GA) \leq 1 \text{ (integer) and} \quad (71)$$

$$Xi(ZW) \leq i(XiZW) \text{ in which case} \quad (72)$$

$$Xi = Xi(GA) + Xi(ZW) \text{ applies} \quad (73)$$

Table 5 shows the summarized optimization model. Here, we assume for restrictions Y36 and Y37

that there are many intermediate values for the variables XI and Xi.

Table 5. Optimization model

	XKSt	XGewSt	XLS	XLESTA	XLESTP	xTAvor	xTAauf
	x1	x2	x3	x4	x5	x6	x7
Z	-x1	-x2	$\pm x3$			-x6	-x7
Y1	x1					+sk·x6	+0,5·sk·x7
Y2		+x2				+sg·x6	+0,5·sg·x7
Y3			$\pm x3$	+x4	-x5		
Y4				+x4			
Y5					x5		
Y6	$(1-0,05 \cdot r) \cdot \text{avor} \cdot x1$	$+(1-0,05 \cdot r) \cdot \text{avor} \cdot x2$	$\pm(1-0,05 \cdot r) \cdot \text{avor} \cdot x3$			$+ [1+(1-0,05 \cdot r) \cdot \text{avor}] \cdot x6$	$+(1-0,05 \cdot r) \cdot \text{avor} \cdot x7$
Y7	$(1-\text{dm}) \cdot (1-0,05 \cdot r) \cdot \text{aauf} \cdot x1$	$+(1-\text{dm}) \cdot (1-0,05 \cdot r) \cdot \text{aauf} \cdot x2$	$\pm(1-\text{dm}) \cdot (1-0,05 \cdot r) \cdot \text{aauf} \cdot x3$			$+(1-\text{dm}) \cdot (1-0,05 \cdot r) \cdot \text{aauf} \cdot x6$	$+[1+(1-\text{dm}) \cdot (1-0,05 \cdot r) \cdot \text{aauf}] \cdot x7$
Y8							
Y9							
Y10							
Y11							
Y12							
Y13							
Y14							
Y15							
Y16							
Y17							
Y18							
Y19							
Y20							
Y21							
Y22							
Y23							
Y24							
Y25							
Y26							
Y27							
Y28							
Y29							
Y30							
Y31							
Y31							
Y33							
Y34							
Y35							
Y36							
Y37							
Y38							
Y39							
Y40							
Y41							
Y42							
Y43							
Y44	$r \cdot 0,05 \cdot x1$	$+r \cdot 0,05 \cdot x2$	$\pm r \cdot 0,05 \cdot x3$			$+r \cdot 0,05 \cdot x6$	$+r \cdot 0,05 \cdot x7$
Y45							
Y46	$-\text{dm} \cdot (1+r \cdot 0,05) \cdot x1$	$-\text{dm} \cdot (1+r \cdot 0,05) \cdot x2$	$\pm \text{dm} \cdot (1+r \cdot 0,05) \cdot x3$			$-\text{dm} \cdot (1+r \cdot 0,05) \cdot x6$	$-\text{dm} \cdot (1+r \cdot 0,05) \cdot x7$
Y47							
Y48							
Y49				-b·x4			
Y50	c·x1	+c·x2		$+(1-c) \cdot x4$	+c·x5	+c·x6	+c·x7
Y51				-d·x4			
Y52	x1	+x2		-e·x4	+x5	+x6	+x7
Y53							
Y54	g·x1	+g·x2		-g·x4	+g·x5	+g·x6	+g·x7
Y55	h·x1	+h·x2		-h·x4	+h·x5	+h·x6	+h·x7
Y56	x1	+x2			+x5	+x6	+x7
Y57	$-(1-j) \cdot x1$	$-(1-j) \cdot x2$	$\pm j \cdot x3$	+x4	-x5	$-(1-j) \cdot x6$	$-(1-j) \cdot x7$
Y58						$-(1-k) \cdot x6$	$-(1-k) \cdot x7$
Y59	l·x1	+l·x2	$\pm l \cdot x3$	+x4		+l·x6	+l·x7
Y60						+m·x6	+m·x7
Y61	n·x1	+n·x2	$\pm n \cdot x3$			+n·x6	+n·x7
Y62	-x1	-x2		+x4	-x5	-x6	-x7
Y63	$(p-1) \cdot x1$	$+(p-1) \cdot x2$	$\pm p \cdot x3$	+x4	-x5	$+(p-1) \cdot x6$	$+(p-1) \cdot x7$
Y64				x4			
Y65	-x1	-x2	$\pm x3$			-x6	-x7

Table 5. Optimization model (continued)

	xA	XA	xAü	XAü	xa	Xa
	x8	x9	x10	x11	x12	x13
Z	+x8	+x9	+x10	+x11	-x12	-x13
Y1		-sk·x9		-sk·x11		+sk·x13
Y2		-sg·x9		-sg·x11		+sg·x13
Y3						
Y4	+s·x8		+s·x10		-s·x12	
Y5	-s·x8		-s·x10		+s·x12	
Y6	-(1-0,05·r)·avor·x8	-(1-0,05·r)·avor·x9	-(1-0,05·r)·avor·x10	-(1-0,05·r)·avor·x11	+(1-0,05·r)·avor·x12	+(1-0,05·r)·avor·x13
Y7	-(1-dm)·(1-0,05·r)·aauf·x8	-(1-dm)·(1-0,05·r)·aauf·x9	-(1-dm)·(1-0,05·r)·aauf·x10	-(1-dm)·(1-0,05·r)·aauf·x11	+(1-dm)·(1-0,05·r)·aauf·x12	+(1-dm)·(1-0,05·r)·aauf·x13
Y8	x8					
Y9		x9				
Y10			x10			
Y11				x11		
Y12					x12	
Y13						x13
Y14						
Y15						
Y16						
Y17						
Y18						
Y19						
Y20						
Y21						
Y22						
Y23						
Y24						
Y25						
Y26						
Y27						
Y28						
Y29						
Y30						
Y31						
Y31						
Y33						
Y34						
Y35						
Y36						
Y37						
Y38						
Y39						
Y40						
Y41						
Y42						
Y43						
Y44	-r·0,05·x8	-r·0,05·x9	-r·0,05·x10	-r·0,05·x11	+r·0,05·x12	+r·0,05·x13
Y45						
Y46	+dm·(1-r·0,05)·x8	+dm·(1-r·0,05)·x9	+dm·(1-r·0,05)·x10	+dm·(1-r·0,05)·x11	-dm·(1+r·0,05)·x12	-dm·(1+r·0,05)·x13
Y47		-(1-s)·x9		-(1-s)·x11		+(1-s)·x13
Y48	x8	+x9	+x10	+x11	-x12	-x13
Y49	+(1-b)·x8	+(1-b)·x9	+(1-b)·x10	+(1-b)·x11	-(1-b)·x12	-(1-b)·x13
Y50	+(1-c)·x8	+(1-c)·x9	+(1-c)·x10	+(1-c)·x11	-(1-c)·x12	-(1-c)·x13
Y51	-d·x8	-d·x9	-d·x10	-d·x11	+d·x12	+d·x13
Y52	-e·x8	-e·x9	-e·x10	-e·x11	+e·x12	+e·x13
Y53	x8	+x9	+x10	+x11	-x12	-x13
Y54	+(1-g)·x8	+(1-g)·x9	+(1-g)·x10	+(1-g)·x11	-(1-g)·x12	-(1-g)·x13
Y55	+(1-h)·x8	+(1-h)·x9	+(1-h)·x10	+(1-h)·x11	-(1-h)·x12	-(1-h)·x13
Y56						
Y57	+(1-j)·x8	+(1-j)·x9	+(1-j)·x10	+(1-j)·x11	-(1-j)·x12	-(1-j)·x13
Y58	+(1-k)·x8	+(1-k)·x9	+(1-k)·x10	+(1-k)·x11	-(1-k)·x12	-(1-k)·x13
Y59	+(1-l)·x8	+(1-l)·x9	+(1-l)·x10	+(1-l)·x11	-(1-l)·x12	-(1-l)·x13
Y60	+(1-m)·x8	+(1-m)·x9	+(1-m)·x10	+(1-m)·x11	-(1-m)·x12	-(1-m)·x13
Y61	n·x8	n·x9	-n·x10	-n·x11	+n·x12	+n·x13
Y62	+x8	+x9	+x10	+x11	-x12	-x13
Y63	+(1-p)·x8	+(1-p)·x9	+(1-p)·x10	+(1-p)·x11	+(p-1)·x12	+(p-1)·x13
Y64	+x8	+x9	+x10	+x11	-x12	-x13
Y65	+x8	+x9	+x10	+x11	-x12	-x13

