

Research & Technology Institutes

Meeting the Challenges of the Post-Recession World



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Executive Summary

Research and Technology Institutes (RTIs) around the world are facing a number of strategic and operational challenges: changes in their role, pressures on funding, more global competition, and increasing demands from their sponsors and customers. To adapt successfully, institutes need to avoid the trap of incremental changes and death-by-a-thousand-cuts. Instead, they need to take a more fundamental approach by revisiting role and strategy, sharpening the focus of research activities, and making real changes to operational processes, organization and incentives. RTIs have the potential to become even more important in the post-recession world of virtual, networked corporations and collaborative innovation. Based on Arthur D. Little's experience working with over 60 institutions in the last decade, this paper provides some practical examples of how RTIs can address the challenges of change.

Introduction

Research and Technology Institutes (RTIs) are organisations that provide research and development, technology and innovation services to governments, industry and other clients. In developed countries, RTIs often have a long history, with many being founded decades ago as government-funded national research laboratories. Today they have evolved into a number of different forms with varying emphasis on research, technical services and technology development and exploitation. There are thousands of RTIs around the world, both big and small – for example there are some 750 in Germany alone. A few have become widely known, such as the Massachusetts Institute of Technology in the US, or Fraunhofer in Germany. Others occupy specialist niches with only very limited public profiles.

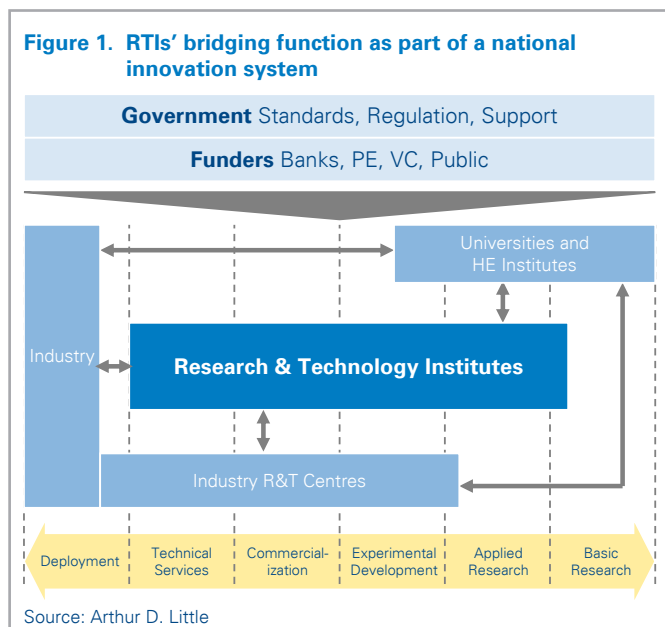
RTIs have a key role in any country’s national innovation system (see Figure 1), typically centering on applied research, but often providing a wide range of complementary science, technology and innovation (STI) services including technical consultancy, commercialization, and experimental development. In Europe, RTIs account for over 40% of public R&D spending.

Unlike universities, which have a dual role to provide education and produce knowledge, the role of RTIs has typically been to provide STI support to both the private and public sector. In that sense, their role as an intermediary bridging organisation is concerned with the practical *transfer and application* of knowledge, normally in pursuit of national policy goals and to support industrial capability development. They often also support public policy and regulation by providing essential scientific evidence, datasets, advice and technical support.

In keeping with their public role, virtually all RTIs have some significant core funding from the government, although increasingly RTIs are expected to generate some offsetting commercial income, or bid for competitive funds provided by government. For this reason, in developed countries RTIs’ main mission is often orientated towards serving the R&D needs of industry. By contrast, in developing countries RTIs tend to have a mission centred on promoting economic development through STI and commercial exploitation of technology and knowledge, often substituting for the lack of private sector R&D.

However, our experience in working with RTIs and other research organisations suggests that many are today facing difficult strategic and operational challenges. What’s more, the role of RTIs is likely to evolve still further as we move into the new post-recession world. All of this means that RTI leaders are under pressure to rethink strategy and organisation more than even before.

In this article, we explore the key challenges facing RTIs, discuss the causes of these challenges, and provide a framework for addressing them including some best practices for implementation. This is illustrated with a selection of examples from Arthur D. Little’s project work with over 60 research-based organizations in the last decade.

