



Hertie School of Governance - working papers, No. 25, April 2008

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Creating Group Alignment and Commitment with Decision Analysis**

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## The MARA Projects: Creating Group Alignment and Commitment with Decision Analysis

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Keywords: socio-technical decision analysis, decision conference, resource allocation, option prioritization, marketing, human resources

### Summary

In this paper, we explore the results of the applied research project MARA. MARA served to advance the application and teaching of decision analysis in geographic areas where decision analysis has not yet been extensively applied. To inspire similar efforts in other geographical regions, we outline the MARA project setting and the core learning experience in this paper. The project consisted of eleven case studies, carried out in Germany and Argentina, which served to explore the impact of decision analysis on group alignment and commitment in organizations. We identify stakeholder complexity, multiple objectives and extensive expert judgments as three decision characteristics which make the application of the approach particularly effective. Three MARA case studies from two less common areas of application, human resources and marketing, serve to analyze this finding.

### 1. Introduction

The technical side of decision analyses has been one of the focus areas of *Decision Analysis* over the last years. These developments include, for example, influence diagrams (Buede, 2005; Detwarasiti and Shachter, 2005; Pearl, 2005), information and value of control (Matheson and

Matheson, 2005) or preference programming for even swaps (Mustajoki and Hämäläinen, 2005). In contrast, analyses of the ‘behavioral’ effects of decision analysis on stakeholder alignment and commitment are still relatively scarce. The analytic-deliberative approach to guide public policy deliberations (Gregory, Fischhoff et al., 2005) is one of the few recent contributions. The approach emphasizes the inclusion of stakeholder values, based on value-focused thinking (Keeney, 1992), explicit trade-off analysis and impartial facilitator guidance (Gregory, McDaniels et al., 2001). It has been applied to public policy contexts, in particular environmental policy deliberations, such as water management (Gregory and Failing, 2002) or energy transmission deregulation (Gregory, Fischhoff et al., 2003). With an emphasis on the private sector, the dialogue decision process (Matheson, 2005) is another approach to create alignment and commitment within a diverse group of stakeholders. The Strategic Decisions Group, a private consulting company, introduced this approach in the early eighties to target problems with high organizational complexity, involving many stakeholders and conflicting values (Matheson, 2006, Spetzler, 2007). The approach advocates a structured inclusion of a ‘Decision Board’, responsible for making the final decision and for representing the corporate perspective, as well as a cross-functional ‘Decision Team’, which delivers expert information and participates in the implementation of the decision (Spetzler, 2007; Matheson and Matheson, 2007).

This article aims to explore the impact of a third approach – applied both in the private and public sector – to create group alignment and commitment using decision analysis. This socio-technical ‘school’ (Phillips and Bana e Costa, 2007) advocates group decision modeling with a special emphasis on simple MAVT-based models, developed in decision conferences on-the-spot (Phillips, 2007). The projects MARA<sup>1</sup>, which consist of case studies using socio-technical decision analysis, served as vehicles to observe the ‘behavioral’ impact of the approach in a variety of organizations. In particular, we tested the effectiveness of the approach (Schilling, Oeser et al., 2007) and explored two less common areas of application – human resources and marketing.

In addition, the MARA applications proved to be surprisingly effective in promoting decision analysis in two geographical regions, Germany and Argentina, where published applications of large-scale decision analyses in English-language journals have so far been rare. Although in both countries, text books and publications in decision analysis are available (cf. for example Keeney, von Winterfeldt et al., 1990; Eisenführ and Weber, 2002; Pavesi, Avenbourg et al., 2004), a community, comparable to one in the UK or the US, currently does not exist. To

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<sup>1</sup> MARA is an abbreviation of the Spanish title ‘Methodologías para la Asignación de Recursos: Argentina/Alemania’ (‘Resource Allocation Methodologies: Argentina/Germany’)

promote the development of decision analysis in these countries, a group of German and Argentinian academics started the first MARA project in Buenos Aires in 2005 and repeated the project in 2006 in Germany with an enhanced setup and additional research components. Since the completion of MARA, the number of ongoing applications of decision analysis in these countries has been increasing. Consequently, the second aim of this paper is to outline the core learning of the MARA projects to promote decision analysis as a discipline both towards organizations and young researchers. We received several suggestions to replicate the project in other countries and therefore aim to inspire similar efforts to promote decision analysis.

The remainder of the paper is organized as follows. First, we outline the methodological approach and the objectives of socio-technical decision analysis as well as the characteristics of decision situations, which make the approach particularly effective. In order to enable successful replications of the project, we, second, outline the set-up of the initiative. With a special emphasis on marketing and human resources, we subsequently present the results of four of the eleven MARA case studies. Finally, we reflect on our learning experiences with regard to promoting decision analysis and to working with young decision analysts.

## **2. Socio-technical decision analysis**

Socio-technical decision analysis combines decision modeling, based on multiple-attribute utility theory (Keeney, Raiffa et al., 1976), with decision conferencing (Phillips and Bana e Costa, 2007). Decision conferencing usually includes on-the-spot modeling guided by an impartial facilitator and extensive sensitivity analyses to create a shared understanding of the issues at stake. The core objective of the approach is to create a sense of common purpose and commitment towards a joint way forward while preserving individual paths (Phillips, 2007; Rohrbaugh, 1992). The method can either be applied during an intensive two-day meeting or through repeated interaction with the client over the course of several weeks or months (Phillips and Bana e Costa, 2007). The decision models, developed interactively in decision conferences, aim to include as much information as is necessary, but as the minimum possible to resolve the issues at stake. These simple models are neither normative as they do not indicate an ideal decision, neither descriptive as they do not describe actual behavior, nor strictly prescriptive as they are not designed to tell a group explicitly what to do. Phillips (1984; 1989) therefore calls these models ‘requisite’ as they represent a simplified version of a shared social reality, sufficient in form and content to create both alignment of stakeholders and insights into better decisions.

The approach is in particular applicable to resolve ‘organizationally complex’ decisions, for example, due to conflicting views of multiple stakeholders (Spetzler, 2007; Matheson, 2006), in particular when prioritizing options or allocating resources. In our experience, three distinguished characteristics of decision situations make the approach particularly effective.

#### *High Stakeholder Complexity*

First, stakeholder complexity, the need to involve many stakeholders – possibly across several organizations – with conflicting values, objectives and motivations, as well as intense group dynamics and micro-political behavior – characterize decision problems to which socio-technical decision analyses can be applied successfully. In particular in the public sector, we prefer the term stakeholder complexity to organizational complexity (Spetzler, 2007), as many problems involve stakeholders from a variety of organizations. Silo-thinking – the lack of communication and coordination across organizational departments and hierarchies – is one characteristic of stakeholder complexity (Dibb and Simkin, 2000; Dibb, 2002). In these cases, socio-technical decision analysis provides a common language and a process to enhance systematic intra-organizational communication. It thereby facilitates an effective bargaining-like process, where two or more parties with interdependent preferences jointly negotiate an agreement about the allocation of resources or the prioritization of options (Lewicki, Saunders et al., 2001; Raiffa, Richardson et al., 2002).