Table 5. Optimization model (continued)

	$x_{a\ddot{u}}$	$X_{a\ddot{u}}$	x_U	X_U	$x_{U\ddot{u}}$	$X_{U\ddot{u}}$
	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}
Z	-x14	-x15	+x16	+x17	+x18	+x19
Y1		sk·x15		-sk·x17		-sk·x19
Y2		sg·x15		-sg·x17		-sg·x19
Y3						
Y4	-s·x14		+s·x16		+s·x18	
Y5	+s·x14		-s·x16		-s·x18	
Y6	$+(1-0,05\cdot r)\cdot \text{avor}\cdot x_{14}$	$+(1-0,05\cdot r)\cdot \text{avor}\cdot x_{15}$	$-(1-0,05\cdot r)\cdot \text{avor}\cdot x_{16}$	$-(1-0,05\cdot r)\cdot \text{avor}\cdot x_{17}$	$-(1-0,05\cdot r)\cdot \text{avor}\cdot x_{18}$	$-(1-0,05\cdot r)\cdot \text{avor}\cdot x_{19}$
Y7	$+(1\text{-dm})\cdot (1-0,05\cdot r)\cdot \text{aauf}\cdot x_{14}$	$+(1\text{-dm})\cdot (1-0,05\cdot r)\cdot \text{aauf}\cdot x_{15}$	$-(1\text{-dm})\cdot (1-0,05\cdot r)\cdot \text{aauf}\cdot x_{16}$	$-(1\text{-dm})\cdot (1-0,05\cdot r)\cdot \text{aauf}\cdot x_{17}$	$-(1\text{-dm})\cdot (1-0,05\cdot r)\cdot \text{aauf}\cdot x_{18}$	$-(1\text{-dm})\cdot (1-0,05\cdot r)\cdot \text{aauf}\cdot x_{19}$
Y8						
Y9						
Y10						
Y11						
Y12						
Y13						
Y14	x14					
Y15		x15				
Y16			x16			
Y17				x17		
Y18					x18	
Y19						x19
Y20						
Y21						
Y22						
Y23						
Y24						
Y25						
Y26						
Y27						
Y28						
Y29						
Y30						
Y31						
Y31						
Y33						
Y34						
Y35						
Y36						
Y37						
Y38						
Y39						
Y40						
Y41						
Y42						
Y43						
Y44	+r·0,05·x14	+r·0,05·x15	-r·0,05·x16	-r·0,05·x17	-r·0,05·x18	-r·0,05·x19
Y45						
Y46	-dm·(1+r·0,05)·x14	-dm·(1+r·0,05)·x15	+dm·(1-r·0,05)·x16	+dm·(1-r·0,05)·x17	+dm·(1-r·0,05)·x18	+dm·(1-r·0,05)·x19
Y47		+(1-s)·x15		-(1-s)·x17		-(1-s)·x19
Y48	-x14	-x15	-a·x16	-a·x17	-a·x18	-a·x19
Y49	-(1-b)·x14	-(1-b)·x15	-b·x16	-b·x17	-b·x18	-b·x19
Y50	-(1-c)·x14	-(1-c)·x15	+(1-c)·x16	+(1-c)·x17	+(1-c)·x18	+(1-c)·x19
Y51	+d·x14	+d·x15	-d·x16	-d·x17	-d·x18	-d·x19
Y52	+e·x14	+e·x15	-e·x16	-e·x17	-e·x18	-e·x19
Y53	-x14	-x15				
Y54	-(1-g)·x14	-(1-g)·x15	-g·x16	-g·x17	-g·x18	-g·x19
Y55	-(1-h)·x14	-(1-h)·x15	+(1-h)·x16	+(1-h)·x17	-h·x18	-h·x19
Y56			-i·x16	-i·x17	-i·x18	-i·x19
Y57	-(1-j)·x14	-(1-j)·x15	+(1-j)·x16	+(1-j)·x17	+(1-j)·x18	+(1-j)·x19
Y58	-(1-k)·x14	-(1-k)·x15	+(1-k)·x16	+(1-k)·x17	+(1-k)·x18	+(1-k)·x19
Y59	-(1-l)·x14	-(1-l)·x15	+(1-l)·x16	+(1-l)·x17	+(1-l)·x18	+(1-l)·x19
Y60	-(1-m)·x14	-(1-m)·x15	+(1-m)·x16	+(1-m)·x17	+(1-m)·x18	+(1-m)·x19
Y61	+n·x14	+n·x15	-n·x16	-n·x17	-n·x18	-n·x19
Y62	-x14	-x15	+x16	+x17	+x18	+x19
Y63	+(p-1)·x14	+(p-1)·x15	+(1-p)·x16	+(1-p)·x17	+(1-p)·x18	+(1-p)·x19
Y64	-x14	-x15	+x16	+x17	+x18	+x19
Y65	-x14	-x15	+x16	+x17	+x18	+x19

