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MAKING ENDS MEET

Local socio-technological transformations in the South

by Jens Müller

Paper for FAU Conference
Workshop 5 on Local Finances & Resources
CBS, Copenhagen, May 2007

Abstract

Many local large-scale companies in the South are closing down, and local small and medium scale enterprises are diminishing in number. But this apparent *de*-industrialization process is accompanied by a process of *re*-industrialization: we find multinational large-scale investments, mainly in free zone settings, and expansion in local micro and small-scale enterprises in the *informal* sector.

The issue of local or endogenous generation of technological innovations has often been underestimated. A fundamental problem is that the micro-innovative strengths that really exist often remain isolated and encapsulated. This paper explicates the informal segments of the national technology systems by identifying their most important constituents. The purpose is to highlight the innovation capability of informal endogenous technology change agents.

This necessitates a broader theoretical outlook than conventional euro-centric conceptual frameworks allow. The paper therefore applies a wider analytical framework than is usually used in development studies. Local knowledge systems and organisational forms make up unique production systems that indicate the formation of an *other* and *different* evolutionary *path* or trajectory than "*the*" technological evolution experienced in the North.

In order to mobilise the local technological dynamism in the South, a much closer *link* than exists to day needs to be established between the formal/exogenous and the informal/endogenous segments of the national systems of innovation. A first condition for such links to be established is that the informal technologists are *recognised* and their conditions of operations fully understood.

Contents:

1. Introduction

- The present situation (2007)
- The colonial scientist

2. Conceptual framework

- The constituents of technology
- Social conditions of technology
- Technology transfer
- Technological construction of society
- Social construction of technology

3. Informal becoming the normal

- From SME's to MSE's
- Urban settings
- Rural settings
- Manifestations of different production systems

4. Structures and Institutions

- The double set of segments
- The intriguing "by pass"
- Formal and informal infrastructures
- Diversifications, livelihood strategies, labour markets

5. Another Path

- Technological transformations in the South
- Overall global view
- Local systems of innovation

6. Reconciling the national systems of innovation

- A post-pessimist outlook

References

1. Introduction

Some 30 years ago the author of this paper undertook a development research project in Tanzania about village blacksmiths. The purpose was to find out what “appropriate technology” could be transferred from Europe to Africa in order to assist the development of their production systems.

In the course of the project, three pieces of scrap iron were cut up at a town garage so their origin was not immediately obvious. These pieces were brought to an old village blacksmith and he was asked to tell what *types* of iron were at hand. One by one he placed the pieces into his charcoal fired furnace and systematically hammered them. During this operation the blacksmith did talk, and when asked about what he was saying, he told that he asked our question to the iron itself. The answer, he later said, came through his eyes (what colour), his nose (what smell), his ears (what sound), and most importantly through his arm and shoulder. After two hours he concluded: "This piece is good for a hoe or an axe; this may make a reasonable knife; this piece is really useless".

However, this was not what I had asked him about. So samples of the same iron were later sent to the Danish Technological Institute. The answer came two weeks later in the form of three small reports describing - in tables and diagrams - the percentage of carbon and other ingredients, penetration strength, bending properties etc. This information I would have had to bring to some manufacturer to be told what good use could be made of these iron types. I did not do so: *the village blacksmith had already told me!*

However, most of the Tanzanian civil servants, politicians and academics interviewed during the research project did not really appreciate the recordings made from the field work: “Why study these indigenous artisans, they are backward, lazy and crazy – ignorant”. Yet the conclusion of the research was that the village blacksmiths are *skilled, industrious and sane – wise*. It was also demonstrated that whatever alternative technologies I could think of bringing to these artisans could not be considered as “appropriate”, given the local socio-economic conditions at the time. *They were already using the most appropriate technology!* What needed to be changed were the local conditions (Müller 1980).

Moreover, the research report was rejected by the Danish Development Research Council that had funded the project. The peer review concluded that the report could not be approved for publication. However, Aalborg University Press did so. But more frustrating, the book did offend the director of the Small Industries Development Organization (SIDO) in Tanzania who originally had provided research clearance and other assistance; he totally rejected the analyses and conclusion.

The present situation (2007)

Fortunately, in the late 1990'ies I met Tanzanian researchers with a critical outlook of the Euro-centric conception of technological development. Jointly we made a follow up research project titled Indigenous Systems of Innovation in East Africa, which certainly verified my previous findings¹. And finally, 25 years after SIDO had rejected my first book, I was asked by the Ministry of Agriculture and Food Security in Tanzania to take part in the design of a project that would mobilise the village blacksmiths to boost agricultural development (Diyamett, Mwende & Müller 2005).

¹ The project was made between 1998 and 2003 in collaboration with Department of History, University of Dar es Salaam, and Institute of Development Management, Mzumbe, Tanzania, and reported in some detail in Bertelsen & Müller (2001 and 2003). Apart from the village blacksmiths, the project focused on the local boat builders around Lake Victoria.

In other words, there seems to be an encouraging change underway of past times ideological conceptions of technology and development in the South. Impressive work is being done by the African Technology Policy Studies (ATPS) network, the director of which recently stated: “There is a strong understanding that without appropriate science and technology (S&T) policy to anchor and support the economic policies, the economic recovery and renaissance in Africa will be weak at best” (Ogbu 2004).

ATPS and other likeminded Southern organisations have over the last decade worked intensively to formulate in great detail how an *appropriate* S&T policy should look like. Generally speaking, however, the proposals appear mainly concerned with how the South one day may “catch up” technologically with the North. Still, very few refer to the urban and rural artisans in the so-called informal sector or economy. A first step would be to recognise the local resources of these artisans, and then to include them in whatever policies that may be implemented. This paper is an attempt to raise this issue.

The colonial scientist

Over the past three decades it became more and more apparent that what Basalla (1967) call the “dependent colonial scientist” is not capable of providing adequate and relevant insight and knowledge about the development processes in the South. Sagasti (2004:1) elaborates this: “The colonial scientist is dependent in the sense that the sources of his education and training, the origin of the scientific traditions that he adheres to, the orientation of his activities and the ways of obtaining recognition for his work, are all defined in the metropolitan scientific power and not in the country or region in which he lives and works”.

Sardar (1999:44) explicates this view by saying: “The real power of the West is not located in its economic muscle and technological might. Rather, it resides in its power to define. The West defines what is, for example, freedom, progress and civil behaviour; law, tradition and community; reason, mathematics and science; what is real and what it means to be human. The non-Western civilisations have simply to accept these definitions or be defined out of existence”.