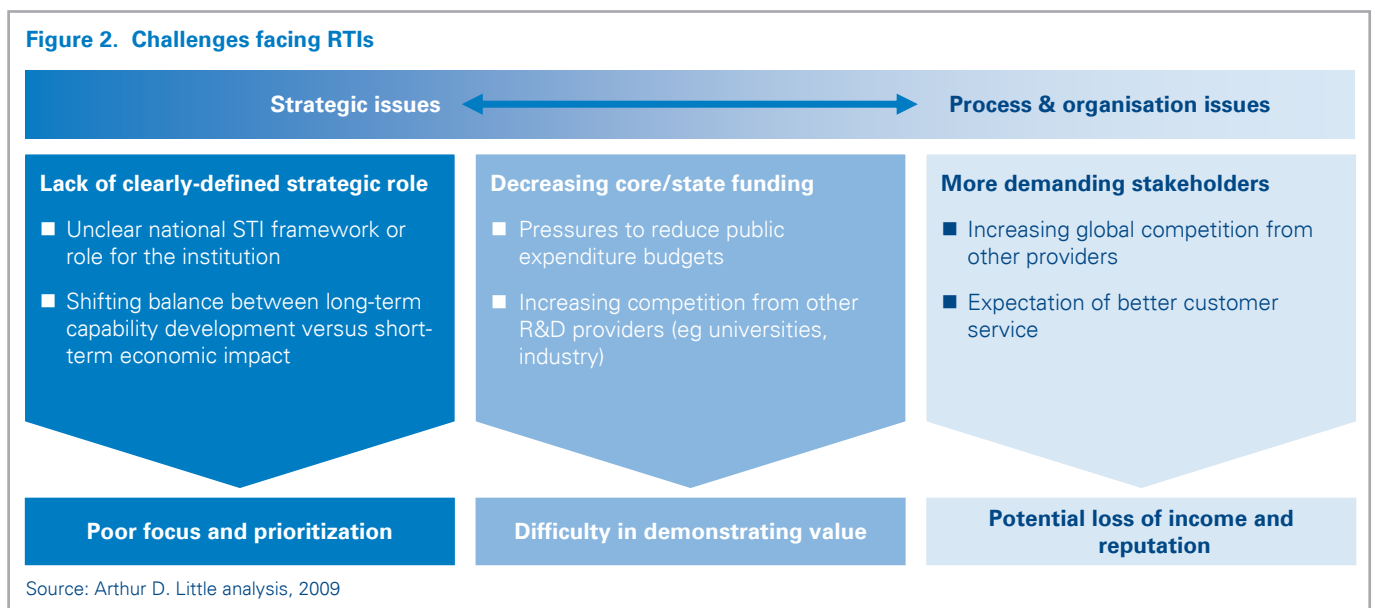


The Challenges Facing RTIs

We see three common sets of challenges facing RTIs today which relate to a combination of strategic, process and organisation issues (see Figure 2):

- the lack of a clearly-defined strategic role
- decreasing core/state funding
- more demanding stakeholders

All three of these sets of challenges can have negative consequences for the effectiveness and efficiency of the RTI organisation itself if inadequately addressed. At worst, this can lead to a vicious circle of further funding cuts, loss of commercial income and a further loss of capability and performance. We will consider each set of challenges in turn.

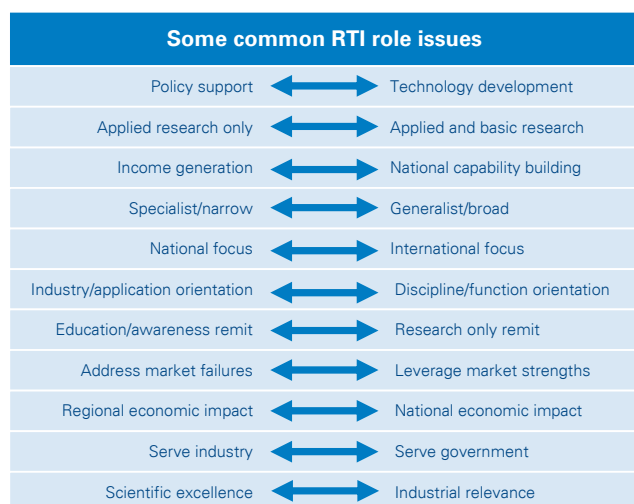


1. Lack of a Clearly-Defined Strategic Role

The problem

In Arthur D. Little’s experience, less successful RTIs tend to underperform often because they operate within a national or regional STI system in which their precise role and mission is insufficiently defined or inadequately focused (see Figure 3).

Figure 3. Defining the role of an RTI



Source: Arthur D. Little analysis, 2009

A common problem is that different stakeholders may have conflicting objectives – for example, different government bodies may have different requirements (eg regional vs national or international, industrial development departments versus environmental or health departments). In developing countries, there may be little in terms of a formal national STI policy framework or system. This means that an RTI may be asked to address a much wider range of activities than would be expected in more developed national innovation systems. Sometimes the original mission and rationale for the institute drifts over time as a result of economic, technical, social, environmental or political changes. Even in developed countries there are grey areas, overlaps and gaps between different RTIs and universities, often as a consequence of history and context. The distinction between the role of universities and RTIs is becoming increasingly blurred as universities are encouraged to focus on applied research addressing cross-disciplinary government and business problems. For many RTIs, strategy is little more than

a lofty set of principles and goals that gets reviewed every few years, but in practice has little or no impact on specific research programs or day-to-day operations. And even when there is a clear strategy, we find that poor implementation of strategy is a common problem.