#### *Multiple objectives*

Second, socio-technical decision analysis is designed for dealing with multiple objectives in decision situations where decision-makers face difficult trade-offs between conflicting objectives. These types of decision problems are ubiquitous in non-for-profit organizations (Quaddus, Atkinson et al., 1992) as well as in the public sector (Bana e Costa, 2001), and common in the private sector (Phillips and Bana e Costa, 2007; Collins and Porras, 1996).

The STDA approach facilitates the assessment of options with multiple objectives based on the standard additive value model  $V_i = \sum_j w_j v_{ij}$ , with  $v_{ij}$  representing the value associated with the consequence of option  $i$  on criterion  $j$ , and  $w_j$  representing the weight assigned to criterion  $j$ . The total value score for one option is calculated as the sum of the weighted scores on the individual criteria. In addition to integrating multiple objectives analytically, IT-based MAVT models are designed to graphically display corresponding potential trade-offs and sensitivity analyses. A group of decision-makers can thereby test the impact of different judgments on possible consequences of

decisions. Risk is usually modeled as one dimension of the MAVT model. Due to this simplified treatment of risk, the approach is therefore only suitable, when extensive risk modeling is not a major concern to the decision-makers.

### *Required Expert Judgments*

Finally, if these multiple objectives have to be assessed extensively by experts rather than using statistical forecasts, socio-technical decision analysis can be used effectively. Expert judgments play a particular prominent role in the appraisal of options or the prioritization of alternatives when the impact of single activities or measures has to be assessed on relatively soft dimensions, such as corporate image or employee motivation. This is often the case in areas such as marketing or human resources. However, decision models incorporating judgments of decision-makers can suffer from strategic mis-representations of preferences (Vetschera, 2005, Jones and Euske, 1991), in particular when decision-makers focus extensively on individual goals rather than on the organization as whole. Socio-technical decision conferencing – during which a group of decision-makers transparently discusses scores and weights of an MAVT-based model – provides a basis for on-the-spot, peer-reviewed appraisal processes and hence can reduce strategic behavior, as shown in the cases outlined below.

In recent applications of socio-technical decision analysis, these three decision characteristics – high stakeholder complexity, multiple objectives and required expert judgments – provided one basis for successful case studies. These applications include the analysis of nuclear waste management options in the UK (Phillips, 2006), the evaluation of flood control measures in Portugal (Bana e Costa, Da Silva et al., 2004), water resource planning in South Africa (Stewart, 2003), the allocation of software development (Barcus and Montibeller, 2008) and tender evaluation in the public sector (Bana e Costa, Correia et al., 2002). Phillips (2007) and Rohrbaugh (1992) provide a more detailed review of decision conferencing applications. The MARA projects reported in this article complement this list with applications outside the ‘classical’ application areas. We outline the set-up of the MARA projects in the following section.

### **3. The Set-up of the MARA Projects**

To promote decision analysis in Argentina and Germany, as well as to explore the impact of socio-technical decision analysis, we designed a project setting with a multi-phased project



structure. This project included prominent partners from the scientific community as well as federal politics and international participants.

To secure public visibility and wide PR coverage, the Federal Ministers of Science in Argentina and Germany, several ambassadors and university directors served as the patrons of MARA. As the MARA participants had little previous experience of applying decision analysis, several senior decision analysts from the Decision Analysis Society trained and partly supervised the MARA project teams. The MARA partner organizations, companies and public sector organizations in Argentina and Germany, provided suitable real-world decision problems to which the teams applied decision analysis. To select the participants, acquire these projects, pre-develop the models and to manage MARA logistically, each year an organizational team of around 15 people invested approximately 2,200 man days. Figure 1 outlines the MARA project set-up with the relevant MARA partners.