Alvares (1991:3) suggests the following: “African anthropologists’ analysis of the ethnocentrism supporting the main body of anthropological literature on African peoples can be repeated in areas as diverse as political science, economics, art, law, sociology, and psychology, more crucially, with the understanding of technology and culture in the world at large”.

In the following we zoom in on the notion of technology and start by quoting Tucker (1999:8) where he states: “Societies that deviate from the European techno-economic standards are designated as “traditional” or “primitive” despite the fact that they are *contemporaneous* with those who label them as such. In the real world there are no traditional societies, only ways of looking at societies as traditional”.

A first step would be to try to de-construct or de-colonise what has become commonly understood as *the* technological development, evolution etc. Doing so would counter argue the predominant one-liner technological determinism: the nuclear plant was always there since the Stone Age, it has just been waiting for man to be clever enough to discover it.

In other words, there is an urgent need for scrutiny of the conception of technology as such. Being Northern European, I am ill equipped to do so, but have tried (Müller 2003), and hereby invite concerned Southerners to join in a dialogue. What hopefully may come out of such a dialogue would be a much deeper understanding of the relations between technology, society and culture.

2. Conceptual framework

Although numerous new conceptions and theoretical frameworks have been forwarded in recent decades that attempt to abandon the Euro-centric notions and approaches in development research (e.g. Pieterse 2000), these have mainly been within the social and political sciences confines. However, for some reason *the concept of technology as such has not really been challenged*.

Very few, if any, development researchers make an explicit effort to specify how they define technology; it seems – so to speak – to go without saying, and the concepts of technique and technology are often used interchangeably. Yet, most development literature does not make this distinction, but is full of all kinds of primitive comparisons as demonstrated and commented below:

Northern technologies	Southern technologies	Comments
High	Low	Presumably of labour productivity, but not of capital or knowledge investments
Advanced	Backward	Signifying the common one-dimensional perception
Modern	Traditional	Taken from the “stages of growth” perception
Developed	Underdeveloped	Assuming need for Southern countries to “catch up”
Complex	Simple	Referring mainly to the vertical division of labour
Sophisticated	Rudimentary	Wrong: sophistication is synonym for wisdom
Evolving	Devolving	Again assuming a one-path technological trajectory
Innovative	Imitative	Not considering that all innovations carry imitation

A first step towards de-colonising the concept of technology would be to elaborate a holistic and ontological universal definition of technology. What is needed is an open-ended technology conception that enables us to comprehend the relations between technological and social change, and to elaborate inter-disciplinary methods to identify and solve problems related to technological transformation. For a recent discussion of different definitions of technology, see McLoughlin (1999).

The constituents of technology

Following this discussion, and in line with the above-cited purpose, our definition of technology reads:

Technology is one of the means by which mankind reproduces and expands its living conditions. Technology embraces a combination of four constituents: Technique, Knowledge, Organisation and Product².

The four constituents are *inseparable* components of any technology. A comprehensive analysis of a particular technology therefore has to include *all* constituents *and* their interrelationships.

² This definition was first forwarded by Müller (1973) and has proven its methodological applicability since then. For an elaborated presentation see Müller (2003).

Each constituent or component can of course be described and analysed separately. In fact they make up the main fields of a technology analysis, each field being equally valid as an entry to such analyses. The four components can also be conceived as the main interacting *variables* of technology. They are thus all to be included when it comes, not only to analysing, but to effect technological change.

Our definition of technology is symbolically illustrated in Figure 1. All four components are depicted as pieces of a jigsaw puzzle, arguing the following thesis:

A qualitative change in any one of the components will eventually result in supplementary, compensatory and/or retaliatory change in the others. If this does not happen, *the initial change initiative will become abortive.*

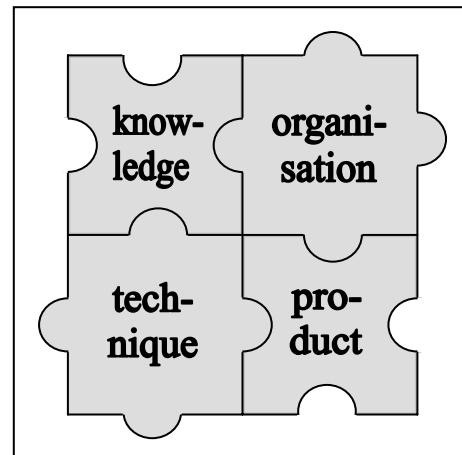


Figure 1: The technology concept

This, however, is not to say that there is any one-to-one deterministic relation between the variables.

Social conditions of technology

What actual changes do occur is as much dependent on the external socio-political/economic and cultural setting, i.e. the “local conditions” mentioned in the introduction, as on the internal variables. Examples of important external variables that condition technological change are symbolically indicated by the open-ended jigsaw pieces that “stick” together with other “outer” pieces in Figure 2.

When and if a change in e.g. the social infrastructure or say the international relations occurs, this will not only have repercussions for most of the other “local conditions”, it will likewise influence the technological setting of the country. Not that there is any static concord between the jig-saw bits and pieces, but there nevertheless needs to be some fit over time.

In other words, technology does not have a predetermined logic of change.

Technology transfer

Perhaps the most palpable use of the model in Figure 2 is to apply it to the issue of technology transfer as illustrated in Figure 3.

A technology package sent from the North to the South is transferred from one social setting to another and does not fit into the latter. This problem may be solved in 3 ways:

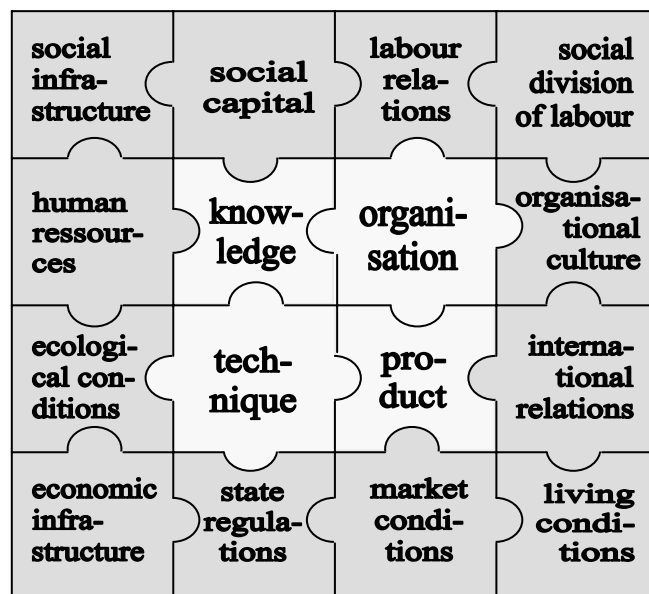


Figure 2: Technology and selected contextual conditions illustrated

Option 1: The technology being supplied is fully adapted to the social setting of the receiver.

