Sociotechnical Relations and Development Assistance

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Abstract:

Process research is increasingly used to assess and monitor the implementation of development projects. In natural resource management and agriculture, the results have contributed to consensus-building amongst village groups, agricultural extension and other governmental agencies, NGOs and donors. This paper draws on Latour's science studies programme to compare these results with process research in industrial development projects. Process research should reflect sociotechnical relations. Latour's definitions of sociotechnical relations thus allow us to describe the context of development projects and add to the theoretical framework of process research. Ethnographic methods reveal the insider perspective and implementation logic of development interventions also in industry. An interpretation of the ethnographic results according to the layer of sociotechnical relations is proposed.

Key words: sociotechnical relations, development project management, process monitoring, process research, institutional development, appropriate technology, ethnography

Introduction

The label 'White Elephant' is often used to describe technical equipment financed with development aid that then lies unused or is inefficiently operated in developing countries[1]. Recently, a different category has appeared. Sophisticated technology from industrialized countries has been used successfully, for example, satellite telephones in villages in Bangladesh[1]. By freeing them from social and cultural boundaries, these telephones enhance the economic activities of village women. Albert Hirschman's classic observation, that developing countries are much better at aeroplane maintenance than at road maintenance long ago challenged the assumption that technology's adequacy to a social, cultural and economic context is understood. We know little about the social impact of the introduction of telephones to industrialized countries, how could we then understand what telephones do in Bangladeshi villages ? Had sociologists studied the social dimension of technology in industrialized countries in more depth, the conceptual framework for context adequacy would have emerged.

There is an alternative route, which might produce some elements of context adequacy, and this route is explored in this article. After 40 years of experimentation with aid administration, development agencies are increasingly employing 'process' approaches to managing development aid. These management approaches can entail a large number of learning steps, internal feedback loops and consultations with all social groups concerned. Through such methods, an adaptation or transformation of the hidden social components of

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[1]A 'White Elephant' is recognizable by its isolation from its social, cultural and economic context: it results from ignorance on the part of development experts. This observation is often simplistic because it denounces a rather implausible defect, a blindness to local conditions.

technology becomes possible. After sufficient experimentation, specific process management approaches for particular technologies might appear: for example, a type of process management for irrigation systems, another for health care, and a third for manufacturing industrial machines. When process management reaches a state where it becomes specific to a sector of the economy (or a field of technology), then the components and tools of that process management approach can reflect the hidden components of technology. In other words, the operational reforms of development assistance can reveal social dimensions of technology.

This route is rather speculative and implies that learning in development agencies can lead to elements of the social dimensions of technology that one cannot isolate by looking at individual technologies in a specific context. This is not as far-fetched as it appears at first sight, assuming that a 'technological style'[2] is the product not of firms or individual organizations but of sets of institutions such as schools, universities, firms and governments in a particular region or country. In that case, the evidence for a technological style appears on an aggregate level. This article starts with such a speculation and attempts to pursue it further. Later, the concept of 'appropriate technology' can perhaps be replaced with a concept of 'appropriate organizations for technology', where appropriateness consists of addressing the sociotechnical relations that an organization can attain. First, it must be shown that process management, as it evolves in some development agencies, indeed uses management tools and variables that are specific to a type (or layer) of sociotechnical relation. Demonstrating this here, I hope that much more empirical evidence can be added so that this induction can gain solid ground.

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[2]A technological style is embedded in institutional complementarities between education, firms and administrations in a country or economic sector. These complementarities are possibly more

Comparing Process Management Approaches

Development assistance is in a state of constant reform since the early Eighties. Two general trends are evident, i.e. the decentralization of operations and the regionalization of policy and projects in some development agencies. Many agencies were structured according to professional disciplines such that the agriculture department was responsible for agriculture in all regions, the energy department was responsible for energy in all regions and so on. In the Eighties, agencies like GTZ (german governmental agency) and the World Bank were reorganized so that regional departments (comprising one to around five countries) are now responsible for all projects in their region and the former agriculture department is reduced to a service organ for the regional departments. The same is also true of the departments dealing with energy, water, health, etc. A second trend is related to this one, development agencies increasingly transfer operational responsibilities to their respective country representatives. These country representatives call on services from the headquarters at their discretion, thereby, adapting operations to the local context. Whereas before the agriculture department started its policy and planning from agronomic data on productivity, for example, and then imposed technocratic improvements in standard projects, after the reorganization, a country department starts from the local context, firms and administrations and concentrates on the 'process' of a development intervention. 'Process management' thus concerns how organizations co-operate, who contributes what insight, who defines objectives, how to monitor and evaluate, who is responsible and so on. These two trends were preconditions for specific process management approaches to appear.

