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Rapid Appraisal of Local Innovation Systems (RALIS):

Assessing and Enhancing Innovation Networks

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1 What is “Rapid Appraisal of Local Innovation Systems”?

Rapid Appraisal of Local Innovation Systems (RALIS) is a methodology to conduct a rapid diagnosis of a locality, a value chain or a cluster with a special focus at technology and innovation. The starting point is an observation which is consistently coming out of the analysis of successful localities: innovation is not only based on intra-firm efforts but also, and in particular, on dense networks of interaction between a variety of actors – companies, training institutions, research and technology extension organisations, and others. Thus, RALIS is designed in a way which permits the identification of such networks, or their absence, and a rough assessment of their density and effectiveness.

RALIS is a methodology to get an overview of the main features of a local innovation system or the innovation processes along a value chain within a short period of time. In the wider sense, it is a rapid, practical, bottom-up, participatory and network stimulating approach to local/regional economic development or value chain promotion.

RALIS can be used for two different purposes:

1. for a diagnostic without implications for immediate action,

2. as an action-oriented method.

If it is used purely as a diagnostic method, it has the potential to render reliable results within a relative short period of time. However, it must be taken into account that it is not really a "scientific" method, so it has to be complemented with other methods in case scientific accuracy has to be achieved. At the same time, for policy-oriented research it may be sufficient.

If it is used as an action-oriented method, scientific accuracy is of secondary importance; the approach rather follows the principle “better be roughly right than precisely wrong”. If it is action-oriented, this has implications for the overall organization of the project, especially in terms of a strong involvement of local actors.

2 How is RALIS different from other diagnostic approaches?

Conventional approaches often involve huge up-front investment in terms of time and money, it often takes long for proposals to come up, and the proposals are not always practical and compatible with the local mindset. RALIS suggests to do the opposite. It is an action- and results-oriented methodology which is based on principles of rapid and participatory appraisal. Its basic elements are:

- Quickly scanning the structure of the local innovation system and identifying main mechanisms and bottlenecks of technology transfer. The initial diagnosis will take no more than ten to 14 days, and the results are presented and discussed with local stakeholders immediately after that.

- RALIS involves both external specialists and local stakeholders in the diagnosis. The local active participation facilitates the transfer of methodological and conceptual know-how, motivates local actors to enhance interaction and empowers them to continue with the initiative once the external consultants have left.

- External consultants play a role in the first diagnosis, but the responsibility for implementing concrete activities rests with local actors and institutions.

A RALIS exercise pursues the following specific objectives:

- To gather and filter ideas on how to improve critical factors related to innovation in localities or along a value chain (input cost, productivity, innovativeness, framework conditions, etc.).

- To identify ways to overcome bottlenecks in the interaction between different actors in a local innovation system or between elements of a value chain.

- To formulate practical proposals that will enhance innovation and strengthen the competitiveness of companies.

- To formulate suitable actions for overcoming resistance to innovation in a locality or industry, both through practical suggestions for incremental upgrading and through the creation of opportunities for a recombination of existing assets which may lead to radical innovation.

The main difference between RALIS and other approaches is that it combines the mobilisation of stakeholders and the research of the local innovation system with the identification of immediate activities, rather than running these activities in a sequential way. If RALIS is used as a market research method by an innovation promotion agency, it delivers not only an analysis but also proposals for action that are supported by local stakeholders.

3 What does a RALIS Exercise look like?

A RALIS Exercise involves a team of between four and eight persons, most of them from the respective location, who conduct a rapid appraisal of the local innovation system: the RALIS Team. The sequence of their activities is as follows. It starts with a preparatory phase where available data and information are collected and assessed. Then there is a phase of intense research, involving representatives of all four pillars of the local innovation system. The following activities are conducted:

- a hypotheses workshop, where the RALIS Team clarifies its expectations,

- a kick-off workshop, where additional information is gathered from key stakeholders who are at the same time informed about the RALIS Exercise,

- Mini-workshops, where a number of specific formats are applied to gather information on specific sectors and innovation networks in a very efficient way,

- interviews with key companies, institutions and informers,
- a Results Workshop of the RALIS Team to elaborate findings and proposals,
- a Presentation Event to present and discuss diagnostic and proposals with local stakeholders,
- a series of Way Forward Workshops to plan the details of the implementation of proposals.

A RALIS Exercise lasts no more than two weeks. After that, implementation of practical activities to enhance innovation and improve the competitiveness begins. A first series of RALIS Monitoring Follow-up Workshops should be organized after no more than six months, to assess the progress and to define a new round of activities. A tool such as the "Compass of Local Competitiveness"[1] may be employed in this exercise. In the meantime, it is often advisable for external organisations that have encouraged and supported the use of RALIS to accompany the process with facilitation and further encouragement.

Table 1: Sequence of a RALIS Exercise

Preparation
Recruitment of RALIS Team
Collection of advance data
Organization of workshops and interviews
Hypothesis Workshop of the RALIS Team
↓
Kick-off Workshop (3 hours)
• Inform relevant stakeholders about the purpose of the RALIS
• Gather information on local innovation system
↓
RALIS Fieldwork (1 – 2 weeks)
• Mini-workshops to gather information about specific sectors and innovation processes
• Interviews to get in-depth information
↓
Results Workshop of the RALIS Team (1-2 Days)
• Elaborate diagnosis
• Elaborate practical proposals
↓
RALIS Presentation Event (3 hours)
• Present diagnosis and proposals to local stakeholders
• Get feedback and suggestions for implementation
↓
Way Forward Workshops
Implementation

Suitable proposals identified during a RALIS exercise need to meet the following criteria:

- Suitable to be implemented quickly.
- Suitable to show visible and tangible effects within 3 - 6 months.
- Suitable to be implemented with available resources (motivation, skills, time, funds).

The underlying logic of selecting typical RALIS proposals is that they are likely to be implemented. Fast and visible results will encourage further collaboration and a joint effort of local stakeholders to upgrade their innovation capacity. As ongoing collaboration creates

1 see www.mesopartner.com/englisch/e-compass.html

trust and energy, more ambitious and longer-term initiatives are more likely to succeed. Such more strategic and complex interventions should be targeted once quick-win activities have succeeded.

4 How did RALIS come about?

The RALIS methodology emerged in the context of a research and advisory project in Indonesia (2000-2002). The German Ministry of Education and Research had contracted the German applied research organisation Fraunhofer Gesellschaft (FhG) to give advice to the Indonesian Ministry of Research and Technology and to particularly evaluate the Indonesian science research and technology landscape (PERISKOP Project). One of the elements of PERISKOP was the analysis of technology transfer to the regions and technological capability and technology diffusion at the local level. As a complement to more orthodox methods, such as standardized questionnaires, it was decided also to conduct qualitative research. It was expected to give a fairly representative picture, but it was also supposed to be relatively quick and cheap. Therefore, we decided to adapt a methodology of rapid appraisal for local economic development (Participatory Appraisal of Competitive Advantage / PACA)[2] and to combine it with earlier work on technological capability and innovation systems (Hillebrand, Messner and Meyer-Stamer 1994).