Option 2: The social setting of the receiver is fully adapted to fit the technology supplied.

Option 3: Both the technology supplied and the social setting of the receiver are changed or “moved” to fit each other at some point, which hardly can be pre-determined.

Option 1 was a very popular prescription in the 1970’ies: The technologies transferred to developing countries should be *appropriate* to the local conditions. However – as already indicated – it turned out that, taken to its full consequence, this strategy leads nowhere, because what would be a totally appropriate technology would *already* be there (Müller 1980).

Option 2, to bring in the newest technology from a foreign and thus very different setting and then hope that the local conditions can be adapted accordingly, is obviously not feasible either. E.g. it would probably take some centuries – if at all desirable – to change say the Tanzanian social conditions to become fully equal to the Danish.

Only by leaving the either-or notion and opting for *something of both*, i.e. option 3, where both the technology and the social setting are changed, a sustainable assimilation process may be set in motion.

This is also to say that there is no clear-cut "recipe" for what must be done. Almost each case has to be treated separately.

Technological construction of society

Returning to the general model in Figure 2 we can now pin down two opposing notions of the relations between technology and society.

The most common understanding is that it is primarily technological change and innovation that drives the socio-economic developments of society, i.e. that it is the four inner jig-saw puzzle pieces that drive and turn the picture. Science (most often understood as natural science) centres are the knowledge intensifying engines and back-bone incubators of technique and product innovations that again leads to new organisational settings in the production systems.

These moves change i.a. the market conditions, the international relations and the social division or labour, which again necessitate changes in the economic infrastructure, and so on in order to fit the new technology. If this does not happen, the technological innovation becomes obsolete.

In other words society is *technologically* constructed. We find numerous so-called technology assessment analyses, being analyses of the social consequences of technological change.

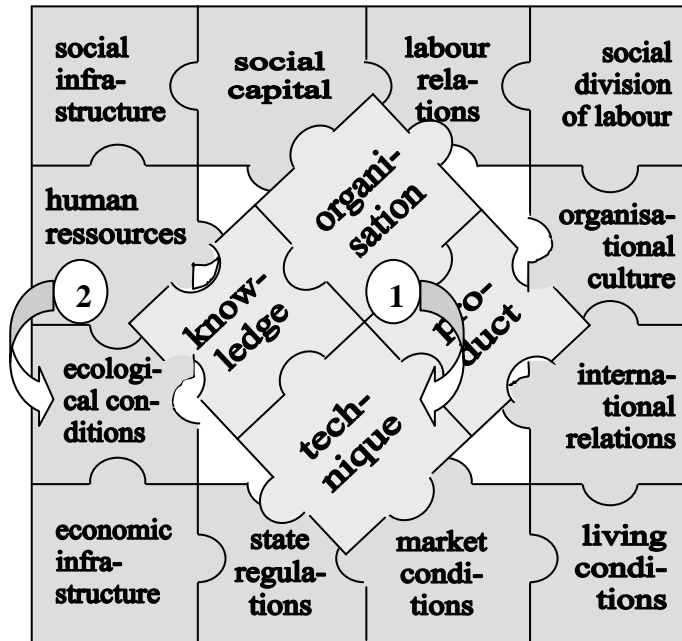


Figure 3: Technological construction of society or social construction of technology

Social construction of technology

The other notion has been forwarded and promoted over the last two to three decades: It is the social conditions of production that shapes whatever technology is being developed. I.e. it is the ever changing “outer” jigsaw puzzles that force the technology pieces to follow suit in order that they eventually fit.

This is also to say that technology is *socially* constructed as argued by Bijker, Hughes & Pinch (1987) and elaborated i.a. by Müller (2003). This view calls for analysing the technological consequences of societal change.

A useful supplementary method to get to grips with and operationalise the social construction of technology approach is the National Systems of Innovation (NSI) approach (Edquist 1997). Societal structures and institutions are also here regarded as key determinants of whatever innovative transformations may take place in technique, knowledge or organisation and thus products.

In sum, arguments for both notions can be forwarded. However, the most important thing to consider is a *dialectical* outlook. It may be seen as the chicken-or-the-egg discussion; but in the final analysis we consider that the social construction of technology conception is the primal determinant. Its application will be demonstrated in what follows.

3. Informal becoming the normal

The trend in the South under the present globalisation of production systems appears to be a widening of the international technological divide. Under the policies of state directed development in the 1960-70's a number of import substitution arrangements were made together with the establishment of national R&D organizations. These policies were abandoned during the 1980's under pressure for neo-liberal structural adjustments. Privatization, deregulation, trade liberalization, and currency devaluation were introduced, leading, for instance, to reduction in real wages, increased unemployment, and credit squeeze for small-scale producers (Dijkstra 1996).

Many local large-scale companies either merged with multinational companies or closed down. And local small and medium scale enterprises (SMEs), including those that acted as sub-contractors to large-scale companies, diminished in number (Gwynne and Kay 2000). Countless SMEs have been forced to exit the market altogether, and whatever national research, development, and formation of novel technologies that existed are also in a state of decline (Katz 2001)

However, this apparent *de*-industrialization process has been accompanied by a process of *re*-industrialization: we find expanding multinational large-scale investments, primarily in free zone arrangements for exports, and an increasing level of expansion in local micro and small-scale enterprises in the so-called informal sector.

The issue of local or endogenous generation of technological innovations has often been underestimated in analyses and policy interventions. A fundamental problem is that the micro-innovative strengths that really exist often remain isolated and encapsulated, thus weakening their potential contribution to the up-keep and viability, let alone the international competitiveness, of national economies (Arocena & Sutz 2002).

For several decades researchers and practitioners have been occupied with the intriguing distinction between the formal and the informal sector. An ILO employment mission to Kenya introduced the term “informal sector” by observing that

- “the bulk of employment in the informal sector, far from being only marginally productive, is economically efficient and profit-making...” and “there exists considerable evidence of technical change...” (ILO 1972:5).
- “informal activities are the way of doing things, characterised by (a) ease of entry; (b) reliance on indigenous resources; (c) family ownership of enterprises; (d) small scale of operation; (e) labour-intensive and adapted technology; (f) skills acquired outside the formal school system; and (g) unregulated and competitive markets” (ibid:6).
- “the designation [formal and informal] is not intended to contribute to an academic proliferation of labels; we merely seek an analytical terminology to describe a duality that avoids the bias against the low-incomes sector inherent in the traditional-modern dichotomy. Both sectors are modern...” (ibid:503).

