Measuring and reporting intangible assets and results in a European Contract Research Organization

Paper prepared for the Joint German-OECD Conference
Benchmarking Industry-Science Relationships

October 16 – 17, 2000, Berlin, Germany

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Abstract

As the biggest Contract Research Organization in Austria, Austrian Research Centers Seibersdorf (ARCS) performs research and development services for the economy and exercises an important function as a link between basic research at universities and the specialized applied research carried out by companies. As a node of the Austrian innovation system ARCS offers its own researchers and partners access to various sources of knowledge that they can then combine with their existing experience to come up with new concepts to solve technological and market-related problems.

For Contract Research Organizations a challenge in an increasingly competitive environment is to evaluate and communicate their research and business activities and results. Research is not self-explanatory, its benefits must be interpreted and communicated in a comprehensible way. ARCS is interested in improving the transparency of its intangible assets and results that are not supported by the traditional reporting system. With the first Intellectual Capital Report*) published for the year 1999, ARCS wants to communicate the achievements and intangible value added it created during a period.

In comparison with other organizations and institutions an Intellectual Capital Report of a research enterprise must reflect the specifics of the business. The most important one is the broad range of results due to the specific tasks of a Contract Research Organization. In the case of ARCS results are ranging from publications, lectures and testing services, expert opinions, prototypes and software to the management of networks. They mainly reflect relations between science and industry.

To implement the Intellectual Capital Report an integrated process oriented model that combines corporate strategy, corporate knowledge goals and knowledge processes with intangible results was developed and implemented. It relies on quantitative and qualitative data that are interpreted on the basis of the framework model. Due to the many different forms of knowledge and values created during research projects, results must be considered in differentiated ways. In the Intellectual Capital Report 1999, financial results are presented beside non-financial results, which are represented as research-, economy-, and society-oriented output.

This paper will discuss the underlying principles of reporting intangible assets and results in the context of a Contract Research Organization. After presenting the background, the model and experiences with the implementation of the Intellectual Capital Report are illustrated, especially when developing indicators to measure the outcome of the research process.

*) The Intellectual Capital Report 1999 of ARCS can be downloaded from www.arcs.ac.at/publik/fulltext/wissensbilanz

Introduction

Contract Research Organizations (CRO) exercise an important transfer function between the basic research at universities and the applied research and development in companies. CROs have a broad scope of activities, which differs from universities and private firms.

CROs are faced with three challenges mainly caused by the transformation of the economy into a knowledge-based economy, the transition of the science and innovation system, and the increasing competition because of scarce research funds.

The emerging knowledge-based economy stresses the importance of knowledge as new production factor. Even though knowledge creation has always been an important task of research organizations, investment in knowledge has also been increased in these type of organizations. This entails new organizational structures and requires new forms of measurement and management. The fundamental change of companies towards knowledge-based organizations is indicated by several findings. The most important ones are the increased intangible investments in most western countries. However, growing markets for knowledge-based products and services reflect the emerging knowledge-based economy. Intangible investments are important for the competitiveness of research organizations and industrial firms, but because of their nature they are difficult to fix and manage.

The transition of the science system is characterised by a stronger orientation towards applied research and the necessity of an interdisciplinary research approach. This trend is sometimes labelled as modus II of knowledge production. Innovation as the economic output of the research process does not only depend on the independent performance of firms, universities and research organizations but also on their interaction. Stronger co-operation between different actors (firms, universities, CROs, training institutions, public agencies etc.) are therefore necessary for the improvement of the innovation performance of economic actors.

As an organization which is partially funded by the public sector, there is an increasing demand for transparency in the use of those funds. Austerity policy of public agencies and an increasingly competitive-oriented climate within the industry of applied sciences force CROs to raise funds via professional research contracts. Because of the still substantial funding from public institutions, transparency about its use for the public is desired.

To meet these challenges ARCS decided to develop and publish an Intellectual Capital Report (IC Report). ARCS as a science based organization wants to communicate the achievements and intangible value added it created during a period and thus create a culture of openness and transparency. There is a need to document and assess the potential and the development of its most influencing success factor, is Intellectual Capital.

The Intellectual Capital Report 1999 provides information on the products and services supplied by ARCS and the resulting value added. The IC Report represents a new tool that can be used to measure the intangible assets not shown in the annual report and describes the results of the company's knowledge-based activities.

With the IC Report not only the Intellectual Capital of the company is measured, but also the output of the knowledge production process with different partners within the innovation system. Thus it is also possible to trace the performance regarding the science-industry relationship.

Moreover the valuation and assessment of intangible assets is a serious academic task, and therefore perfectly fits into the mission of a research organization to work on new approaches and new models for further reference. The development of the IC-Report is highly influenced by the present research on valuing intangibles and the modern innovation theory.

