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LIGHT INDUSTRY TECHNOLOGIES AND RURAL DEVELOPMENT

Background Paper

LIGHT INDUSTRY TECHNOLOGIES AND RURAL DEVELOPMENT

by

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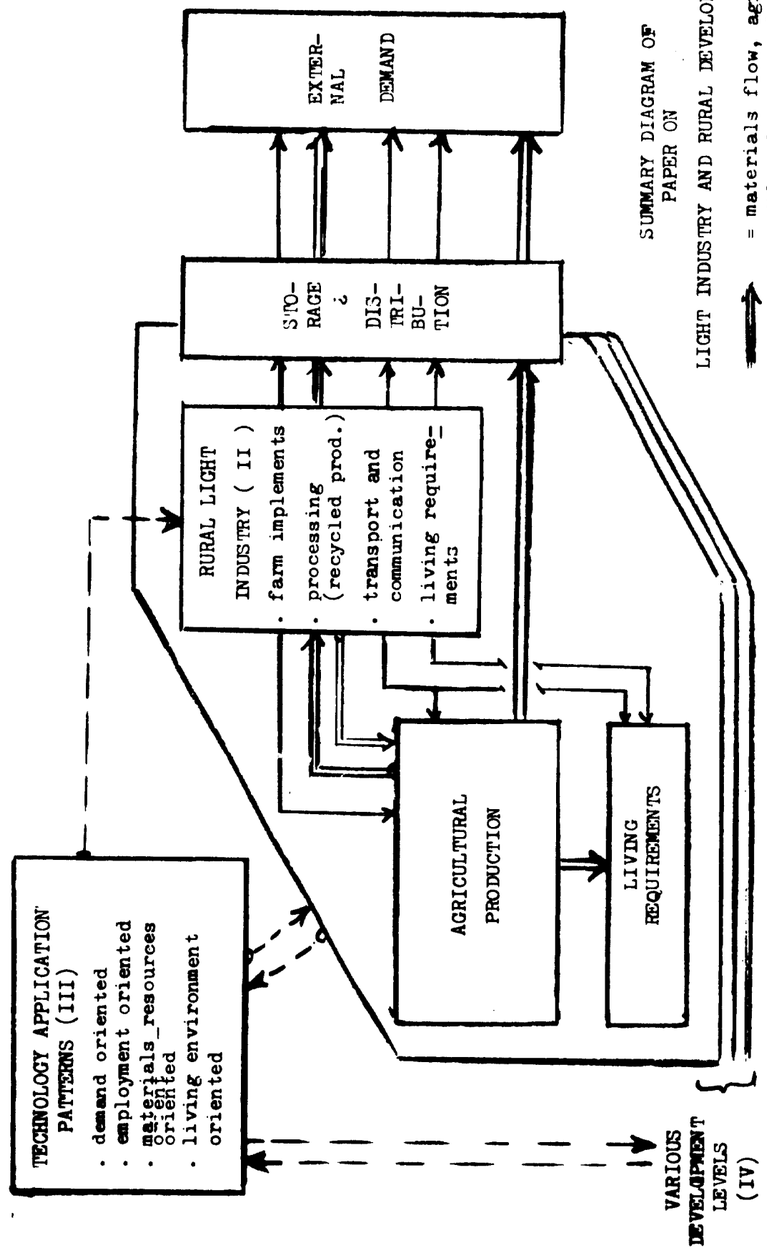
I. INTRODUCTION

1. The introduction of industrial technology in rural areas has multiple objectives. A primary aim is to open new avenues, and to bring to the traditional rural structure new dimensions for development; i.e. a fresh perspective for evolutionary yet dynamic change. In the rural structure great potentials are embedded, not least in the human field; a potential, which has remained dormant due to the want of an agent, which can cause a change in the traditional way of life. This catalytic function has to be provided by many elements. The contribution of industrial technology is the widening of the spectrum of productive skills by adding new skills thus diversifying the socio-economic basis of rural communities and giving the communities improved capabilities to evolve higher rates of economic growth and less sensitivity to agricultural patterns of production with their seasonal character and vulnerability to natural adversities. Awareness, readiness and possibility to acquire, utilize and integrate these new industrial skills is the basic premise.

2. The rural structure - unlike urban areas with rather distinct infrastructural and institutional facilities - provides industrial technology with a rather amorphous environment. A number of situations and possible approaches will be explored in the following text. Particular reference is made to the role of technologies for rural light industries. The term "light industry" as used in the text is described in the first annex. The annexes also contain an elaboration of more typical rural development functions to which light industry can contribute. The main structure of the paper is summarized in attached diagram. Chapter II outlines the various elements of rural light industry development. Relevant technology application patterns are described in the third chapter. Chapter IV describes the incorporation of the levels of development into rural industrialization approaches.

SUMMARY DIAGRAM OF PAPER ON
LIGHT INDUSTRY AND RURAL DEVELOPMENT



Note : roman figures refer to chapters in the text, dealing with "Elements of Rural Industry Development" (ch. II), "Technology Application Patterns" (ch. III) and "Levels of Development" (ch. IV) respectively.

II. [illegible] AGRICULTURAL DEVELOPMENT

A. Implements, machinery and supplies to support the farmer's work

3. Direct support to the farmers' work is an approach interlocking industrial technology closely with the agricultural scene. It comprises a variety of activities, ranging from the provision of suitable farm implements and machinery to supplies of fertilizers, phytopharmaceuticals, animal feed and other products. The application of industrial technology aims at generating an interactive process of upgrading farming practices and improved utilization of productive potentials. As stated earlier, industrial technology is only one of the elements, which contribute to this development process. Plantbreeding technology is for agriculture naturally the basic core-element. Fertilizers and agricultural chemicals assist in the soil-conditioning and plant protection; and implements and machinery augment mechanical abilities and energy applied. Also essential is irrigation. It is the combined effect which is required. Such an approach can increase production rates substantially above the population growth rate; also in areas where food production is mainly based on small landholdings. For instance, yields per hectare of rice increased from 1965 to 1975 in Indonesia with 70 % and in Columbia with 100 %. Continuous further increase is feasible, as experiences in the northern far eastern countries have shown. In these countries local production of aformentioned supplies and indigenous development of agricultural equipment and machinery suitable to small-acreage farming are experienced as contributing key-factors.

4. Small acreage farming is a common feature in the Asian region, but is also of primary significance in Africa and Latin America. Intensification of yields through the abovedescribed approach is the main objective, and could in its overall effects also be evaluated on its economic merits in order to suit different situations. Organizational aspects would have also to be taken into accoutn; in particular the availability of adequate extension services and effective distributive methods for the various supplies. In addition it is to be recognized, that large tracts of arable land - notably in Africa and Latin America, but also in certain Asian areas - can still be brought under cultivation. In many instances, however, basic infrastructure development of a major order may have to precede the actual cultivation process.

(B) Processing of agricultural products

5. Processing of agricultural products ia another major interface between industrial technology and agriculture. For agriculture it would offer, among others, a possibility for improving the durability of its produce. To industry, agricultural materials are a significant source of input to provide for consumers requirements. The processing is not confined to preservation alone. It should preferably relate to a wider spectrum, including the utilization of by-products to meet various requirements outside as well as within the agricultural production-consumption stream. Substantial improvements in added value are derivable; a factor which could serve as a yardstick to evolve a development path with optimal economic merits.