Nevertheless, over the years many policy makers and researchers have been more occupied with what else to label the informal sector (e.g. the hidden, underground, shadow, black, invisible, parallel, subterranean, or extralegal economy) rather than trying to understand in depth – let alone to recognize – what the activities in the sector signify. It is most often defined by what it is not, or what it is lacking.

However, the definitional confusion also comes about because of the vastly different activities within the informal economy. Taken as a whole, it – apart from genuine productive ventures – includes all kinds of more or less criminal endeavours, semi-legal hagglers, hawkers, or huskers (Casanovas 1992).

In this paper we primarily deal with *manufacturing* enterprises – in urban as well as in rural areas – that go under the ILO characterization quoted above³. The entrepreneurs and workers in the informal sector are referred to as craftsmen.

From SME's to MSE's

Another reason for the relative neglect of dealing with the informal sector is the original belief that it would fade away, i.e. that the micro and small-scale enterprises (MSEs) would gradually become small- and medium-scale enterprises (SMEs), and some eventually even large-scale firms.

However, as already indicated, the opposite has happened in most parts of the South, i.e. the MSEs have expanded, and the SMEs have contracted. But many SMEs in the formal sector have only disappeared from the national statistics and merged with the MSEs in the informal sector (Peattie 1996). This movement has created the problem of “the missing middle”, which is one palpable expression of the national technological divide (Ferrand 1997).

Romijn (2002) observes that registered small-scale firms still generate about 60 percent of manufacturing employment in developing countries; but this percentage would be much higher still, if we could give an estimate that also includes the countless unregistered activities that typify the small-scale manufacturing sector.

In the following some empirical records from both urban and rural settings are presented. Most authors deal with the urban informal setting. However, since the rural-urban interface is crucial to bear in mind, the rural setting is just as important to look at. Informal sector enterprises in rural areas are often referred to as non-farm employment activities.

³ Recently the ILO decided to use the term informal “economy” (ILO 2002). However, in this paper the old “sector” term is applied since it is still the most commonly used. The “sector” notion is used as analytical paradigm only.

Urban settings

De Soto in his path setting book *The Other Path* (1989:3) observes: “A steady stream of small craft workers, tools under their arms, expands the range of activities carried out in the city. Indigenous local adaptations add to the production of essential goods and services, dramatically transforming certain areas of manufacturing, retail distribution, building and transportation”.

And Conger (2002:1) states: “While the jobs and working conditions of these [informal] vendors, household repairmen and craftspeople employed in thousands of cottage industries appear marginal and precarious, taken together they account for a huge proportion of the Latin American economy”.

According to ILO (2002) 40% of Latin American workers are employed in the informal sector, and individuals working in micro enterprises produce from 10 to 50% of the GDP of Latin American countries. It is estimated that 60% of the population lives off the informal economy. E.g. in Mexico, the informal sector accounts for 58% of new jobs.

Turning to the African situation, recent studies indicate that the share of the informal economy generally exceed 60% of total employment. It accommodated about 75% of the new entrants into the labour force in the 1980'es. And by the year 2020 it is predicted that the informal economy will grow, while the formal economy will stagnate, thereby resulting in a contribution to GDP that will grow from under 50% to 66% (Hope, 2001:35). See also Hansen & Vaa (2004).

Rural settings

Lanjouw (2001:3) records that 47 % of the labour force in rural settlements and towns are employed in non-farm activities in Latin America. In El Salvador this rate is 36%, and nearly 30% of these are engaged in some form of manufacturing activities (ibid:6). Non-farm activities are likely to employ labour beyond the point where the marginal product of labour is equal to the prevailing average agricultural and urban wage.

Most rural non-farm employment is informally embedded, and is often of part time or seasonal nature; much of it is manufacturing related to agricultural production such as processing crops or making farm tools. Reardon et al. (2001:3) describes this as household “multiactivity” and estimates that between 30 to 50% of rural incomes in Latin America stems from it. In Nicaragua 40% of the rural households are multiactive in one way or another, however only 18% of these are estimated to be earning 20% or more of their incomes from participating in the non-farm informal sector.

Bryceson (2002:730) reports from Africa that while surveys of non-farm activities from the 1980'es and early 1990'es provided estimates that these accounted for roughly 40% of rural household income, research findings from late 1990'es show much higher levels, between 60 to 80%. Together with these quantifications, the more qualitative investigations give rise to the argument that there is a process underway of what she terms “de-peasantization” and “de-agrarianization” (ibid:726).

In sum, we go with de Soto (2000:27) where he, in trying to break “the mystery of missing information”, notes: “extralegality has become the norm – it is legality that is marginal”.

Manifestation of different production systems

Detailed recordings of recent technological transformations in the rural informal sector are very rare. Presently we can only provide some insight from our own research in rural Tanzania. As indicated in the introduction, one of the activities studied in a perspective of 25 years

(1974-1999) was that of the village blacksmiths. This gave reason to suggest that while the population has doubled during this period, the number of active blacksmiths has tripled (Müller 2001).

More important, in the context of this paper, are however the current variations in the internal and external division of labour of the blacksmith enterprises. For this purpose we - for lack of better conceptions - regrettably have to refer to the ache typologies taken from early European technology history. In what follows we briefly characterise the different production systems that we observed during our survey of the activities of the village blacksmiths,

1. *Simple artisan system:* The master smith works with 2-5 apprentices or assistants, to a large extent using "home made" tools. The group often makes its own charcoal and collects the raw materials, i.e. scrap iron like broken steel springs from trucks.
2. *Complex artisan system:* As above, however supplemented by the use of various imported tools, e.g. anvils, blocks or vices. Some operations, e.g. welding jobs, may be sub-contracted to nearby workshops with access to electricity.
3. *Simple putting-out system:* The blacksmith group works systematically with one or more middlemen who mediate orders from distant customers, and who often bring raw materials as well.
4. *Complex putting-out system:* Besides ordinary production to order, the group perform modest mass production of products in high demand, e.g. kitchen knives. Apprentices or assistants take on relatively independent tasks in the production process.
5. *Simple manufacturing system:* Several master smiths have grouped together and work in a line under the same roof, each with their particular apprentices. Each is however completing their own jobs, i.e. the internal division of labour of the group is minimal.
6. *Complex manufacturing system:* The master smith is the production leader for a number "graduated" smiths. More than one furnace and other work places are in use at the same time. The relatively large assortment of products requires different work processes.

NOTE: Although these production systems are presented in a consecutive way as if they signify a "progressive" pattern of transformation, both the spatial distribution and, more importantly, the variation over time do change very much.

4. Structures and institutions

Having presented some empirical recording of the changing national structures of production, this chapter now attempts to provide some theoretical insight of the endogenous systems of production.