Table 5. Optimization model (continued)

	xu	Xu	xuü	Xuü	xFl	XFl
	x20	x21	x22	x23	x24	x25
Z	-x20	-x21	-x22	-x23	+x24	+x25
Y1		+sk·x21		+sk·x23		-sk·x25
Y2		+sg·x21		+sg·x23		-sg·x25
Y3						
Y4	-s·x20		-s·x22		+s·x24	
Y5	+s·x20		+s·x22		-s·x24	
Y6	$+(1-0,05\cdot r)\cdot \text{avor}\cdot x20$	$+(1-0,05\cdot r)\cdot \text{avor}\cdot x21$	$+(1-0,05\cdot r)\cdot \text{avor}\cdot x22$	$+(1-0,05\cdot r)\cdot \text{avor}\cdot x23$	$-(1-0,05\cdot r)\cdot \text{avor}\cdot x24$	$-(1-0,05\cdot r)\cdot \text{avor}\cdot x25$
Y7	$+(1-\text{dm})\cdot (1-0,05\cdot r)\cdot \text{aauf}\cdot x20$	$+(1-\text{dm})\cdot (1-0,05\cdot r)\cdot \text{aauf}\cdot x21$	$+(1-\text{dm})\cdot (1-0,05\cdot r)\cdot \text{aauf}\cdot x22$	$+(1-\text{dm})\cdot (1-0,05\cdot r)\cdot \text{aauf}\cdot x23$	$-(1-\text{dm})\cdot (1-0,05\cdot r)\cdot \text{aauf}\cdot x24$	$-(1-\text{dm})\cdot (1-0,05\cdot r)\cdot \text{aauf}\cdot x25$
Y8						
Y9						
Y10						
Y11						
Y12						
Y13						
Y14						
Y15						
Y16						
Y17						
Y18						
Y19						
Y20	x20					
Y21		x21				
Y22			x22			
Y23				x23		
Y24					x24	
Y25						x25
Y26						
Y27						
Y28						
Y29						
Y30						
Y31						
Y31						
Y33						
Y34						
Y35						
Y36						
Y37						
Y38						
Y39						
Y40						
Y41						
Y42						
Y43						
Y44	$+r\cdot 0,05\cdot x20$	$+r\cdot 0,05\cdot x21$	$+r\cdot 0,05\cdot x22$	$+r\cdot 0,05\cdot x23$	$-r\cdot 0,05\cdot x24$	$-r\cdot 0,05\cdot x25$
Y45						
Y46	$-\text{dm}\cdot (1+r\cdot 0,05)\cdot x20$	$-\text{dm}\cdot (1+r\cdot 0,05)\cdot x21$	$-\text{dm}\cdot (1+r\cdot 0,05)\cdot x22$	$-\text{dm}\cdot (1+r\cdot 0,05)\cdot x23$	$+\text{dm}\cdot (1-r\cdot 0,05)\cdot x24$	$+\text{dm}\cdot (1-r\cdot 0,05)\cdot x25$
Y47		$+(1-s)\cdot x21$		$+(1-s)\cdot x23$		$+(1-s)\cdot x25$
Y48	$+a\cdot x20$	$+a\cdot x21$	$+a\cdot x22$	$+a\cdot x23$		
Y49	$+b\cdot x20$	$+b\cdot x21$	$+b\cdot x22$	$+b\cdot x23$		
Y50	$-(1-c)\cdot x20$	$-(1-c)\cdot x21$	$-(1-c)\cdot x22$	$-(1-c)\cdot x23$	$-c\cdot x24$	$-c\cdot x25$
Y51	$+d\cdot x20$	$+d\cdot x21$	$+d\cdot x22$	$+d\cdot x23$	$-x24$	$-x25$
Y52	$+e\cdot x20$	$+e\cdot x21$	$+e\cdot x22$	$+e\cdot x23$		
Y53					$+f\cdot x24$	$+f\cdot x25$
Y54	$+g\cdot x20$	$+g\cdot x21$	$+g\cdot x22$	$+g\cdot x23$	$-g\cdot x24$	$-g\cdot x25$
Y55	$-(1-h)\cdot x20$	$-(1-h)\cdot x21$	$+h\cdot x22$	$+h\cdot x23$		
Y56	$+i\cdot x20$	$+i\cdot x21$	$+i\cdot x22$	$+i\cdot x23$		
Y57	$-(1-j)\cdot x20$	$-(1-j)\cdot x21$	$-(1-j)\cdot x22$	$-(1-j)\cdot x23$	$+(1-j)\cdot x24$	$+(1-j)\cdot x25$
Y58	$-(1-k)\cdot x20$	$-(1-k)\cdot x21$	$-(1-k)\cdot x22$	$-(1-k)\cdot x23$	$+(1-k)\cdot x24$	$+(1-k)\cdot x25$
Y59	$-(1-l)\cdot x20$	$-(1-l)\cdot x21$	$-(1-l)\cdot x22$	$-(1-l)\cdot x23$	$-l\cdot x24$	$-l\cdot x25$
Y60	$-(1-m)\cdot x20$	$-(1-m)\cdot x21$	$-(1-m)\cdot x22$	$-(1-m)\cdot x23$	$-m\cdot x24$	$-m\cdot x25$
Y61	$+n\cdot x20$	$+n\cdot x21$	$+n\cdot x22$	$+n\cdot x23$	$-n\cdot x24$	$-n\cdot x25$
Y62	-x20	-x21	-x22	-x23	+x24	+x25
Y63	$+(p-1)\cdot x20$	$+(p-1)\cdot x21$	$+(p-1)\cdot x22$	$+(p-1)\cdot x23$	$+(1-p)\cdot x24$	$+(1-p)\cdot x25$
Y64	-x20	-x21	-x22	-x23	+x24	+x25
Y65	-x20	-x21	-x22	-x23	+x24	+x25

Table 5. Optimization model (continued)