In the following paper we will describe the instrument of IC Reporting for research organizations. The IC Report is based on a framework model, which allows to document and measure intangibles that are strategically important for running the business of contract research organizations, for their corporate governance as well as for an increased transparency of communication with external stakeholders. The background for IC Reporting is highlighted and the aspect of output measurement is illustrated, too.

The role of CROs in the innovation system: the case of ARCS

Innovation is spawned by interactive contact between different players, such as companies, universities, research laboratory and educational institutions, all of which produce, combine, disseminate and employ a wide range of types of knowledge. In the Austrian innovation system, ARCS assists the transfer of knowledge from universities to the economy, enhancing the quality of Austria[1] as a research location in the process.

Fig. 1 illustrates the transfer function of CROs. The diagram shows the extent of co-operation based on 10,600 EU projects under the 4th EU research framework program (all 18 programs through 12/1998)[2]. Participating organizations are represented by circles. Their proximity to each other expresses the intensity of co-operation: universities (light grey) and companies (grey) usually do not co-operate primarily with each other, while contract research organizations (dark) are heavily involved in both areas.

As the biggest contract research institute in Austria, ARCS performs research and development services for the economy and society and exercises an important function as a link between basic research at universities and the specialized applied research carried out by companies. In concrete terms, this means that – like several other contract research institutes – ARCS:

– transfers academic knowledge to practical application

– provides an infrastructure and a platform for co-operative research projects

– addresses the need for information and concepts that benefit society as a whole, e.g. the need to develop procedures that save resources or improve consumer safety

– assumes the risk of innovative research in the early stage, if it seems too great for private organizations to bear.

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[1] Austrian Research Centers Seibersdorf - ARCS - is the biggest research Organization in Austria with public and private owners and run as a private limited enterprise. ARCS was founded as nuclear research institution at the end of the fifties and diversified its research range during the seventies and eighties. Currently ARCS performs research and development in the fields of information technology, material technologies and engineering, life sciences, nuclear technology services and systems research. ARCS performs research and development services for the economy and society, more than 700 employees are working on public funded research projects and industry funded applied research and development projects.

[2] The analysis was carried out using a process developed by ARCS for the bibliometric management of technology and knowledge.

To perform this task, ARCS is linked in national and international university-, industrial- and public networks. As a network node, ARCS offers its own researchers and partners access to various reserves of knowledge that they can then combine with their existing knowledge to come up with new concepts to solve technological, market-related and general economic problems. One of ARCS's particular strengths lies in the development of new networks, for example in the form of virtual teams involving universities, companies and public institutions.

Internal and external networking also necessitates extensive interdisciplinary capabilities – a factor that is becoming increasingly important to the development of new technologies and the generation of new knowledge. ARCS represents a number of different disciplines and makes it possible for different areas of knowledge to be employed for new applications and for problem solving.

ARCS provides a wide variety of services to promote interaction between independent research and contract research. This involves results ranging from publications, lectures and testing services to expert opinions, prototypes and software to the management of networks. The international nature of the research activities undertaken by ARCS also benefits the Austrian economy as it strives for greater internationalization.
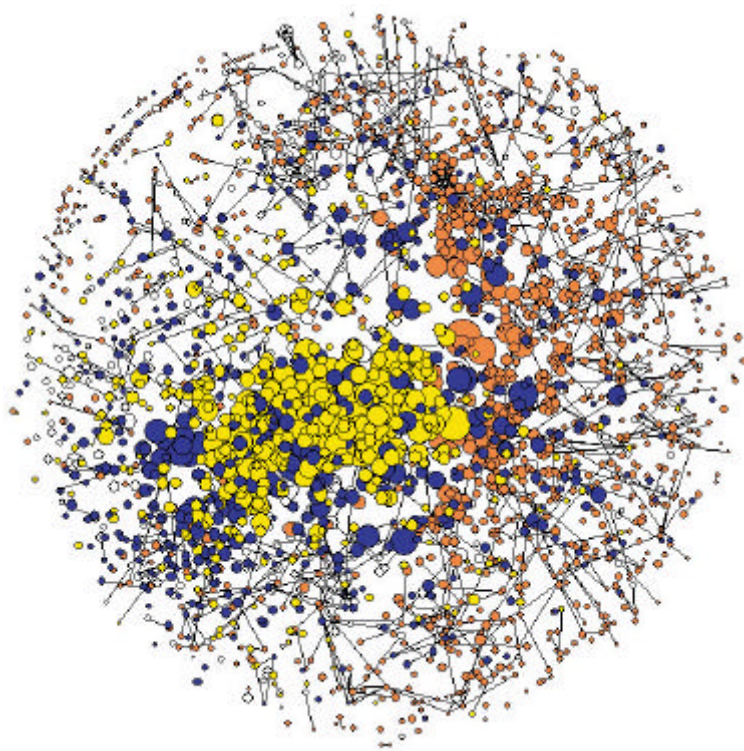
Fig. 1. Transfer function between universities and companies exercised by contract research
Source: Topolnik, M./Kopcsa, A. et al. (2000): PROVISO Project report, BMVIT, Vienna.