However, it is difficult to explicate these systems because considerable parts of these exist under informal institutional settings that differ from those of the formal sector, and also vary from region to region within the same country. For example, Raikes (2000) explains that it is a fatal mistake to think of one and only one commodity market setting at work. Weeks (1991) likewise document the fallacy of regarding the labour market as one homogenous institution. In short, several markets are instituted with very different "rules of the game".

And for analytical purposes, the national production systems should not only be divided into formal and informal segments. They can also be split up between endogenous and exogenous segments with reference to the qualitatively different technology systems that characterise them. Both sets of segments have been subject to a number of studies, but they have rarely satisfactory been integrated!

The double set of segments

As said, the distinction formal-informal sector is well described, although certainly not always emphasizing the same features. Our contention is that the distinction primarily must be in regard of *institutional* disparities. At the extreme ends we find very different rules of the game as defined by the predominant, but co-existing modes of production (Jansen 2000:195).

In the formal sector we find so-called modern norms and value systems, and state and/or capitalist market regulations, frequently with strong international relations. On the other hand, in the informal sector we find post-traditional norms and value systems, civil society dominance and petty commodity market relations. De Soto (1989:13) refers to these as “extralegal norms”.

It is important though to note that the area of interaction between the sectors is sizeable depending of course on what features one looks at⁴. In particular in regard to the legality of activities Tokman (1992:6) observes that an intermediate status is common. He cites cases where the production process of some products is illegal, but the marketing legal.

Exogenous technology is largely of foreign origin. It depends on imported inputs in terms of technique and knowledge, and its organisation is thereby to a large extent influenced by foreign management structures.

Endogenous technology is largely of local origin. Traditional artisan operations belong to it, but it also includes all kinds of technologies that originally came from abroad. The distinction is whether or not this technology has been innovatively assimilated (Müller 2003:78). The operators of endogenous technology are capable not only of handling all aspects of the technology; they are also able to adapt it to changing circumstances. Again, the area of interaction between the two technology systems is of noteworthy dimensions.

Putting the two sets of segments together, as we do in Figure 6, we begin to be able to go into some details of the dynamics, both of what we call the institutional dimension and the technology dimension of the national systems of production.

There has been a tendency to conceive the structure of production in the South as being situated either within segment [1], [3] or [4]. In the formal (modern) sector we saw either large-scale industries - often parastatals - in segment [1] or small and medium scale enterprises (SMEs) in segment [3]. In the informal (traditional) sector we saw micro and small-scale enterprises (MSEs) in segment [4].

What was happening in segment [2] was blurred, and in any case the area was looked upon as one rack bag of all kinds of activities. Some empirical efforts have been devoted to segment [2] where we e.g. find various repair workshops (King 1996). Transistor radios, video cameras, computers etc. are being repaired in numerous urban and semi-urban workshops. Repairs

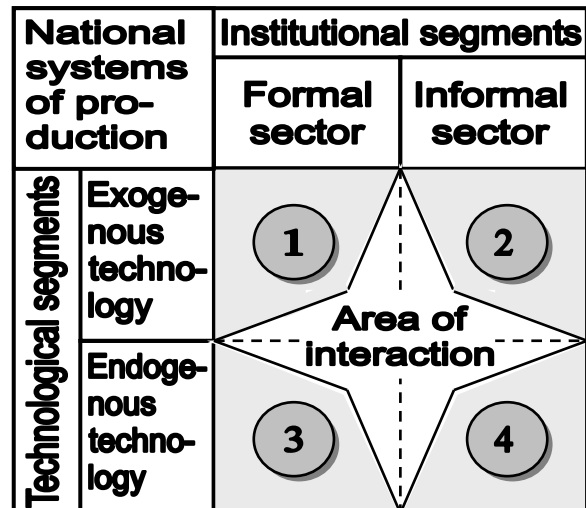


Figure 6: Matrix of the 4 segments of the national systems of production.

⁴ We are not proposing to use the conventional dual economy theoretical outlook. We address the national economies as a whole, and apply the notion of segmentation for analytical purposes only.

that are rejected in European shops (why don't you buy a new one?) are now effectively and very cheaply done in such workshops.

However, it is the area of interaction that is the most interesting to penetrate empirically when the focus is on innovation. What kind of interactive learning, user-producer communication and other exchange processes take place between the four segments?

The intriguing “by-pass”

The conventional idea that exogenous technology inputs in the formal sector would be assimilated and eventually become part of the endogenous technology system, i.e. be directly transferred from segment [1] to segment [3] has largely been frustrated. And as said, the number of large and medium scale enterprises that were established under previous import-substitution regimes is declining.

However, as illustrated in Figure 7, a noteworthy and increasing amount of hard-ware (technique), but also soft-ware (knowledge) is transferred from segment [1] to and *adapted* in segment [2]. E.g. some of the retrenched or dismissed workers from the formal sector get employed or establish themselves in similar activities applying their accumulated knowledge base.

Also, knowledge and bits and pieces from segment [2] are eventually *assimilated* in the endogenous technology systems in segment [4] and become inputs to the innovation efforts that constantly take place here. Finally, some technologies in part or whole may gradually be *domesticated* and embraced by the formal institutional setting in segment [3].

The movements from [1] via [2] and [4] to [3] we see as a “by-pass” to the conventionally projected path from [1] to [3].

King (1996:102) provides very detailed records of numerous instances of what he terms “second stage” import substitution that takes place in the informal sector via the “by-pass” described above. In other words, although the former state directed and subsidised import substitution efforts are diminishing, it increasingly takes place in the private, however, informal sector. One reason for this is a combination of decreasing incomes for the majority of populations and devaluations that are not compensated by the falling prices of imported goods (Qualmann 2002:172).

In sum, while most politicians and academicians are mainly trying to find ways to improve formal sector national production systems with the aim to maintain or achieve *international* competitiveness, informal sector operators are daily striving to maintain and achieve *national* or local competitiveness making use of informal sector systems of innovation. They are daily searching and searching – constantly re-searching – for technological solutions to their business problems.