6. Various stages need to be distinguished in the processing. The first stage to make the produce directly suitable for consumer use, e.g. dehusking of grains, is often integrated with the agricultural operations itself. It emerges as a separate operation only as some advancement in economic development has been attained. The same holds true for the subsequent stage, the further processing into some kind of intermediate materials, e.g. the milling of the grain to flour or the extraction of vegetable oils from various types of seeds. Preservation processes also offer a wide variety, ranging from simple drying and the use of natural preservatives (salt, vinegar) upto canning (with sterilization and use of selected preservative agents) and freezedrying (with related refrigerated distributive methods). Improvement of the durability also opens the possibility for extending the market range beyond local relationships towards national and international demand-requirements. On the other hand within the context of long distance transportation and storage operations a backwards extending technology has emerged also, by which, for certain products, preservation can be avoided, e.g. through incorporation under controlled transportation-and-storage conditions a part of the final stage of the plant-growth process (e.g. the ripening of bananas).

7. Recycling of byproducts back into the agricultural scene takes place, first of all, within the agricultural production process itself. Use of compost as natural fertilizer is a common example. In modern non-tillage farming, this function is extended. Mulch-coverage have been found to reduce soil-erosion, although increased attention

and application of selective herbicides is necessary in order to ensure proper weed-control. Another avenue consists of the further processing of selected byproducts into protein- and vitamin-rich food supplements (e.g. fibres of the peels of tangerine-fruits, or the utilization of oil-meals). Common applications are also the use of by-products and waste-material as fuel, or as basic or reinforcing textures for strawboard, paper and building materials. In these processes a blending with supplies from other sources would often be appropriate; a blending which may in itself lead to new openings and possibilities for developing and diversifying the rural economic base.

8. Forestry resources, animal husbandry, fisheries and a variety of cultivated food and fibre crops (such as sugar, tea, coffee, cocoa, cotton and jute) constitute rich additional fields, in which industrial technology can provide contributing elements to the rural development process. These sectors perform significant linkages for rural-based industries serving urban and also international markets. In many instances a wide range of technological options apply. An evaluation on the basis of economies of scale would provide insight in the viability of sector-specialization at a given locality. Availability of infrastructure would constitute a factor, which often requires separate attention. In case significant infrastructural additions - which nearly always are of a multifunctional nature - are needed, it would be useful to consider such a development in a broader area oriented context; in which the industrial plant - itself geared to economic viable conditions - and its ancillary establishments could serve as a <u>rural development nucleus</u>. A similar approach would apply to the clustering of various smaller industries on a particular location. These would then constitute an agro-industrial or light-industry complex of a relatively modest scale. As indicated above, the development of common infrastructural and institutional facilities would be aimed, however, at the development needs of the entire area and should function as synergy-providing linkages between the various constituent sectors of its economy.

(C) Providing for transportation and communication

9. Marketplaces and small shops in villages and townships are the traditional locations for exchange of agricultural products, They may however only be partially suitable for rural industrial products, and often it may be desirable to evolve new distributive channels. As development progresses a higher rate of inter-area activity will generally occur, requiring also expansion of transportation and communication facilities. This will have to be realized by cooperative efforts - formal or informal - of external and local origin. The external efforts, for instance by a higher government authority, would concern major networks, such as main raods, railroads, waterways, airlinkages and telecommunication facilities. Development of adequate feeder linkages would be a natural field of corresponding activities on the local scene. Also suitable means for short-distance transport of goods and persons would be needed, and could constitute a requirement, which - depending on various factor-conditions - might be fulfilled by rural-based light industries. Similarly, battery-operated transistor radios and other types of electronic equipment, could make essential and cost-effective contributions in expanding the communication pattern of rural areas with the external world.

(D) Providing for daily living requirements

10. Household utensils (plastic, metal, ceramic) lighting, stoves, furniture and similar items would be suitable for dispersed production by rural-based industries. Vis-à-vis urban industries, land and labor costs would in general be factors, in which rural-based industries have comparative advantages. On the other hand assurance of basic materials and energy supplies might require more attention. A clustering on a light industry estate would, as indicated above, often be a manner in which land, energy and other infrastructural requirements could be optimally evolved.

11. A significant role can also be performed by home-industries. Mat- and basket-weaving are, for instance, activities which blend logically with agricultural activities. By their nature they are storable items produceable in slack-periods. Moreover, they constitute utility-articles used in rural and urban areas alike. Various countries have even been succesful in developing on these items noteworthy exports to industrialized countries. For traditional crafts, which would represent in many instances fulltime occupations for persons with highly refined skills, such a development can in an even more pronounced manner be generated.

12. Building materials with its relatively significant transport cost-content and dependance on availability of local material-resource-deposits, is antother sector suitable for dispersed production. Its development has to be relatea to the evolution of construction-activities, which in rural areas contain often a large degree of self-help shelter construction. Roofing-, walls- and other structural elements would be primary items to be substituted by improved industrial supplies. The development of building materials of an intermediate nature, such as cement, construction-steel, plastic sheets and the like, would constitute a second layer, which often requires to be considered in conjunction with public works and other larger construction programmes. Development of such second layer type industries would have generating effects also beyond the manufacturing and construction industries, and particularly on transportation activities. The job-creating potential of labour-intensive transport in developing countries is also from time to time a focus for international attention. The transport activities on themselves provide, however, little more than exertion of human energy and add little, or are even detrimental, to the development of skills and other abilities. As much as the rickshaw is a debasing object earmarked for complete abolishment, use of human energy solely for transport and materials-handling purposes should be replaced as rapidly as possible. When such is economically (not yet) feasible, suitable educative and productive skill development programmes should accompany such transport-oriented work-activities.

13. Garments and textiles are - similar to other items mentioned above - products which can fit rural local needs as well as urban and international requirements. A variety of technical options exist. These options arise from differentiations in consumer needs and preferences as well as from variations in the materials supply structure. Combinations of cloth and yarn supplies are the most common. In fibre-crop growing areas full integration from fibre-preparation and -processing onwards would also apply. In such instances, the processing complex might, as indicated above, serve as an area.development nucleus.

14. In certain instances the availability of adequate institutional facilities is an absolute prerequisite to the introduction of a particular industrial activity. This would, for instance, be the case in medical supplies. Dosage-form fabrication often requires only relatively simple equipment, which should, however, be operated only under hygienic-controlled conditions and by proficient personnel. A similar situation applies to the assurance of distilled water availability (vital to cholera-infested areas) and to other types of health care and medical supplies. The development of formularies typical to a country's (or area's) health care requirements, and which can comprise both modern pharmaceutical products as well as traditional medicine, should serve preferably as reference for evolving local fabrication facilities. For quality assurance purposes a suitable linkup with adequate (rural) hospital facilities would be desirable and practicable.

III. TECHNOLOGY APPLICATION PATTERNS

15. At the core of the industrialization process stands the element of technology, and in particular manufacturing and related technologies, such as energy, mining, construction, transportation and communication. A major aim pursued in the application of these technologies is to transform and process materials into useable products. In these applications a number of distinct patterns can be distinguished, such as :

- demand-oriented application patterns,
- employment-oriented application patterns,
- materials-resources oriented application patterns and
- living-environment oriented application patterns.

No specific order of priority or development sequence is implied in the enumeration above. These aspects will have to be considered in the context of a particular locality, its sectorwise potentials and level of development. Particular reference is in this paper made to rural areas and the role of light industries in their development.

(A) Demand-oriented Application Patterns

16. Examples of local-, urban-, national- and export-demand-oriented rural light industrial activity have been described in an earlier chapter. Local-demand-oriented are, for instance, the production of farmer implements, some types of byproduct recycling and the provision of various utensils and appliances for use in village households. Some of the latter would also be applicable to meet broader, e.g. urban-, requirements. Relevant levels of expendable income of the local population will in most instances determine the economic viability of these types of light industry activity. Product-sales are to a large extent undertaken according to traditional practices, although, as indicated earlier, a clear need for development of new channels and modernization of distribution and salespractices exist, and should be pursued gradually in accordance with the improvement of income-levels.