In the context of the RALIS application in Indonesia, the methodology has been used as diagnostic tool only. In order to find out about the technology transfer processes and networks on the local level, RALIS teams conducted field research in ten exemplary locations in the country, successfully identifying local innovation networks or their absence, innovation efforts in industries and institutions and sources and modes of intra-regional, inter-regional and cross-border technology transfer. We have consolidated the results to generate a representative picture of the performance of local innovation systems in Indonesia (Mertins 2002).

In 2003/2004, a RALIS training and exercise was organised by the Tshumisano Technology Station Programme in South Africa supported by GTZ and the South African Department of Science and Technology (DST). Here, we applied RALIS for the first time as an action-oriented method and for the assessment of innovation efforts along a regional value chain that faces a severe crisis, the clothing and textile (C&T) value chain in Western Cape.

A Technology Imbizo, i.e. a major stakeholder meeting, in Western Cape in early 2004 highlighted bottlenecks in the interaction between different elements of the C&T value chain, in particular the small clothing manufacturers and the local textile manufacturers. In addition, it was highlighted that the C&T industry was facing a very critical situation due to the strong Rand and the resulting cheap imports. Whereas the low productivity of the small clothing manufacturers appeared to be one of the critical issues to be addressed, it seemed necessary to deeper investigate all other factors related to the value chain, the microeconomic factors and the local framework conditions.

2 see www.mesopartner.com and www.paca-online.org

Based on this information, GTZ and DST proposed to apply RALIS to further investigate potential bottlenecks in the innovation process and along the C&T value chain. The expectation was that the RALIS exercise in the C&T industry in Western Cape would lead to formulate, jointly with players from various elements of the value chain, practical proposals that would bring about more effective communication and collaboration along the value chain, which again may give rise to innovation and may help to make the clothing and textile sector more competitive on global markets. This RALIS exercise has been conducted in April and May 2004 hosted by the Technology Station in Clothing and Textiles at Peninsula Technikon in Cape Town.[3] In chapter 7 of this paper, some key results of the abovementioned RALIS exercises are presented.

At this stage, the RALIS methodology has only been applied in two countries, i.e. Indonesia and South Africa. However, due to its connection to the methodology PACA (Participatory Appraisal of Competitive Advantage), the status of the RALIS methodology benefited from the experiences gained in frequent and extensive applications of PACA in recent years, especially with respect to generic features such as communication, stakeholder mobilisation and follow-through. Whereas PACA addresses local economic development and is frequently used, though not exclusively applicable, in relatively poor regions, RALIS is particularly adequate for locations and regions that are facing the challenge of international competitiveness.

5 What are the conceptual foundations of RALIS?

The RALIS methodology itself can be considered innovative, since it recombines some fundamental concepts, tools and definitions in a new way. In particular, RALIS is based on:

- The Rapid Appraisal school of thought
- Participatory Appraisal of Competitive Advantage (PACA)
- Broad definitions of innovation, technology and innovation systems
- The Four-Pillar-Model of Technological Capability

5.1 What is Rapid Appraisal?

The basic idea of the RALIS concept is this: It is possible to undertake a diagnostic of a local innovation system quickly, i.e. within a few weeks, at maximum three weeks for fact-finding and elaboration, presentation, and discussion of results, and in less complex localities even within days. A key aspect of such an appraisal is that it is conducted jointly by external specialists and by local actors. The appraisal should build on some principles which have been formulated in the participatory rural appraisal work:[4]

3 See report on "Observations and Results from the RALIS Exercise conducted in the Clothing and Textiles Sectors of the Western Cape, South Africa", April 2004, http://www.mesopartner.com/publications/RALIS_Report_C+T_VC_WC_SA.pdf

4 Quoted from *The PRA Pages*, http://www.ids.ac.uk/pra/intro/origins.html.

- offsetting biases (spatial, sector, person - gender/elite, public/private etc, seasonal, professional, courtesy...)
- rapid progressive learning – flexible, exploratory, interactive, inventive
- reversals – learning from, with and by local people, eliciting and using their criteria and categories, and finding, understanding and appreciating their knowledge
- optimal ignorance, and appropriate imprecision – not finding out more than is needed, not measuring more accurately than needed, and not trying to measure what does not need to be measured. We are trained to make absolute measurements, but often trends, scores or ranking are all that are required
- triangulation – using different methods, sources and disciplines, and a range of informants in a range of places, and cross-checking to get closer to the truth through successive approximations
- principal investigators' direct contact, face to face, in the field
- seeking diversity and differences

There is no reason why this kind of approach should be limited to rural environments. On the contrary, our experience so far shows that such a perspective renders a very valuable diagnosis of urban and industrially advanced economic structures as well, specifically if it is combined with analytical concepts to understand the key determinants of successful development.

5.2 What is Participatory Appraisal of Competitive Advantage (PACA)?

PACA is a participatory, bottom-up, pragmatic approach to local economic development. It is based on a set of tools that permit a rapid appraisal of the competitive advantages and disadvantages of a locality. It delivers concrete, practical proposals to stimulate the local or regional economy (PACA Exercise).

A PACA exercise is conducted in a given location by a team of external facilitators and local economic development (LED) champions. It involves mini-workshops with groups of local actors and a series of interviews with local players (firms, business associations, supporting institutions, local government, and others). Depending on the size and diversity of the locality, this takes between one and two weeks. The diagnosis and a limited number of practical proposals for quick-win interventions are presented right afterwards and immediately operationalised with local players.

PACA provides quick delivery of practical LED activities. A PACA exercise leads to the identification of opportunities and critical bottlenecks for local economic development. It helps to prioritise practical LED activities. It shows how to better connect local agencies, LED stakeholders and businesses. It also indicates who can take charge of practical activities.

PACA aims at quick, visible results. It is not starting with an extensive attempt to formulate a grand strategy. Since it targets the early phase of LED, PACA includes a very strong learning element. Learning and transfer of LED skills is not something that happens as a side-effect but is rather conceptualised as a key element of PACA. Until mid-2007, PACA-Exercises have been conducted in more than 30 counties on four continents.

RALIS is related to PACA, focusing on local innovation systems instead of local economies. Most of the experiences and lessons learnt with the frequent application of the PACA methodology in recent years inform the further development of the RALIS methodology.