The lack of a meaningful mission, vision and strategy is usually crippling for any organization. It makes it very difficult for the RTI to prioritise its activities, often resulting in project resources being spread too thinly across the organization with no critical mass in any one area. Without any clear strategic focus in terms of customers and activities, and in the absence of suitably aligned performance and incentive systems, management typically finds it easier to operate more like a university. The individual research interests of staff begin to dominate the organization and it gradually moves to a structure based on strongly independent research units which operate as a set of loosely associated technological fiefdoms rather than as an organization with an overriding business mission to serve industry or national stakeholders. Over time, such an organization can lose sight of what’s important to key external stakeholders, become inwardly-focused and drift into underperformance.

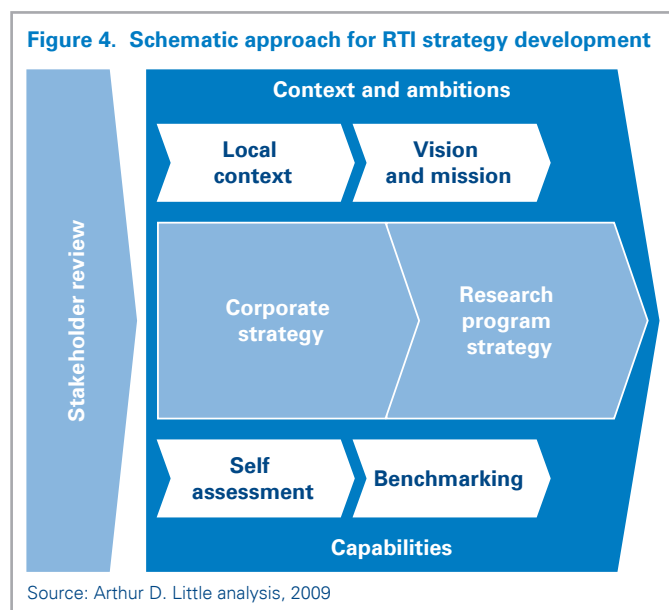
The solution: press for strategic clarity and prioritize

RTIs in this situation face a real challenge if the root cause of the lack of clarity in their role (and therefore lack of strategic direction) is the absence of a clear regional or national STI framework and/or policy. This is primarily a government-level issue that involves many stakeholders, and consequently the RTI is not in a position to solve it on its own. In situations like this, we have seen RTIs taking one of two basic positions:

- Do nothing: accept the ambiguity and live with the negative consequences.
- Capture the upper ground: take proactive steps to redefine role and strategy and implement it throughout the operations.

“Do nothing” may be a valid response if the RTI does not believe it is in a position to make the change – for example, through lack of funds, lack of stakeholder support or lack of internal motivation. However, this position is unlikely to be sustainable over time for the reasons outlined above.

A better approach is to take proactive steps to define and implement a strategy. This can be difficult, especially in an environment where there is no clear STI framework, or where there are conflicting stakeholder requirements. At Arthur D. Little, we help RTIs by using a structured approach to define context and stakeholder needs, assess capabilities, and then working in a highly-interactive way, to create a vision and mission around which an Ambition-Driven Strategy™ can be developed and implemented. This is completed first at the corporate level and then for each of the research programs (see Figure 4).



The high level strategy allows the leadership team to be explicit about the role of the institute and to begin to prioritize its R&D project portfolio. This is the point where strategy starts to have real meaning for the organization. In order for the new prioritization processes to work, the process must compel the organization to abandon some activities and to increase the internal competition for resources in order to develop areas of strength where the institute can be nationally or internationally competitive.

Here we have found that there needs to be a real break with the way things have been done in the past, especially in terms of prioritization processes. Whilst a lot of RTI institutes typically

want to “fix it themselves”, Arthur D. Little finds that the most sustainable approaches involve outside help. Our experience is that if the organization has drifted, it is because there has been no successful change so far – as a result, the existing organization and processes are part of the problem and cannot be relied upon to deal with the situation. Existing staff can contribute to the solution, but need to be augmented with external help (typically in the form of international R&D experts and technically relevant clients).

The strategy process must force the organization to abandon some activities and to increase the internal competition for resources in order to develop areas of strength where the institute can be nationally or internationally competitive. Deciding what R&D activities to abandon can be a highly-charged, emotive and controversial process. The use of careful facilitation, including non-partisan and credible international external experts as well as key customers is valuable to manage the process and prevent the outbreak of “civil war.” Indeed, it is the threat of this type of unrest, and the power bases of the various scientific factions that often exist within the RTI, that may be the greatest barrier to change.