17. Within the structure of the traditional channels often product-items can be recognized in which a particular locality (also rural ones) has gained a national reputation. These might apply to consumable and utility items as well as to products with some artistic touch (e.g. ceramics, traditional garments, etc.). When (potential) export demands exist, aforementioned "reputation-products" would be logical elements for technology-upgrading. The natural incorporation of modern technology with national cultural appreciations is another aspect requiring due attention. 1/ It may be applied in various countries differently, depending on cultural backgrounds and levels of development. A blending with demand requirements of a broad national scale would be an inducive factor. Traditional clothing, or development of a modernized style of national dress, is a typical example. 1/ Children's preferences for certain traditional toys over modern ones devoid of folklore value is sometimes another instance.

18. Whenever possible, abovementioned technology-upgrading should be a fundamental one. It should go beyond mere substitution of natural by mechanical power. The techniques concerned might have evolved often over many centuries and might still be chiefly oriented in the setting of the past. A revival without fundamental technical improvement would not be suitable, and a development policy orchestrated widespreading even be detrimental. Evolving of basic innovations to ensure longer term viability in the present demand structure is a prerequisite. These innovations may pertain to the use of new base-materials, new processes, tools and equipment. Also modern product development and marketing concepts will have to be applied and the evolving of a system for effective dispersed production; extending from current levels of skills and workpractices upwards and providing them a new perspective for continuous upgrading.

19. In relation to export markets, quality control and use of carefully selected production technologies are often necessary. The choice of technology is to be seen, in these instances, within a demand frame

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1/ Ref. see example on traditional clothing described in annex III, item 2.

with many external aspects beyond direct control. On the other hand, the technology-choice should lead on the internal scene to a clear dimension for socio-economic progress. For rural light industries - where industrial system-structures are relatively simple or a given premise - these technology-choices would concentrate chiefly on the selection of particular processing-units or machines.1/ For such selection, reference-information regarding the full range of possible options is desirable. In a technical sense no prejudice should be introduced in the information. That might imply a risk-sharing responsability at incorrect levels of decision-making. Education, extension and various types of economic, financial and fiscal incentives are available as instruments to indicate macro-type constraints and desired directions of general development; indicators which, similar to micro-level decisions, may also have their failabilities. Nor should too rigid patterns - laisser-faire-, centrally planned- or mixed-structure-oriented - be instituted. The pattern of industrial decision-making, as a.o. reflected in the choice of machinery and equipment, should evolve as a dynamic element in the total development process.

(B) Employment-oriented Application Patterns

20. Seasonal activity patterns as well as structural employment issues are factors to be considered in rural industrialization. To meet seasonal employment requirements various home-industry activiities can, as indicated earlier, provide to a certain extent a solution. On a more organized basis assembly activities, e.g. of mechanical sub-assemblies and appliances, could be undertaken. Such acitivities would require generally the employment of a few persons at least for yearround operations, whilst expanding its workforce during slack agricultural seasons. It is in this connection to be noted, that industries processing agricultural products may aggrevate sometimes the seasonal employment pattern, because the processing needs

1/ Regarding a further discourse on the choice of technology in relation to development policy see K.H. Yap "On the Establishment of an Industrial Technology Development Policy", paper prepared for Unido, Vienna, june 1978.

generally to be done simultaneously or in a partially overlapping manner with the agricultural harvesting periods. A more structural employment contribution is therefore pursued with establishment of lattermentioned processing industries.

21. Light industries provide by their nature[1/] a relatively favorable employment generation effect, i.e. light industries provide,under otherwise comparable circumstances, relatively larger employment opportunities per unit of capital resources employed than heavy industries, This advantage is particularly pronounced in smaller light industries. Typical sectors are garments and footwear, furniture and woodworking, toys and similar articles. Also fruits and vegetables processing, and manufacture of certain metalproducts can be included.Demand aspects pose limits on the extent to which these industries could provide new employment opportunities to the rural population. Availability of infrastructure, particularly energy, suitable housing and location, transport and communication, are other limitations, for which, as indiated in an earlier paragraph, due to their common nature establishment of industrial estates could provide an effective solution. The unavailability of such infrastructural facilities is often a main reason for industries to favor urban locations, which have the advantage of proximity to important markets. To an industrialization policy aimed at building up a geographic dispersed structure of industries, the establishment of planned industrial areas is therefore a key-factor. The estate itself, and even establishment of required institutional facilities, would however not suffice. Viable industrial operations are and remain the core-element; and in measuring their economic viability the infrastructural development efforts should also - in an equitable manner - be taken into account.

22. A similar approach would apply in circumstances, where one of the industries assumes a general development role and provides structural facilities used by other industries in the area. These developments warrant assesment on a subsector or subarea basis.

1/ Ref. annex I, annotation on the term "Light Industry"

The objects concerned require a combination of development capital inputs with various recovery durations; a situation, which financing institutions in developing countries are often not (yet), or only to a limited extent, equipped to meet. Fragmentation of the object result as a consequence with increased chances that sight is lost on the main objectives. Furthermore, the rural light industry objects, although agglomerated in abovedescribed form, are relatively small and numerous. An institutional approach, which causes these modest objects to fragmentize, is not inducive to their development contribution; although succesful instances are known, in which strong dedicated leadership has been able to maintain coherence and sense of purpose. These experiences underscores the significance of active local participation as a basic premise for aforementioned objects, and precludes a fully preplanned approach from sources external to the area. Rather an interaction between viable local initiatives and the overall development framework, suitably adjusted to cope with these objects, would be optimal and conducive to meet development aims. Within the context of these subsector or subarea objects, local employment requirements can be given due consideration and, among others, also guidelines could be established for selection of required technologies, its acquisition, usage and further development.

23. In appraising employment-oriented technology applications a dynamic approach is necessary. From a socio-economic point of view, the labor-capital relationships could serve as a first indicator 1/; a relationship in which, as indicated above, a direct equipment- and plantunit-related dimension can be distinguished, and a dimension incorporating also energy-, utility-, infrastructure- and other inputs at subsector and subarea levels. From a technological point of view, versatiltiy (general purpose or specialized machinery), and savings on capital and on operating and maintenance costs require identification. Adoption of standardized elements (and connections) are significant to facilitate future replacement and reduce relevant expenditures.

1/ A relationship of direct employment to fixed assets of the firm is used by the World Bank to illustrate the employement generating effect of smaller industries (Ref. "Employment and Development of Small Enterprises", World Bank, Washington, D.C., 1978).

Standardized equipment is also inducive to training, and to obtain investment savings through collective purchase. Well researched guidelines on a national level could provide additional advantages. It is , for instance, estimated[1], that only one eighth to one seventh of the rural population in developing countries is served with electricity. Autogeneration will in many rural industry projects have to be applied. Adequately researched guidelines on recommended types of equipment could have significant impact on direct project costs as well as on future conversion and integration into broader area networks for electricity supply. In general, quality aspects do not allow a compromise on technical performance requirements. However, for the equipment used in the discussed types of light industries, technical adjustments[2] may well be justified with respect to speed factors, multiple operation functions and ancillary equipment for materials handling. Many of these elements govern the rate in which machines and equipment augment human skills and abilties. In this interplay human skill development - interpreted in its broadest sense and comprising also product- and process development capabilities - is, as described earlier, the key-factor. It is the innovative element which industrialization aims to add to the traditionally available spectrum of human capabilities.

(C) Materials resources oriented application patterns.

24. Use of various agricultural resources, processing of agricultural products and utilization of byproducts are some examples, described in an earlier chapter, of the utilization of materials resources for light industry development in rural areas. The technology application patterns concerned aim at improving the added value. The utilization of forestry resources may serve as an illustration of such an application.

1/ Reference annex V - background annotation on rural electrification.