5.3 What are innovation and technology?

5.3.1 What is Innovation?

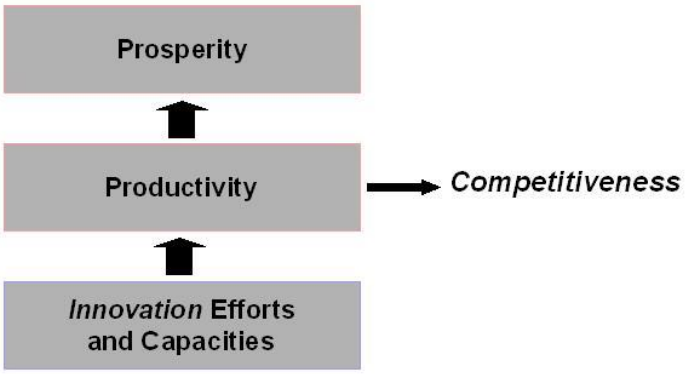
Innovation is here defined broadly to include all relevant stakeholders and any action that will result in improved competitiveness. It is not just confined to production factors, nor just on the roles of firms. Innovation means to find a new way of doing things, i.e. to create something new by pulling together existing elements ("recombination"; Schumpeter 1911/1964). This can be producing a given garment or fabric in a more efficient way – by means of a better organization of the workflow (organizational innovation) or by using a better machine (technical innovation). It can also be finding a better way of defining the development priorities of the society (societal innovation) including labour-related issues (Freeman 1987).

Innovation must not be confused with invention. Invention means to identify a new way of doing something, or to develop a new artefact, for the first time. An invention is a one-time occurrence whereas a given innovation may occur over and over again in different firms and places. For instance, if a new way of organizing quality assurance in an industrial firm (like Kaizen, total quality management, or ISO 9000) is diffused from one country to another and is there diffused among firms, it must be perceived as an innovation at each place where it is being introduced.

Innovation is the key ingredient of economic and social development (OECD 1992). Innovations are the basis of productivity increases which lead to the generation of a surplus that can be invested, which in turn leads to further productivity increases and accordingly the strengthening of a sector's competitiveness. This is the reason why the question of how to stimulate innovation receives such a great attention. Productivity sets a region's standard of living (wages, returns to capital, returns to natural resource endowments).

Figure 1: Innovation, productivity and competitiveness

Source: Porter (2003)



Competitiveness is determined by the *productivity* with which a sector or a company within a specific sector uses its human, capital, and natural resources. In general, a sector's *competitiveness* is driven by its micro-environment, macro-environment, and quality of business strategy and operations. If the increases in *productivity* resulting from *innovation* are sustainable, *innovation* can lead to improved standards of living for the average person and in the end to *prosperity* and rising welfare (see Figure 1 above).

Innovation occurs in all sorts of settings and situations. The fashion industry is creating new styles all the time. The music industry frequently creates new music styles. Political actors sometimes come up with new solutions to societal problems, i.e. with policy innovation. Research institutes develop new processes. Entrepreneurs come up with innovative business models. Firms develop new products.

Among the places where innovation occurs there is a limited set which is relevant in the context of this work, namely firms and institutions dedicated to creating and disseminating knowledge and applying it to create innovation. A firm has multiple means of acquiring knowledge that leads to innovation. Asking its employees is one of them, hiring new employees with specific knowledge is another one, and technology transfer is yet another one. But what is technology, and technology transfer?

5.3.2 What is technology?[5]

Innovation and technology are related issues, but they are not synonyms. The invention of a new fashion has little to do with technology: all it needs is a pencil and piece of paper, and theoretically it could also be done with the finger in the sand, i.e. without any technology at all (at least based on the common understanding of what establishes technology). At the same time, there can be technology without innovation. Imagine a factory which has once been set up (that was an innovation at that time) and subsequently is being run without any changes to process or product: there is technology, but no further innovation.

5 This section draws on Meyer-Stamer (1997).

But these are extreme cases. In the day-to-day of a firm innovation and technology are closely related. Yet it is not at all simple to define technology, and definition is not made any easier by the fact that the semantics of the term technology differs in different countries and setting, sometimes emphasizing the science of technology, sometimes the application of technical knowledge.[6] Summing up the widely accepted definition, it is possible to delimit two variants – a narrow definition and a broad one.

In the more narrow sense technology is the know-how required to develop and apply technical methods. It appears in a bound form in machines and plants, in an unbound form in blueprints, and manuals. Technology transfer is the transmission of this know-how. The term technology transfer is frequently used as a synonym for the *international* transfer between industrialized countries or from industrialized countries to developing nations; yet it is not seldom that a transfer of know-how within the boundaries of one country is referred to as technology transfer.

The narrow definition refers to technical artefacts. At first glance it has the advantage of being handy. But its drawback is that its use entails the risk of loosing sight of the complementary factors. Complementary factors, without which the employment of technical artefacts makes no sense, are above all *qualification, skills, and know-how* (of the people who work with artefacts) and *organization* (i.e. the process of tying artefacts into social contexts and operational sequences).

This leads to three conclusions:

(1) Technology should not be seen in isolation from the environment in which it emerges, or from the organizational structures in which it is used. Technology does not come about in a vacuum, it always develops in concrete social contexts. It is therefore never neutral, and is always developed on the basis of given (economic, social, political) interests.

(2) Technology often embodies organizational factors. A closed process in the chemical industry or a production line in the metal-processing industry, for instance, consists not only of technical knowledge of individual processing sequences, it also implies organizational knowledge about possible transitions between these sequences.

(3) Any narrow definition of technology, looking at hardware only, accompanied by the view and approach that go along with it, can thus be tantamount to a guaranty that projects will fail – in development cooperation no less than in many international high-tech corporations.

The discussion on development policy and the field of development cooperation has in recent years experienced a general acceptance of the broad definition of technology, one that does justice to the problems outlined here. This definition includes four components:

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6 Although different definitions have in the meantime been introduced in English. The *Collins English Dictionary* (Glasgow 1991, 1583) distinguishes three variants: “1. the application of practical or mechanical sciences to industry or commerce. 2. the methods, theory, and practices governing such application: *a highly developed technology*. 3. the total knowledge and skills available to any human society for industry, art, science, etc.”.

(1) technical hardware, i.e. a specific configuration of machines and equipment used to produce a good or to provide a service;

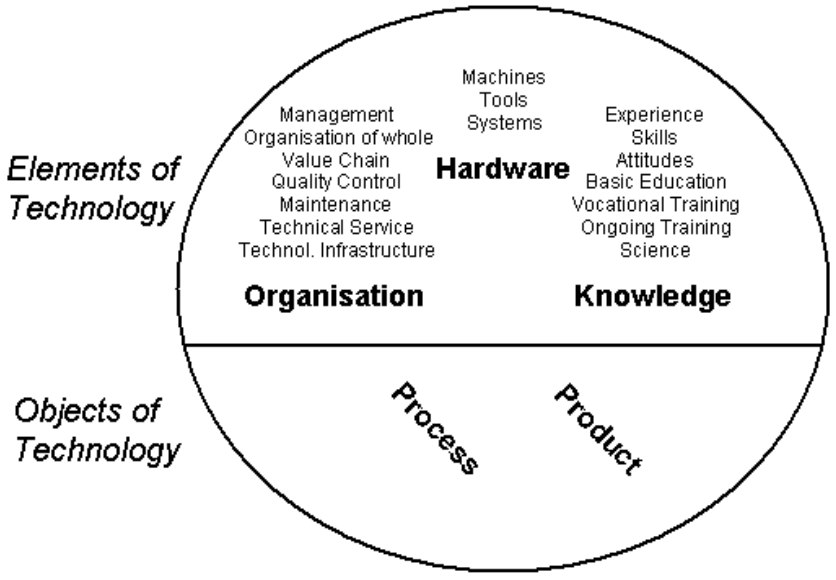
(2) know-how, i.e. scientific and technical knowledge, formal qualifications and tacit knowledge;

(3) organization, i.e. managerial methods used to link hardware and know-how;

(4) the product, i.e. the good or service as an outcome of the production process.