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influential than natural resources and factor prices. Many institutional theorists refer to Max

However, it seems that agencies are not yet at the stage where different process management approaches are sufficiently defined[3]. Nonetheless, we can compare two proposals for process management from different fields of development assistance to see whether the relationship between technology and social context in one field is distinguishable from that in another field. If process approaches in agriculture in different countries resemble each other, then they are specific to the agricultural knowledge and not to countries. On the other hand, if they are only specific to the respective countries, then they reflect first of all political conditions. At the end of this article, we will see that the specificity to the field, for example, irrigation or industrial sectors, appears more important. This would imply that informing process management with sociotechnical relations can be crucial to bring the process management innovations from different countries together and consolidate them.

The first proposal described here is by Mosse[2], concerning agricultural aid projects. The second one is my own[3] proposal on process management tools for industrial technical assistance. The basis for a comparison of the two is the science studies programme endorsed by Bruno Latour[4], amongst others. I first introduce Latour's hierarchy of sociotechnical relations, describe process management in agriculture and in industry, and then assess whether the differences correspond to Latour's conceptualization of sociotechnical relations. The first objective is to see whether this comparison is feasible. As yet, no process management approach in development aid is sufficiently advanced, or its sociological analysis consolidated, for us to be certain of a correspondence between unknown social dimensions of technology and process management tools. By linking process management efforts to the science studies programme of Latour, we can enrich and advance the definition

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Weber's sociology to explain different industrial development patterns.

of 'process'. The level of abstraction necessary to describe sociotechnical relations allows only to verify whether such process management is coherent with theory, but not to predict or guide how it could evolve.

Such a comparison of process management has to consider that these are the result of ethnographic fieldwork. Applied anthropologists use participant observation to work in and on development assistance. This imposes a problematic conflict between the fieldworker's methods and the cultural distance/power in development discourse and development practice[5]. Comparing process results is therefore also a comparison of the utilization and exploitation of ethnography for development agencies' objectives. This comparison complements ethnographic evidence with social theory in an original direction. Strengthening the theoretical basis of ethnographic results is important to 'defend' their quality with respect to agencies' agendas and to encourage more process research through participant observation. Such a comparison is not strictly empirical, one has to account for the fact that process research cannot be generalized.

We are looking for context adequacy of technology. What are the social and cultural conditions of technology that make it useful, meaningful or developmentally effective[4]. Scholars such as Denis Goulet and Johan Galtung suggested in the 1970s that 'underlying technology there is a certain cognitive structure, a mental framework, a social cosmology, serving as the fertile soil in which the seeds of a certain type of knowledge may be planted'[6]. Their metaphor was on track, but the cognitive structures assumption leaves open the naturalization of unknown social knowledge characteristics, and thus the metaphor turns the

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[3]Often they reflect the conditions inside a development agency rather than conditions of the field where the agency operates.

[4]Arguably, the economic adequacy of technology, the relative prices of inputs and outputs, are not a sufficient condition for appropriateness. In some cases even economically inappropriate technology

wrong way. Klitgaard[7] [5] suggested that social scientists should attempt to change cultures themselves just as agronomists study soil composition, a suggestion that leads to a behaviourist programme. There are no essential soil nutrients of cultural phenomena in humans to which to tailor development projects. Until today, there is little insight on what technology is adequate for a particular development context.

Layers of Sociotechnical Mediation

Latour's humanist programme of studying science and technology is built on refuting the dualism between the natural (or material) and the social. Instead of treating technology on one side and then adding some independent social dimension, Latour shows constantly that only a hybrid object of analysis, containing human and nonhuman elements (a symmetric anthropology), allows to understand how humans create technology and what they do to themselves in the process. He reconstructs the hybridity, the nonhuman relations transformed into human ones and vice versa, in all his empirical cases, first for research in biology at the

can be shaped to local economic conditions and institutions, by ingenious reverse engineering or policy modifying factor prices.