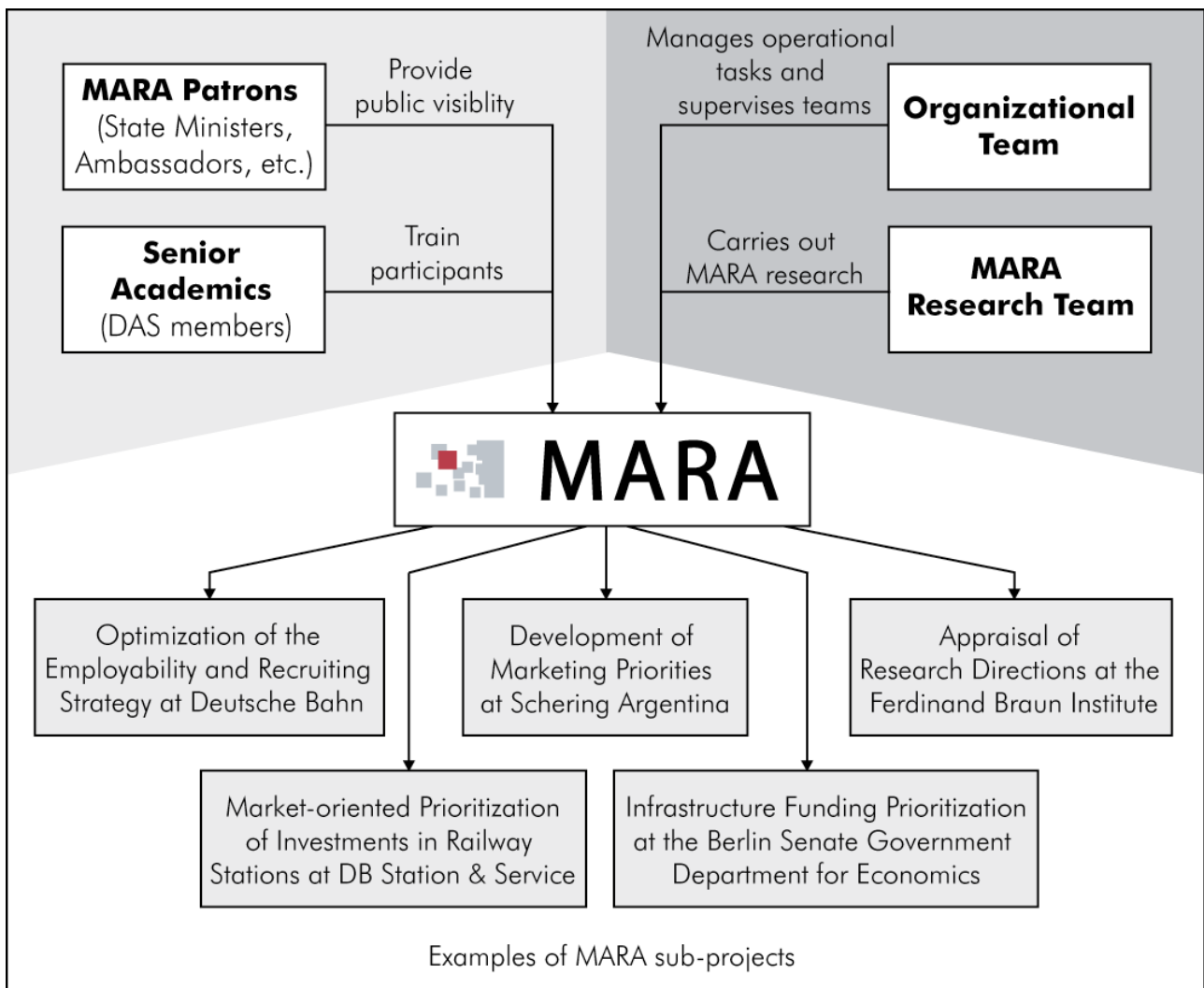


Figure 1 – The MARA Project Setup

The involvement of 61 participants that were relatively inexperienced in decision analysis, but with sound academic and interdisciplinary backgrounds, was a key factor for the success of the MARA projects. As outlined in Annex A, 61 participants from eleven countries with academic levels ranging from assistant professors to undergraduates took part in the project.

To apply decision analyses and carry out the field research effectively, we divided MARA into a training, an application and a documentation phase. The training phase provided MARA participants with professional and methodological skills, such as the basis of multiple-criteria decision analysis, Value-Focused Thinking and risk modeling. During the application phase, the MARA teams applied this knowledge to respectively six (MARA 2006) and five (MARA 2005) projects in organizations both in the public and private sector. The eight to ten weeks projects covered topics such as the development of marketing priorities, employability and recruiting strategy optimization, market-oriented prioritization of investments in railway stations, appraisal of research directions in the laser technology field and infrastructure funding prioritization. To ensure high quality results, we supervised the project teams on a weekly basis and provided practical assistance during the most important stages of the decision analyses. One of the MARA projects was awarded the status as finalist for the 2006 Practice Award of the Decision Analysis Society. In addition, for MARA 2006, we developed two empirical studies to evaluate the perceived process effectiveness of the decision analyses as well as quantitative group alignment effects (cf. Schilling, Oeser et al., 2007).

#### **4. MARA Case Studies**

The MARA project teams overall worked on eleven case studies for clients both in the private and public sector. In the following section, we present three cases, one of which was a Finalist for the INFORMS Practice Award 2006. The other two were winners of the ‘MARA Excellence Award Competition’ which was based on the evaluations of clients and several senior decision analysts at the end of each MARA project. A special emphasis lies on the two less common areas of application – human resources and marketing.

##### **4.1. Overview of the Case Results**

In all MARA applications, we applied socio-technical decision analysis to aid with the selection of options or the prioritization of resources. All decision problems had the three above-mentioned characteristics of decision situations making the application of socio-technical decision analysis particularly effective. First, each analysis served to resolve issues of organizational

complexity (Spetzler, 2007). In each case, at least ten decision makers from different organizational levels took part, representing a variety of opinions and values regarding the overall strategy. The analysis hence aided in particular the leader of the respective groups to align its members to a joint way forward. Second, all prioritization decisions involved multiple conflicting objectives. Software-based sensitivity analysis with groups of decision makers on scores and weights helped explore the impacts of the different alternatives on these objectives. Finally, expert judgments played an essential role in the MARA projects. In particular in the human resources and marketing case studies the challenge was to assess uncertain impacts of activities on soft factors, such as corporate image and staff motivation. Table 1 summarizes the four MARA projects presented in the following sections.

**Classification of the MARA Case Studies**

Cases	Client organization	Objective of the Analysis	Clients involved	Results
<b>Development of Marketing Priorities at Schering Argentina</b>	Subsidiary of a German pharmaceutical company	Identification of an efficient portfolio of customer service activities across the major product lines	Executive board of the subsidiary and several senior managers, 13 decision-makers in total	The decision model provided an opportunity to combine operational expertise of line managers with strategic vision of top-level decision-makers. Analysis aided executive board to agree on a significant shift of internal resources away from the traditional cash-cow business.
<b>Optimization of the Employability and Recruiting Strategy at Deutsche Bahn</b>	Private company, Railway industry	Prioritization of activities to sustain employability of existing employees and attract new employees	18 members of the HR department, incl. areas strategy, health, qualification and labor relations	Models provided an opportunity to exchange knowledge and explore synergies between different HR sub-department, as well as to analyze differences in recruiting efficiencies between the departments.
<b>Appraisal of Research Directions at the Ferdinand Braun Institute</b>	Publicly funded research institute	Appraisal of optimal research direction in a emerging, strategically important research field	10 decision-makers, incl. the director and the heads of the departments Optoelectronics and Materials	The analysis aided the institute to align the major decision makers to the most promising research directions in a specific area of expertise.

**Table 1 – Overview of the Four MARA Case Studies**

#### **4.2 Decision Analysis and Marketing: Development of Marketing Priorities at Schering Argentina**

In recent years, marketing researchers have identified a variety of analytical, behavioral and organizational impediments to the effective setting of strategic marketing priorities (Piercy and

Morgan, 1990). These include ‘incrementalism’ (Piercy, 1986; Webster, 1988; Piercy and Morgan, 1990; Dibb, 1997; Simkin, 2002) ‘silo-thinking’ when developing and executing marketing strategies (McDonald, 1992; Dibb and Simkin, 2000; Dibb, 2002) and a lack of commitment to the implementation of marketing strategies (Cespedes and Piercy, 1996; Lane and Clewes, 2000; Thomas, 2002). Analytical methods, such as linear programming and the analytic hierarchy process, have been applied to address these impediments. Focusing on the monetary dimension only, linear programming approaches aid to develop optimal marketing resource allocations. Little (1976), with his ‘decision calculus school’, pioneered this approach by developing simple and adaptive marketing models. For a review of recent applications of linear programming models applied to marketing see Richardson (2004). Using pairwise comparisons, the Analytic Hierarchy Process (Saaty, 1977, 1980) has been applied extensively to marketing decisions, such as new product development (Wind and Saaty, 1980), lease versus buy decisions in industrial purchasing (Vargas and Saaty, 1981) and new product screening (Calantone, Di Benedetto et al., 1999). For more details on the interface between marketing strategy development and decision analysis, see Schilling and Schulze-Cleven, 2007.