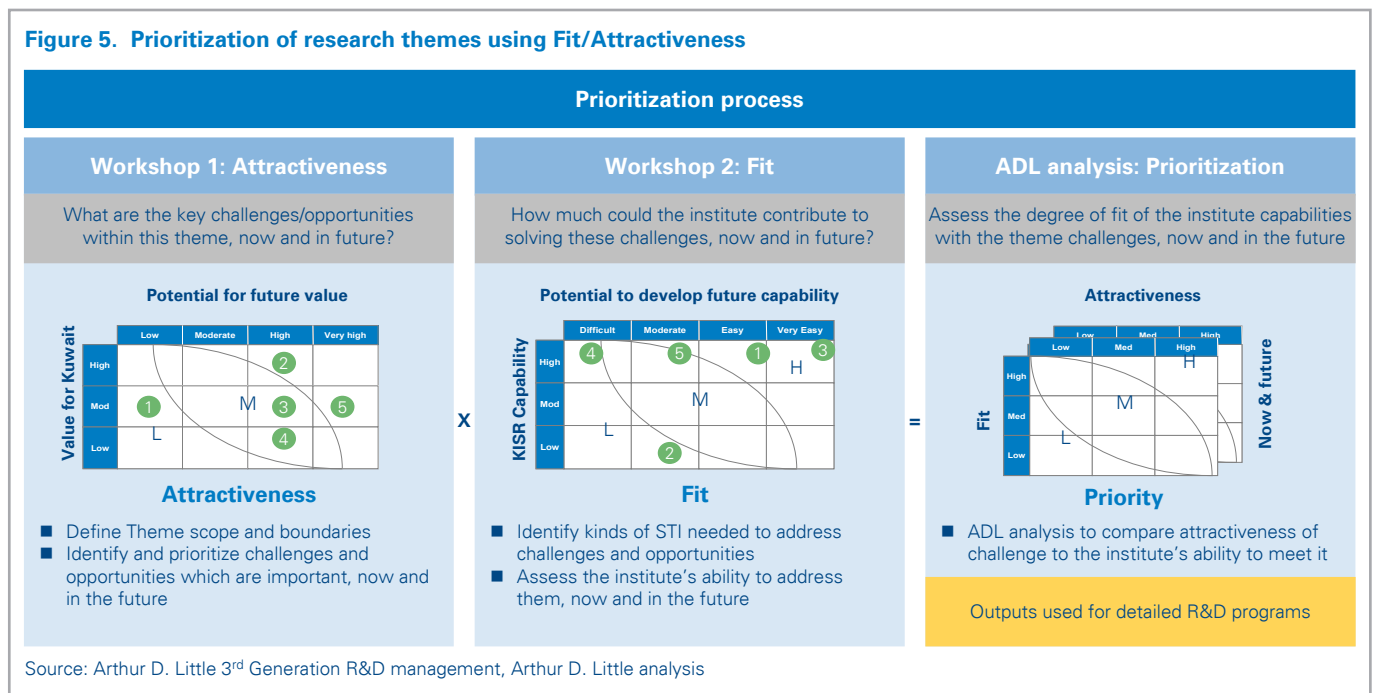
In situations where there is little or no broader STI framework, we have found it effective to identify R&D theme priorities using an adaptation of classical business “Fit/Attractiveness” methodology. This type of approach lends itself to broad engagement with RTI staff in a workshop context (see Figure 5 overleaf).

We start with a review of the relative attractiveness of dealing with key *technical challenges* – we focus on challenges rather than research areas because this creates a technical end goal around which it is possible to structure future activities. So rather than saying “micro-electronics is an attractive area”, we specify a challenge to be addressed such as “Achieving desalination costs of less than 4.0kWhr/m³”. “Attractiveness” is defined using word models in terms of current and future strategic importance to the country, region or sector. Typically, an attractive challenge is one where there is significant upside if successfully addressed (or downside if unaddressed) and where a science and technology solution could have a major impact.

We then look at the fit of those challenges with the RTI's existing *capabilities* in terms of what the client genuinely knows how to do. The strength of these capabilities needs to be validated with international R&D peers, and the potential to develop future capabilities as well as current capabilities is taken into account. A process of "unbundling" and reclassification of current and potential capabilities may also be required in order to conduct the analysis

The outcome of the process is a prioritized set of research "themes" which the RTI should pursue, based on a rational and objective assessment of what is most important, and where the RTI can have the greatest impact. These can then be further translated into detailed objective-driven research programs.