	xFk	XFk	xfl	Xfl	xfk	Xfk
Z	x26	x27	x28	x29	x30	x31
Y1	+x26	+x27	-x28	-x29	-x30	-x31
Y2		-sk·x27		+sk·x29		+sk·x31
Y3		-sg·x27		+sg·x29		+sg·x31
Y4	+s·x26		-s·x28		-s·x30	
Y5	-s·x26		+s·x28		+s·x30	
Y6	-(1-0,05·r)·avor·x26	-(1-0,05·r)·avor·x27	+(1-0,05·r)·avor·x28	+(1-0,05·r)·avor·x29	+(1-0,05·r)·avor·x30	+(1-0,05·r)·avor·x31
Y7	-(1-dm)·(1-0,05·r)·aauf·x26	-(1-dm)·(1-0,05·r)·aauf·x27	+(1-dm)·(1-0,05·r)·aauf·x28	+(1-dm)·(1-0,05·r)·aauf·x29	+(1-dm)·(1-0,05·r)·aauf·x30	+(1-dm)·(1-0,05·r)·aauf·x31
Y8						
Y9						
Y10						
Y11						
Y12						
Y13						
Y14						
Y15						
Y16						
Y17						
Y18						
Y19						
Y20						
Y21						
Y22						
Y23						
Y24						
Y25						
Y26	x26					
Y27		x27				
Y28			x28			
Y29				x29		
Y30					x30	
Y31						x31
Y32						
Y33						
Y34						
Y35						
Y36						
Y37						
Y38						
Y39						
Y40						
Y41						
Y42						
Y43						
Y44	-r·0,05·x26	-r·0,05·x27	+r·0,05·x28	+r·0,05·x29	+r·0,05·x30	+r·0,05·x31
Y45						
Y46	+dm·(1-r·0,05)·x26	+dm·(1-r·0,05)·x27	-dm·(1+r·0,05)·x28	-dm·(1+r·0,05)·x29	-dm·(1+r·0,05)·x30	-dm·(1+r·0,05)·x31
Y47		+(1-s)·x27		-(1-s)·x29		-(1-s)·x31
Y48						
Y49						
Y50	-c·x26	-c·x27	+c·x28	+c·x29	+c·x30	+c·x31
Y51			+x28	+x29		
Y52	-x26	-x27			+x30	+x31
Y53			-f·x28	-f·x29		
Y54	-g·x26	-g·x27	+g·x28	+g·x29	+g·x30	+g·x31
Y55	-h·x26	-h·x27			+h·x30	+h·x31
Y56	-x26	-x27			+x30	+x31
Y57	+(1-j)·x26	+(1-j)·x27	-(1-j)·x28	-(1-j)·x29	-(1-j)·x30	-(1-j)·x31
Y58	+(1-k)·x26	-(1-k)·x27	-(1-k)·x28	-(1-k)·x29	-(1-k)·x30	-(1-k)·x31
Y59	-l·x26	-l·x27	+l·x28	+l·x29	+l·x30	+l·x31
Y60	-m·x26	-m·x27	+m·x28	+m·x29	+m·x30	+m·x31
Y61	-n·x26	-n·x27	+n·x28	+n·x29	+n·x30	+n·x31
Y62	+x26	+x27	-x28	-x29	-x30	-x31
Y63	+(1-p)·x26	+(1-p)·x27	+(p-1)·x28	+(p-1)·x29	+(p-1)·x30	+(p-1)·x31
Y64	+x26	+x27	-x28	-x29	-x30	-x31
Y65	+x26	+x27	-x28	-x29	-x30	-x31

Table 5. Optimization model (continued)

	xRa	XRa	xra	Xra	XI	Xi	xGV
Z	x32	x33	x34	x35	x36	x37	x38
	+x32	+x33	-x34	-x35			x38
Y1		-sk·x33		+sk·x35	-sk·x36	+sk·x37	
Y2		-sg·x33		+sg·x35	-sg·x36	+sg·x37	
Y3							
Y4	+s·x32		-s·x34		+s·x36	-s·x37	
Y5	-s·x32		+s·x34		-s·x36	+s·x37	
Y6	-(1-0,05·r)·avor·x32	-(1-0,05·r)·avor·x33	+(1-0,05·r)·avor·x34	+(1-0,05·r)·avor·x35			
Y7	-(1-dm)·(1-0,05·r)·aauf·x32	-(1-dm)·(1-0,05·r)·aauf·x33	+(1-dm)·(1-0,05·r)·aauf·x34	+(1-dm)·(1-0,05·r)·aauf·x35			-aauf·x38
Y8							
Y9							
Y10							
Y11							
Y12							
Y13							
Y14							
Y15							
Y16							
Y17							
Y18							
Y19							
Y20							
Y21							
Y22							
Y23							
Y24							
Y25							
Y26							
Y27							
Y28							
Y29							
Y30							
Y31							
Y31	x32						
Y33		x33					
Y34			x34				
Y35				x35			
Y36					x36		
Y37						x37	
Y38							x38
Y39							
Y40							
Y41							
Y42							
Y43							
Y44	-r·0,05·x32	-r·0,05·x33	+r·0,05·x34	+r·0,05·x35			
Y45							
Y46	+dm·(1-r·0,05)·x32	+dm·(1-r·0,05)·x33	-dm·(1+r·0,05)·x34	-dm·(1+r·0,05)·x35			
Y47					+(1-s)·x36	-(1-s)·x37	
Y48							
Y49	-b·x32	-b·x33	+b·x34	+b·x35			
Y50	+(1-c)·x32	+(1-c)·x33	-(1-c)·x34	-(1-c)·x35			
Y51	-d·x32	-d·x33	+d·x34	+d·x35			
Y52							
Y53							
Y54	-g·x32	-g·x33	+g·x34	+g·x35			
Y55	-h·x32	-h·x33	+h·x34	+h·x35			
Y56							
Y57	+(1-j)·x32	+(1-j)·x33	-(1-j)·x34	-(1-j)·x35			
Y58	+(1-k)·x32	+(1-k)·x33	-(1-k)·x34	-(1-k)·x35			
Y59	+(1-l)·x32	+(1-l)·x33	-(1-l)·x34	-(1-l)·x35			
Y60	+(1-m)·x32	+(1-m)·x33	-(1-m)·x34	-(1-m)·x35			
Y61	-n·x32	-n·x33	+n·x34	+n·x35			
Y62	+x32	+x33	-x34	-x35			
Y63	+(1-p)·x32	+(1-p)·x33	+(p-1)·x34	+(p-1)·x35			-p·x38
Y64	+x32	+x33	-x34	-x35			
Y65	+x32	+x33	-x34	-x35			+x38

Table 5. Optimization model (continued)

	xvv	xRENTK	xRENTG	xRENTS	xRENTAG	xreing	xreins	xreina	xreinü
Z	x39	x40	x41	x42	x43	x44	x45	x46	x47
Y1	-x39	+x40	+x41	+x42	+x43	-x44	-x45	-x46	-x47
Y2									
Y3									
Y4									
Y5									
Y6	$-(0,05 \cdot r - 1) \cdot \text{avor} \cdot x39$						+avor · x45		
Y7	$-(1 - \text{dm}) \cdot (0,05 \cdot r - 1) \cdot \text{auf} \cdot x39$	-auf · x40	-auf · x41	-auf · x42	-auf · x43		+auf · x45		+auf · x47
Y8									
Y9									
Y10									
Y11									
Y12									
Y13									
Y14									
Y15									
Y16									
Y17									
Y18									
Y19									
Y20									
Y21									
Y22									
Y23									
Y24									
Y25									
Y26									
Y27									
Y28									
Y29									
Y30									
Y31									
Y31									
Y33									
Y34									
Y35									
Y36									
Y37									
Y38									
Y39	x39								
Y40		x40							
Y41			x41						
Y42				x42					
Y43					x43				
Y44	+r · 0,05 · x39					x44			
Y45							x45		
Y46	-dm · (1+r · 0,05) · x39							-x46	
Y47									x47
Y48									
Y49									
Y50									
Y51									
Y52									
Y53									
Y54									
Y55									
Y56									
Y57									
Y58									
Y59									
Y60									
Y61									
Y62			+o · x41	+o · x42	+o · x43	-o · x44	-o · x45	-o · x46	-o · x47
Y63	+p · x39	-p · x40	-p · x41	-p · x42	-p · x43	+p · x44	+p · x45	+p · x46	+p · x47
Y64									
Y65	-x39	+x40	+x41	+x42	+x43	-x44	-x45	-x46	-x47

Table 5. Optimization model (continued)