The advantage of the broad definition is that it can help to avoid barren discussions in that it prevents, for instance, any equating of technical artefacts and technology. It to this extent mirrors experience gathered, for example, in development cooperation – in view of this definition it is obvious that technology can not be transferred in package form. At the same time it is, against this background, easier to comprehend that technology is involved whenever production goes on – even when seemingly primitive technical artefacts are utilized in the process, for "no country is without technology, not even the most primitive." (Enos 1991, 169)

Figure 2: The Elements of Technology



Still, this definition is not entirely satisfactory in that it is not inclusive enough. True, it is plausible to break down the definition into the elements technical hardware, know-how, and organization; yet the fourth element, the product, resists this schema. It would thus appear that the schema is in need of modification; a useful definition should distinguish between the elements and the objects of technology (Figure 2). The elements that remain are technical hardware, know-how, and organization. The object is on the one hand the production process, on the other the product itself. This breakdown mirrors the experience that in the production process very different goods can be manufactured with similar combinations of

elements, i.e. process technology, organization, and know-how are, within a given framework, independent of the good produced; an example would be the production of furniture and automotive parts which can be manufactured in factories with machines and organizational patterns that are on first, and possibly even at second, glance very similar. On the other hand, the same product can be manufactured with very different combinations of the three elements; to go on with the example cited above: a furniture component of identical quality can be produced both by a qualified joiner using traditional tools and by a qualified machine operator making use of a computer-controlled manufacturing center.

Technological and economic development are linked inseparably – sustained economic growth results in particular from increasing the efficiency of inputs, i.e. from the introduction of new, better machines, through organization improvements, successful learning processes, and enhanced qualifications – in short: through technological progress. This insight has all along left its mark on the discussion and the practice of development policy; the latter has regarded technology transfer, beside the transfer of capital, as an approach crucial to overcoming underdevelopment. This goal has been achieved in a few countries; all in all, the welfare gap between industrialized and most developing countries has widened. There is no doubt today that more than technology and capital are required for dynamic development. Political and economic framework conditions, sociocultural factors, and an eye for specific ecological conditions are what decide on the success or failure of development strategies.

Economic framework conditions are a particularly relevant factor determining innovation behaviour and the approach to technological development and upgrading in a given economy. Companies and other organisations introduce innovation and seek to use technology more effectively because they are under pressure to perform. A company that is not subject to competitive pressure may decide not to innovate at all.

5.3.3 A simple innovation typology

The discussion on innovation and technology has primarily been shaped by research on industrialised countries and highly successful latecomer countries such as Japan, South Korea and Singapore. Those are countries where the industries that form the backbone of the economy are competing at the leading edge of technological progress. Thus, a huge body of literature on technology and innovation is, in a way, biased since it is based on the investigation of companies and sectors that are at the frontier of technological progress.

Latecomer countries are facing a situation that is quite different. Some companies and sectors are close to the leading edge, but many are not. With respect to developing countries it is useful to distinguish three types of innovation:

- **Catch up innovation.** The craft producer in a deep rural area would be a typical example for this. Small businesses in the informal sector typically also fall into this group. They are using artefacts and processes that are several generations, and sometimes several centuries, behind the state-of-the-art. With catch-up innovation, producers and companies close the efficiency and quality gap that separates them from the state of the art.

- **Running to stand still innovation.** Any company in that is involved in competitive markets needs to innovate all the time in order to match its competitors' innovations. However, even a steady innovation process does not necessarily mean that a company's competitive position changes. Think, for instance, of a company that supplies Ikea with one type of furniture. Ikea expects that the price drops every year. Thus, the producer has to constantly increase its productivity in order to be able to produce cheaper. It is upgrading all the time, yet its position in the value chain does not change (Meyer-Stamer 2004).

- **Innovation for competitive advantage.** Ongoing process and product innovation is a minimum requirement for any company. But a company that operates in a competitive market and does not come up with unique innovation will suffer from serious profit squeeze (Porter 1996). Leading companies try to establish a competitive advantage by doing things differently from their competitors, i.e. by being the first to introduce a given process or product innovation.

These three types of innovation have profound implications regarding the innovation system that producers are embedded into.

5.4 What is an Innovation System?

An innovation is based on knowledge, i.e. one of the elements of technology. This knowledge may be acquired in two different ways: in a solitary way and by interaction. The first way of getting knowledge is through experimentation without communication. The second way involves personal or non-personal communication. Non-personal communication includes reading books or manuals, watching TV programs or CD-ROMs, browsing the world-wide web, or listening to broadcasting. Personal communication includes attendance of school education and other training activities, cooperation with colleagues in a firm, and discussions with outside technicians or consultants. Both approaches need to be balanced, yet there is no doubt that acquiring knowledge by interaction is very efficient.

A large part of the knowledge a firm need is available internally, namely the knowledge of the engineers, managers, technicians, and other employees. Their knowledge is partially acquired externally, based on formal training, and partially acquired in a cumulative process based on learning-by-doing. This internal knowledge, which is available at any given time, is the main resource of a firm when it comes to doing innovation. Apart from that, there are sources of knowledge outside the firm. Most important are other manufacturing firms – customers, suppliers of inputs and equipment, and other firms (including competitors in the same branch). Also important are service firms which offer consultancy, software, or access to databases. Other external sources include business and professional associations, technology institutions, research centers, universities, government agencies, and others.

From a different perspective, it is obvious that a firm relies on external knowledge in two ways, an indirect and a direct one. The indirect way includes school education, vocational training, and higher education of its employees as well as ongoing training. This creates the knowledge base of a firm; it is not aimed at resolving an immediate problem but rather at providing the knowledge that helps in finding a solution. The direct way includes exchange of

information and experiences with other firms, or contracting consultants, or cooperating with a contract research institute.

It is by no means obvious that direct acquisition of external knowledge is a paramount feature of a firm's innovation effort. One reason why a firm may rely mostly on its internal knowledge is the "not-invented-here-syndrome", i.e. a firm's conviction that its knowledge is leading-edge, that it knows best how to do things, and that therefore the effort to acquire knowledge elsewhere is a waste of time and money. Another reason is that knowledge-acquisition often takes place on a give-and-take-basis and that a firm prefers not to disclose its knowledge, in particular not to other firms, as it fears that this might undermine its competitive advantage.