5 "After collecting such decentralized sociocultural data, the task is to study their connections with local development outcomes, such as indicators of economic development, loan repayment rates, success of family planning programs, educational outcomes and so forth. The result might in turn suggest experiments to local people, perhaps abetted by external assistance as they try to take their

Salk Institute, to his latest case, the Aramis transport system in Paris[8]. Using the diversity of his reconstructions of hybrids, he derives types of these transformations, as instructions, translations, enrollments and displacements between human and nonhuman elements. This diversity spanning basic science, up to simple artifacts in everyday life, needs to be stressed here because that range is important in order to show the applicability of his programme to the range of process management in development.

To transcend case studies of actors and networks sustaining scientific facts and technologies, he introduced a hierarchy of eleven distinct layers of sociotechnical relations, each with a type of 'crossover' where human parameters are transformed into nonhuman ones and vice versa[9]. This hierarchy is a new departure, instead of defining these transformations, it classifies the objects (social and material) these transformations bring together. Each layer corresponds to a type of sociotechnical relations and the crossovers consist of the change from one type to the next type of sociotechnical relations.

> "Each of those crossovers results in a dramatic change in the scale of the collectives, in its composition, and in the degree to which humans and nonhumans are enmeshed,'[10] ..... 'For each layer of meaning, whatever happens happens as if we are learning, on our contacts with one side, ontological properties that are then reimported to the other side, generating new, completely unexpected effects"[11].

For simplicity, I present these layers more descriptively, referring readers to Latour's analytical presentation. As these layers alternate between human and nonhuman relations, the uneven ones are human and the even ones are nonhuman in Latour's convention.

At the highest (eleventh) layer, Political Ecology, nonhuman conditions such as climate change or ozone depletion are interpreted into human relations (obligations of OECD countries to stop squandering global commons, for example). Such interpretations, the 11th-10th crossover, can take place at international negotiations and in the mass media. Latour

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symbolic soil conditions' into account". He then recalculated the correlation between Social

labels these nonhuman conditions Technoscience, the tenth layer, the fusion of industry and science. Technoscience constitutes the origin and the options for the planet. This constitution thoroughly mixes up the contributions and interests formed at the ninth layer, labelled Networks of Power[12], comprising global organizations running vast economic structures such as the electricity grid or the global food trade. Their organizational logics create the input into Technoscience. This 10th- 9th crossover is the one where washing machines, powder, clothing and electricity meet, and where telephones, TV and computers converge and create the modern consumer choices. Unfortunately, this ninth layer is not a pure power game because these organizations are conditioned by factories which constitute their nonhuman constraints. This factory level, the eighth, is labelled Industry by Latour. The 9th- 8th crossover, from Industry to Networks of Power, is the matter of entrepreneurs and financial markets, for example. At the eighth level, industrial engineers are at their best organizing human actions to operate machines and automates. The human conditions constraining the engineers are education systems, labour or transport infrastructure, the seventh layer, called in allusion to Lewis Mumford[13] the Megamachine. The Megamachine is made with administrations, accounting, political organizations and cities. The 8th- 7th crossover, from the Megamachine to Industry, consists of much legislation and demands on industry's products (this crossover concerns the process research in industry described later). In this crossover, British coal capitalists once argued that only children could work in the mines (in the eighteenth century) because adults were too tall. The change in that crossover is radical, nowadays, educating children to become mining engineers is more productive. Below, at the sixth layer, lies the Internalized Ecology, agriculture and the domestication of animals, the exploitation of the biosphere, villages and farms, necessary to the

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Soundness Analyses and project success, but these suggestions have not been further pursued.

Megamachine's functioning. Therefore, the 7th- 6th crossover consists of local trading, medicine or nutrition (this crossover concerns the process research on irrigation described later). For space, I stop this description here, "at this level we pass beyond the gates of history and enter more profoundly those of prehistory, of mythology"[14]. The fifth layer corresponds to Society and social order, four is Techniques such as the plough, three Social Complication where humans rely on other humans' use of tools, the second is labelled the Basic Tool Kit, and the first concerns Social Complexity at the level of primate groups.