	RS
Z	=sBI-vJvor
Y1	=sk-(vJvor±ka*)
Y2	=sg-(vJvor±ka*+Vk±ga)
Y3	=LESTPvor+LESTAvor
Y4	=s·AD+ΣKVvor5-sk+ΣGVvor5-sg
Y5	=s·PD
Y6	=(1-0,05·r)·avor-vJvor+(r-1)·avor-reinn
Y7	=(1-dm)·(1-0,05·r)·aauf-vJvor+[(dm-1)·(1-r)·reinn-0,04·Aus]·aauf
Y8	≤oAs(x8)-vAs
Y9	≤oAs(x9)-vAs
Y10	≤oAü(x10)-vAü
Y11	≤oAü(x11)-vAü
Y12	≤vAs-uAs(x12)
Y13	≤vAs-uAs(x13)
Y14	≤vAü-uAü(x14)
Y15	≤vAü-uAü(x15)
Y16	≤oUv(x16)-vUv
Y17	≤oUv(x17)-vUv
Y18	≤oUü(x18)-vUü
Y19	≤oUü(x19)-vUü
Y20	≤vUv-uUv(x20)
Y21	≤vUv-uUv(x21)
Y22	≤vUü-uUü(x22)
Y23	≤vUü-uUü(x23)
Y24	≤vFl-uFl(x24)
Y25	≤vFl-uFl(x25)
Y26	≤vFk-uFk(x26)
Y27	≤vFk-uFk(x27)
Y28	≤oFl(x28)-vFl
Y29	≤oFl(x29)-vFl
Y30	≤oFk(x30)-vFk
Y31	≤oFk(x31)-vFk
Y31	≤oRa(x32)-vRa
Y33	≤oRa(x33)-vRa
Y34	≤vRa-uRa(x34)
Y35	≤vRa-uRa(x35)
Y36	≤l(x36)
Y37	≤l(x37)
Y38	≤vGV-uGV(x38)
Y39	≤vVV-uVV(x39)
Y40	≤vK-uK(x40)
Y41	≤vG-uG(x41)
Y42	≤vS-uS(x42)
Y43	≤vAG-uAG(x43)
Y44	=r·0,05·vJvor+ (1-r)·reinn
Y45	=reins
Y46	=dm-[(1-r)·reinn-(1-r·0,05)·vJvor]
Y47	≤(1-s)·(vZ+vP)
Y48	≤a·vU-vA
Y49	≤b·(vA+vU+vRa)-vA
Y50	≤(c-1)·(vA+vU+vRa)-c·(vFl+vFk-vKSt-vGewSt-vLESTP-vTAvor-vTAauf)
Y51	≤d·(vA+vU+vRa)-vFl
Y52	≤e·(vA+vU+vRa)-(vFk-vKSt-vGewSt-vLESTP-vTAvor-vTAauf)
Y53	≤f·vFl-vA
Y54	≤g·(vU+vRa-vFl-vFk+vKSt+vGewSt+vLESTP+vTAvor+vTAauf)-(1-g)·vA
Y55	≤h·(vA+vU+vRa-vFk+vKSt+vGewSt+vLESTP+vTAvor+vTAauf)-(vA+vUv)
Y56	≤i·vU-(vFk-vKSt-vGewSt-vLESTP-vTAvor-vTAauf)
Y57	≤j·vJvor-(vA+vU+vRa-vFl-vFk+vKSt+vGewSt+vLESTP+vTAvor+vTAauf)
Y58	≤k·vJvor-(vA+vU+vRa-vFl-vFk+vKSt+vGewSt+vLESTP+vTAvor+vTAauf)
Y59	≤l·vJvor-(vA+vU+vRa)
Y60	≤m·vJvor-(vA+vU+vRa)
Y61	≤n·vJvor
Y62	≤o·(vS+vG+vAG)-(vA+vU+vRa-vFl-vFk+vKSt+vGewSt+vLESTP+vTAvor+vTAauf)
Y63	≤p·vJvor-(vA+vU+vRa-vFl-vFk+vKSt+vGewSt+vLESTP+vTAvor+vTAauf)
Y64	≤BS-(vA+vU+vRa+vLESTA)
Y65	≤sBI-vJvor

Table 6. Structure of the mixed-integer optimization approach

		x_A (GA)	x_A (ZW)	X_A (GA)	X_A (ZW)		RS
Z	...	$[oAs(xAGA) - vAs] \cdot x_A$ (GA)	$+ x_A$ (ZW)	$+ [oAs(XAGA) - vAs] \cdot X_A$ (GA)	$+ X_A$ (ZW)	...	$= SBI - vJvor$
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
$Y(xAGA)$	...	$[oAs(xAGA) - vAs] \cdot x_A$ (GA)				...	$\leq oAs(xAGA) - vAs$
$Y(xAZW)$	...		x_A (ZW)			...	$\leq oAs(xAZW) - vAs$
$Y(XAGA)$	...			$[oAs(XAGA) - vAs] \cdot X_A$ (GA)		...	$\leq oAs(XAGA) - vAs$
$Y(XAZW)$	...				X_A (ZW)	...	$\leq oAs(XAZW) - vAs$
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
$Y(a)$	.	$[oAs(xAGA) - vAs] \cdot x_A$ (GA)	$+ x_A$ (ZW)	$+ [oAs(XAGA) - vAs] \cdot X_A$ (GA)	$+ X_A$ (ZW)	.	$\leq a \cdot vU - vA$
$Y(b)$	.	$(1 - b) \cdot [oAs(xAGA) - vAs] \cdot x_A$ (GA)	$+ (1 - b) \cdot x$ (ZW)	$+ (1 - b) \cdot [oAs(XAGA) - vAs] \cdot X_A$ (GA)	$+ (1 - b) \cdot X_A$ (ZW)	.	$\leq b \cdot (vA + vU + vRa) - vA$
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.

2.3.7 Restrictions on the action parameters that draw on results

The following action parameters for the disposition of the result are included in the optimization models that

are based on the commercial balance sheet for stock corporations after partial allocation of the annual result (sec. 268[1] HBG in conjunction with sec. 279[2] HGB) and transfer of the annual result to the balance sheet result (sec. 158[1] AktG).