Decision analysis applied to setting marketing priorities has not yet been extensively covered in English-language journals of OR and decision analysis. Whereas applications in other business functions, such as R&D (Stewart, 1991; Perdue and Kumar, 1999), product planning (Beccue, 2001, Millet, 1994) as well as technology choice (Dyer, Edmunds et al., 1998; Perdue and Kumar, 1999; von Winterfeldt and Schweitzer, 1998) have been presented extensively, reported marketing applications are still scarce (Keefer, Kirkwood et al., 2004). Socio-technical decision analysis can contribute to overcoming some of the above-mentioned impediments. In the strategic marketing decisions we encountered during the MARA cases for the pharmaceutical company, Schering Argentina and the automotive company, Volkswagen Argentina, socio-technical decision analysis helped to set strategic marketing priorities, bundling expertise within the company and, hence overcoming silo-thinking. We report some details of the marketing case for Schering Argentina below. This case won the MARA 2005 Excellence Award, the competition based on a client satisfaction survey and a review of the final reports by several senior decision analysts (Junghänel, Kura et al., 2005; Schaub and Schilling, 2006).

### **Case background**

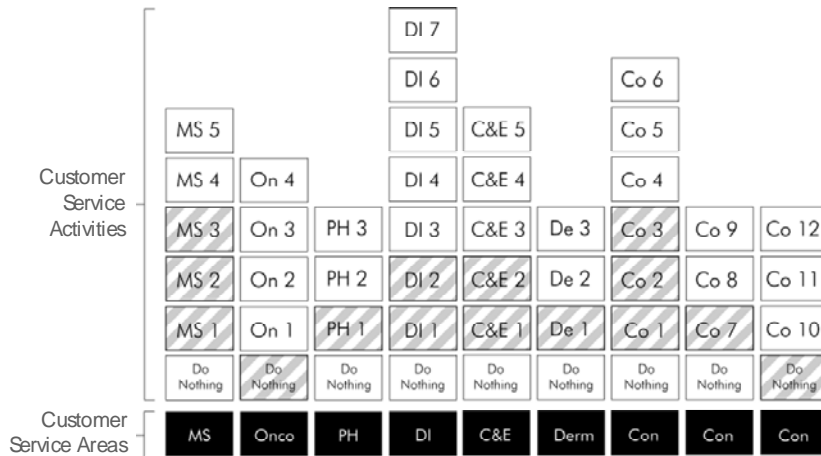
Since the Argentinian subsidiary of the pharmaceutical company Schering was established in 1926, its market prospects initially had always been promising. However, over the last few decades,

producers and suppliers of generic products started to challenge Schering. The Argentinian economic crisis in 2001/2002 further increased the pressure on the company's departments to control costs and maximise the effectiveness of activities. In 2005, a new CEO took office, who tried to open up communication between the local business units, which had developed a great sense of autonomy in the previous years. During the research project MARA 2005 (Junghänel, Kura et al., 2005), we analyzed Schering's customer service activities across all departments. A follow-up study in 2006, which the Fundación MARA performed, analysed a more diversified marketing portfolio based on a larger budget (for more details on this case, see Schilling and Schulze-Cleven, 2007).

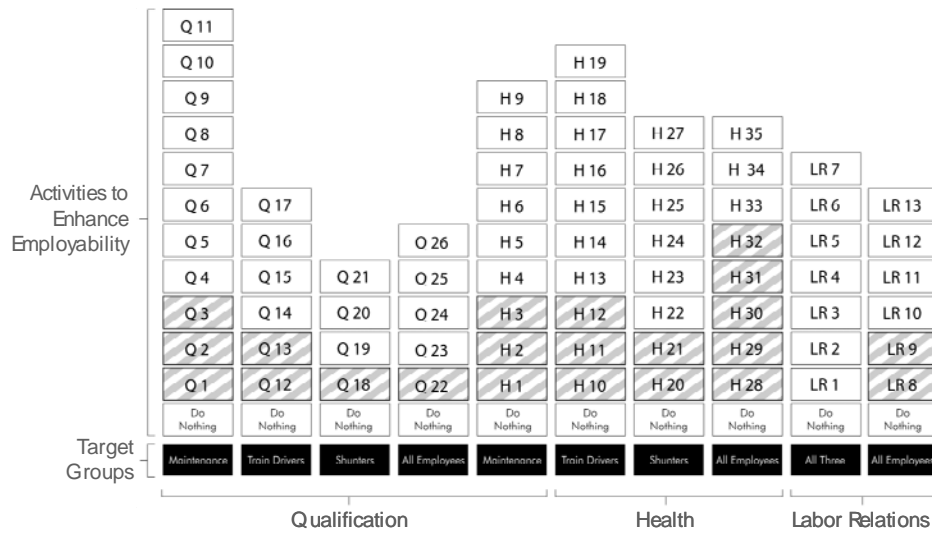
### **Analysis**

To aid the Schering managers with the allocation of marketing resources, we constructed a marketing activity portfolio, consisting of a variety of customer service areas with several investment options. As depicted in Figure 2, the areas included customer service activities in the different product lines, such as expansions of nursing networks, additional training or extended web services.

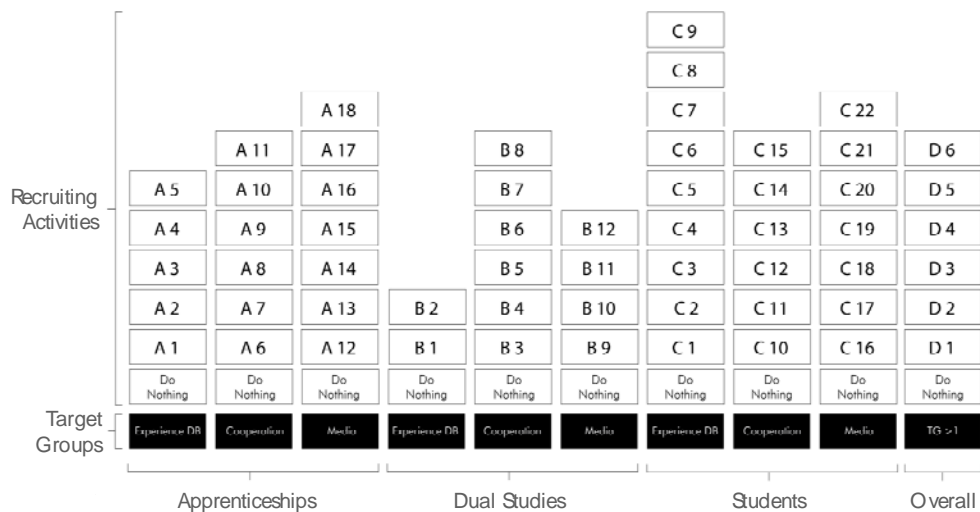
### Development of Marketing Priorities at Schering Argentina