Background on the valuation of intangible assets

Intangible assets are of increasing importance for the corporate value creation processes of all kind of organizations (see OECD 1999). This has severe consequences for internal and external reporting and hence for the decision making processes. Intangibles treated as resources of distinctive value should then be developed and allocated according to "objective"

measures and according to excepted economic criteria. We are confronted with higher expectation for measuring methods and reporting tools to properly monitor investments into intangible assets. Questions about technical feasibility and cost- benefit arise, but so far could not be resolved satisfactory (see OECD 2000) to the extend of defining standards or legally binding procedures.

A frequently set first step in the quest to measure and manage knowledge and intangibles is to start defining categories of intangibles, coming up with a popular differentiation of intellectual capital into human capital, structural capital and some sort of relational capital (Sveiby 1997). This usually takes place parallel to the internal learning process to acquire the basic underlying theoretical framework. Traditionally, accounting for tangible assets started with documenting several categories and then creating an inventory of the stock. This provides the raw data to calculate annual profits or loss. However, this simple mechanism is no longer sufficient in the knowledge based economy, since an increasing share of a company's (market) value is not representing inventory or physical assets, but intangibles in a broad sense. Especially industries with considerable investments in research and development such as the chemical-, pharmaceutical-, or aviation industry as well as IT-oriented businesses find themselves in a position, where they create high value added by developing innovative methods, processes and business-models to perform more productive relative to their competitors. This is also true for research organizations.

For several reasons these achievements are treated as expenses rather than as accountable investments (Lev 1999, Anthony and Reece 1993). This is especially problematic for long term oriented projects (of start up companies) or fast growing industries in need for new capital. Because of restricted accountability, these companies eventually might face a situation of acute liquidity crises because of a lack of transparency in capital markets, although in reality, they have great support in fundamental development. Lacking transparency inevitably results in higher cost for capital and therefore disadvantage on the market.

Until today, investments in intangible assets are usually not documented in a systematic manner. As a consequence, external reporting fell short of creating the required transparency because of data not available. Consequently, a reasonable estimate about the future performance potential of an organization could not be provided.

Valuing intangibles is not a new issue for service and knowledge intensive areas of the economy. There is a huge body of literature covering the legally protected assets, such as patents, licenses, trademarks and copyright (see IASC E38 or Brockington 1995 for further details). But this is only a small fraction of what usually is summarized under the term of intangibles. Beside these elements there exists a list of legally not protected elements of value that is already widely discussed in the literature (most prominently: Sveiby 1997, Stewart 1997, Edvinsson and Malone 1997). There exists literature on the valuation of technology and R&D, which is especially relevant for research and technology organizations, but the findings of this work is inadequate so far (see Lev 1999).

Besides the mentioned factum of the increasing relative importance of intangibles compared to traditional sources of value generation, there remains the question, why this is so, and how this could be measured. The discussion quickly moves to the fundamentals of (financial) valuation, in extreme cases even to principles of measuring the gross domestic product (OECD 1998a). However, if we manage to focus the discussion on productivity, we usually might find ourselves with the observation, that some enterprises are more successfully

creating value (e.g. expressed in ROI leveled over several years) than do others. Automatically, a cause-and-effect analysis leads to dimensions such as corporate governance, strategy, corporate culture, investment in personnel development, procedures concerning innovation and renewal of the organization, furthermore customer relations or product development. All of these dimensions are "soft" compared to other – usually strictly defined - measures of financial accounting. Generally some sort of numeric value can be assigned, such as e.g. total investment in marketing or acquisition cost per customer. However, a holistic view usually is missing.

The present lack of an integrated approach to a comprehensive valuation and reporting is due to a marginal demand in theory and practice until the late nineties. Prominent exceptions are Machlup (1980) and Becker (1975) who developed a very advanced framework on human capital in the early seventies. The reason can be found in insufficient managerial capacities, that were already occupied with the task of monitoring the not trivial financial matters. Since then the competitive pressure increased dramatically due to globalization, market liberalization and new technologies. This forced organizations to look for additional reserves of productivity and almost naturally led to the less convenient traceable intangible assets. They seem to represent an almost infinite source of wealth because of their generic characteristic: intangibles are not depreciated after use – in fact, they seem to have a catalytic character. They can be reused and grow in value when shared. Therefore they create positive returns, an effect neglected by classical economics theory.