2/ Note : such adjustments, although based chiefly on common sense judgements, are rather universal in developing countries, and are in any case much more widespread than would seem to appear from information sources and publications in the industrially advanced countries.

25. Main industrial uses of forestry resources comprise : (a) preparation of logs for construction and building purposes, (b) cutting into sawnwood and further processing towards panels, building elements, veneer, plywood, furniture and other products, (c) construction of boats and small ships, (d) processing for manufacture of pulp and paper, (e) utilization as fuel for domestic and industrial purposes (also processing into charcoal as reduction agent for steelmaking and other processes), and (f) various other uses, such as woodcarving, but also resins and other byproducts. Wastematerial reprocessing is a significant factor, and intertwines with the abovementioned product- and processing streams (e.g. manufacture of particle boards, fuel-uses, etc.). Some of these processes, notably the streams of pulp, paper and board manufacture, are quite capital-intensive. In most instances, however, a light industry pattern as described above would apply. For instance, when an adequate materials supply structure exists, a fair correlation on the employment generation effect can in general be established for capital deployed in the woodworking sector manufacturing panels, doors, windowframes, furniture and similar products. The value added by these products is a multiple of the sawnwood, which in itself represents a multiple of the log-value. Also significant are the multiplier effects on other industries. Much transport is involved in the handling of logs from the forests, during the various states of intermediate processing and in the distribution (for construction purposes also in the installation) of final products. Preservation provides linkages with the chemical industries. Furthermore services for maintenance and renovation are needed.

26. Unprocessed roundwood and sawnwood contribute about seventy percent of the total wood-exportearning for developing countries. Improved wood-seasoning facilities and further processing to intermediate products (e.g. plywood, panels, etc) would be areas for an export-oriented added value development on short term. Planned reforestrations may in many developing regions have to accompany forest-utilization programmes in order to ensure an optimal structure in which ecological as well as more comprehensive economic objectives could be pursued. The domestic an export market components provide to such a development a broad spectrum of possibilities, from which in most countries suitable

elements for short- and medium-term implementation can be identified. Moreover, in the light industry component immediate development actions are often possible.

27. In evolving these developments new technologies can play a significant role. For the drying and seasoning of timber, for instance, use of solar timber kilns represents such a new development. Experiences gained over the past decade [1] indicate reduced investments and also some distinct qualitative advantages. Along similar lines in-depth search is also needed and applicable to other rural light industry sectors. For instance, in many areas unique phytogeographic conditions have provided the basis for specializations of certain tropical fruits, cultivated crops and fibre resources. A revitalization and/or expansion - which can provide continuous evolvement into areas of further processing and improved added values - is for these productsectors often desirable and potentially feasible. To these development objectives effective technological research can make vital contributions.

(D) Living environment oriented application patterns

28. In addition to food and clothing, adequacy and improvement of shelter, housing and physical environment as well as of health, education and social communication are to the rural populations tangible and basic signs of progress; quality-of-life indices not quantitatively expressed but - even more important - emotionally experienced. These benefits accrue from active construction as well as from actions with preventive value or from the mere availability of a particular facility and the opening of perspectives. Selfhelp programmes can make significant contributions, particularly at initial stages. Supply of building materials and improved construction elements have been mentioned in an earlier part of the text as one of the linkages to which industrial technologies can contribute. Other linkages concern equipment for supply of utilities,

1/ Ref. "Technology for Solar Energy Utilization", UNIDO, 1978.

auxiliary materials required for their operation (e.g. lubrication oils, water purification agents, etc.) short distance transportation and communication equipment, and related maintenance services. Although technically of a different nature, provisions for health care service (medicaments, but also protein- and vitamin-enrichment food-supplements) is a field of such interlinkage with industrial technology. In all these fields local industrial activity are, as indicated, feasible and needed. However, these activities will require often a back-up structure, which extends into basic industries (e.g. cement, basic metals and bulk chemicals). When local resource deposits exist, an integrated operation would be feasible. Otherwise, linkup with a broader supply structure is needed. Identification of possibilities for use of recycled materials at various intermediate stages of the materials and products streams would be useful. Sometimes suitable technologies require development. When mature, these possibilities would also be a factor conducive to the locational dispersal of the industrial activities concerned.

29. From a techno-economic point of view, disposable income elements and relevant public fundings for area development would constitute the means for embarking on these activities. A pragmatic approach should nevertheless prevail and due account should also be given to the dynamic nature of various factors involved. Supply of safe water may in this connection be used as an example[1/]. Availability of safe water is a basic human requirement, which will occupy indisputably a high priority ranking. Its provision in many rural areas can be realized with few investments by making groundwater sources available through protected wells. A further elaboration would be to provide the well-water through a village or neighbourhood system equipped with public hydrants. Subsequently the distribution system can be extended with house-connections. With these expansions the water will be utilized for various other purposes than human consumption. A sharp increase in the per capita consumption is generally experienced. Whilst these additional usages are to a certain extent justifiable, they

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1/ Ref. annex II "Providing for Safe Water Requirements in Rural Areas".

relate clearly to a different category of priorities than at the initial stage. The investment pattern also shifts from investments for water production towards increasing shares of investments in the distributive system. Moreover ancillary facilities, such as safeguarding the water for contamination requires elaboration (an evolvement towards a public sewerage system). In these expansions the relationship with the industrial technologies required also changes rather drastically. Whereas, at the inital stage, availability of local craftsmen would suffice for the basic system, a more elaborate structure would be required for the subsequent steps. The evolution of such a more elaborate structure need not - as indicated above and elaborated in the relevant annex to this paper - be a prerequisite to meet such a basic human need as availability and access to safe water. However, provision should be made that, as described, such an industrial structure can develop parallel with, and provide in a synergic manner contributions to the improvement of the human living environment.

IV. INCORPORATING DIFFERENT LEVELS OF RURAL DEVELOPMENT

30. A wide diversity of industrial technologies is applicable, as described above, to support the rural development process. Moreover, for each technology a range of options exist. Also new technologies emerge, a stream whose generation-rate needs enhancement in order to effectuate a spreading of constructive industrial innovation in the broadest possible manner amongst the entire population. For the application of technologies, the development level of the area concerned is a major factor. Three broad levels - with an increasing share of industrial contributions - could be distinguished : (a) a development attuned towards provision of basic requirements, (b) a predominantly agricultural operations oriented activity-spectrum, and (c) an industrial growth oriented approach.

31. Basic living requirements - particularly food, water, clothing and shelter - and, for dry lands, means to overcome aridity, are factors of overriding importance in evolving activity programmes related towards the first of abovementioned levels. These subsistence level requirements are estimated to concern currently about a quarter[1/] of the population of the developing countries. Preservation of food supplies, logistical operations, industrial components for selfhelp construction programmes, and also basic craftsmen and maintenance technicians training are key-elements to which industrial technology could contribute. In the text above reference has been made already to the application of industrial technology to the supply of safe water for rural areas[2/]. As described, an approach is feasible, which bases itself initially on the provision of safe water as a basic living requirement. As higher developments are reached, the technology inputs are extendable accordingly. For dry areas experiences are being gathered regarding methods for applying the generally abundantly available solar energy. A similar approach is also applicable to the other fields of

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1/ Estimate based on World Bank data.

2/ See also annex II "Providing for safe water requirements in rural areas".

basic human requirements mentioned above. The approach described emphasizes a maximum possible involvement of the local population groups. Relevant local initiatives are also to be integrated as valuable core-elements. Nevertheless external support will in most instances be indispensable; to establish the initial pattern and also to provide the necessary further back-up. Several layers could be distinguished in such a back-up structure. An important outerlayer would concern assistance for the prevention, or at least the reduction of risk-chances, related to weather-disasters, droughts, insects - and other plagues. Communication-technologies are vital. The developments in this field of technology have in the past decades undergone a fundamental change, making many older methods obsolete and also unsuitable for the backup system requirements of aforementioned development areas. Humanitarian considerations would be a primary basis for providing assistance at the back-up system level. The programmes directly related to the living requirements and activities of the population would have also such a humanitarian component. Generation of productive capabilities is essential, and this objective would be an element for efforts aimed at reaching self-sufficiency in the course of one to two generations. In the pursuit of such a development perspective new technologies of the nature described above, could provide increasingly some cost-effective contributions.