### Optimization of the Employability Strategy at Deutsche Bahn



### Optimization of the Recruiting Strategy at Deutsche Bahn

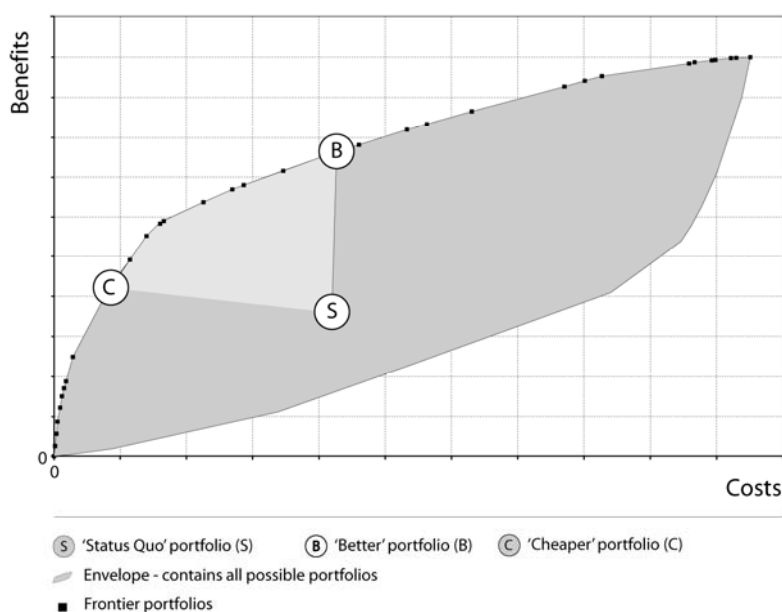


Existing Options Potential Options

Figure 2 – Models Structures of the Three MARA Portfolio Cases

The decision-makers scored the impact of each option in the marketing activity portfolio on sales volume, company image and the long-term ‘future value’ of sales and image effects. After the criteria weighting and the assessment of the monetary costs for each activity, the analysis served to calculate the marketing value-for-money for each activity.

Based on these benefit/cost ratios of the activities, the analysis revealed efficient marketing portfolios with improved allocations of resources. The grey-shaded area in Figure 3, depicts the benefit and cost values of the possible combinations of customer service activities. The black dots on the upper frontier indicate the most efficient portfolios, which result in the highest marketing value-for-money given a certain level of budget.



**Figure 3 – Benefit and Cost Values for Schering Customer Service Portfolios. ‘S’ refers to the current allocation of resources (status quo), ‘B’ to a more beneficial allocation of resources, ‘C’ to a cheaper allocation.**

The model identified potential improvements in resource efficiency relative to the status quo of the current marketing budget allocation (‘S’ in Figure 2). More efficient allocations of resources would either result in substantially more benefit at similar costs (‘B’) or achieve a similar benefit level as the status quo but with substantially reduced costs (‘C’). Efficiency increases, hence, could be realised by a re-allocation of resources and by omitting costly ‘political’ projects, initiatives favoured by interest groups within the organization. We derived ‘envelopes’, as outlined in Figure 3, for all MARA cases, to compare currently performed options with potential new ones.

## Results

The marketing portfolio analysis for Schering Argentina resulted in several valuable insights for Schering Argentina. The analysis provided the executive board of the company – which was

involved in the framing and weighting stages of the process – with insights into an efficient re-allocation of marketing resources from traditional ‘cash-cow’ businesses to new and quick growing product lines. The analysis thereby served, first, to overcome silo-thinking across different business units and difficulties in effectively combining judgments from Schering line managers with strategic expertise from top-level management. The decision conferencing approach helped to focus the attention of senior managers on the strategic issues and create a sense for the direction of the company as whole. Second, the marketing decisions of Schering had to incorporate the impact of different initiatives on conflicting objectives. To better understand the implications of these objectives, the analysis provided that the executive board try out different marketing activity portfolios focused, for example, on maximizing sales or image only. Third, as it is usually difficult to calculate the impacts of specific marketing activities, expert judgments played a crucial role.

During the two decision conferences with the executive board when the weights of the model were assessed, the transparent process seemed to provide incentives for managers to state preferences truthfully. Instead of ‘over-promising’ the value of activities in their areas, several members of the board were concerned not to overly raise expectations, in particular as the CEO was present at the table. As a result, a strong commitment to the analysis and a sustainable strategic consensus on marketing priorities beyond departmental ‘silo-thinking’ was the consequence and served as a basis for the follow-up analysis in 2006.

### **4.3. Decision Analysis and Human Resources: Optimization of the Employability and Recruiting Strategy at Deutsche Bahn**

Over the last years, both researchers and practitioners have emphasized the importance of linking corporate strategy to human resources management (Becker and Huselid, 2006; Huselid, Beatty et al., 2005). With increasing pressure on firms’ competitiveness as a core success driver, valuable, scarce and inimitable ‘human capital’ can be a source of sustainable competitiveness (Barney, 1995). With the resource-based view (Wernefelt, 1984) as a theoretical rationale, the link between human resources and firm performance became one focus of recent research (Becker and Gerhart, 1996; Delery and Doty, 1996; Guest, Michie et al., 2003). The recent transfer of the balanced score card to the area of HR (Becker, Huselid et al., 2001; Huselid, Becker et al., 2005) indicates the relevance of the topic for practitioners.

Despite this development, the degree of logic and analytical rigor in HR decision-making is often not yet comparable to the one in finance or product development (Boudreau, 2004). According to the feedback of the MARA clients, HR departments are often criticized internally for



not providing sufficient quantitative analysis for their proposed prioritization of investments. Although the usefulness of analytical methods for HR management has been recognized (Roth and Bobko, 1997), few applications have so far been published in the OR / Management Science literature. Decision analysis, with an emphasis on the interactive side, can play a particularly beneficial role in HR management, as shown in the two MARA cases outlined below. The HR project on optimizing the employability strategy at Deutsche Bahn, won the MARA 2006 Excellence Award (cf. Beer, Evrard et al., 2006).

### **Case Background**

In 1994, following the reunification of Germany, the West German railway company, Bundesbahn and the East German, Reichsbahn, merged under the name of Deutsche Bahn. The subsequent transition phase from a state-owned monopolist to an international logistics company led to a major reduction in the number of employees. Due to the aging blue collar work force and an agreement not to lay off any staff for several years, the HR department worked on a strategy to sustain the long-term employability of the company's work force. This strategy had two parts: an internal one to develop efficient activities to face the internal change in age structure and an external one to optimize recruiting activities in order to ensure sufficient inflow of qualified staff. For both parts decision analysis played a major role in the definition of objectives and prioritization of activities. One important aspect of these projects was to facilitate an effective information exchange between the participating HR sub-departments strategy, qualification, health and training and the three recruiting sub-departments.