As a result of the properties of knowledge, its value can only be measured inadequately using the tools of classical accounting, or perhaps even not measured at all. IC Reporting represents a new tool that can be used to measure the intangible assets not shown in the annual report. In other words, this report describes the results of the company's knowledge-based activities.

Although we will not discuss the methods to measure and evaluate intangibles in this paper, a list with some key terms will be provided[3]. There are two ways to differentiate the approaches, monetary and non-monetary measures, that in turn can be split into more detail:

a) monetary measures:
- cost approach (production cost and replacement cost)
- market approach (what the market is willing to pay)
- income approach (predicts the income and discounts it to present value)
- real options (financial value of different strategies that alternatively could be applied in a given situation)
b) non-monetary measures
- structural models (e.g. Intangible Asset Monitor by Sveiby 1997 and the Skandia Navigator by Edvinsson and Malone 1997)
- process models (e.g. European Foundation for Quality Management)

From the investors perspective (who wants to invest in an enterprise) there is a strong demand for methods compatible with already established methods to assess the financial value of the enterprise. From the perspective of corporate governance there is a need for a broad and reliable information base that determines the daily decision processes. Managers frequently face a situation of high uncertainty, and therefore take account of almost any information available, even if it has to be characterized as "soft". Anyway, we have to consider, what goal

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[3] for further reference please see: Leitner et al. (2000), Butler et al. (2000), Canibano et al. (1999).

should be reached. Currently, we have no method available that fulfills all requirements equally. The discrepancy between a more financial oriented management and measurement approach (like via EVA) and an approach, which focus rather one the competence base of the organization (which could never fully measured in monetary terms and requires also non-financial indicators) will keep going in the future (Mouritsen 1998).

The topic of complementary internal and external reporting was intensely discussed at the OECD conference in Amsterdam in 1999 (Measuring and Reporting Intangible Assets), concluding, that it is still too early to recommend a standard to do so, but rather found a consensus, that further empirical research needs to be done. National programs to deliver such empirical data are currently under way, mainly in the Netherlands and Scandinavia (via an EU - funded MERITUM project), and in the UK (MARIA project).

Trends in evaluation research and innovation theory

Apart from the discussion in the micro economic and management literature about how to measure and value intangibles a similar discussion could also be found in the political science/economy and evaluation research about the valuation of the social and economic effects of public spending. There has been a long debate about how to evaluate public spending and how to estimate economic effects of public (research) programs. In their practical work evaluators are furthermore faced with the question of accountability. On the one hand there is the rather scientifically elaborated evaluation research approach, on the other hand the rather pragmatic performance management approach exists, which is based on output indicators (Blalock 1999).

Because of their complex nature and diverse impacts, evaluation of public initiatives and programs is often restricted to qualitative analyses. Cost-benefit estimations are not always possible due to a lack of valid data. Evaluation of public research and innovation activities is limited to qualitative information and non-financial data. Therefore economic effects could often not be measured in financial terms.

Evaluations of publicly funded research programs and institutions are based to a high degree on the modern innovation theory. The innovation theory delivers answers to the question of the interfaces between different actors of the innovation system. Quite a huge body of literature exists for the analyses of the university-industry relationships (e.g. Bonaccorsi and Piccaluga 1994, Kanishi 2000, Schartinger et al. 2000) and different indicators have been presented in the literature. These studies describe different kinds of interactions and knowledge flows. Important knowledge flows are joint research projects, contract research, joint supervision of theses and the mobility of university researchers into private firms, whereas a quantitative measure of these interactions is hardly possible. In comparison the relationship between research and technology organizations and industry is rather neglected, even tough they play an important transfer function within the innovation system.

To evaluate science, technology and innovation policy and to analyse the economic development on the macro economic level, a set of main indicators on the national and international level has been defined and is commonly used. The OECD plays an essential function in the development of new science and technology indicators (OECD 1998b). To trace the innovation process of the economic actors, input (process) and output indicators are separated (Gabolde 1998). The development of new indicators is strongly dependent on new theories about the innovation process (for an overview see e.g. Edquist 1997).

The similarities between the requirement for measuring research and innovation on the micro and macro level reveal the fundamental problem of measuring and valuing intangibles and often rather „non-measurable" elements and factors in our economy.

The ARCS-model for Intellectual Capital Reporting

The primary challenge for designing a model for intellectual capital reporting for the applied research organization ARCS was to establish a "perfect" fit with the given specific organizational requirements and simultaneously reflect the knowledge creation processes in an optimal way[4].

The IC Report 1999 is based on a model (see fig. 2) that reflects the cycle of knowledge within the company. One underlying principle is that knowledge in the form of human, structural and relational capital is always both an input and an output. With this model, which in future will be used by all divisions of ARCS, highly specific combinations of intangible resources can be traced.