Table 1: Layers of Sociotechnical Relations

State of Social Relations	Crossover	State of Nonhuman Relations	Developmental Objects Adequate to a Layer
Political ecology	⇦ 11 - 10		climate mitigation (JI, CDM)
	9 - 10⇨	Technoscience	?
Networks of Power	⇦ 9 - 8		ex.: technological momentum of cogeneration insufficient
	7 - 8 ⇨	Industry	?
Megamachine	⇦ 7 - 6		ex: reification of irrigation management
	5 - 6 ⇨	Internalised Ecology	perhaps many health projects
Society	⇦ 5 - 4		possibly 'sector-wide' projects
	3 - 4 ⇨	Techniques	possibly 'livelihood' projects
Social complication	⇦ 3 - 2		
	1 - 2 ⇨	Basic tool kit	
Social complexity			

New phenomena such as the Mad Cow disease call for complex revisions of different crossovers and sociotechnical relations on different layers. Their novelty can challenge age-old political and social alliances, and rearrange sociotechnical relations between the layers.

The disease originates in the Megamachine, whose economic rationale can rearrange industrial conditions but much less the systemic conditions of rural communities, where the unintended and new nonhuman condition appears nonetheless. Possibly, the disease can be prevented either on the sixth or the seventh layer, or between them.

This hierarchy of sociotechnical mediations is admittedly speculative, but as Latour always insists, there is hardly an alternative to avoid the essentialisation in opposing society to technology. Such a typology is required to say something about the translation of material conditions into social relations, and this is what development aid often claims to be about. Despite the empirical complexity, the social reality of using technical knowledge in another society than the one where it was created should resonate in science studies. This social reality comprises the professional habits of development experts and volunteers, the individual and institutional discourses, the planning practices, management approaches and other rules of the "development industry". The question as to which aspects of development aid are most directly connected to sociotechnical relations is theoretically difficult, but even more so empirically, because the social reality of aid is sparsely documented. The huge amount of grey literature in development agencies contains perhaps sufficient evidence to define the change of human and nonhuman conditions articulated by development practice. But this literature is not accessible and its analysis is an equally immense undertaking.

Introducing sociotechnical relations to development theory should reduce the modernization ethos (and myths) in development more readily than in science policy. On the nonhuman layers as much as in the human layers, technology and the social context are mutually dependent and causal. A development intervention which mobilises technology triggers changes in the sociotechnical relations embedded in technology and in the sociotechnical relations existing in the local social context where the intervention occurs.

This could be the key contribution, as the technical knowledge transmitted by the development intervention should be described with the same concepts as those at the local context. In place of "appropriate technology", the analysis concerns the differences in sociotechnical relations, a type of sociotechnical relations pre-existing and another type introduced from outside. For example, a technology created in a social context, where sociotechnical relations of the Megamachine-type exist, contains these sociotechnical relations in embodied form, but these sociotechnical relations change when the technology is brought into another social context. In addition, the new social context can be dominated by a different type of sociotechnical relations, say Internalized Ecology.

Little is known of these sociotechnical relations (and development policy makers would reject them anyway, being "afraid of mob rule", as Latour qualifies the authoritative dismissal of anything else than the one objective reality known only to the expert), but the implementation of a development intervention should nonetheless lead to evidence for changes of sociotechnical relations. Improving our understanding of the extent of the unknown can be an advance for development theory. If, despite the theoretical speculation involved, the evidence resembles the speculation, additional insight into the matter of process monitoring / research can appear, at least. At most, there is simply no alternative to the assumption that particular social structures facilitate the accumulation of skills and technical knowledge in a different manner than other social structures, which made Galtung to assume undefined cognitive structures. Latour's ambition of a symmetric anthropology certainly suggests an application of his theory to the organizations dealing with the historical heritage of the asymmetry (the alterity between the colonial power and the peoples dominated) from which the discipline anthropology came about. Introducing sociotechnical relations into an analysis of development practice is in fact addressing both asymmetries at the same time, the

asymmetry between North and South and the asymmetry between human and nonhuman conditions.

Process Documentation and Monitoring in Agricultural Development

Mosse et al. have produced a comprehensive overview of research approaches subsumed under the heading of process monitoring/research. It is the result of a decade long research mainly at the Overseas Development Institute (ODI) in London. Mosse resumes the most influential process management innovations from sociology and anthropology of development of the last 20 years. Most prominent amongst these sources is the work of David Korten[15] in the Philippines and Lawrence Salmen[16] in urban Latin America. Korten showed that development interventions need to be flexible and iterative as the social context is too complex for 'blueprint' projects (where project inputs and outputs are only assumed to be causally linked). ODI appears to exert more influence on the aid policy debate than university departments specifically created for development research.