### **Analysis**

The HR department used two portfolio analyses to identify efficient options targeted to enhance the employability of the workforce and to optimize the recruiting channels. Both portfolios are displayed in Figure 2. The 70 activities to enhance employability focused on three particularly relevant blue collar target groups. These included maintenance workers (electricians, locksmiths and electrical engineers), train drivers and 'shunters' (workers moving wagons in stations). These groups account for approximately 40,000 of the 230,000 employees within the company. An intranet platform to provide information on internal qualification programs or a campaign for more sports activities were examples for the qualification and health areas, respectively. The labor relations options focused, for example, on shifts in regular working hours dependent on the age of the employees.

The recruiting portfolio included 58 activities targeted at university students, high school graduates with a technical background and other pupils without a high school degree who could qualify for one of the DB apprenticeship programs. Within each target group, a set of options referred to media activities, such as online postings of job descriptions, to co-operation activities, such as participation in a job fair and to ‘Experience DB’, with activities such as personal contact with DB staff, respectively. The analysis served to identify efficient current and future recruiting activities as well as a methodological basis on which to explore synergies between different HR sub-departments.

One of the most challenging aspects of the analyses was to establish measurement criteria which all sub-departments would accept. This was particularly difficult due to the involvement of various ‘soft’ assessment criteria. After several weeks of interviews, workshops and subsequent re-definitions, the client decided to use the criteria ability, motivation, self-responsibility and long-term impact, as described in Table 2, for the assessment of the employability options. In the recruiting case, we used the costs for the activities, the contribution to enhancing employer image and to ensuring the inflow of high quality and quantity of staff, as criteria to determine the ‘recruiting value-for-money’ of each activity.

<b>Benefit criterion</b>	<b>Description</b>
<b>Ability</b>	The extent to which an option maintains or improves employees` capability to perform their jobs and prepares them for future positions. It includes taking care of physical and psychological fitness, as well as empowering employees to develop additional skills. Moreover, it requires the workforce to sustain their learning potential.
<b>Motivation</b>	The extent to which an option improves employees` work satisfaction and increases their commitment to Deutsche Bahn. First, it includes improving working conditions. Second, it includes employees` willingness to change by keeping employees informed of their roles, the evolution of their roles and open opportunities.
<b>Self Responsibility</b>	The extent to which an option promotes employees` personal responsibility. It implies a sustainable behavioural change towards a healthy lifestyle and employees` own initiative to develop additional skills.
<b>Long term impact</b>	The extent to which an option generates added value (has a positive impact on Ability, Motivation, self responsibility) or decreases costs beyond the five year time frame or both.

**Table 2 – Benefit Criteria of the MARA 2006 Project ‘Employability Optimization at Deutsche Bahn’ (from Beer, Evrard et al., 2006)**

To facilitate the assessment, we carefully elicited expert judgments of various groups of HR specialists at Deutsche Bahn on relative 0-100 scales. Each expert group consisted of several

members of different HR sub-departments, who had sufficient knowledge to score the activities on one criterion. To improve the quality of the judgments, we encouraged the decision-makers to further break down the scoring process by assessing, first, the impact of each option per employee on the criteria and, second, the number of employees that each option would address over the five-year time frame. Both assessments entered into the final scores. After assessing scores and weights, the benefit-to-cost ratio of each option subsequently served to establish a priority list for the efficient allocation of resources. For a more detailed explanation of the technical details, see Phillips and Bana e Costa (2007).

## **Results**

For the analysis of efficient employability options, the decision analysis aided the company to identify low cost activities with high benefits, which served as the basis for a board proposal. In the recruiting case, the analysis, first, aided in particular the exploration of differences in efficiencies across HR sub-departments. Similar activities were performed in different departments with differing degrees of success. The analysis aided the exchange of knowledge between the departments, helping to overcome cross-functional communication and to exploring potential synergies between the participating HR sub-departments. The criteria, developed during the analyses, continue to help the HR department to develop and modify options to enhance the employability of the existing workforce and to select recruiting activities. Besides addressing stakeholder complexity in HR departments, the decision analysis, second, served to balance conflicting objectives. Multiple objectives are almost always present in HR decision-making as the impact of specific HR activities on overall company profit or share price is hard to analyze. Means objectives, such as the ability to work effectively, the motivation or employer image, serve as 'proxies' to capture the likely impact of HR activities on overall company profit or its ability to fulfill core values, such as enhancing customer mobility in the case of Deutsche Bahn. Finally, due to these indirect measures, extensive expert judgments play a crucial role in HR decision making. In particular, soft objectives, such as the degree of motivation enhancement due to a specific activity, often cannot be calculated, only estimated. The need for analytical methods to enhance expert judgments is therefore particularly evident in HR. To structure these assessments and to encounter criticism regarding overly soft reasoning, decision-makers at Deutsche Bahn rated socio-technical decision analysis as significantly more effective than the traditional way of HR decision-making in their company. For detailed results of the effectiveness study, see Schilling, Oeser et al (2007).

#### **4.4 Appraisal of Research Directions at the Ferdinand Braun Institute**

One of the cases, carried out during MARA 2006, focused not on resource allocation, but on the appraisal of a limited number of strategic options. One of the MARA teams aided the management committee of the 'Ferdinand Braun Institute for High Frequency Technique' (FBH) to identify promising research directions in a new, strategically important research field. The FBH project was nominated as one of the five finalists for the INFORMS DAS Practice Award 2006 (Larson, Schilling et al., 2006).