It is largely undisputed that successful firms rely to a large, and increasing, extent on external sources of knowledge. There are several reasons for this:

- Technical progress is accelerating. It is increasingly difficult for a firm to be up-to-date technologically if it is trying to go it alone.

- There is a phenomenon called technology fusion. Not only do borders between technologies become blurred (e.g. telecommunication and data processing). Moreover, products and processes increasingly incorporate technologies that used to be quite clearly separated in the past, like mechanics and electronics (in the case of digital watches or NC machine tools).

- Many firms follow the advice of management consultants to concentrate on core competences, i.e. the parts of the value chain which establish their respective competitive advantage, and to outsource all the other activities. This means that a firm has to deal with a huge number of subcontractors, suppliers, and service providers, and to cooperate with many of them on technology issues (e.g. with the suppliers of key parts in the development of a new product, or with an external firm in adapting the outsourced data processing operation to organizational changes).

As the interactive mode of knowledge generation is becoming increasingly important, the phenomenon of innovation systems has received increasing attention among innovation researchers. It is one thing to note that there is an interactive mode of knowledge generation. It is quite a different thing to understand how exactly this works.

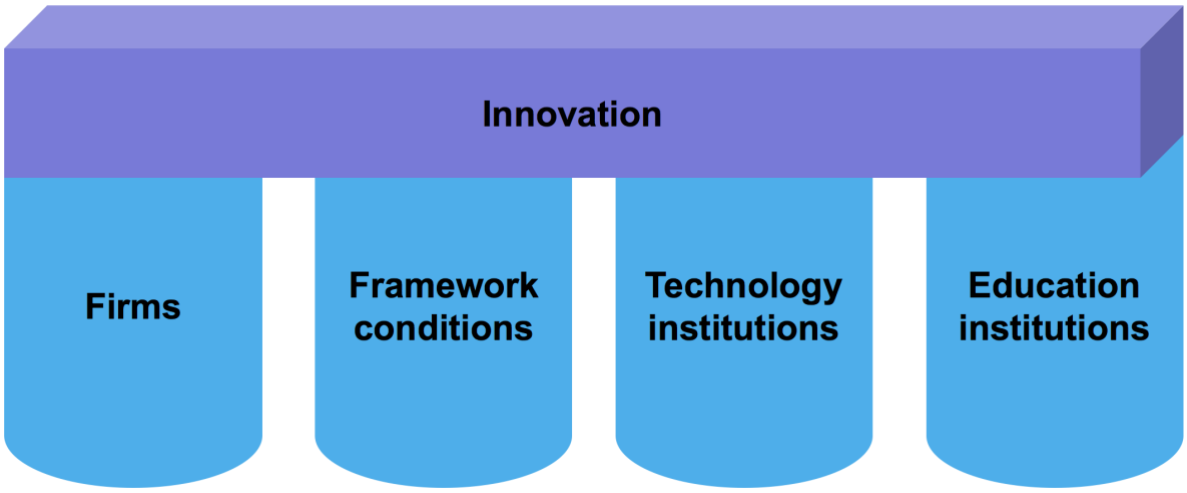
There are two different perspectives at the innovation system phenomenon. Perspective one is the National System of Innovation approach (Nelson 1992, Lundvall 1992, OECD 1999, OECD 2002). Researchers tried to find out how innovation takes place in different countries, and they found remarkable differences – between advanced industrialized countries, and even more so once they included advanced developing countries. This approach is less concerned with the specific way different actors cooperate within a given system, and more with differences between countries. These differences can be traced back to historical development trajectories and the set of institutions in each country. Factors like the basic organization of the economy (*Wirtschaftsordnung*), the structure of the finance system, the emergence of the science and university system, and the general set of incentives that firms and other innovation actors face are paramount in explaining differences.

Perspective two addresses phenomena like regional innovation systems and sector-specific innovation patterns.[7] This perspective is much less about the macroeconomic and regulatory framework and much more about, well, the innovation system in a very narrow and specific way. It is about a system and its environment, i.e. a set of actors who cooperate to innovate. Researchers try to find out how exactly this works: Who cooperates with whom, why are things so different between regions, even if they have similar industrial structures, or between branches, even if they face the same macroeconomic and regulatory framework conditions.

5.4.1 The Four Pillar Model of Innovation Systems

In trying to synthesize these approaches, we have formulated the four pillar model of innovation systems (Figure 3; Hillebrand, Messner and Meyer-Stamer 2004). Trying to outline the key elements of an innovation system, it draws on both perspectives.

Figure 3: The Four Pillars of Innovation Systems



The key insights that underlie this model are the following:

- The most important place regarding innovation is the firm. The ability of firms to generate process and product innovation, thus establishing a competitive advantage and being able to generate jobs and income, drives growth in an economy.
- The innovation behaviour of firms is driven by economic framework conditions. Firms innovate because they have to, not because they like to.

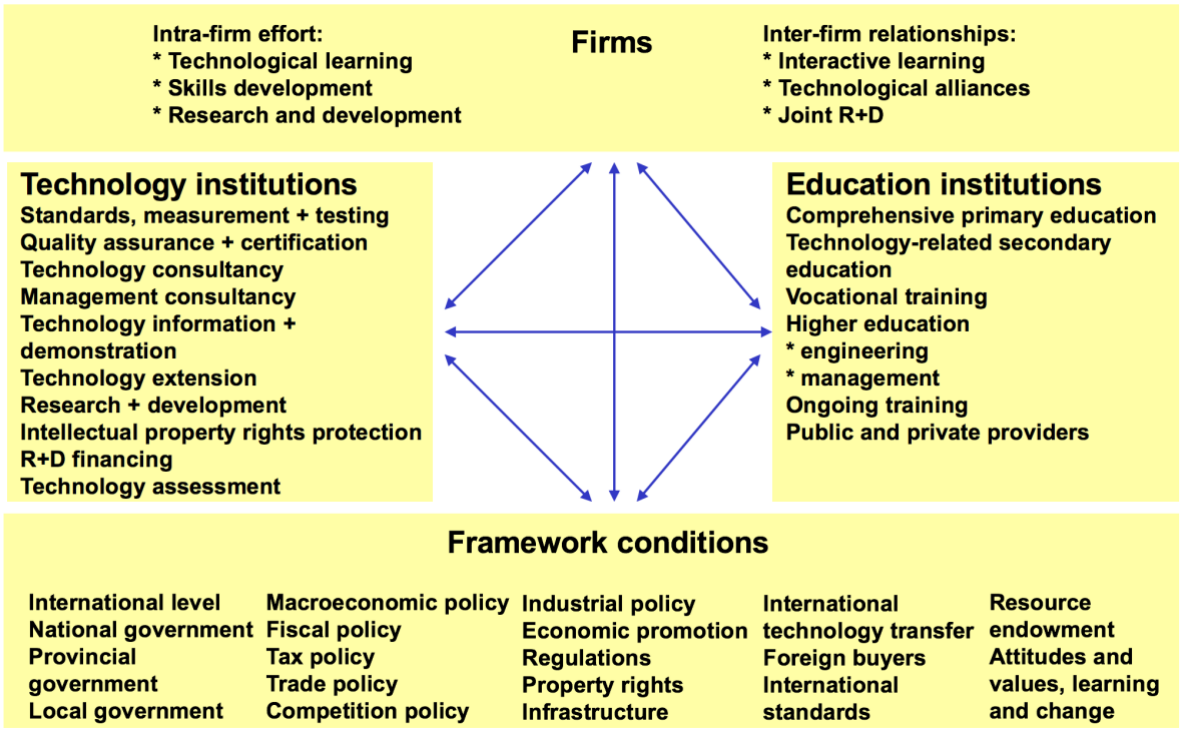
7 There is a huge body of literature on this subject; see, for instance, Cooke (1992), Cooke (1996), Braczyk, Cooke & Heidenreich (1998), Koschatzky (2000), Storper (1993), Malmberg & Maskell (2002), and Doloreux & Parto (2004). For a critical review of the concept see the articles in Regional Studies, Vol. 39 (2005), No. 1.