Mosse et al. expands on Korten and Salmen's results and proposes six more specific purposes for which process management approaches are being tested: to include new and more complex objectives in development efforts, to innovate development policy, to improve evaluation and impact studies, to facilitate the collaboration between development agencies, to understand the institutional conditions in development efforts, and finally, to expand the political roles of development interventions. These six purposes are not all compatible and

sometimes conflicting. Mosse et al. show thereby that the process management currently tested can expand in different directions. A process management approach can be specific for one or two of these purposes. "Different process monitoring approaches need to be used selectively, the type and timing of work being dictated by objectives, circumstances, and the type of development work involved"[17]. This implies that a process management approach can be specific to an economic sector, which we need for the comparison with Latour's theory. For Mosse et al., the type of development work involved corresponds first of all to the specific developmental organizations, different NGOs, or governmental administrations. Later on, we will relate the type of development work to sociotechnical relations and see whether the latter allow to qualify the type of development work not according to the specific organization but to these organizations' role in the economy. This also serves to qualify the six purposes of process management approaches that Mosse suggests.

The most detailed process information is produced from village-level participant observation by long-term resident researchers. Less intensive research can use routine meetings of project staff or other events in the context of the development interventions such as village meetings. Process management comprises the use of the information gained, the medium used to distribute the results and the reactions and interpretations of the concerned people to the results. 'Process' refers also to the systemic conceptualization of the information matter treated. 'Management' comprises everything related to the production and consumption of process information, by whom, when, how it is being used, analysed and then applied. The conditions of participant observation as research methodology are obviously central to achieving this systemic conceptualization. Mosse et al. do not suggest which conditions of participant observation are most important.

Most of the research results Mosse et al. described discuss how social structures are affected by development interventions. Sometimes these results themselves are useful without a corrective measure to the development intervention, possibly by preventing counter-productive activities. In other cases, the organization of project implementation was modified, for example, by creating different structures for different castes represented in an Indian village[18]. The research results have sometimes been useful below the project level, at times at that level and on the national level. In both countries where most process research described by Mosse et al. has been used, Philippines and India, the results obtained have also led to important changes in agricultural policy nation-wide. Water Users' Associations have become new actors and local and national political bodies attempt to nurture and empower these associations, replacing governmental administrations.

The relation between development intervention and process research is complex. The research methodologies shape this relation as much as institutional interests and ideological differences between NGOs, governments, villagers and researchers. For this reason, it is often difficult to draw a general conclusion from the results. Since process research seeks to reveal the unique dynamics of the development intervention, the specificity of the local context and the adaptation of the technical packages involved are important. As the research objective is the unique character of the intervention, the quality of the research results is unique as well.

The potential mutual benefit between the development intervention and the research activity is to advance both understanding and change. The economic reality of the caste relations being modified by the development intervention, researchers can observe the social relations being opened up, something they would not have been able to speculate about without the intervention. On the other hand, the development intervention attains a

reflexivity that is only possible from scrutinizing its implementation. The mutual benefit is also highlighted by the conclusion that the process research is more effective when there is a better defined developmental intervention, for example, an irrigation system, as a defined technological package comprising machines, water flows and maintenance. When the intervention is less well defined, such as in small-scale farming systems, process research results are less salient[19]. One possible cause would be that the impact of the development intervention is less separable from other economic activities of the project participants. Another potential cause is that the irrigation intervention involves knowledge and skills which are more salient in the local context, not more or less linked, but more prominent in whatever social changes are occurring at the time. This invites an examination of sociotechnical relations as a way to assess this prominence.