Formal and informal infrastructures

We also need to look at the infrastructural features of the changing structure of production. The point is that we regard the structure of production as the front side of the "coin", and the infrastructure as the other side of the coin; the coin itself being the productive and reproductive

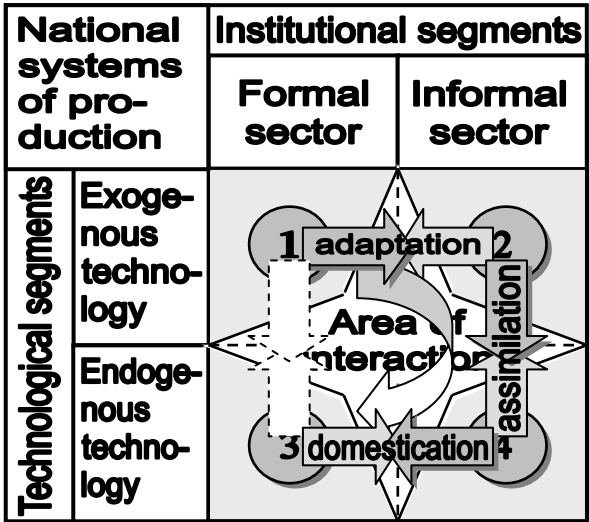


Figure 7: The technological assimilation "by-pass"

capacity of society. What infrastructure⁵ is in effect facilitating the observed changing structure of production?

Whilst public ownership initially was one of the characteristics of infrastructure, this has changed since the neo-liberal trends during the 1980's, where privatisation became one of the policy aims of many states. Here we refer to what can be termed the formal infrastructure, i.e. those facilities that either are undertaken by governmental organisations or operated under governmental regulations and formal institutional setting.

However, a massive volume of infrastructure facilities are maintained and established under a vast variation of informal institutional settings. Apart from the informal transportation and communication networks we must note the presence of a wide range of different assembly places that ensures the connection or networking of the territorially dispersed individuals, households and enterprises. All these utilities are managed according to local basic institutions that vary from place to place and often escape public regulation (Wilson 2004). The vast number of different market spaces must be mentioned, which facilitates the crucial user-producer relations.

In sum we claim that insight in the *informal* infrastructure is important for understanding the dynamism of most informal sector technical, organisational and thus product innovations.

Of particular importance for understanding how the so-called knowledge infrastructure is manifested concerning the routines of searching and interactive learning carried out by informal craftsmen. How do they obtain information and ideas about new ways to perform their activities, as regards product innovations, knowledge exchange and accumulation, new materials treatments, or technical innovations?

Relatively few craftsmen have had more than a few years of formal primary education or contact to the formal vocational training system. However, almost all have been apprentices with elder relatives or neighbours. In a sense the apprentice system therefore constitutes part of the predominant informal social infrastructure.

Since the informal sector operators have only had marginal contact with the formal training systems many politicians and academics claim that they therefore are “backward, lazy and crazy” or just “ignorant” (Müller, 2001). In a closing footnote to his highlights of the informal economy in Latin America, Ghersi (2000:7) states: “Sociology books suggest that we Latin Americans – especially Peruvians – have the defect of being stupid, which explains our inability to progress. Indigenous heritage and Spanish colonialism retarded us to such a degree that, along with corruption, the climate, and spice food, we have turned into depraved peoples – into something like cultural imbeciles.”

Endogenous knowledge is often confused with and conceived synonymous with traditional knowledge. Although most traditional knowledge is contained within the endogenous knowledge confines, these systems also include all such contemporary exogenous knowledge elements that have been gradually assimilated or “endogenised”.

The knowledge acquired by craftsmen in the informal sector is based on experiential and implicit learning with a high degree of tacit knowledge. In the informal apprentice system for skill transfer the apprentices learn, not only how to produce a range of specialised products, but also how to co-operate with other craftsmen, customers and to navigate in the community and society as such (Coy 1989).

⁵ We define infrastructure as the technological system that facilitates the material and institutional exchange and transaction processes, which connect the socially divided labour processes (Müller 2003).

Diversifications, livelihood strategies, labour markets

In order to grasp some of the driving forces that shape the structures and institutions recorded in the previous chapter we need to draw on an actor-oriented perspective by reference to relevant studies in political science and anthropology. Below we contend to mention but a few that immediately appear to be relevant.

In regard of diversification we refer to the active livelihood strategies of the actors in question, i.e. how they apply a multitude of economic means, social arrangements and cultural orientations towards different directions simultaneously. Together the different elements compose a strategic combination where different elements support each other. Seppälä (1998) develops a theory of diversification on the basis of empirical studies in rural East Africa.

Jansen (2000:195) identifies three livelihood strategies pursued in the rural setting, and they relate these to changes in the social division of labour. The point is that the conventional perception that *either* the rural population is desperately trying just to survive, *or* they are accumulating physical capital and reinvesting in expansion of their businesses is too simplistic. In between we find many micro enterprises and households that are primarily occupied by reproducing their livelihood, investing whatever surplus they generate as much in social as in physical capital. This supports the view of (Biller & Quintero 1995:7) that “the poverty argument is often overused by the informal industry lobby”.

A very important point to note is that the enterprises within the reproduction livelihood strategy segment are constantly changing and innovating their technology in step with the ever-changing socio-economic and political conditions. If they did not, they would soon be out of business and become survival agents.

Much of what we have said about livelihood strategies is intimately related to the question of labour market relations. The central characteristic of urban labour markets is that they are comprised of a heterogeneous collection of subordinate relations, which while they coexist and overlap cannot be effectively integrated (Weeks 1991). Kongstad (1986) provides a detailed overview of what this “overlap” implies in terms of shifting modes of employment under petty commodity production.

Standing (1991:36) states: “The enormous growth in so-called informal economic activities in most parts of the world cannot be divorced from the question of labour regulation – the unemployed have taken up small-scale employment, family enterprise production and the like, or those whose formal employment earnings have fallen have supplemented them with secondary activities” and “[this] raises doubts about assumptions that the informal sector is a producer of non-tradable goods and uses only unskilled labour”.

Formal sector firms cut labour costs by using home workers, sweatshops, street vendors, neighbouring shop keepers and others in the informal sector, while nominally self-employed, are actually “disguised workers” with none of the benefits or safeguards of formal employment. Adjustment policies seek to “flexibilise” labour. In practice, this means cracking down on trade unions and making it easier for managers to hire and fire employees (Green 1999).

5. An Other Path

In this chapter we attempt to generalise our empirical and methodological findings and to offer a framework for understanding some of the important features of what technological transformations presently are happening in the South.

Technological transformations in the South

When it comes to describe the technological transformation witnessed in the South we are, as indicated, hard up against the prevailing modernisation discourse. E.g. we often talk about the *less developed countries*. This is an expression of fruitless and derogative Euro-centric comparative perspective that leads us nowhere if we really want to understand what happens in these social formations.

As already indicated, studies of the change process that took place in many Southern countries in the 1980'ies and 90'ies have (as in the North!) been labelled as one of *de-industrialisation* (Nyong'o & Coughlin 1991). This has been a convenient catchword where former state subsidised enterprises have more or less collapsed under the structural adjustment policies imposed by the IMF and the World Bank

However, these analyses are concentrating on the diminishing fordist factory systems. What they miss out is the dynamic diversification processes – explained in the previous chapter – that primarily are found in the informal sector.