Figure 5. Prioritization of research themes using Fit/Attractiveness



2. Decreasing Core/State Funding

The problem

In many nations, research institutes have been traditionally funded by “block” grants, where capital and operational costs are funded by annual budgets set by government. As governments strive to achieve better value for money from their investment, these mechanisms have evolved into more complex and often competitive research funding schemes, underpinned by core funding grants for essential services and infrastructure. Increasingly, RTIs are expected to demonstrate much more clearly how their use of public funds delivers added value to society – be it economic, environmental, social, strategic or tactical added value. These trends mean that RTIs need to address a number of challenges, in particular:

- How to secure continued government funding in a much more competitive world?
- How to increase R&D project fees from commercial clients?
- How to develop other income streams, for example from commercialization?

The solution: follow the money

If RTIs are to continue to thrive in an increasingly cash-constrained environment, they need to take all possible steps to “follow the money.” We would highlight three approaches which RTIs are typically taking: aligning research programs better with client-funding streams; improving commercialization returns through partnership; and making a stronger justification for STI funding.

Align research programs better with client funding streams

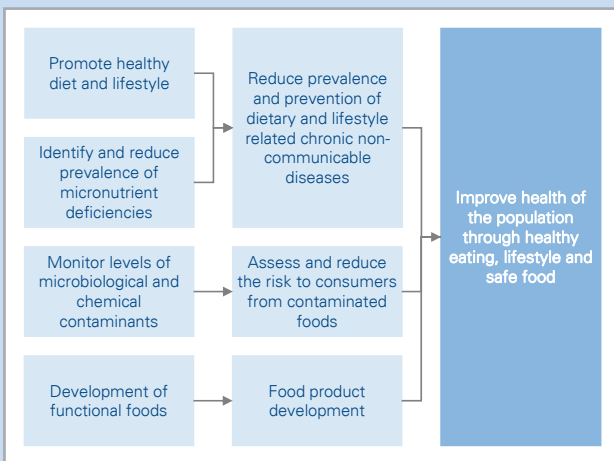
We have already emphasized the importance of establishing a clear top level strategic direction for an RTI and reflecting this in the definition of priority research themes. Once this has been done, the next step is to translate these into specific research programs, in a way that demonstrates in a clear and transparent way how they will contribute to addressing key challenges which attract government funding.

A successful RTI applied research program may be defined as a time-bounded series of projects which collectively seek to overcome specific key challenges or help achieve important policy goals. Each project would typically be concluded with a decision point, to ensure that the program content remains relevant, and that the scientific outcomes justify further research. Research programs should be aligned to the needs of one or more stakeholders or funding agencies that set a specific goal. Typically, research programs are developed through discussions with the RTI’s direct customer, often a research council or commercial entity rather than a government department directly.

Where clear customer end goals are not apparent or where there are conflicts or gaps, RTIs may need to take the lead in identifying specific science challenges and structuring programs to meet them. Good practice in this respect is to use “logic trees” to help define long term research challenges, first-level solutions required to address those challenges, and, working backwards, to contribute sub-solutions and sub-sub-solutions etc. This discipline ensures that research projects are, as far as possible, outcome-driven and contributing to the solution of critical long-term challenges (see box for example overleaf).

Case example: Major Middle East Research Institute Program Strategy

The Institute is establishing a new 20 year vision, mission, strategy, organization and set of procedures. As part of this project, it has established a research program strategy that differentiates clearly between Applied Research (AR) projects aimed at addressing critical long-term challenges, Policy Support projects to provide essential evidence and analysis to enable government policy-making, and Technical Services to support private and public sector clients on fee per service basis. The AR projects are based on logic trees, generated by research teams with support from international experts (see example below).



Specific research projects are then defined according to this logic and road-mapped over a 20 year period. This approach:

- promotes outcome-driven research with greater focus on high priority areas
- provides measureable, targeted outcomes for research to demonstrate value for money
- clearly demonstrates relevance to industry and economic impact – short term and long term

Improve commercialization returns through partnership

RTIs face considerable tension between diverging objectives such as: delivering high quality research; satisfying the desire of principal investigators to publish their own results in peer reviewed journals, and generating their own income through commercial activity. In many instances, this latter objective of commercializing the outputs of research programs (sometimes referred to as the Third Mission) is considered by scientists to be of a lower priority, either because they are not incentivized towards this, or because they are motivated by “pure science” and consider commercialization to be a negatively constraining influence. What’s more, where successful, expectations are often set extremely high for the levels of income which such initiatives hope to achieve.

A popular misconception of a commercialization function is that it seeks to generate high levels of income from industry through lucrative licensing royalties or highly successful spin-outs, in a “high-risk, high-return” model. More often, successful commercialization involves the transfer of knowledge, people and expertise through collaboration, effective licensing and joint venture, rather than the retention and financial exploitation of prized intellectual property.