32. Mechanical and process engineering inputs of an increased magnitude are necessary in a light industrial technology approach aimed at supporting agricultural operations. Particular capabilities to be developed are: functional design and production of agricultural implements and machinery, transport and storage equipment, materials-analysis, various processing and preservation techniques, packaging, recovery-methods, equipment-maintenance and repair. A close integration with the agricultural operations, as, for instance, illustrated by some examples described in the annexes 1/. These light industrial activities are strongly based on human engineering capabilities. A rather high degree of flexibility is desirable to meet differences in locally prevailing situations and unforeseen circumstances.

1/ Ref. see examples on farm implements (annex III, item 1) and preserved fruits (annex IV)

As indicated earlier, light industries are for effective operations highly dependent on assured supplies of basic materials, energy and other items. The described development of a multi-layer structure for the farm-implements industries, with somewhat larger plants supplying blanks and other intermediates to village-based light industries and craftsmen is an example of such interdependence 1/. Another example is the important linkage of container supplies to the fruit preservation industries 1/. Identification of such linkages and developing adequate provisions to ensure "normal" conditions of operations is essential. The viability of relevant plant level activities should take such a normalization of operational conditions into account.

33. Diversification in meeting a range of demand and living environment requirements would be a first element by which light industry could constitute towards a growth-oriented rural development approach. Such an approach would be also desirable to provide employment opportunities both of a structural and seasonal nature. Essential to these developments is the availability of local leadership capabilities 2/. Actions needed to be taken range from technical training and development of manufacturing methods, establichment of production facilities, development of marketing and distributive channels, financing, and evolving suitable organization-structures. A good attunement towards locally prevailing adaptive capabilities to change is important. Very often introduction of new talent is needed. These may originate from other areas, also urban areas. Young college graduates with a pragmatic outlook and the correct development motivation can make particularly valuable contributions. At medium and longer term a different rhythm of life should be reached, also in rural areas; a rhythm, which has to develop gradually, but which should have as early a start as possible. It

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1/ Ref. see examples on farm implements (annex III, item 1) and preserved fruits (annex IV).

2/ See annex III, item 3, for description of such an example of rural industries development.

may require also specific institutional measures. Imposing areawide rules for all traffic to maintain rather slow speeds could be one of such measures, for instance. As further progress is reached a gradual easing towards higher speeds could be undertaken. Aforementioned instance is another illustration of the aforementioned attunement necessary for optimal integration of industrial activities to rural areas.

34. In order to develop adequate impetus, specific actions of an agglomerate nature may be required. These could relate to energy and infrastructure for a variety of industrial activities to be concentrated at a particular location, e.g. in the form of industrial estates. or could take a form in which manufacturing technology is integrated, such as a agro-industries complex or a rural development nucleus in which industrial activity of some scale is incorporated. In both instances a comprehensive feasibility study is needed. As indicated earlier in such studies it would be preferable to appraise the plant-level components and the infrastructure (or rather the mezzo-structure as chiefly the infrastructure directly surrounding the plants concerned) separately.

35. When the abovementioned three stages are taken as a sequence in transitional development, each phase would require, according to present economic growth experiences, about one to two decades. For the larger part of the rural areas, however, the first stage can be generally omitted, or largely omitted. The prospect of reaching an industrial growth oriented approach would therefore be realizable in a reasonable timeframe. In order to bring such a development within the perspective of a coming generation in the rural areas where subsistence level conditions still prevail, accelerated measures could be considered. These could currently - although no precise figures are known [1] - concern an estimated seven to eight hundred million persons out of a total of two billion persons in the rural areas of the developing countries.

1/ Estimates are based on UN and IBRD data.

V. Summary

36. The perspective for rural areas in achieving gradual progress through introduction of industrial technology is the main theme explored in the preceding text. A broadening of human skills with an entirely new range of capabilities, and a wider utilization of agricultural resources are key-contributions. Local supply of various household articles and improved transportation, communication and external economic relations are other factors of primary importance. For the deployment of the industrial technologies various application patterns can be distinguished. Depending upon the objectives pursued these application patterns could have a domestic - or export - demand orientation, or an employment - , a materials resources - or a living environment - orientation. Also a combination of these orientations would be applicable. The practice of these light - industry - elements and technological application-patterns in different rural settings have been illustrated with various examples. Some typical illustrations have been elaborated further in the annexes. They relate to the provision of safe water as a basic element of human requirements, to various aspects of industrial procuction to meet local requirements and to pursue export-development potentials. Also an annotation is enclosed on the supply of electric energy for rural industries. Finally, aspects are considered pertaining to the incorporation of the development level into aforementioned approaches on rural light industry development.

Annex I

An annotation on the term Light Industry as used in the context of this paper

The Bureau of Statistics of the United Nations Department of Economic and Social Affairs classifies the following sectors as light industries :

ISIC No. 1/	Description
31	Food, beverages, tobacco
32	Textiles, wearing apparel, leather and footwear articles
33	Woodproducts, furniture
342	Printing, publishing and allied industries
355	manufacture of rubber products
356	manufacture of plastic products (not elsewhere specified)
39	miscellaneous products not elsewehre specified

The term light industry used in the context of this paper corresponds largely with the above enumeration as far as the manufacturing industry is concerned. It is however used in a somewhat broader sense, and includes construction (ISIC 5), transport and storage (ISIC 71), repair and maintenance services (ISIC 951). Also home-industries and handicrafts are included. In general, the term light industry is used therefore, to describe industrial activities, which - in relative terms - are predominantly skill- and labor-oriented and are less capital-intensive than the complementary group of heavy industry sectors.

1/ ISIC = International Standard Industrial Classification of All Economic Activities (U.N. Statistical Papers, Series M, No. 4, Rev. 2)

Annex II

Providing for Safe Water Requirements in Rural Areas

1. The purpose of village water supply is to provide "safe water" to rural populations, i.e. water, which does not contain any chemical, biological or other matter affecting the safety or acceptability for human consumption. It is estimated, that to some 80 % of the rural population such safe water is not available 1/ posing a basic needs issue of great priority.

2. Apart from surfacewater (rivers, lakes, etc) or linkups with larger area water supply systems, the most significant water resource for village systems is groundwater from protected springs, wells and boreholes. It requires generally little or no treatment to make it safe. Applicable technical systems for development of such groundwater resources are :

   - water production by handpunps (without distribution system)
   - water production by motorised pumps with storage and distribution through public hydrants (e.g. one hydrant for each hundred persons and/or within convenient walking distance of the people's dwellings)
   - water supply system extending to houseconnections

   Protection of the watersources and storages against contamination is essential. Also adequate measures and facilities are required for excreta disposal. Development of a community sewer system becomes a requirement related to the establishment of a watersupply system with household connections. When pollution of groundwater occurs (or is likely to occur) treatment is necessary. Treatment is also needed when surface-water is used. Treatment methods include chlorination, filtration and/or use of water treatment plants. To the latter considerable economies of scale apply, and it would in many instances be optimal to consider the establishment of a common water treatment plant to serve a group of villages.

1/ A survey of WHO covering 91 developing countries estimated, that over a billion people, or 80 % out of a rural population of 1. 25 billion had no reasonable access to safe water. These data relate to 1970. A mid-seventies appraisal by the World Bank indicated, that the rate of development of village water supply facilities was below the population increase in rural areas.