The technological transformation taking place in the informal sector we, for argument sake and for lack of better expression, propose to term *convolution*⁶, the meaning of which according to Collins Thesaurus dictionary (1995) connotes “coil, coiling, complexity, contortion, and intricacy”.

What emerges is a picture of integration of the artisan system, the putting-out system, the manufacturing system *and* the fordist factory system as depicted in Figure 8. Local knowledge systems and organisational forms make up unique production systems.

Further research is of course needed, and most importantly, new non Euro-centric conceptions are needed in order to come to grips with a proper characterisation.

The convolution process at work we characterise as: *Flexible integration of innovative and novel, increasingly sophisticated, co-existing systems of production.*

Overall global view

The fordist factory system is thus seemingly “fading out”, both in the South as in the North.

However, counter to this thesis we must be aware that numerous fordist factory systems are being established in the South. This mainly happens in the so-called “free zones”, where “unskilled” (and almost unpaid) labour can be exploited with no tax or other benefits to the host country. These are primarily found in the so-called newly industrialised countries, the NICs (AMRC 1998).

But a large number of other countries in the South are presently competing to attract foreign investments through incentive schemes that introduce an institutional set-up that differs from that of ordinary formal sector “rules of the game”. By the way, these rules are to some extent similar to those in the informal sector⁷.

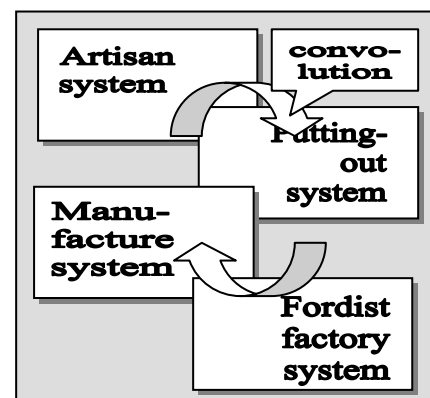


Figure 8: The process of technological convolution in the South

⁶ We initially did propose to use the term “involution” in line with Geertz (1963). However, this concept was denoting a situation of stagnation or degeneration.

⁷ The Granada Free Trade Zone in Nicaragua operates by the following “incentives”: 100% income tax exemption; no capital gain taxes; no duties on raw materials; no duties on building supplies; 100% foreign ownership permitted; no sales, excise or consumption taxes; no export taxes; no foreign ex-

We thus identify three main co-evolving technological trajectories as illustrated in Figure 9. All three are of course heavily dependent and interlinked with the others. None would be feasible without the others.

Seen in a global perspective - and without the conventional but intriguing comparative perspective - what we initially did term convolution should really be conceived as evolution; however an *other* and *different* evolutionary path or trajectory than "the" technological evolution experienced in the North.

In other words, what is referred to as the "technology gap" or "technology divide" should be conceived as a three tier co-evolving transformation process. Where this leads to, or whether this is a regrettable process (as it usually is described to be) is another story.

However, most politicians, academicians and practitioners in the North and in most places in the South are preoccupied with the question of how to close the gap or cross the divide. Others would discuss the issue as a question of how the South may one-day would be able to "catch up", e.g. see Göransson (1993). These considerations are embedded in the notion of a one-liner, modernist conception, often technology determinist outlook that we do not share.

Local systems of innovation

As recorded in the previous chapters, all kinds of technical, organisational and product transformations take place in the informal sector. Here we infer that since this is the case it must be possible to identify some related local systems of innovation. What we deduce is that since the informal sector apparently is expanding and thus co-evolving with the changing socio-economic and political institutional settings in the South, this is empirical manifestation of innovative capability of informal sector craftsmanship.

In other words the national systems of innovation (referred to in Chapter 2) in the South must be seen in two highly separated and diverging parts, (1) the formal and (2) the informal as indicated in Figure 10.

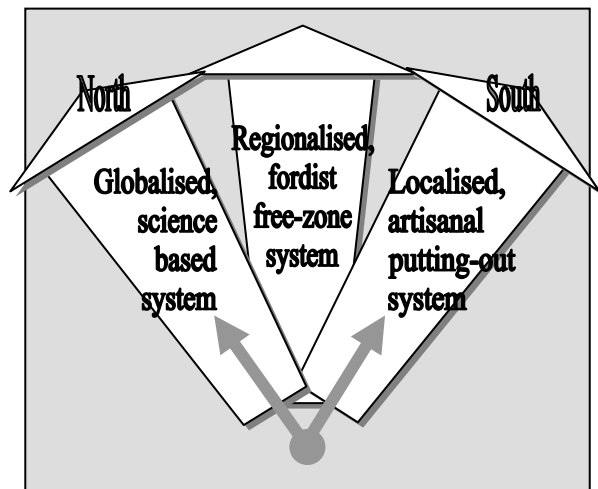


Figure 9: Globally diverging technological systems trajectories

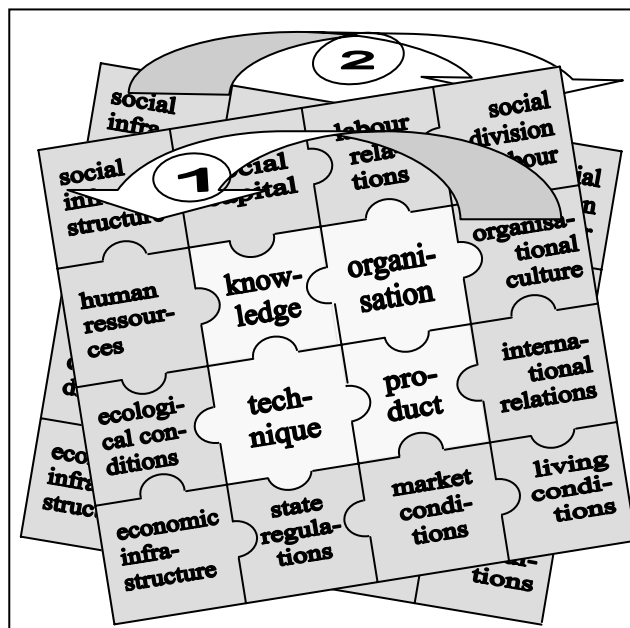


Figure 10: Formal sector (1) movement and informal sector (2) movement

change regulations; free capital repatriation. Quoted from pamphlet. When picking up the pamphlet in Nicaragua, February 2001, we were also (verbally) told that questions of pollution, waste management etc. - like in Europe - would be of no concern for the authorities: "So why don't you move your factory to our place?"