To enable this, a successful commercialization function requires:

- **Embedding commercialization at the highest level of the organization** as a core component of an institute-wide strategy, led and reinforced by the RTI head, such that the organization establishes a reputation for being commercially focused and commercialization efforts are framed within the defined role of the organization.
- **Providing a market-facing technology transfer function**, with the dual role of seeking market-driven opportunities and providing centralized services to effectively protect and exploit intellectual property emanating from the institute.
- **Establishing champions within each research theme**, involving senior principal investigators who are familiar enough with developments within the sector to spot promising opportunities early, and push these forward for commercial exploitation.

- **Defining appropriate mechanisms for measuring performance**, to incentivize researchers to engage in commercial activity whilst alleviating excessive workload, two common complaints within the research community. Appropriate metrics for the technology transfer function itself must encourage a focus on “deals” (joint ventures, licensing agreements and ongoing collaboration) rather than a desire to “get rich quick” by selling technology.
- **Establishing long-term partnerships and collaboration with customers.** Technology transfer efforts can be further leveraged to establish long-term partnership and collaboration opportunities with customers. These provide opportunities for institutes to access stable, long term sources of funding; deliver broader, cross-sectoral capabilities to individual customers; better tailor research efforts to changing customer need and focus future initiatives on expected customer need.

Make a stronger justification for STI funding

As an alternative strategy, Arthur D. Little has seen examples where reduction in core funding and an increasing requirement for focused research may present a RTI with the opportunity to negotiate additional fees for activities which were previously taken for granted by customers. These may include issues of national prestige, safety nets of standards and technical infrastructure, and background data collection to support policy research. Such a stance helps to agree what will be no longer delivered, and helps to prioritize research efforts going forwards. See box for an example of where this alternative has proven successful.

Case example: South Korea’s R&D Funding – the other end of the spectrum

In South Korea’s case, the situation is quite the opposite. The government funding for R&D institutes (universities, RTIs, industry) has grown at CAGR 14% (’03~’07), higher than that of the US (5.4%), UK (3.5%) and Germany (3.2%) over the same period. Considering the size of the Korean economy, the investment level is also quite high, similar to that of Germany, at around \$33 billion (’07). The R&D policy reflects the difference in the primary mission for government funded R&D between Korea and developed countries such as the US and UK. Korean state R&D funds are coined predominantly for “national economic development” usage and enabled world class R&D to flourish in specific focus areas such as telecom and IT.

However, this strategy’s effectiveness has diminished over the years. Problems arose in the biased sourcing from state funds that in turn resulted in leakage and low R&D ROI.

ADL Korea proposed a reworking of RTI’s source of funds so that government funds be reduced and effort be made to source more from the private sector. More than 80% of the R&D funds for RTIs were sourced from the government and private sector’s actual benefit from RTI activities was marginal. A balanced sourcing of government “core funds”/“block funds” (30%), project-based public funds (30%), and industry/private funds (30%) was recommended to the RTIs. To entice private sector’s commitment, incentives such as “matching funds” from government and strengthening of key account management within the RTI organization were proposed. Policy renewal and consensus with the stakeholders are on the way; ADL Korea expects positive results within the next few years.

3. More Demanding Stakeholders

The problem

Historically, RTIs have been very much associated with their countries of origin. In the developed world, many of the earliest RTIs were set up in the post Second World War period in order to support economic rebuilding. More recently the developing world has also viewed RTIs as being an essential component of the national economic development machine. In many cases, this has led to an inward-looking culture amongst RTIs, some of which have failed to keep pace with the accelerating globalization of industry.

Today, RTIs no longer have the right to expect that key industrial, or even government, customers will automatically come to national or regional RTIs for science and technology support – instead they will select the best providers from the global market. True market forces prevail more than ever before, meaning that RTIs must now compete on bases of competition similar to those of related sectors like international Consulting or Engineering Services. This means that qualities such as client focus, timeliness, flexibility, and project delivery effectiveness – key success factors for international consultancies and engineering contractors – are becoming much more important for RTIs. These qualities do not always come naturally to scientific researchers, who tend to be motivated more by achieving academic excellence and individual recognition than by pursuits such as formal project management or developing and maintaining relationships with clients.

Clients also expect RTIs to be able to deliver state-of-the-art science and technology expertise. As access to global state-of-the-art knowledge becomes ever easier, clients are also much better informed about what is and is not possible, and where thought leadership exists around the world. In order to meet their expectations, RTIs need continuously to maintain and refresh their knowledge of international developments and be increasingly adept at helping stakeholders relate research requirements and findings to policy priorities. This required greater sophistication in proposal design and increased use of partnering.

The solution: align processes, organisation and culture for client focus

In order to thrive in the world of global competition, RTIs need to become truly client-focused, whilst at the same time safeguarding and strengthening their ability to maintain state-of-the-art scientific excellence. This can be a tough balancing act and is not achieved just by training researchers in customer focus – playing around at the edges but leaving the core organization, processes and culture unaltered will not deliver the change that RTIs need to survive and prosper.