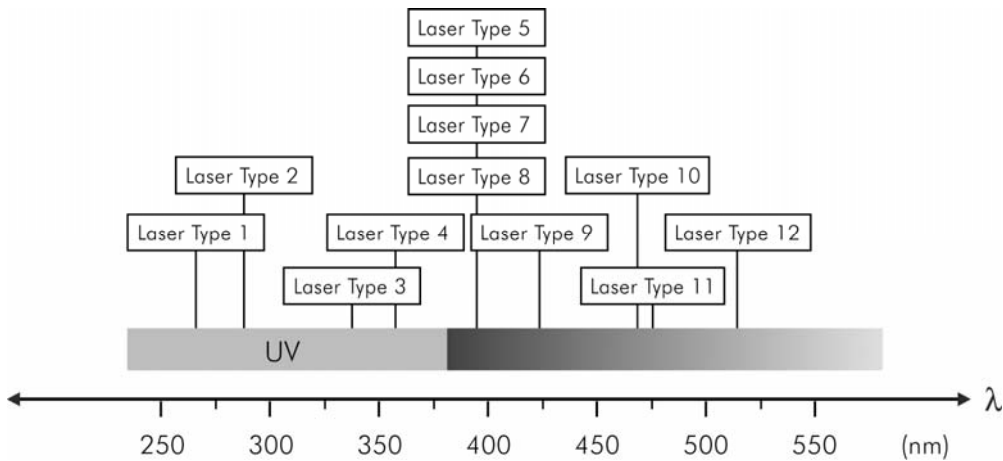
##### **Case Background**

The FBH is a partly publicly funded research centre with a focus on the areas of microwave technology and optoelectronics. In order to bridge the gap between applied research and the market, the FBH aims to develop new technologies and to create commercial spin-offs in areas such as high-end lasers, circuits for communication and sensor technology. Due to technological progress in the area of optoelectronics, the institute had to decide on the best way forward regarding potential research strategies in this field. This decision was of particular importance for the future of the FBH as it committed a substantial amount of resources over the years that followed.

Decision-making in similar cases had been done in the past on a rather intuitive basis. Using decision analysis, the director aimed to rationalize strategic decision making at the FBH. This was in particular relevant as strategic and technical expertise has been dispersed on various levels throughout the organization. The analysis helped to bundle this knowledge, facilitate an exchange of perspectives, as well as stimulate creativity and establish a shared understanding of the strategic research direction.

##### **Analysis**

The research directions, on which the analysis focused, consisted of different laser fields, as outlined in Figure 4. These devices are the basis, for example, for display, security and telecommunication devices. As developing lasers in this field is time-intensive, the institute had decided to focus its activities on one or very few of these areas. As the time of the researchers is limited and results can be expected after several years, the decision involved substantial risk.



**Figure 4 – Potential Research Directions in the Area of Optoelectronics ( $\lambda$  refers to the wave length of light in nm)**

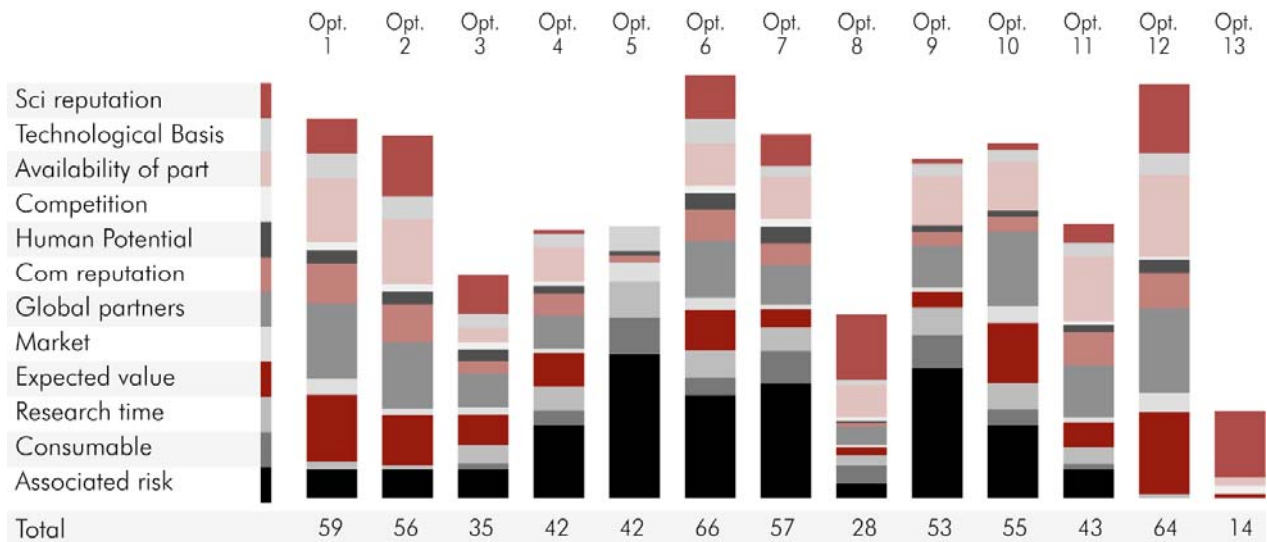
As the institutes follows both commercial and scientific aims, multiple objectives needed to be balanced for the appraisal decision. On the scientific side, the FBH is, for example, concerned with the extent to which research in an area contributes to the scientific reputation (measured in potential publications and PhD theses), the extent to which the field provides a basis for future technological developments as well as the degree of scientific competition when pursuing the chosen research direction. On the commercial side, three criteria served to assess the research directions: the probability of creating spin-offs, the availability of industry partners and the estimated market size of the to-be-developed applications. Expected private and public funding within a time frame of three years as well as the costs associated with the research direction also served as relevant decision criteria (Oelze, La-Ornual et al., 2006).

After an initial kick-off meeting with the relevant key players, including the director, the heads of the involved departments and several physicists on the laboratory level, we engaged in a series of workshops with the researchers. After the development of the criteria, as outlined above, differently mixed groups of physicists and the respective heads of the departments scored the research strategies on the different criteria. In a final decision conference, the director and the heads of the departments discussed weights and explored the model.

## Results

After scoring and weighting the options and criteria, Options 6 and 12 emerged as the most promising research directions. Figure 5, which summarizes the individual criteria contributions to the overall result for each option, provided a basis for an effective discussion between the heads of different departments and the director of the FBH. The FBH had not previously developed a systematic decision process to bundle their joint expertise. In this context, the decision model

served to combine the strategy expertise of the director and the heads of departments with the technical expertise of various researchers in the institute. Extensive sensitivity analysis on the criteria weights at the end of the project aided the alignment of the FBH team on a joint way forward, i.e. to carry out the two most favorable research strategies.



**Figure 5 – Criteria Contributions to the Potential Research Directions in the Area of GaN-based Optoelectronics (For reasons of confidentiality, option labels do not match labels in Figure 4)**

Beside addressing stakeholder complexity due to the different departments and levels involved, second, the analysis aided in incorporating the 12 scientific and commercial objectives regarding the research strategy. Multiple objectives as basis for a decision was in particular relevant to the FBH, as they reflect the institute’s position at the interface between science and practice. Finally, the possible consequences of following the different research strategy is very difficult to forecast quantitatively. Instead, expert judgments based on profound knowledge of the field, is of high relevance, in particular, in assessing research strategies in laser development. Socio-technical decision analysis helped to address these challenges at the FBH. The evaluation interviews after the completion of MARA 2006 confirmed that the FBH later indeed pursued these two suggested research directions. The results served, in addition, as a discussion basis for several subsequent strategy sessions at the institute.