Table 7. Action parameters for the disposition of the result

1.	Target annual result	sJnach
2.	+ Profit carried forward from the preceding year	xGV
3.	– Loss carried forward from the preceding year	xvv
4.	+ Withdrawals from capital reserves	xRENTK
5.	+ Withdrawals from legal reserves	xRENTG
6.	+ Withdrawals from statutory reserves	xRENTS
7.	+ Withdrawals from other retained earnings	xRENTAG
8.	– Transfers to the legal reserves pursuant to sec. 150(2) AktG	xreing
9.	– Transfers to the statutory reserves pursuant to the articles of association	xreins
10.	– Transfers to other retained earnings pursuant to sec. 58(2) AktG	xreina
11.	– Other transfers to other retained earnings pursuant to sec. 58(2a) AktG	xreinü
12.	= Target balance sheet result	sBI

The decision-makers can decide in accordance with legal and statutory rules if and to what extent profits or losses carried forward from preceding years and withdrawals from or transfers to reserves are

required and admissible. In the case of options, they can be used in the context of accounting policy to reach the target balance sheet result. Accordingly, the following applies:

$$xGV \leq vGV - uGV \quad (xGV) \quad \text{with } vGV \geq uGV \quad (xGV) \quad (74)$$

$$xvv \leq vVV - uVV \quad (xvv) \quad \text{with } vVV \geq uVV \quad (xvv) \quad (75)$$

$$xRENTK \leq vK - uK \quad (xRENTK) \quad \text{with } vK \geq uK \quad (xRENTK) \quad (76)$$

$$xRENTG \leq vG - uG \quad (xRENTG) \quad \text{with } vG \geq uG \quad (xRENTG) \quad (77)$$

$$xRENTS \leq vS - uS \quad (xRENTS) \quad \text{with } vS \geq uS \quad (xRENTS) \quad (78)$$

$$xRENTAG \leq vAG - uAG \quad (xRENTAG) \quad \text{with } vAG \geq uAG \quad (xRENTAG) \quad (79)$$

If the legal or statutory provisions (Freidank and Velte 2013, p. 770–786) allow the use of any number of intermediate values, there are no objections to including the six restrictions in the above form in the optimization models (see restrictions Y38 to Y43 in Table 5). In these cases, the possible or required minimum values have to be entered into the model. If action parameters should not have an impact on the target balance sheet result due to legal or statutory provisions or because of accounting policy decisions, the minimum values have to be entered in the optimization models for the provisional balance sheet values of the profits or losses carried forward and reserves. For example, one is not allowed to make withdrawals from the legal reserves in the event of a net annual loss if profit has been carried forward from the previous year or if other retained earnings are available for reversal. However, if only certain amounts of these components have to or should be

included in the target balance sheet result, the corresponding restrictions must be expressed as = conditions. For example, there is a legal obligation to loss repayment if there is a sufficient profit for the year. In this case, the bottom limit of the commercial loss carried forward from the previous year [uVV (xvv)] must be 0, which means that the total loss carried forward is set off at the expense of the balance sheet result. If the company is planning to distribute the other retained earnings (or a specific part), it is to proceed analogously.

In regard to those action parameters that affect the transfers to the retained earnings, there is a dependency of these accounting options to the annual result, which must be taken into consideration for formulating the respective restrictions. The provisions of sec. 150(2) AktG must be observed regarding the limits for transfers to the legal reserve (see Sec. 2.3.4 and restriction Y44 in Table 5)

$$-r \cdot 0.05 \cdot (-XKSt - XGewSt \pm XLS - xTAvor - xTAAuf + xM - xm + XM - Xm - xvv) + xreing = r \cdot 0.05 \cdot vJvor + (1 - r) \cdot reinn \quad (80)$$

Statutory reserves pursuant to the articles of association must be formed from the net annual profit in accordance with the agreement defined in the articles of association by the management board at the expense of the balance sheet profit. Based on the

assumption that the envisaged transfer value of the reserves required in terms of the articles of association is defined in the articles of association (reins), then the following restriction applies (see restriction Y45 in Table 5):

$$xreins = reins \quad (81)$$

With regard to the transfer to the other retained earnings (sec. 58[2] AktG), the following restriction applies in the case of the adoption of the annual financial statement by the management board and the supervisory board and provided that the special case

of a deviating authorization in the articles of association regarding the disposal of the management board pursuant to sec. 58(2), sent. 2 and 3 AktG is not taken into consideration:

$$-dm \cdot [(1 + r \cdot 0.05) \cdot XKSt - (1 + r \cdot 0.05) \cdot XGewSt \pm (1 + r \cdot 0.05) \cdot XLS - (1 + r \cdot 0.05) \cdot TAvor - (1 + r \cdot 0.05) \cdot TAAuf + (1 - r \cdot 0.05) \cdot xM - (1 + r \cdot 0.05) \cdot xm + (1 - r) \cdot XM - (1 + r \cdot 0.05) \cdot Xm - (1 + r \cdot 0.05) \cdot xv] + xreina = dm \cdot [(1 - r) \cdot reinn - (1 - r \cdot 0.05) \cdot vJvor] \quad (82)$$

The transfer to other retained earnings (xreinü) is based on the provisions of sec. 58(2a) AktG. According to this section, the management board and the supervisory board may enter the equity share of tax-related appreciation in value in the case of fixed and current assets as well as liabilities that have been formed as part of the tax income determination in the other retained earnings (Cahn and Spannenberg 2010, note 52a on sec. 58, p. 557; Förschle and Hoffmann (2012), note 258 on sec. 272, p. 1032.). Whereas the reversals amount to attributions to asset items that

must be recognized according to sec. 253(5) HGB with the consequence of income tax-related impacts, the factual circumstances of the liability items include all tax-related provisions that lead to a reduction in the tax-assessment basis in the reference period (e.g., the formation of tax-free reserves). When determining the equity share (EKA) of the tax-effective attribution (vZ) or the increase in the liability items in the tax balance sheet (vP), the prospective income tax burden (s) that must be deducted from the amount must be calculated in principle specifically for each company.

$$EKA = (1 - s) \cdot (vZ + vP) \quad (83)$$

The company can transfer the equity share at a maximum value or in an intermediate amount in the other retained earnings. The underused amount cannot be rescheduled later. The company may transfer the equity share without credit per the restriction of sec. 58(1) AktG and sec. 58(2) AktG in the other retained earnings. Sec. 58(2a) AktG does not contain any provisions on when the retained earnings formed have to be resolved. Since this item does not have the character of an adjustment factor for the amounts of the value-appreciated assets and does not present a substitute for implementing tax-related privileges but is clearly designed to make the resulting equity shares available for the tax-related allocations and formations of liability items of the distribution of profits, the dissolution of the amounts in question can only be carried out as part of the disposition powers of the competent corporate bodies (Hüffer 2012, note 20 on sec. 58, p. 293). Accordingly, the general provisions that apply to the dissolution of the balance sheet item for other retained earnings must be applied here as well. To direct the retained earnings, and thus to direct the balance sheet result and their distribution, the following options are at the disposal of the decision-makers for the accounting policy:

- to transfer (or not) the equity share to the other retained earnings,

- to determine the amount of equity share as part of the latitude of discretion, or

- to resolve (or not) the other retained earnings formed in regard to the equity share. Reversals of retained earnings formed in accordance with sec. 58(2a) AktG are recognized in the form of the variable xRENTAG or the restriction $\leq vAG - uAG$ (xRENTAG) (see restriction Y43 in Table 5).

When integrating the xreinü variable into the optimization models, it must be taken into account that the value of the tax-related effective attributions and the formed liability items that define the equity share pursuant to sec. 58(2a) AktG is composed of three elements:

- attributions that necessarily result from tax reversals of fixed or current assets that have already been taken into account as part of the preparation of the provisional annual financial statement (vZ),

- the formation of tax liabilities that have already been recognized as part of the preparation of the provisional annual financial statement (vP), and

- changes in the preliminary write-ups (vZ) and the provisionally formed liabilities (vP) that are triggered by the action parameters of the option group II (commercial and tax-related options) and the option group III (noncompliant options).