In our work with clients, we've found that success depends heavily on getting three things right:

- improving key processes to support strategy implementation
- adapting organizational structure to enable client focus and scientific excellence
- aligning incentives and performance indicators

Improve key processes to support strategy implementation

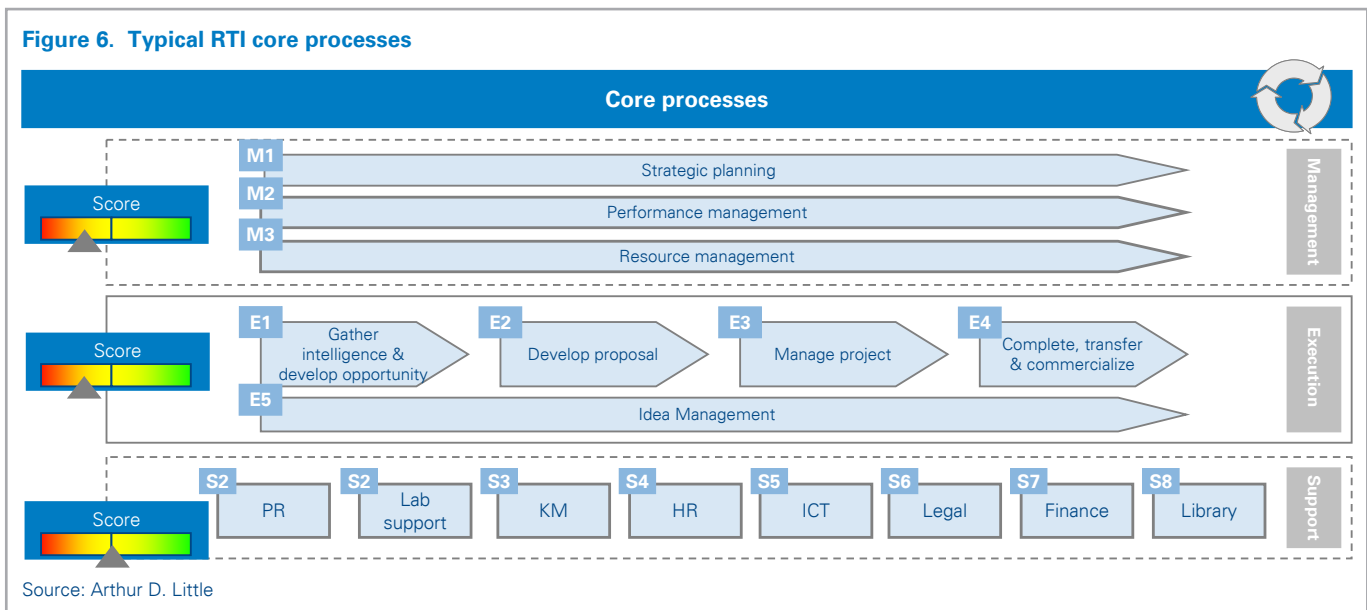
As stated earlier, poor implementation of strategy is a more common problem than lack of strategy. In order to connect strategy with "what really happens," RTIs need to make basic changes to the core processes they use.

A typical map for a set of RTI processes is shown in Figure 6 overleaf.

In our work with RTIs around the world, we see common weaknesses in a number of areas:

- **Management Processes:** whilst strategic planning processes are usually well-defined, control processes to enable management regularly to monitor progress and performance tend to be weaker. Resource allocation and prioritization is often unclear at the corporate level.
- **Execution Processes:** traditional RTIs often have rigid project proposal and delivery processes that are heavy on review and approval, but poor on speed, flexibility, consistency and client responsiveness. Key client account management may also be weak or poorly-defined. Intelligence gathering and knowledge management may be inconsistent.

Figure 6. Typical RTI core processes



Source: Arthur D. Little

- **Support Processes:** although most organizations led by scientists will focus on Management and Execution processes, we often find that in organizations where so much of the value is in the skill of its staff, critical HR processes such as recruitment, appraisal, and career development need to be aligned with strategy. Because you “get what you measure,” aligning the incentive system (remuneration and promotion to management roles) is the only way to reinforce the effectiveness of the organization.

Redesign of these processes – especially client-facing processes such as project proposal and delivery – using best practice benchmarks is essential if the RTI wishes to change its performance.

Adapt organizational structure to enable client focus and scientific excellence

RTIs around the world have a wide variety of organizational structures that reflect their history, role, scale and context. However, in general terms, based on Arthur D. Little’s benchmarking of RTI structure, three archetypes can be recognized:

- **Discipline-based:** split into units reflecting scientific disciplines (eg Materials Science, Ecology etc). This is the

typical structure for university research organizations or large decentralized RTIs (eg Fraunhofer).