- Firms that have to survive in highly competitive markets rely on a variety of technology-related institutions, something that the competitiveness guru Michael Porter would discuss under the heading of "factor conditions" (Porter 1990).

- The ability of firms to innovate depends, among other things, on the skills and mindsets of their employees. In this regard, they rely on education institutions, in particularly secondary and higher education. The main function of education institutions is to educate. Other activities, such as contract research, contribute to more effective and updated training.

The following figure looks in some more detail at the factors that are relevant with respect to each of the pillars.

Figure 4: The Innovation System: Four Pillars of Technological Capability



Let us explore the main elements mentioned for each of the pillars:

- The first pillar is the firm. This is where a large part of innovation takes place, and firms are the target of efforts to stimulate innovation. The measure of effectiveness of an innovation system is the extent to which firms use innovation to create a competitive advantage. While business owners, managers and engineers like to emphasise that their in-house effort is the main factor driving innovation, research consistently shows that interaction with other firms, in particular suppliers and customers, is also a key driver of technological learning and innovation.

- The second pillar is established through the macroeconomic, regulatory, political and other framework conditions. They define the set of incentives firms are facing. More specifically, they establish whether or not firms have to innovate. Firms' innovative efforts

usually are not the result of enthusiasm for innovation but the outcome of necessity – firms have to innovate because their competitors are innovating, too, and because they get kicked out of the market if they don't innovate. In turn, this means that firms which are little competitive pressure will often not feel inclined to put much effort into innovation, something that is perfectly rational as innovation always involves cost and risk.

- The third pillar are technology institutions. In a developed economy, there is usually an enormously diversified set of such institutions. Some of them do basic research, an activity that is rarely directly relevant for firms (except for very new industries which draw directly on scientific breakthroughs, like genetic engineering). Some do more applied research and development, i.e. come up with new products and new ways of manufacturing them. Some are specialized in transferring such know-how to firms (transfer agencies), or focus on waking-up firms which are unaware of innovations they will need to survive (extension agencies). Then there are technology incubators, i.e. institutions which host new, technology-intensive firms. Other institutions include, for instance, those which specialized in technology assessment and forecasting, or in social science research on technology. Also, institutions like business associations can play an important role here, not so much in terms of R&D but in terms of stimulating interaction and learning. Last, but certainly not least, there are institutions in measurement, standards, testing, and quality assurance (MSTQ); in fact, they are the very basic institutions which should even be present in environments where other institutions have not yet a role to play. – Technology institutions are the world of perspective two. They interact with each other, and with firms, and they do that in various ways. There cannot be a blueprint for interaction, because it depends on framework conditions, on firm size, on industrial branch, on the phase in an industry's lifecycle, and so forth. The only thing that is for sure is that something is wrong with a technology institution which does not interact. There can, however, hardly be a prescription with whom a given institution is supposed to interact. Determining this requires a careful analysis of the institutional setting, i.e. the incentive framework, further technology institutions, and firms. The outcome of such an analysis can be that a given institution has just no role to play, at least not under given conditions. This will often be the case in developing countries where firms are not prepared, neither in terms of qualification nor in terms of attitude, to cooperate with technology institutions.

- Finally, there is the fourth pillar which consists of education and training institutions. There is certainly some overlap with the third pillar, as some research institutions will do some training, and some training institutions (especially universities) may be involved in research and development. However, it is crucial to understand that even in the case of universities their core mission is training. There is currently a lot of controversy about the ability of universities to do research and development, and to transfer its results to firms. The model of the research university was created in 19th century, when universities where quite elitist places, and it is unclear whether it is the adequate role model for the mass university of the late 20th century. In any case, it is important to acknowledge that even in advanced countries the importance of universities for economically research and development (as different from basic research) is often overestimated. In developing

countries, the potential of universities to contribute to firms' upgrading efforts is usually very limited.

The four-pillar-model helps to avoid too narrow a perspective. For instance, it is common to find innovation deficits at the firm-level, particularly in developing countries. Typical causes are deficient management know-how and technical education. A typical development cooperation response is then to create certain mesolevel activities, like technology extension, management training, and technical training. More often than not, the analysis of macrolevel factors is at best superficial. Yet macrolevel factors are often the main causes for firms' behaviour; what may appear dysfunctional to the external observer may be highly rational in the perspective of the firm owner. Therefore, it is crucial to develop a systemic view, including macrolevel factors, to understand the incentives and restrictions which shape the behaviour of businesspeople, and to understand whether the conditions for interaction between firms and mesoinstitutions are in any way favourable. In practical terms, it is often helpful to employ methods like action research to identify potential for change and possible points of entry for external support, and to stimulate learning processes among key actors.