Accruals and deferrals are not included in the recording of changes since they are set-off items that

are not valued separately and are, moreover, excluded according to the wording of the law. Accordingly, the following applies (see restriction Y47 in Table 5):

$$-(1-s) \cdot (XA + XAü - Xa - Xaü + XU + XUü - Xu - Xuü - XF_l - XF_k + Xf_l + Xf_k - XI + Xi) + xreinü \leq (1-s) \cdot (vZ + vP) \quad (84)$$

It is necessary that the optimization model makes only positive values available for the forty-seven structural variables. Therefore, the following non-negativity requirements apply:

$$\begin{aligned} & XKSt, XGewSt, XLS, XLESTA, XTESTP, xTAavor, xTAAuf, xA, XA, xAü, XAü, xa, Xa, xaü, Xaü, \\ & xU, XU, xUü, XUü, xu, Xu, xuü, Xuü, xF_l, XF_l, xF_k, XF_k, xfl, Xfl, xfk, Xfk, xRa, XRa, xra, Xra, XI, \\ & Xi, xGV, xvv, xRENTK, xRENTG, xRENTS, xRENTAG, xeing, xreins, xreina, xeinü \geq 0 \end{aligned} \quad (85)$$

2.3.8 Restrictions on selected annual financial statement indicators

The planning of annual financial statement indicators is part of the target-oriented planning of annual financial statements. Therefore it is necessary to formulate restrictions. The annual financial statement indicators that are usually considered relevant to an analysis of the annual financial statement or as part of

a balance sheet rating are included in the optimization approaches (Conenenberg, Haller, and Schultze 2012, p. 1029–1186; Gibson 1983, p. 23–27; Küting and Weber 2012, p. 281–322; Lachnit 2004, p. 39–60). The following indicators have been taken into consideration for the purposes of the model (see restrictions Y48 to Y63 in Table 5). In principle, it is possible to include further restrictions in the form of indicators.

$$\text{Fixed assets : current assets} \leq a \text{ is equivalent to} \quad (86)$$

$$xA + XA + xAü + XAü - xa - Xa - xaü - Xaü - a \cdot xu - a \cdot XU - a \cdot xUü - a \cdot XUü + a \cdot xu + a \cdot Xu + a \cdot xuü + a \cdot Xuü \leq a \cdot vU - vA \quad (87)$$

$$\text{Fixed assets : balance sheet total} \leq b \text{ (investment ratio) is equivalent to} \quad (88)$$

$$\begin{aligned} & (1-b) \cdot xA + (1-b) \cdot XA + (1-b) \cdot xAü + (1-b) \cdot XAü - (1-b) \cdot xa - (1-b) \cdot Xa - (1-b) \cdot xaü - \\ & (1-b) \cdot Xaü - b \cdot xU - b \cdot XU - b \cdot xUü - b \cdot XUü + b \cdot xu + b \cdot Xu + b \cdot xuü + b \cdot Xuü - b \cdot Xaü - b \cdot \\ & xRa - b \cdot xra + b \cdot xra + b \cdot Xra - b \cdot XLESTA \leq b \cdot (vA + vU + vRa) - vA \end{aligned} \quad (89)$$

$$\text{Balance sheet total : equity} \leq c \text{ (} c = \text{equity ratio)} \quad (90)$$

The equity ratio must be formulated as a reciprocal value because it arrives as a $\leq$ condition in the planning approach. The same applies for the following indicators of coverage as well as the values of profitability of equity and total capital. A corresponding transformation of the equity ratio specified in Inequality (90) is more complicated because in this case, owing to income tax and bonus

effects, there are interdependencies between the desired ratio level, equity, and liabilities and the use of result-altering action parameters. The tax bonuses result will be made in Inequality (90.2) below through the following variables while a corresponding change in the income tax provisions and other liabilities (i.e., of short-term borrowed capital) is assumed:

$$XKSt + XGewSt + XLESTA + xTAavor + xTAAuf \quad (90.1)$$

$$\begin{aligned} & c \cdot XKSt + c \cdot GewSt + (1-c) \cdot (XA + XAü - Xa - Xaü + XU + XUü - Xu - Xuü - XF_l - XF_k + Xf_l + Xf_k - XI + Xi) + \\ & xA + (1-c) \cdot XA + (1-c) \cdot xAü + (1-c) \cdot XAü - (1-c) \cdot xa - (1-c) \cdot Xa - (1-c) \cdot xaü - (1-c) \cdot \\ & Xaü + (1-c) \cdot xU + (1-c) \cdot XU + (1-c) \cdot xUü + (1-c) \cdot XUü - (1-c) \cdot xu - (1-c) \cdot Xu - (1-c) \cdot \\ & xuü - (1-c) \cdot Xuü - c \cdot xF_l - c \cdot XF_l - c \cdot xF_k - c \cdot XF_k + c \cdot xfl + c \cdot Xfl + c \cdot xfk + c \cdot Xfk + (1-c) \cdot \\ & xRa + (1-c) \cdot xra - (1-c) \cdot Xra \leq (c-1) \cdot (vA + vU + vRa) - c \cdot (vF_l + vF_k - vKSt - vGewSt - \\ & vLESTA - vTAavor - vTAAuf) \end{aligned} \quad (90.2)$$

Similarly, the remaining indicator restrictions are taken into consideration in the planning model. The integrated indicators are listed below. We refrain from presenting the detailed structure of the accounting policy Equations at this point (Freidank 1990, p. 118–123).

$$\text{Non-current liabilities : balance sheet total} \leq d \text{ (ratio of long-term debts)} \quad (91)$$

$$\text{Current liabilities : balance sheet total} \leq e \text{ (ratio of short-term debts)} \quad (92)$$

$$\text{Fixed assets : non-current liabilities} \leq f \text{ (1: f asset coverage rate I)} \quad (93)$$

$$\text{Fixed assets : equity} \leq g \text{ (= 1: g asset coverage rate II)} \quad (94)$$

$$(\text{Fixed assets} + \text{inventories}) : (\text{Equity} + \text{non-current liabilities}) \leq h \text{ (long-term asset coverage)} \quad (95)$$

$$\text{Current liabilities : current assets} \leq i \text{ (1 : i = liquidity ratio)} \quad (96)$$

$$\text{Equity : net annual result (earnings after taxes)} \leq j \text{ (= 1: j return on equity after taxes)} \quad (97)$$

$$\text{Equity : net annual result before taxes (earnings before taxes)} \leq k \text{ (= 1: k return on equity before taxes)} \quad (98)$$

$$(\text{Equity} + \text{liabilities}) : \text{net annual result (earnings after taxes)} \leq l \text{ (= 1: l total return on capital after taxes)} \quad (99)$$

$$(\text{Equity} + \text{liabilities}) : \text{net annual profit before taxes (earnings before taxes)} \leq m \text{ (1 : m = total return on capital before taxes)} \quad (100)$$

$$(\text{Effective} + \text{deferred income taxes}) : \text{net annual result before taxes (earnings before taxes)} \leq n \text{ (tax rate)} \quad (101)$$

$$\text{Equity : retained earnings} \leq o \text{ (1 : o = rate of own financing)} \quad (102)$$

$$\text{Equity : balance sheet result} \leq p \text{ (1 : p = distribution rate)} \quad (103)$$