The process of acquiring, applying and exploiting knowledge starts with the definition of knowledge goals, which can be derived from the corporate strategy. These goals form the framework for the utilization of the intellectual capital at ARCS, which is composed of structural, human and relational capital. Projects are carried out at the operating level, and value added by utilizing these intangible assets, which need to be constantly developed and maintained. There are numerous interactions and spill-over effects in the process, which give ARCS its unique interdisciplinary character.

A specific attribute of the ARCS-model is the integration of intangible results. Intangible results are non-financial results with respect to economy, research and society. In addition to these results, there are also financial returns that appear in the ARCS annual report.

ARCS divides its value-added activities into independent research, which is increasingly being structured as programs, and contract projects carried out for various different customers. While contract research keeps ARCS in close touch with practical applications and the market, independent research promotes continuity and creates opportunities for the production of new knowledge.

Depending on the assignment, either all three elements of intellectual capital are utilized equally or individual elements are applied selectively to projects. In general, large, long-term research projects will tend to combine all three elements. In more customized contract research projects the emphasis is likely to be on structural capital (e.g. trade fairs, testing) or on relational capital (e.g. EU projects). In its independent research, ARCS carries out long-term (lasting from two to five years) pre-competition research with the goal of building up expertise and ideas for potential clients. The general problem or application area is defined in an outline, which allows the necessary leeway for knowledge- oriented research.

Contract research projects are carried out for national and international customers. The results are passed on to the client and charged at the going market price.In some cases they are also published. Contract research at ARCS is self-financing. Independent research provides some

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[4] The design of the ARCS-model was the result of a co-operation between ARCS and the University of Graz.

initiatives for contract research and vice versa (spill-over). Some of the services offered by ARCS are sold on the market, but some are performed as public services. Profit alone has limited value as a measure of the success of these services. The model identifies non-financial results which have a financial impact only at a later date, or there is no direct financial benefit, but a benefit as an externality in another area. Examples are knowledge for which other parties find an application, or ideas learned from publications or lectures and then put into practice, or the leverage effect of an R&D link between companies.

Spill-over is particularly important – i.e. interaction between independent research and contract research projects. This means that new knowledge is generated in the course of independent research that is then applied in contract research projects, leading in turn to benefits for private and public customers. However, contract research also generates incentives for independent research, e.g. when customers raise new questions.
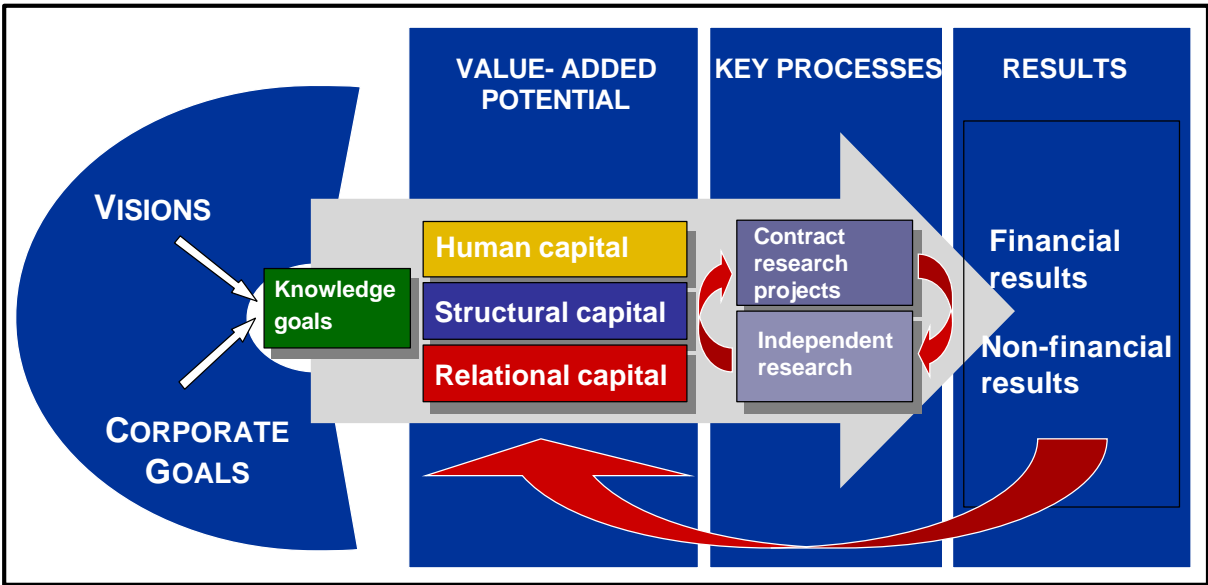

Fig. 2: The ARCS Intellectual Capital Report Model

The model helps to picture the development of intangible assets over the past reporting period and helps to interpret the processes. The complexity of the processes in a research institute caused by interactions can only be hinted at, since as in a classical balance sheet details are lost in consolidated presentation. Nevertheless, the IC Report represents an important step in highlighting on relations that have not been covered in the annual report.