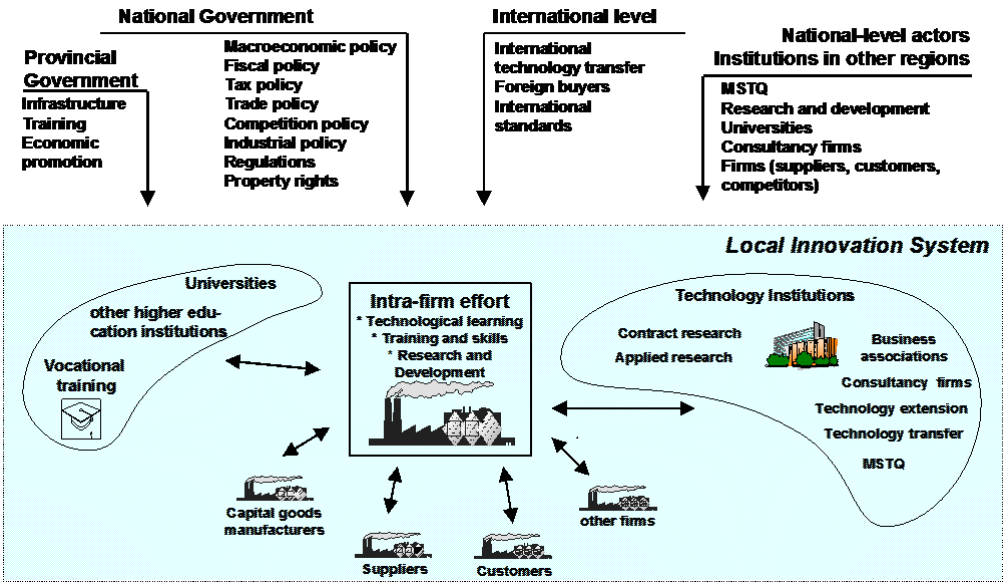
It is important to point out that the relevance of different elements of an innovation system depends on the stage of development. In a country where "catch-up innovation" is the predominant pattern, a highly specialised, leading edge research and development institution will battle to find clients for its services. A cluster of leading edge high technology firms, a technology demonstration centre will in all likelihood not need a technology demonstration centre. In other words, the examples mentioned in the figure above are illustrations rather than a blueprint. The structure of an innovation system, and the organisations that are part of it, will change over time and according to the level of economic development.

5.4.2 What is a Local Innovation System?

Innovation is based on interaction, and a lot of this interaction is highly localized. Despite globalization, proximity is still an important element. It is not by chance that locations such as Silicon Valley are so dynamic. And it is due to this fact that locality has received an increasing share of attention in the recent past – most notably in the discussion on industrial clusters, but also in the discussion on regional and local innovation systems.

A local innovation system is a geographically concentrated network of different actors who are interacting frequently, and for whom this interaction is essential for their innovation effort. The following figure tries to depict this.

Figure 5: The Context of the Local Innovation System



But the figure does more than just depicting a local innovation system. It also points at the fact that local innovation systems are usually integrated into larger network. Local innovation systems, national innovation systems, and international networks and transactions are not alternatives, but complementary features. The local innovation system is an empirical, often tangible fact. In includes firms and institutions which are dealing with the specific demands of local firms in terms of skills development and technological support. The national innovation system is less tangible; it is more about the overall incentive structure which may create the necessity to innovate.

What are the typical challenges that an effort to upgrade a local innovation system faces? We would suggest that there are three typical challenges:

1. Building an effective, interaction-based innovation system: This is a challenge in particular for emerging countries with a relatively recent evolution of competitive sectors that only occasionally have established constructive relationships with technology-oriented organisations such as universities or research centres.

2. Increasing the effectiveness of an innovation system, overcoming fragmentation: This is a challenge that needs to be confronted in locations with a relatively long tradition of innovation promotion measures and a relatively complex landscape of technology-related organisations. There is necessarily some fragmentation, and there is always room for improvement in terms of use of existing capacities. Many innovation promotion activities aim at addressing fragmentation and making better use of existing capacities.

3. Introducing disruptive innovation, fundamentally restructuring an innovation system: Some locations, and some clusters, are facing the challenge of disruptive innovation. For instance, a local cluster with a long tradition in mechanical engineering is typically unprepared when mechanical devices are combined with, or even substituted by,

electronic devices. For some locations, addressing such disruptive innovation is a matter of survival.

5.4.3 Consequences for the design of a RALIS Exercise

The design of a RALIS Exercises needs to reflect the pattern of innovation predominant in the chosen location. Moreover, during the build-up to a RALIS Exercise, it is important to assess the main challenge the location is facing.

- In locations where the predominant pattern is "catch-up", RALIS is not necessarily the ideal approach. However, a RALIS Exercise can still deliver important insights and proposals regarding a possible upgrading and modernisation effort. In particular, it can guide an effort to create a functioning innovation system, including suggesting the type of organisations that need to be creating to support companies' upgrading effort.

- In locations where the predominant pattern is "running to stand still", it is important to identify the drivers of innovation, which may be, for instance, buyers (i.e. lead firms in the value chain that the local producers are connected to) or suppliers of inputs or capital goods. In order to formulate realistic proposals for local technological upgrading, it is crucial to keep the demands and offers of those players in mind. Regarding the main challenge, any one of the three mentioned above can apply.

- In locations where the predominant pattern is "innovation for competitive advantage", it is paramount to identify the relevant challenge: Is the location battling with fragmentation, and should the RALIS Exercise focus at practical ways of addressing it? Or is the location facing disruptive innovation, and should the RALIS Exercise investigate the specific features of this challenge and focus at possible responses?

6 What are results of RALIS exercises?

In 2001, the first RALIS exercises were conducted to carry out regional investigations in the context of a comprehensive evaluation of the Indonesian national innovation system with a specific focus on the SME sector and on ongoing decentralisation efforts. Exemplarily in 10 selected districts in Indonesia, RALS field research was conducted by two teams, each consisting of four consultants. Their task was to assess the extent and performance of regional technology transfer and the technological capabilities of the regions.[8]

The RALIS teams spent one week in each of the locations. Figure 6 gives some data on the fieldwork. We can summarize some of the key findings of the RALIS diagnostic in Indonesia in 2001 as follows:

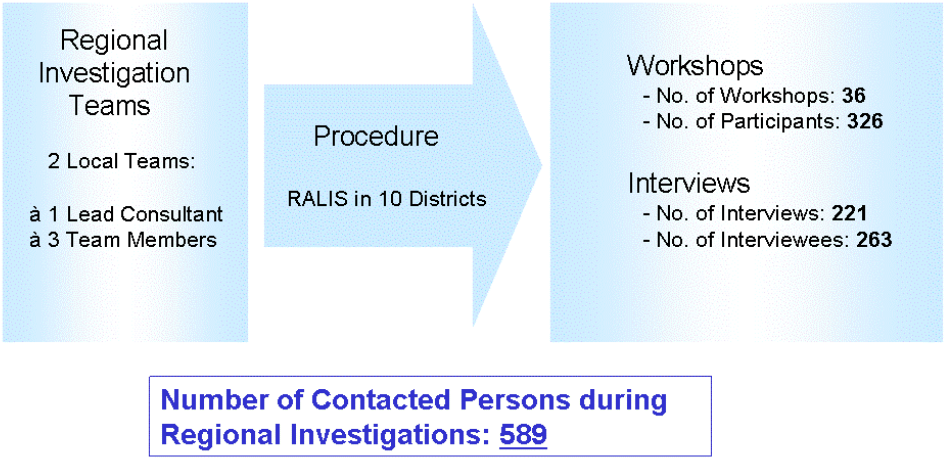
- There is hardly any local/regional innovation system anywhere. This is not to say that there is no technological capability building and innovation within firms and also in

8 The 10 locations selected for case studies in Indonesia were Bandung, Yogyakarta / Klaten, Semarang, Surabaya, Medan, Padang, Samarinda, Manado, Mataram, Makassar.

institutions. But technological capability building is rarely based on intense interaction between different actors / organizations at the local level.