Another way to explain the same is to use the model presented in Figure 2. We must realize that the formal social or contextual conditions of technology are qualitative different and moving in opposing directions compared to the informal conditions, thus shaping *qualitatively different technological transformations*.

We must imagine that there, so to speak, “behind” the formal innovation systems are numerous local informal systems at work. In fact, most of this paper has been devoted to highlight exactly some of the contents of these hitherto, so to speak, hidden systems.

6. Reconciling the national systems of innovation

In order to mobilise the technological dynamism in the South in general, and in the informal sector in particular, a much closer *link* than exists to day needs to be established between the formal/exogenous and the informal/endogenous segments of the national systems of innovation. Everybody would benefit:

- Informal sector enterprises would get information about technological innovation options for enhancing their capacity for the benefit of themselves, their local customers, and the national economy at large.
- The formal sector, including not least public research and development organisations, would get essential feed back about the need and real demand for technological transformations in the informal sector.
- International technology transfers would stand a greater chance of being dynamically assimilated if foreign suppliers are getting essential feed backs about the contextual conditions of their recipients.

A first condition for such links to be established is however that the informal technologists are *recognised*, and that their conditions of operations are fully understood.

What we conclude is that there is an urgent need to establish *coherent* national systems of innovation. As Johnson & Lundval (2003) put it: “A need to include all sectors both low and high tech and finding ways to utilize local knowledge”.

It needs to be said, that there is no reason what so ever to indulge in craftsmanship nostalgia. The technology of the urban and rural craftsmen is extremely labour demanding, cumbersome and low level productive. Labour relations are not complying with generally accepted standards (ILO 2002; Scrase 2003). Some of the technology systems are also not at all ecological sustainable. On the other hand, the innovation potential of the informal technologists could be the “just-in-time” backbone of future technology transformation processes.

However, when it comes to more concrete policy recommendation for doing the proposed reconciliation of the various systems of innovation we are short of ideas. The presently imposed dogma for the “retreat of the state” makes little room for constructive policy proposals. Suffice to note that there apparently are two opposing strategies offered. One is the neo-liberal; the other may be termed a neo-structuralist position.

Throughout this paper we have been inspired by and have quoted De Soto’s *The Other Path* (1989). However, in his follow up study *The Mystery of Capital* (2000) he concludes that this other path he was seeking is one that would eventually lead towards a fully developed capitalist market economy: “Only capital provides the means to support specialization and the production and exchange of assets in the expanded market. It is capital that is the source of increasing productivity and therefore the wealth of nations” (De Soto 2000:221).

His call for “formalizing the informal” is essentially an argument for the creation of a “good legal property system” (ibid:232). Slightly implicit we take this call as an argument for the neo-liberal policy of privatisation of all assets.

On the other hand, Cross tells us (1994:2): “De Soto uses a simplistic model in which broader economic factors are ignored, and state regulation is seen as the only limiting factor on growth. On the other hand, he completely ignores super-exploitation and the lack of worker benefits within the informal economy – precisely the types of evils that state regulation is designed to cure.”

We go with Pisani (2000) where he states: “The informal sector should be nurtured now to assist millions in improving their lot in life as well as improving the health and national economies. To nurture this sector means to revolutionize economic development schemes to provide financial and technical assistance to informal sector entrepreneurs, foster a macroeconomic environment conducive to informal sector growth and undertake the reforms necessary to legitimise governments”.

Thus, formalising the informal must go alongside with increased and flexibly designed state interventions (Portes et al. 1989). Pearce (1998) holds that structural adjustments without an effective state is detrimental, and criticises the new NGO’ism that just attempts to fill in the gap between the state and civil society.

A post-pessimist outlook

The outlook may seem grim since “relatively few companies with worldwide connections dominate the four intersecting webs of global commercial activity on which the new world economy largely rests: the Global Cultural Bazaar; the Global Shopping Mall; the Global Workplace; and the Global Financial Network - - The driving force behind each of them can be traced in a large measure to the same few hundred corporate giants” (Barnet & Cavanagh 1994:15).

Therefore we find that the call of Hines (2000:vi) makes sense: "to protect the local, globally ... which involves a move away from acquiescence to the theology of globalisation towards considering the possibility of its replacement with a localism that protects and rebuilds local economies worldwide".

This is what the majority of informal sector agents already are trying. However, this to succeed will need a re-nationalisation and re-regulation, i.e. innovation of *governance*, not more privatisation. The human resources in its widest sense are there – ready to be mobilised. The craftsmen are already mobilising these resources to some extent on their own initiatives, but they need a *radically* changed policy environment and some assistance for the benefit of the rest of the society.

As regards the international or supra-macro level, and related to what we may term the presently globalising *market terrorism*, we will end by quoting Mittelman (2000:128): “at present, a counterthrust to neoliberal restructuring is emerging in what might be called the stirrings of *transformative regionalism*, i.e., a regionalism grounded in civil society, more as a future prospect than as a current phenomenon”.

In any event, we need to do away with the prevailing "Afro-pessimism" (Bourenane 1992) and what we may term “Latin-pessimism”. Not because there is any reason to be optimistic on the part of the craftsmen in the informal sector. We know too much of what is happening there. But the pessimism creates a sense of defeat, is fatally hindering clarity, and is an expression of lack of creative imagination. Our records and studies of the informal sector fortunately gave us the necessary inspiration to mobilise our imagination and to abandon this pessimism.

Not that we think that there is reason for any optimism though. For as Jevtusjenko, a Russian writer, recently said in a TV-interview: “The optimist has too little information” (about what is going on), but “The pessimist has lost his imagination” (about what might still happen).

A final anecdote from the village blacksmith follow up studies in Tanzania may give an impression of what we are up to (Bertelsen & Müller 2003): Our research team did revisit a blacksmith group that had been interviewed in the 1970'ies. The workshop had certainly changed and very apparently improved. The workshop building had been moved from a low thatched roofed work shed to a high corrugated roofed building. The tools and equipment had changed, and the range of products multiplied. Very impressed we told the master smith: "What a fantastic development that has happened here!" We were speaking Kiswahili, and we did translate the word "development" by "maendeleo". However the blacksmith quickly responded by saying "This is not maendeleo – we did it ourselves!" implying that no donor, NGO or government agency had had anything to do with the improvement.

In another remote location, the village blacksmith being revisited patiently did allow us to interview and take pictures of his workshop tools, and of the multitude of agricultural and other implements the group was producing. In the afternoon on the second day of visiting him, he apparently got a bit impatient and told us: "But can't you see? – if we go on strike, hunger will happen!"

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