The IC Report 1999 furnishes information on the knowledge available at ARCS and on the flow of knowledge within the company. Intangible assets are represented by indicators, for each of which a frame of reference is described. For each element of the model indicators are defined. Interrelatedness between indicators, developments and especially target achievements are also described in the IC Report, often in the form of best practices or examples of excellence.

Output indicators

The services provided by ARCS for the Austrian economy and society are diverse. On the one hand ARCS carries out numerous projects for private companies, both national and

international. On the other, ARCS also makes contributions in the form of publications, policy advice and opinions in the public media. The output of the interaction between independent research and contract research is a wide variety of services. This involves results ranging from publications, lectures and testing services to expert opinions, prototypes and software to the management of networks. Additionally, a new initiative to spin off new science oriented start up companies is planned.

Important channels of Interactions between ARCS and its partners and customers are contract research, consultancy and services, human mobility, network activities, spin-offs and knowledge spill overs via publications and lectures.

To picture the different kinds of outputs three different types of non-financial results have been defined in the IC Report: these are research-, economy-, and society-oriented results. The majority of this indicators reflect the transfer function of the organization and illustrates knowledge flows and interactions with the industry.

Table 1 shows the indicators which have been defined in the IC Report to illustrate the output of ARCS:

Financial results
Total turnover in million ATS
Growth in turnover compared to the previous year*)
Percentage of financing from own resources
Economy-oriented results
Number of new contract projects with customers
Number of new customers in %
Number of projects for private customers
Number of new EU contract projects
Research co-ordination and network management:
EU, competence centers, cluster initiatives (prime contractor)
Authorizations and certifications
Number of spin-offs
Number of customers – training
Research-oriented results
Publications: scientific journals
Publications: trade journals, conference proceedings, books
Presentations at scientific conferences
Patents
Teaching assignments
Completed theses and dissertations
Society-oriented results
Involvement in scientific, technical or business boards
Policy consultancy projects
"Response indicator" (name ARCS mentioned in the media)

Tab. 1: Output indicators within the IC Report

The IC report delivers a rich set of indicators to map the different types of interfaces between our organizations and their environment. Important indicators, which reflect the particular relationships between the CRO and the industry, are the number of new customers and private customers and the number of customer-training (see Tab.1). EU contract projects and the number of managed networks by ARCS (e.g. clusters, EU-programs, and competence centers) reflect the performance as network node. Through these activities ARCS supports and initiates

the establishment of networks between companies, universities and other institutions. These networks help to improve export opportunities and promote the development of new technologies where the objective is to combine expertise or to reduce a risk through joint research. The participation in boards contributes partially to the networking.

The number of publications, lectures, theses and presentations is a more indirect output measurement whose effects could not be traced exactly. These knowledge flows are nevertheless important for the relation between CROs and industry. This measurement is also mainly used for the performance measurement of universities. However, the amount of the publications is not directly comparable with these of universities.

Apart from the indicators listed on the result side of the IC model, other indicators are shown in other parts of the IC Report[5]. Sometimes indicators are both, input and output. It is a general complicating element that IC-indicators can measure different things and sometimes similar resources and results[6].

Due to the many different forms of knowledge and values created, results must be considered in differentiated ways. Like a financial balance sheet, in which all different key figures illustrate different facts, an intellectual capital report supplies a range of indicators that require individual interpretation.

The interpretation of indicators could be carried out by comparisons. The IC Report tries to deliver the necessary data. Such comparisons may be made with historical information, they may relate to the achievement of strategic goals or represent a benchmark, indicating a position in relationship with comparable research organizations. Only then differences and deviations come to light, which prompt the ongoing modification of the company's strategy. In this context it is particularly important to have a clear understanding of the facts and the set of circumstances for which a certain indicator supplies information. Furthermore texts, stories (e.g. examples of excellence) and metaphors deliver a framework and help to interpret indicators.

The (e)valuation of the performance of ARCS as CRO is based on indicators. Yet, the impact of the work done by ARCS on the business world and society cannot be quantified in the IC Report 1999 in financial terms. For this to happen, extensive evaluations would have to take place. Due to the lack of suitable analytical methods, even then it is not certain that the impact could be ascribed to the work of ARCS. Research multiplier mentioned occasionally in other reports or analyses can at most be used as a rough guide.

The process of defining indicators

In the following section a short illustration of crucial aspects of the implementation process with respect to the definition of indicators within ARCS is provided.