3. Adequate groundwater resources are believed to be available. Experience in fully utilizing this potential is however still limited. Technological access methods are adequately known. These include geological survey methods to ascertain the location of aquifers and drilling of wells to great depth. In the last decades some experience is also being gained in methods of artificial recharge of groundwater reservoirs. Wider application of recharge would greatly enhance the potentials of groundwater reservoirs. In relation to these potentials the requirements for village water supply systems as described above are only of minimal consequence.[2/] Its benefits, although at present not yet fully quantifiable, are obvious; with improvement of public health conditions and productive capabilities as major items.

4. Intensified efforts to extend safe water to all persons are needed. The goals set for the second development decade - aiming at increasing the availability of safe water to about a quarter of the rural population, as compared with 14 % in 1970 - appear to be rather limited. It would seem, that also more priority should be placed to provide for the requirements of the low-income groups through installation of manual operated systems. Such handpump systems

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2/ Human consumption would at minimal levels correspond with 5 liters per capita per day (lcd). The consumption rates increase, however, with the availability of water supply facilities. Allowing for such increases (and wastages) a consumption rate of 20 to 50 lcd is often used for village systems providing waterdistribution through public hydrants; and a consumption rate of 100 to 150 lcd may apply for systems with distriubution through house connections and also permitting some limited use for light rural industrial activity. Industrial units in rural areas with relatively heavy water supply requirements would often employ a water supply system of its own. Assuming an average rate of 50 lcd the village watersupply requirements for abovementioned one billion people living in rural areas without access to safe water would correspond with (1 billion x 365 days x 50 lcd =) 18.25 cubic kilometers per year, or 0.6 % of the 3000 to 3500 cubic kilometers per year under control of man (out of a total baseflow of about 14 000 cubic kilometers, originating for about three quarters from underground reservoirs). Data sources : WHO, IBRD, FAO.

are estimated to require very little capital investment[3] and their operation could be sustained in villages possessing some craftsmen (metal- and construction-trades [4].

5. Investment costs and organizational requirements of a somewhat higher order are needed, when motorized pumps coupled with distribution through public hydrants are applied[3]. A clear interlinkage appears at this stage with the surrounding industrial structure [4], in which two main types of orientation can be distinguished :

   - a series of rural-area-oriented industries, such as mechanical workshops, foundries, metal- and plastic-pipe-fabrication units, and facilities to manufacture water-treatment agents from locally available materials. These industrial units need not necessarily be situated in the same location, and would generally have a broader scope of activity than the field of rural watersupply requirements alone.

   - a number of specialized industries, covering a wider geographical scope and producing motorized pumps, chemical water treatment agents, and metering equipment, when houseconnections are installed. In addition various supplies, such as piping, cement and other basic materials are needed.

   Specific conditions will also determine to which extent imports would be required for the abovementioned items. Availability of standards and proven standardized designs[4] suitable to various technological application levels would have advantageous effects on installation-costs, as well as for operations and maintenance.

6. The extension of the waterdistribution to houseconnections causes a further increase in (and corresponding changes in the patterns of) capital and organizational requirements[3,4]. A higher per capita rate of water-consumption also occurs[2]. Storage systems require further elaboration and metering systems to be installed. Integration with

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[3] ref. figure 1 providing some comparative data for installation costs of various village water supply systems in the range of 20 to 150 liters per capita per day.

[4] ref. figure 2 on the interrelationship between industrial technology aspects and village watersupply development

surfacewater-based systems and use of common watertreatment plants serving various villages would be a next level of aggregation[5/].

7. For arid areas the use of solar energy powered waterpumps[6/] has specific potentials. Installation costs are relatively high and operational availability limited to periods with sunshine; the latter factor poses generally the need to provide additional water storage facilities. In operational costs the solar waterpumps are relatively advantageous. With respect to industrial interlinkages, specialized industrial support would be needed also for the supply of solar panels.

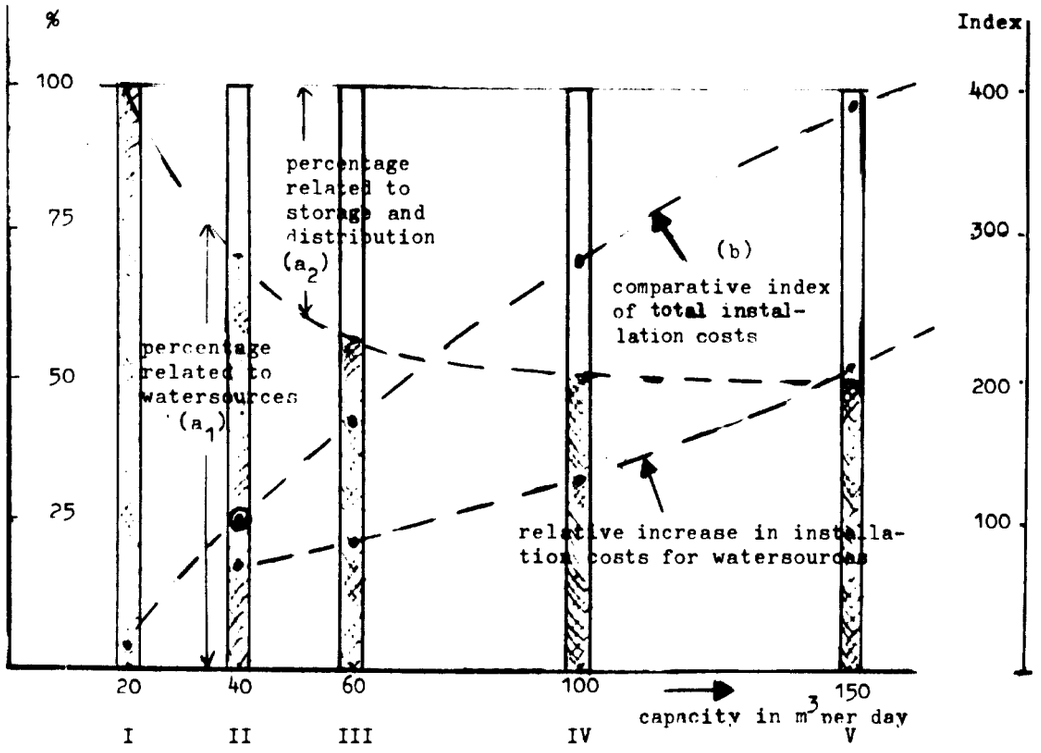
8. Modes of operation and organization will have to evolve parallel with the development. Selfhelp and neighbourhood cooperative efforts would be suitable in the case of handpump supply and of motorized-pumping/publi hydrants-distribution systems. As household connections develop, establishment of special public utility outfits becomes desirable.

5/ A development originating from a larger area-system extending towards and/or integrating groundwater-based and other village watersupply systems is naturally also feasible, and would be particularly relevant in areas where large multipurpose projects are constructed.

6/ Ref. "Technology for Solar Energy Utilization", UNIDO, 1978.

Annex II

Figure 1



Illustrative Comparison of Installation Costs of
VARIOUS VILLAGE WATER-SUPPLY SYSTEMS
(population of 1000 persons)

type of installation	system description	capacity m3/day	installation costs						comparat. index
			watersources		stor.& distrib.		total		
			mon.u.	%	mon.u.	%	mon.u.	%	
I	handpumps - no distribution	20	4000	100	—	-	4000	100	16.7
II	motorized pumps distribution through public hydrants (1 : 125)	40	16500	69	7500	31	24000	100	100.0
III	same with hydrants at 1 : 60/65 ratio	60	22000	57	16500	43	38500	100	160.4
IV	motorized pumps, public hydrant distr. also 50 % house connections	100	33000	52	30000	48	63000	100	262.5
V	same with 100 % house connections	150	49500	51	48000	49	97500	100	393.8
graph references			a_1		a_2				b

Note : above data are illustrative only; they have been mainly derived from data in IBRD-publications The term monetary unit is used in view of the changing rates of eschange; one mon. unit would roughly be aequivalent to a US dollar in the early seventies. The various types of installations assume a same pattern of settlement of the population and proximity of groundwatersources.