By including the following restriction in the model, the accounting policy-makers are able to ensure that the balance sheet total does not exceed the critical thresholds stipulated in sec. 267(1), no. 1 or (2) no. 1 HGB to avoid mandatory audits pursuant to

sec. 316(1) HGB and/or to benefit publicity privileges (cf., e.g., sec. 274a, 276, 326, 327 HGB) (BS = upper limit of the balance sheet total, see restriction Y64 in Table 5) if, for example, the limits on revenue or number of employees are exceeded.

$$vA + xA + XA + xA\ddot{u} + XA\ddot{u} - xa - Xa - xa\ddot{u} - Xa\ddot{u} + vU + xU + XU + xU\ddot{u} + XU\ddot{u} - xu - Xu - xu\ddot{u} - Xu\ddot{u} + vRa + xRa + XRa - xra - Xra + XLESTA) \leq BS - (vA + vU + vRa + vLESTA) \quad (104)$$

If the company strives for a certain balance sheet result (sBI) (e.g., for the purpose of income smoothing), this fixation approach must be taken into

account in the case of a maximum target function by including the following restriction:

$$-XKSt - XGewSt \pm XLS - xTAvor - xTAauf + xA + XA + xA\ddot{u} + XA\ddot{u} - xa - Xa - xa\ddot{u} - Xa\ddot{u} + xU + XU + xU\ddot{u} + XU\ddot{u} - xu - Xu - xu\ddot{u} - Xu\ddot{u} + xFl + XFl + xFk + XFk - xfl - Xfl - xfk - Xfk + xRa + XRa - xra - Xra + xGv - xv\ddot{v} + xRENTK + xRENTG + xRENTS + xRENTAG - xeing - xreins - xreina - xein\ddot{u} \leq sBI - vJvor \quad (105)$$

3 Summary

We have shown that, even after the reforms of German balance sheet law, mathematical procedures of optimal planning can be used to prepare annual financial statements of corporations that consider complex target structures and action parameters simultaneously. However, this requires a significant conceptual adjustment of the existing models, owing to the extensive amendments of the German balance sheet and tax-related accounting principles in 2009 and modifications, triggered by international developments, of the goals of the balance sheet information provided to the recipients of annual financial statements.

The IT-based optimization programs presented here, which can be combined with other accounting and auditing tools such as ACL or IDEA, provide

those in charge of accounting with a means to quickly and clearly identify the appropriate values to base their decisions on in preparing the annual profit and loss account and/or balance sheet in spite of the many interdependencies rooted in accounting law. In those cases in which an optimal solution cannot be determined, the programs identify the conflicting structural and slack variables. This information puts decision-makers in a position to identify the data in the target plan (such as profit targets, planned balance sheet totals, and/or certain analytical indicators of the annual profit and loss account) that prevent an optimal solution and, if necessary, to reformulate the targets on the basis of revised data so as to arrive at an optimal financial statement that is both in line with the accounting policy goals of the company and viable under the given conditions. Against this backdrop, the simultaneous models presented here are to some

degree also of a sequential nature. In assessing the performance and usefulness of the IT-supported accounting policy optimization models, we must take into account that, because of the complexity and interdependence of the relationships in question, optimal accounting policy choices will rarely be achieved under realistic conditions if done by hand; yet at the same time these decisions will have a significant impact on key issues such as perceived company performance, the ability to pay dividends, as well as the burden on the corporation from income taxes and profit sharing.

The optimization models presented here have been adapted to the recent accounting reforms in Germany (e.g., BilMoG) and can be further expanded in various directions, which makes them highly flexible in terms of adaptability. The models can easily be refined to include additional measures (e.g., value indicators) or take particular optional choices into account (also those that do not affect profit and loss). Moreover, a characteristic feature of our models is that they have no difficulty in incorporating all significant accounting policy targets in mathematical optimization Equations, in the form of a target function (primary targets) and/or secondary conditions (secondary targets), provided that they can be sufficiently operationalized. This makes it possible to incorporate multiple, potentially competing objectives of the decision-maker (e.g., maximizing balance sheet profits versus achieving some debt equity ratio) and to determine an optimal overall solution. If we furthermore consider that, when expanding the models, an equation defined to express formally correct secondary conditions (e.g., indicators or balance sheet totals that must be met) can easily be adopted as the target function, then primary and secondary targets basically become completely interchangeable with regard to integrating the intentions of accounting policy.

Finally, the optimization models presented here can also be applied in the case of preparing a so-called “Einheitsbilanz”, i.e., an integrated balance sheet that fulfills the requirements of commercial as well as tax law.³⁶ For this purpose, we must exclude from the optimization iterations deferred taxes as well as those action parameters that may be used in preparing commercial financial statements only. Against this background, the approaches can also be used in decision-making in matters of multi-period accounting policy. Calculating a series of optimal earnings and dividends per period with sufficient precision both for companies and stakeholders from the perspective of tax law poses no difficulties in principle. The formal objectives identified in this way can be entered into the model as set items, which – by utilizing the effectively available discretionary funds for the respective accounting period and by taking additional

secondary targets into consideration (key indicators, balance sheet total) – makes it possible to transform the realized earnings according to the respective ends to be achieved. Moreover, our optimization models can be expected to have additional significance for businesses if we bear in mind, particularly, that the main task of tax-balance-sheet planning is not to determine the optimal reduction – or increase – in profits per annum, but to find the most suitable action parameters for the purpose of success for the period in question (Heinhold 1985, p. 56).

German commercial law does not directly prohibit auditors from providing consultation services to companies in matters of accounting policy provided that such consultation is limited to informing about alternative accounting options and does not result in self-auditing (sec. 319, 319a HGB in conjunction with sec. 23a of the Professional Code of Conduct for Auditors/Certified Accountants [BS WP/vBP]). The presented approaches can thus be expected to be successfully applicable also in the area of business consulting by accounting firms. Moreover, the optimization models, and the possibilities of expansion that they offer, represent a set of tools to assist auditing concerned with corporations’ performance-related expenses (such as taxes on earnings and shares in profits), equity and earnings statements, and appropriation of net income, and are therefore a significant contribution to rationalizing the auditing of annual financial statements under commercial law. The auditor who adopts or (further) develops the models corresponding to his or her audit task only needs to enter the necessary variables into the models (e.g., income tax rates and/or profit-sharing rates, options, margins of discretion, performance indicators, balance sheet totals, accounting policy targets of the client) in addition to the provisional annual financial statement. The respective optimization program then delivers the solutions permissible under commercial and/or tax law.

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³⁶ Pursuant to sec. 274a, no. 5 of the German Commercial Code, small stock corporations within the meaning of sec. 267(1) of the German Commercial Code do not have to take the provisions of sec. 274 of the German Commercial Code on the limitations on deferred taxes into account.

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