To define the different kind of indicators, the aims must be defined. This had been the starting point for the development of the IC Report. Compared to the traditional balance sheet (where aims are implicitly defined or self-evident) the development of an IC Report requires the

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[5] The list of all indicators used in the IC Report can be found in the appendix.
[6] An example should illustrate the problem: The indicator "number of lectures per scientific employee" is, for example, a measurement of knowledge transfer to students, a measurement to value the opportunities for networking, and even a measure for competence enhancement of the lecturer.

explicit formulation of organizational goals. This explicit goal orientation is one of the most significant differences between these two reporting systems. The formulation of corporate goals is necessary for the second step of the process, the definition of the indicators.

The discussion of goals and strategies forces an organization to concentrate on the essential value creating processes which must then be measured, documented and communicated. We tried to get a clear picture of the role of ARCS as CRO in performing knowledge transfer and the priorities for fulfilling this process.

In the past few years, many CROs have considerably changed their strategic orientation and have had to find their position between the university sector and the private sector. Whereas private firms aim to maximise their profits, non-profit Contract Research Organizations do not. Research organizations which have heterogeneous owners, investors and customers have to position themselves in an increasingly competitive environment.

After defining the strategic goals the project team started to formulate the indicators for the IC Report. Apart from the corporate strategies and goals which served as fundament for this project step, the existing data in the firm were another element of reference. The aim was to formulate valid indicators for every category of the underlying model. The ideal way of defining indicators derived from goals was not always possible. Sometimes information and indicators which existed in different departments had to be evaluated on their relevance for the task of valuing intangibles. The development of the indicators was the combination of top-down and bottom-up processes. Sometimes indicators were developed in expectation that afterwards the picture of the essentials and priorities of the firm would be more precise. However, it is not possible to define indicators without an exact idea of the intended development of the organization. During the strategic discussion driving forces of competition, market, and technology were brought into the model. It was important to find out the implicit rules for the research process and research competition.

One of the biggest dangers when developing an IC Report is to define too many goals or indicators. If neither the picture of the company development nor the important intangible resources required are clear, people or organizations tend to want to reach „everything". However, strategic thinking entails setting priorities. For this task the understanding of the innovation process in firms and between different organizations helped focusing the topic.

When selecting indicators, a priority must be to define them as exactly and transparently as possible. During the implementation process in ARCS the project team always had to decide, whether the indicator really measures the phenomenon that it wants to express, whether the measurement is possible and not too expensive.

When defining the indicators the project team also tried to use indicators which are used internationally in other firms or have already been published in the literature. The aim was to create conditions for a sustainable international benchmarking of indicators that are relevant for research organizations. The criterion to define comparable indicators was an important priority.

A meta or macro model which reflects the knowledge flows between ARCS and its environment - mainly represented through different organizations and institutions - is not explicitly integrated within the IC Report. However, the project team designed a framework model to better understand the interactions between ARCS and its environment. This

conceptual framework which was inspired by the modern innovation theory, was an additional fundament for the development of (output-oriented) indicators.

Discussion

The first IC Report in the history of ARCS was finished in April 2000 and then presented and discussed internally and externally. One of the main tasks is to initiate a discussion process with different kind of stakeholders. For the interpretation of the indicators it is crucial to find a common language, which means that all stakeholders refer to the same framework. Assessments can be made on the basis of the development over time, by comparing with the formulated goals or by benchmarking with similar research organizations.

It is perhaps too soon to evaluate the project effects in detail. This is mainly due to the effect that an evaluation of the whole project would have to consider all aspects of communication and intangible effects. However, some results have already become visible: The image of ARCS as innovative player on the transformation to the knowledge-based economy has been strengthened. New corporate values have been communicated through out the organization and its environment, e.g. the awareness for networking has been fostered, new argumentative strategies for the discussion with investors and owners have emerged.

The first IC Report of ARCS has been developed for the whole company, therefore the indicators for the different departments have been aggregated. The aggregation of indicators has the disadvantage that the specifics of the individual departments cannot be considered. Thus, for the internal communication, a separate or individual analysis was carried out.

Organizational goals and strategies are the starting point for the development of an IC Report. Only if one discuss the strategic orientation of a CRO, it is possible to define indicators and to measure results. This is a critical task and helps the management to find its mission in the changing world. So the logic is: to define indicators, one have to define performance, to define performance, one have to define objectives and strategies.

The IC Report is a medium of communication. Besides the external communication the internal communication is important, too. Through presenting and discussing the new report system within the different divisions of ARCS, it was possible to communicate new values and evaluate the results. Through the IC Report managers and scientists have an additional tool to communicate with other management levels and to evaluate the performance systematically and holistically.

The IC Report represents an essential cornerstone to manage the corporate knowledge base, or its intangible assets, since for the first time it provides a sound foundation for management intervention based on sound data.