Annex II
Figure 2

INDUSTRIAL TECHNOLOGY ASPECTS RELATED TO VILLAGE WATERSUPPLY DEVELOPMENT

(groundwater resource oriented supply systems)

MAIN INDUSTRIAL ITEMS	TECHNOLOGY ALTERNATIVES			RELATED INDUSTRIAL FACILITIES										Rem.
				crfm	rural area oriented industr.						special ind.			
	1	2	3		mw	fo	pp	pl	cc	cn	se	sc	bi	
PUMPS														
- handpumps	x	-	-	⟷	⟷									s
- motorized pumps														
• diesel powered	-	x	x		⟷						⟷			sss
• electric powered	-	o	x		⟷						⟷			sss
- submersible pump	-	o	x		⟷						⟷			sss
PIPING (external)														
- nonmetallic	x	o	o	⟷						⟷				
- cast-iron	-	x	x		⟷		⟷						←	ss
PIPING (internal)														
- plastic	-	x	x					⟷						
- metal	-	o	x		⟷		⟷						←	s ss
HYDRANTS, VALVES, TAPS														
- castiron	-	x	x		⟷	⟷								-
- brass	-	x	x		⟷	⟷								ss ss
STORAGE TANK														
- local constr. mat.	x	x	x	⟷						⟷				s
- metal	-	x	x		⟷					⟷				s
DEEP WELL CASING														
- coorosion resistant steel	-	o	x		⟷		⟷				←		←	ss
CONSTRUCTION MATERIALS														
- local constr. mat.	x	x	o	⟷						⟷				o
- concrete	-	o	x							⟷			←	o
- steel fabrication	-	o	x							⟷			←	ss
WATER TREATMENT AGENTS														
- local natural mat. (e.g. carbon filtr.)	-	x	x						⟷					s
- chemical	o	o	x									←		ss
METERING & CONTROL INSTRUMENTATION	-	-	x		⟷						←			sss

- = not applicable; o = optional; x = applicable

Notes :

(a) The table illustrates schematically the interrelationships between main industrial items required for groundwater-based village watersupply systems, the alternatives in terms of technology and related industrial facilities.

(b) Three broad groups of technology alternatives can be discerned with the following scopes and modes of operation :

technol. alt.	technical nature and scope	mode of operation
(1)	handpumping of water and maximum use of locally available construction materials	individual activity by users with maintenance entrusted to local craftsmen
(2)	motorized pumping with storage and	
	(a) distribution through public hydrants	neighbourhood or village cooperative
	(b) distribution extending to house-connections	
(3)	integrated water supply system (linkup with larger area watersupply system)	public utility outfit

(c) The related industrial facilities concern :

- craftsmen and small workshops, indicated as "crfm"
- predominantly rural-area-oriented industrial units :
  - mw - multipurpose mechancial workshop
  - fo - foundry
  - pp - metal pipe fabrication unit
  - pl - plastic pipe manufacturing unit
  - cc - charcoal manufacturing facility
  - cn - construction outfit (multipupose, capable of utilizing local construction materials, concrete mixing, steel construction, etc.)
- supplies from specialized engineering (se), specialized chemical (sc) and basic industries (cement, pipe, steel, etc) operating on a wider masis.

(d) s, ss and sss denote (increasing) intensity of product-standardization efforts required.

Local Production of Industrial Products for Rural Requirements

- Some Examples -

1. Meeting farm implement requirements[1] - Local blacksmiths constitute a significant link in the development and supply of farm implements and other metal-ware requirements of the rural population. Illustratively a contribution in the order of one seventh to one fifth of the total demand is estimated for hoes (jembes) in Tanzania where a nationawide system is being developed in order to gain selfsufficiency in the supply of farmimplements. The role of blacksmiths include, besides the production of farm implements, also the adaptation of factory-produced implements (due to inadequacies in the latter design to meet local requirements), and an essential local distributive function (for an enduser-population unaccustomed to fixed-price distributive systems).

   In order to come to the goal of selfsufficient production of farmimplements an approach is advocated, which incorporates a modernizatopm of these rural blacksmiths into small workshops. Besides various types of farm imp ements also various household utensils could produced. Such workshops, which do not need availability of electric power would provide for the needs of a rural population of about 9 000 families. An expanded range of products and facilities is envisaged for a second (and possibly third) level with progressive degrees of mechanization.

   The supply of raw materials is a key-factor and is envisaged as an activity providing an interlinkage of the two levels. It is in this respect noted, that the traditional technology of ironsmelting, in use for many centuries, is too costly and posseses ecologcial and other disadvantages. In the described approach a major support function is to be performed by the second level for scrapcollection, possible resmelting and provision of semi-finished blanks of various qualities, shapes and sizes to the blacksmiths for further forging and processing into the final products.

1/ Adapated from "Promotion of Rural Implement Manufacture in Tanzania" paper prepared for Unido by J. Müller, november 1977.

Significant economies are anticipated from the above approach as compared with the present import-substituion-by-largescale-production approach. Overcapacity and inadequate organizational and technical flexibility - partly due to overlooking, or at least underesti ating the role of the rural blacksmiths - is in the case of Tanzania observed. In the suggested productrange an evolution seems implied as regards the activities of the various types of workshops in accordance with progress reached and availability of infrastructural facilities.

Illustrative listing of products

typical productrange	level of workshop	
	first	higher
• single function farm implements (e.g.jembes, axes, bill hooks, adzes, pangas, cutting knives, sickles, slashers, etc.)		
• farm implements with a more composite structure (e.g. groundnut shellers, maize shellers, groundnut lifters, hand-operated sprayers and -planters, etc.)		
• mechanized farm equipment		
• simple household utensils (e.g. knives, scissors, frying pans, charcoal stoves, kerosene lamps, buckets,. water cans, dust bins, etc.)		
• transport equiment (e.g. wheel-barrows, hand- or other carts, etc.		
• repair-services of bicycles, equipment and various installations, e.g. for watersupply		

2. Meeting traditional style clothing requirements

Availability of cloth[1/] is a primary factor for the batik-industries, which have a predonminantly local home-industry origin. The batik-technique provides for a simple yet versatile preparatory and dyeing process, which permits the development of patterms of a traditionally valued style on fabrics and other materials.

It is most well known for its wide application in Indonesia; although in its origin, many centuries ago, the process is recorded as having been in use in many countries ranging from Asia to the Middle East, mid-Africa and South-America. In many of these countries the batik-technique has been largely replaced by newer techniques. In Indonesia, and particular on the island of Java, it has been able to withstand this evolution. Main reasons are cultural influences and a development of the batik-technique itself. Through refinement of the technique a widespread customer appreciation could be maintained, and through simplification a mass-type application could be developed simultaneously. Dye-color development was also an important contributing factor. Indigo-blue used to be the traditional colour, until soga-brown was developed and widely applied in southern mid-Java from the 18th century onwards. From the qualitative point of view fabric-textures are important, and a certain quality grading has evolved (with cambric-type and mori-muslin type cotton-fabric as the finest texture-qualities). Currently polyester cotton fabrics are used and synthetic dyestuffs. A similar evolution is taking place in the process preparatory to the dyeing. This involves the preparation of the fabrics with a coverlayer, for which various types of waxes have been developed. With the broadening of the colourspectra, new aesthetic concepts were introduced, which gained rapid introduction in the 1960's. A spreading out of Indonesia and revatilization of batik-activities in Malaysia, Sri Lanka and other countries is since observable; also into various industrialized countries, where batik is recognized

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1/ Similarly, the supply of yarns is basic to home-based handloom industries, a major rural industries activity in India and other countries.

particularly as a distinct arts-handicraft.