My hypothesis is that process research is more successful when the development intervention uses a technical modification of the economic activity that corresponds to the social relations underlying this activity. Agricultural production is one arena where power and income in the village are determined. The development intervention targets the resource efficiency of this production system and, thereby, one arena where social relations in the village are determined. I speculate that the changes to the local social relations are not intrinsic to the irrigation technology used (water harvesting, percolation tanks, and other systems). Therefore, the process research can reveal opportunities to use the development intervention to shape changes in social relations. By offering villagers the potential to shape the social impact of the development intervention via the application of technological knowledge, these social changes become feasible. This does not necessarily require appropriate technology or creating new irrigation methods. The complexity of irrigation systems creates choices in making a system socially meaningful without altering the

instrumental core of the irrigation knowledge (its physical properties, the nonhuman relations in Latour's terminology). Feenberg[20] describes the potential of using technology for different social purposes than the original ones as "subversive rationalisation". The instrumental core of the irrigation knowledge is available even for contradictory ideologies. Different ideologies are quite present in development interventions, and process research might be an approach to such subversive rationalizations.

There seems to be no pattern in process research results regarding the field of development intervention. While most process research started in irrigation development efforts, these research approaches have been demonstrated for forestry, aquaculture, small-scale savings and other finance projects, all in rural areas and all in South and South-East Asia. An exceptional case is described by Rew and Brustinow, who stretch the process research methods to the limits when they work on the privatisation of Soviet-style collective farms in different regions of Russia[21]. Rew and Brustinow define the process research outcome as an 'institutional resolvent' where conflicting visions of the development intervention can be addressed. Whereas in the irrigation cases, the process research aspires to allow local social groups to influence the development intervention, as "it is all too easy for outsiders to misinterpret events or to draw conclusions insensitive to the positions of key actors"[22], process research on farm privatization appears to rest more on the credibility of foreign sociologists and ethnologists who can provide insights in local social realities in a former command economy. One might investigate whether the process research outcomes are shaped by context specific opportunities for institutional resolvents (the Water Users' Associations being another example). Process research would consist of the capacity to detect and foster such a resolvent. However, process research could well comprise more diverse outcomes than new institutions or new institutional functions. An enlightening

parallel with John Law's work[23] on social ordering and, in particular, on modes of accounting provides an interpretation of process research suggesting a more versatile diversity of process research outcomes.

Law's anthropology of management information systems in a nuclear physics laboratory presents a typology of organizational syntax[6]. He opposes empiricist and instrumentalist information systems with a post-structuralist one. The first two generate subject-object distinctions which lead to control regimes; manpower (in the case of the laboratory) is transformed into an object of control. The accounting tools have inherent capacities which determine the status of the subject controlling and the controlled object. The format of documenting how much time researchers spent on a particular project and the analysis of this information assumes that the "true cost" of a laboratory project can be determined and managed. A post-structuralist system implies a different subject-object relation. Law demonstrates this by analysing agendas and minutes of meetings. Individuals and activities in agendas appear in an open relationship. "So in this politics, a politics of involvement rather than command, the very character of subjectivity is linked to the appropriate performance by the subject as an object"[24]. "Which implies that subjects endlessly turn themselves into objects - objects of the rules and procedures which, for instance, take the form of the standing orders or conventions which are performed at meetings. While, at the same time, objects are similarly constantly turning themselves back into subjects so that they may judge whether or not the rules have been properly followed"[25].

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[6]Law's and Latour's science studies are of course part of the same research programme. Law used similar ethnographic means as Latour in the Salk Institute, but where Latour concentrated on the research objects and experiments, Law studied the laboratory management. Both assume that either focus brings them to the relations between human and nonhuman parts of scientific work, its hybridity.

This research applies well to the process approaches of Mosse et al.. Each exercise in process research should be definable in terms of subject-object transformations. While these are in flux, a process research exercise corresponds to a new twist of these transformations. The periodical process reports, pivotal in many cases described by Mosse et al., contain post-structuralist information elements, for example, by providing attributed space of the reports to concerned groups, assuring everyone that the groups' textual product is not edited. Likewise, the agenda items of meetings evolve over time in process research. Consolidating process research with Law's classification of management information systems cannot be pursued here but it should be evident that this will provide much headway. Process research should not be subsumed into science studies because the developmental knowledge has specific characteristics regarding the political context of North - South relations. The objects feasible in development interventions must obey to strategic interests from trade, geopolitics and humanitarian aims, and these are not negotiated in the same manner as a scientific object definition.