When „reading" the IC Report, a variety of interpretations are possible. This range of possible interpretations is wider than with the Reporting System of the Balance Sheet or Annual Report. This is mainly due to the absence of standards and collective reference frameworks. We believe the main challenge for the future will be the standardisation of indicators as well as the establishment of guidelines for developing and applying IC Reports. Also specific research has to be done to further clarify the specifics of the outputs of CROs and their relationships (knowledge interactions) with other economic agents.

The IC Report also consists of qualitative valuations and tries to describe the context for each indicator. These qualitative valuations are an important part of the IC Report. For many decisive relations within the organization and between the environment no indicators could have been defined so far. Also improvements in the management process could predominantly only be valued by qualitative specifications. We believe that currently and in the near future it will be necessary to evaluate intangibles on the basis of qualitative criteria, too.

However, the performance measurement is focused on a limited set of outputs and indicators, respectively. There is nevertheless the risk that the produced and provided information will be insufficient or misleading, even though the additional data and text within the IC Report help to interpret the indicators. Therefore the main task for the future will be to find a common set of indicators to compare and benchmark different CROs and other kinds of research organizations. A more sophisticated theoretical framework to analyse the knowledge flows between these two actors will be helpful.

For the policy makers the preparation of guidelines for the development of new reporting systems for research organizations could help to improve the understanding of the development of the research and innovation system.

Outlook

In the future the IC Report of ARCS should be improved, the existing indicators will be evaluated every year, new indicators will be integrated according to the demands of a changing economic environment. An example of a new indicator will be joint publications and the number of contract projects with SMEs. If selecting and gathering data on indicators, ARCS will have to continue to focus on a few indicators, as this simplifies „reading" the IC Report. The objective is to work up the factors that are important in company management and development. In addition the aspect of Intellectual Property Rights will be explicitly treated.

Next year, the model will be expanded to include the individual research areas at ARCS, thereby creating additional transparency. With the development and implementation of the first European IC Report of a research organization, ARCS wanted to establish an example, which could serve as a reference model. Our model could be easily put into practice by other companies by using their own real figures.

ARCS plans to communicate the lessons learned in the international field and wants to be a mayor contributor to the new discussion of IC reporting and performance measurement. In addition currently a research program is being designed to further investigate the potentials of valuing intangible assets and results.

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Appendix: Indicators used in the first Intellectual Capital Report of ARCS

Human capital
Human resources
New staff total
research staff
Total staff fluctuation
Total staff leaving
research staff, total
of whom aged 25-35
of whom aged 25-35 within 2 years
of whom aged 35-45
of whom aged 45-59
of whom retired
Total retirement
Average seniority (in years)
Percentage of research staff
Number of awards
Training
Days training per employee, total
Days training per employee: communication & management
Days training per employee: computer literacy
Days training per employee: technical
Training cost in % of salary, per employee
Structural capital
IT infrastructure
IT expense per employee in ATS
Processes: project schedule adherence
Success ratio for EU research programs (projects won/submitted)
Success ratio for national research programs/competence centers (pr. won/submitted)
Knowledge-based infrastructure
Number of databases to which ARCS has access
Accreditations and certifications
Relational capital
Project cooperation and networking
EU projects and Kplus (as a % of all new projects)
In-house collaboration (as a % of all new projects)
Research activities abroad in man years
Number of international research scientists (as a % of research workers)
Dissemination and networking
Number of conferences attended, total (per research worker)
Lectures at scientific conferences (per research worker)
Referees: journals and evaluation panels, number of people (per research worker)
Involvement on boards: scientific, industrial, political (per research worker)
Teaching assignments (per research worker)
Customers, image and stakeholders
First-time customers (as a % of all new projects)
New stakeholders
"Response indicator" (name ARCS mentioned in the media)
Independent research
Number of project categories

	Percentage of independent research in total expenditure
	Percentage of international projects
Contract research projects	
	Number of customer projects (not including small projects)
	Revenue from customer projects incl. small projects (orders received) in ATS million
	Revenue per project (not incl. small projects
	Customers
	Average size of small projects in ATS
Results	
Financial results	
	Total turnover in million ATS
	Growth in turnover compared to the previous year*)
	Percentage of financing from own resources
Economy-oriented results	
	Number of new contract projects with customers
	Number of new customers in %
	Number of projects for private customers
	Number of new EU contract projects
	Research co-ordination and network management:
	EU, competence centers, cluster initiatives (prime contractor)
	Authorizations and certifications
	Number of spin-offs
	Number of customers – training
Research-oriented results	
	Publications: scientific journals
	Publications: trade journals, conference proceedings, books
	Presentations at scientific conferences
	Patents
	Teaching assignments
	Completed theses and dissertations
Society-oriented results	
	Involvement in scientific, technical or business boards
	Policy consultancy projects
	"Response indicator" (name ARCS mentioned in the media)