- There is little interaction between firms and training as well as research institutions. Firms rely on other sources of technology.

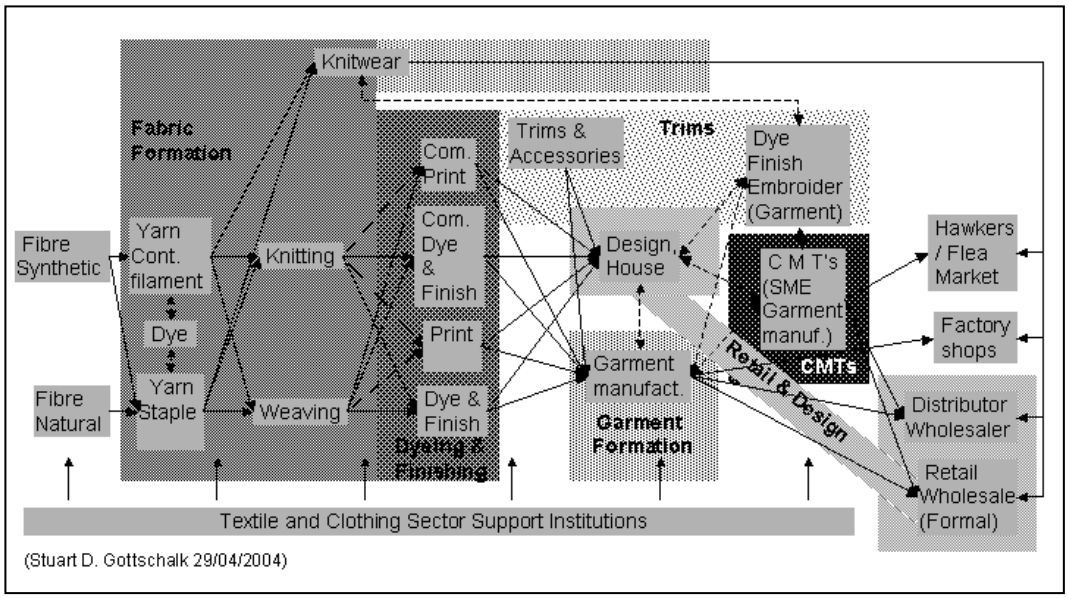
Figure 6: RALIS Field research in Indonesia



- There is an inward-orientation of training- and research-institutions. Their incentive structure so far militates against networking with firms. Training institutions define their courses and curricula mostly without taking demand by private firms into account. Research institutions define their research priorities based on the availability of government funding, or at least the hope that there might be some government funding available.
- There is an enormous distrust of firms vis-à-vis government institutions. Firms prefer to have as little as possible to do with government institutions, including training and research institutions.
- For firms, suppliers and customers are the main sources of technology. This applies particularly to SMEs. An interesting finding, however, is that NGOs play an important role in technology transfer to natural resource based industries.

In the course of the action-oriented RALIS application addressing the clothing and textiles (C&T) value chain in **Western Cape / South Africa** in 2004 the RALIS team had conducted interviews with 25 stakeholders from the C&T sector and supporting institutions and seven mini-workshops with relevant sector elements in the C&T value chain and supporting institutions. The preparation of a value chain map of the C&T sector in Western Cape can be considered a first result (see Figure 7). Some further key results are presented below.

Figure 7: Map of the Western Cape C&T value chain incl. sub-sector clustering



During fieldwork, particularly during interviews the RALIS team interacted with some garment and textile companies that were thriving (extension of production, increase of employment) despite the presently difficult situation, and with other companies that were reducing their production capacities and retrenching their workforce. The successful and growing companies displayed a number of features which we highlighted as key success factors:

- Positive attitude towards the future
- Continuous holistic training (CEOs personally involved as trainers)
- Serving niche markets (at least as part of their activities)
- Very active with product and process innovation (mostly in cooperation with their direct and partly indirect customers and/or suppliers)
- Planned annual capital and technology investment in order to keep the production and processing capacities technologically upgraded
- Effective productivity incentive schemes for their workforce
- Strategic, intimate customer relationships

The RALIS team had identified these key success factors during the first few interviews and subsequently re-examined them during the subsequent interviews.

Moreover, the information collected during the RALIS exercise highlighted some obvious competitive advantages and disadvantages which the South African C&T sector shows in comparison to competitors in other parts of the world (particularly in Asia), for sales in the domestic South African market.

The competitive advantages included the following:

- Quality and on-time delivery
- No delay in communication, since the local manufacturers are located 'on the door step' of their customers
- Adherence to international social compliance standards (ITS, Bargaining Council and individual retailer approved)
- Cheap utility cost (e.g. electricity)

Competitive Disadvantages have been identified in the following areas:

- Labour cost (up to seven times higher than e.g. in China)
- Proximity to major export markets
- Physical infrastructure (e.g. port efficiency)
- Institutional infrastructure (e.g. technology support)
- Productivity and efficiency of manufacturing processes

The RALIS exercise resulted in a list of 16 short, medium and long term proposals addressing marketing issues as well as issues related to productivity, quality and service levels.

One year after the exercise, the status of implementation of the RALIS proposals is mixed. Some proposals, such as 'benchmarking the C&T sector across the entire value chain' have progressed, also due to the strong support from the provincial Government of Western Cape. Others, such as proposals related to labour-rights, are stuck due to the resistance of the relevant trade union which seems to be insurmountable, at least at this stage.

The experience with the action-oriented RALIS application addressing the C&T value chain in Western Cape in 2004 takes us to the following conclusions:

- The RALIS exercise has shown that the methodology is suitable for assessing the competitiveness of a value chain in a highly industrialized environment and even in a situation of crisis and strong problem pressure.
- It is not necessary to contract external value chain researchers to conduct mappings and analyses of regional value chains. A RALIS Exercise can render the necessary results much quicker and at a lower cost. Moreover, it already involves, mobilizes and motivates those players who subsequently would champion practical activities in a given value chain initiative.
- Regional value chain initiatives are up against a variety of obstacles, such as lack of trust between companies and time constraints of business-people. For that reason, RALIS

principles like swift action for quick wins are crucial to convince the players in a value chain that the initiative makes sense.

- RALIS (similar to PACA) is a suitable method when it comes to connecting companies, supporting institutions and government. It is able to overcome communication barriers between these different sectors. Especially for government it is often difficult to project commitment and competence to the private sector. RALIS can be useful in overcoming this perception.

- RALIS (similar to PACA) is a methodology that is not only useful to launch an innovation initiative but also to assess and refocus ongoing initiatives. It can be used both to drive and to monitor and evaluate innovation and development initiatives. It is thus able to solve the difficult challenge of introducing monitoring and evaluation into a value chain initiative.

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