## 5. Conclusion

In this paper, we explore the impact of socio-technical decision analysis during the applied research project MARA. The project helped to identify decision characteristics which make socio-technical decision analysis particularly effective to create commitment and alignment in

organizations. Decisions situations with high stakeholder complexity, multiple objectives and the necessity to extensively rely on expert judgments proved to be a reliable basis for the effective applications of this approach (Schilling, Oeser et al., 2007). Besides creating new case studies, in particular in the two less common areas of applications, HR and marketing, the MARA project helped to promote decision analysis both to organizations and to prospective students. In the following section, we outline the three core lessons learned from the MARA project, which might serve to develop similar project settings to further promote the area of decision analysis.

### **MARA-similar settings can serve to introduce decision analysis in organizations**

The MARA setting proved to be a ‘stimulus’ to increase sustainably the number of decision analysis applications in Germany and Argentina. In particular the politically attractive project setting served as an ‘ice-breaker’ to introduce decision analysis both in private and public sector organizations. The political authorities that served as the MARA patrons and the subsequent PR opportunities for partners served to engage organizations initially. This was particularly valuable, as the responses of organizations towards new methods for decision-making are sometimes negative due, for example, to status quo biases towards existing decision processes (Kahneman, Knetsch et al., 1991) or to the inflation of consulting services over the last few decades. A MARA setting can serve to overcome these impediments to introducing decision analysis in organizations. This can be an impediment to prove the value of decision analysis to organizations – in particular in countries where decision analysis is less known in the academic community. The ‘catalytic effect’ of a first successful application of decision analysis proved to be essential for a sustainable positioning of decision analysis in the MARA partner organizations. Both in Argentina and Germany, several follow-up projects with several partner organizations emerged after the completion of the project.

### **Problem-focused project search serves to explore new areas of application**

The search for projects based on suitable decision characteristics rather than by focusing on specific areas, seems to have opened up applied research opportunities outside the ‘classical’ areas of application. In both years that we carried out the MARA projects, we contacted public and private sector organizations, requesting ongoing strategic decisions with a high degree of uncertainty and stakeholder complexity. Due to this problem-focused rather than area-focused search, organizations could direct decision analysts to suitable decision problems in less common areas of application, such as human resources and marketing. A more widespread project acquisition approach could create access to further new areas of application.

### **The MARA-similar settings provide unique learning opportunities for junior analysts**

The combination of junior analysts as front-room analysts and senior analysts as back-room advisers proved to be an effective learning environment. The setting allowed the valuable time of senior analysts to be saved and gave junior analysts ample learning opportunities during decision analysis applications. The applied setting served as an extended classroom, in which senior decision analysts could effectively transfer their knowledge to more junior analysts. This was particularly relevant as inexperienced analysts in the context of MARA focused their work too narrowly on methodological procedures as opposed to solution-oriented content work. On some occasions, analysts narrowly applied their recently learned tools rather than taking into account the demands of the client and the characteristics of the decision problem. Initially, some participants had difficulty understanding the use of decision analysis as an aid to better thinking and informed decision-making rather than as a technocratic and rigid process. In addition, inexperienced analysts tended to strive for completeness rather than ‘requisiteness’ (Phillips, 1984) when developing decision models. They had to learn to go ‘through complexity to simplicity’ in model building (Belton and Stewart, 2002, p.7). The initial models tended to be overloaded with information, too complex and partly redundant. The senior analysts were able to ‘correct’ this tendency with several supervision sessions, effectively educating young analysts in the art of modelling.

Projects similar to MARA could be one valuable means to further expand the area of decision analysis, in particular in geographic areas where decision analysis applications are still rare. With the learning experiences and the case studies presented in this paper, as well as with the MARA research results (see Schilling, Oeser et al., 2007), we aim to inspire similar efforts which will contribute to the development of the area.



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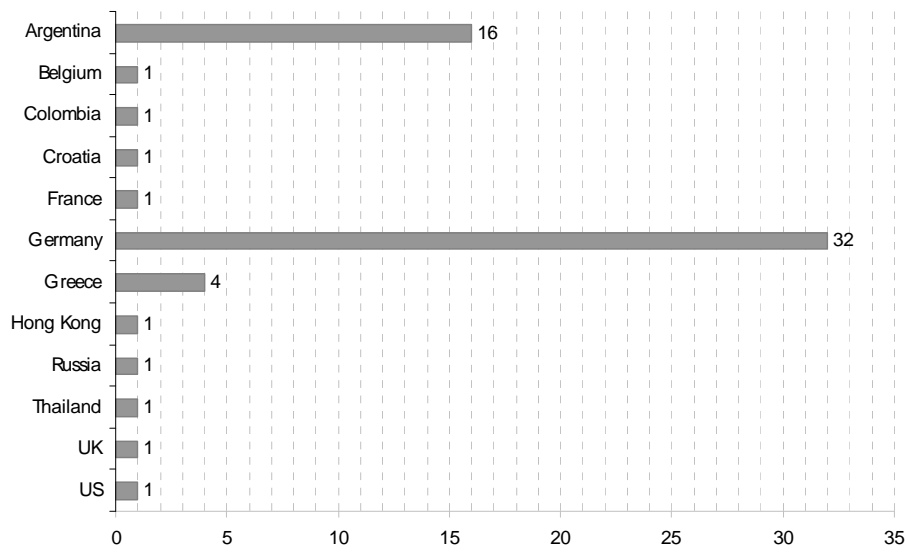
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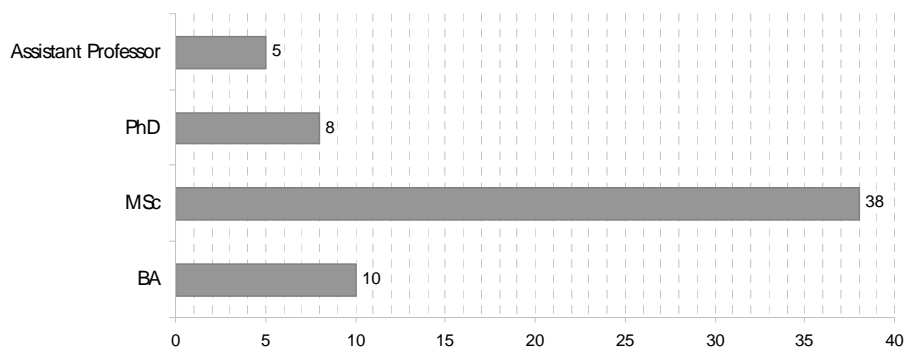
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## Annex A

Nationalities MARA 2005/2006



Academic Degrees MARA 2005/2006



### Nationalities and Academic Degrees of the MARA Participants

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