Process Research in Technical Assistance Projects in Industry

My work[26] on aid project management in industry reconstructs the relations between local and foreign participants. The content of the social processes observed during project implementation in industry can be compared to the information content of agricultural development interventions. The purpose of this article is to explore whether differences in these contents reflect differences between sociotechnical relations in agriculture and in

industry. Contrary to a first assumption one might have, project implementation in industry and the communication between local and foreign engineers are very much determined by cultural factors and differences in perceptions about the knowledge involved in the development intervention.

In case studies from Mexico on power plant construction and from Chad on manufacturing in the informal sector, the implementation resembles a continuous misunderstanding of the interests, objectives and competences of both local and foreign project participants[27]. Rather than an arena where strategic interests are negotiated, the implementation is closer to a labyrinth, where the participants never manage to gain a sufficient understanding of the developmental knowledge, the actors present and the different logics that animate them. All projects studied were funded by the World Bank, whose clients were local government agencies and the technology experts employed were formally equals. The projects were in a stage where the decor and the script are never quite known. When the curtain falls on the stage, after several years of implementation, what is left is the participants' impression that they have not been treated honestly, and that they still do not understand what the skills and needs of the other side (local/foreign) are. Nonetheless, the case studies reveal that the participants appreciated that there were no direct conflicts of interest as the economic parameters of the technologies were in line with the interests of all parties. The cogeneration power plants would have created more work for the US consultants and increased Mexican oil exports. Similarly, the agricultural implements manufactured in Chad would have replaced imports, freed foreign exchange and created more business for the French NGO and the Chadian artisans. Something else than the immediate (technical) objects was at stake in project implementation and should be process management matter.

The differences in the economic and historic situation of Mexico and Chad are as big as they could possibly be. The resemblance of some communication mechanisms between foreign and local participants leads to the hypothesis that these reflect the deficits of the state-of-the-art in management of industrial technical assistance, rather than the economic and historic context. Three latent processes are responsible for the dynamics of project implementation in Chad and in Mexico and each latent process dissolves a paradox[28] currently appearing in evaluations and other outside assessments (from journalists or international relation writers). The first paradox lies between the outside observation of the participants' confrontation on technology and their agreement over its adequacy (content process), the second paradox is between the observed accuracy and the irrelevance of their products (exchange process), and the third paradox between the participants individual intentions and their effects (interface process). The paradoxes are due to the idiosyncrasy of project implementation. The participants cannot render their logic understandable to outsiders, planners and evaluators. All three processes are intrinsic to implementation, latently reproduced anew by the participants in each development project. The organizational and managerial deficiencies result in the resemblance of implementation even in these rather different contexts.

The comparison of the project ethnographies yield the following definitions of latent processes. The content process was created by the participants presenting sociocultural ends of technology as context independent and intrinsic to the technology because they could not themselves explicitly express the professional habits in the organizations where they had gained their experience. This mis-representation became a vicious circle, creating misunderstandings between locals and foreigners. In Chad, this circle was enacted almost daily. For example, the French asked the Chadians whether they preferred scale drawings,

full-size gauges or section drawings and were pleased that the Chadians' choice confirmed their own opinion that gauges were best. Both sides actually used the same reasoning for preferring gauges but they could not question the other side's reasoning and so ignored that this reasoning was context independent. Concerning other aspects, the Chadians qualified some solutions as "*too ugly*" for certain customers, and these obviously sociocultural criteria were treated between French and Chadians in the same manner as the choice of gauges.

The second one, the exchange process, appeared when technical knowledge was used to act upon the cultural distance (alterity) between the participants. The exchange dynamics concerns both knowledge and identity. In Chad, the co-operation was an exo-social process[29] because the technical knowledge was used to act upon the cultural differences (alterity) of the experts and to diminish any sociocultural content that it may have accumulated. Technical objects (tools, prototypes, etc.) can be physically destroyed when they become negotiation matter for identities between foreigners and locals in such an exo-social process. The foreign experts found themselves in agreement with the Chadian experts in their judgment of individual Chadian artisans, even though they always avoided discriminating among the artisans. In Mexico, on the other hand, the conditions of the co-operation were endo-social. When the technical knowledge cannot serve to distinguish individual identity, these objects cannot be adapted to the local context. Everything was spoken in Mexico, but the more they said, the less they understood about each other. Both sides appealed frequently to thermodynamics knowledge of an individual expert, for example, but in the end, concluded that all on the other side hid something (incorrectly so). The