- **Facilities-based:** split on the basis of clustering around major capital equipment, often with very focused or niche application areas (eg IMEC).
- **Application-based:** split into units reflecting application areas or customer segments (eg Renewable Energy, Water etc).

If a RTI is looking to improve its client focus, it needs to structure its research organisation accordingly – which generally means being Application-based rather than Discipline-based. Making this change can be quite traumatic for researchers, but it does provide a powerful mechanism to enable true client focus to be achieved – enabling the best combination of specialists to be brought together to address an Application-based challenge, and providing a means of breaking down the traditional “silos” between different research disciplines.

Making the change to an Application-based structure does have its risks. One implication is that scientists who share the same Discipline (eg. Numerical Modellers) may find themselves split up between different Application groups. In order to ensure that Disciplines still have the opportunity to stay at the forefront of

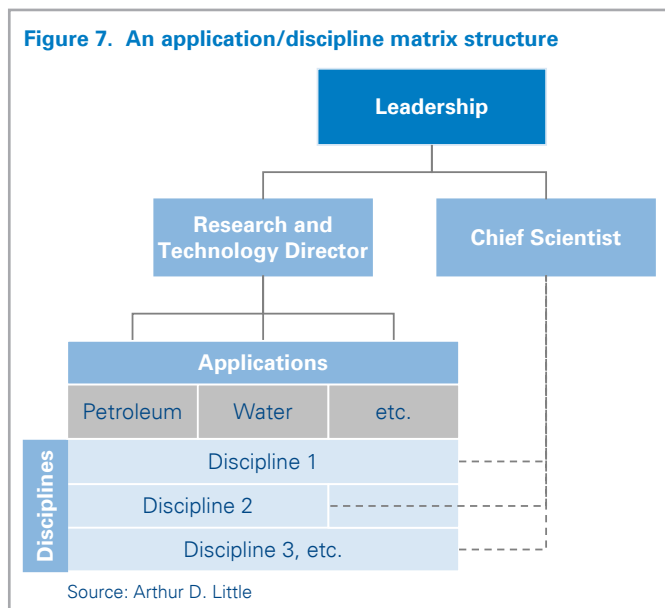
their specialism, some RTIs create “Discipline horizontals” – cross-cutting communities of practice – whose role is to monitor, build, and nurture their discipline. In such a model, there is usually a Chief Scientist who maintains the overall responsibility for ensuring scientific excellence – an essential counterbalance in an Application-based organisation (see Figure 7). This role is also important for ensuring that the RTI proactively develops and maintains suitable international partnerships and exchanges.

Align incentives and performance indicators

Although most organizations led by scientists will focus on Management and Execution processes, we often find that in organizations where so much of the value is in the skill of its staff, critical HR processes such as recruitment, appraisal, and career development need to be aligned with strategy. Because you “get what you measure” aligning the incentive system (remuneration and promotion to management roles) is the only way to reinforce the effectiveness of the organization.

Often researchers are incentivised primarily on the basis of demonstrated scientific performance – using metrics such as number of publications, citations etc. This can be detrimental to the objective of developing client accounts and achieving client satisfaction. RTIs need to review their incentives and KPIs, both at individual, group and corporate levels, to align them better with the demands of stakeholders. At the individual level, a balanced scorecard approach that also includes parameters such as utilization on projects, and achievement of specific (non-academic) development objectives is helpful. At the group or corporate level, KPIs need to include measures of client satisfaction, quality and project delivery effectiveness in addition to scientific excellence.

Finally, RTIs need to be aware of hidden barriers that may constrain progress. At Arthur D. Little we often refer to the “Unwritten Rules” – what really goes on in an organization, as opposed to written policies and procedures. All organizations have Unwritten Rules – the secret is to understand what drives them so that they can be better aligned. In RTIs, Unwritten Rules such as “Stick to your own patch” and “Focus on publications” can be problematic. As well as incentives, RTIs may need to consider a range of other measures, for example new communications and meeting approaches, different promotion and appraisal methods, and last but certainly not least, different leadership styles.



Conclusion

RTIs around the world are facing changes in their role, pressures on available core funding and increasing demands from their stakeholders. Trying to adapt can be difficult, especially for those RTIs with a long history and culture rooted in supporting the national government on the basis of block funding. To adapt successfully, RTIs need to avoid the trap of incremental changes and death-by-a-thousand-cuts. Instead they need to take a more fundamental approach:

- proactively redefine role and strategy
- prioritize and focus research activities to align with income streams and client needs
- use partnerships to help maximize commercialization income
- redesign processes and organization to implement the strategy effectively in practice
- align incentives and key performance indicators and address cultural barriers

RTIs are crucial instruments to bridge the gaps between basic science, policy formulation and technological advancement. They have the potential to become even more important in the post-recession “new normal” world of virtual, networked corporations and collaborative innovation – provided that they can face up to the challenges of change.



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