The versatility of the batik-technique - applicable to artistic items as well as articles for day-to -day use, and to individual home-based activity as well as organized larger scale production activities - is reflected also in the equipment used. Particularly characteristic are the methods for applying the wax-layer prior to dyeing, in which the following methods have evolved :

- the "tjanting" (= instrument, by which the wax is applied to the fabric) - The wax is molten in a pan on a stove, With the tjanting a small part is taken and applied to the fabric. Various types of tjantings are distinguished, ranging from single-line drawing and dot-application to multiple line drawing tjantings.
- the "electric tjanting" - Through electric heating of the tjanting the wax is kept in correct molten condition yielding a more uniform application; also through a somewhat larger quantity of wax storeable in the tjanting a more continuous operation is feasible.
- use of stencils and brushes to apply the wax on the fabric.
- blockprinting - The wax is applied to the fabric through copper dies in which the patterns are engraved.
- mechanical blockprinting - in which (the cruder) multiple layer and consequetive single layer methods are distinguishable.

Corresponding types of dyeing and washing equipment - operable on a home-industry, on a common facility for individual batikcraftsmen and on an industrial basis - have been developed.

The abovedescribed process is in its application pattern summarized in the following diagram :

technique	individual home-ind.	collective organization	industrially organized
• tjanting	0	0	-
• stencil pattern	0	0	0
• blockprinting	-	0	0
Indicative index 1/ of per capita investm investment	20-35	100	150-500

1/ The base (=100) for the index is the per capita investment for collective group of 100 batikworkers (80 tjanting and 20 stencil and blockprinting) with an adequate dyeing and washing facility.

3. Meeting diversified local requirements in rural areas -

Specific efforts directed towards supplying local requirements constituted a primary factor in the establishment of a series of rural industries in the Southern Jalisco region of Mexico. This region is situated about 150 km to the south of Mexico's second largest city (Guadelajara, 1.600 000 inhabitants). It encompasses an area of about 22 000 sq. kms. with a total population of 5 to 600 000 persons. Main townships are Ciudad Guzman (about 50 000 inhabitants) and Tuxpan (about 15 000 inhabitants). Cane sugar has for a considerable time been the areas's main industry.

Local leadership initiatives and strongcentral government support, also in the form of government supply contracts and other forms of encouragement, supported aforementioned efforts. After an early period of trial and error, the described focus on meeting local market requirements was embarked upon. Besides townships-based industries, a dispersal of the productive acitivity into the villages was undertaken. Accompaniment of the production structure - which had in a short time grown to a total workforce of over a thousand persons employed in seventy workshops - was required with a distribution system and with central purchasing facilities. The distributive system comprised locally of a chain of small shops (socalled "People's Grocery Stores") and area warehouses. A central training workshop was established and an organizational structure was evolved in which all workers constituted in a general assembly the highest authority of the collective organization. Efforts were further exerted to broaden the scope with new productlines also catering for other areas and export.Depression in the economy and a reversal of government policy caused, however an adverse trend. Much of the employment gains had to be abondoned. At the end of

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*) Adapated from " The People's Collective Industries of Jalisco : A Casestudy of Rural Industrialization in Mexico" paper prepared for Unido by S.A. Ferrer, november 1977.

the third year employment approached the same number as at the end of the first year; with further decline in the offing, although prospects for a stabilization and subsequent re-expansion were not a priori precluded. Time will prove what the actual development will be. It may however be of general interest to compare the structural aspects of the situations at these two points in time. Some data are to this end summarized in attached table.

In the first place a rather pronounced specialization towards garment and footwear products as the mainstay seems to emerge; to this product range also leather jackets and belts, listed under the new additions, could be related. Food processing, particularly the supply of locally consumed food products, has declined sharply; although fruit-canning related to a wider market has retained its position. Printing and the manufacture of soap has been added to the productrange which is predonimantly local oriented. As indicated earlier, specific background reasons have given the development of this group of industries a strong bias towards supply of local market requirements. In general, however, an incorporation of linkages to markets external to the area and basing itself on certain specializations in which the area has some specific advantages, would be desirable. Facilitating the establishment of such linkages with external market in an interactive manner conducive to the area, would, in fact be a specific contribution of industry to rural development.

Raw materials supply has in many instances been identified as a main problem area. With added difficulties caused by inflation, the financial strength of the collective organization fell short often, causing workshop shutdowns. On the distributive side, insufficient maturity could be gained, particularly for marketing outside the region.

The strongly employment-oriented approach and the government-stimulus provided has led initially to rapid development. Applied industrial techniques were relatively simple, and could through the training provided be easily acquired. With the contraction of the economy, and simultaneous withdrawal, or at least substantial reduction of central government support, efficacy considerations

PRODUCT-STRUCTURE RURAL INDUSTRIES STH. JALISCO, MEXICO

main branches	initial year		number of workshops		typical products
	employ-ment % (1)	rel. p.c. investm. ratio (2)	initial year	end of third year	
food processing	29.5	80	26	5	cheese, sausages, bread, fruit-canning & -juices
clothing, weaving and shoes	29.0	535	25	83	schoolsweaters[3]), shirts, trousers, children garments, furniture-chushions, shoes, sandals
wooden products	18.5	255	3	4	furniture, wooden toys[3])
construction materials	6.5	40	8	3	a.o. cement utility-poles
other products					
- chalk[3])	8.5	305	1	1	
- misc. (initial)	2.0	45	2	1	remaining unit engaged in maintenance services
- new additions	-	-	-	22	straw hats, mattresses, leather jackets, belts, printing, soap.
- non mfg. activ	2.5	..	4	4	
- warehousing, & administration	3.5	..	1	4	
total	100.0	100 [2])	70	127	

Notes : 1) total employment at the end of the initial year was approximately a thousand persons, averaging about 14 persons per workshop unit. After a further upsurge, various circumstances caused a rather drastic decline, which had not yet stabilized during the situation shown for the end of the third year (127 units with a total of about eleven hundred persons employed, averaging 9 persons per workshop unit).

2) In the initial year, the investment per capita average around US $ 1500.- in 1975 values. This average is taken as the base (= 100) for the product-line ratios listed in the table

3) These products are chiefly manufactured upon contract for the central government

prevailed. As implied above, the adverse situation was withstood best by the branches with relative local advantages, particularly materials-availability, and possessing access to wider market potentials. Perhaps somewhat intuitively, during the initial years, the major investment had been made.

The experiences gained at Jalisco, although covering only a relatively short period, has yielded valuable insights in the viability aspects of rural industrialization projects, from which not only Mexico [1/] but also other developing countries may benefit. Particularly noteworthy is also the role and significant contribution to these endeavours by dedicated and capable leadership.

1/ On the basis of the experiences during the initial development of Jalisco rural industries, a national law has beeen enacted to facilitate initiation of similar projects in other regions of Mexico (Law of Social Solidarity Societies, may 1976)

Annex IV

Example of an Export-oriented Preserved Fruits Industry

- The Production and Export of Canned Pineapple -

Pineapple is canned by smaller and larger factories in various countries with tropical climates. Most common is the Cayenne variety, whose origin is South-America [1]. Via France and England the Cayenne pineapple was introduced in various parts of the world: in the latter half of the 19th centruy in the Azores, Florida, Jamaica, Hawaï, Australia, Sri Lanka and South-Africa, and in the first half of this century in other areas, which have also become known as main producers, such as Central America, the Far East, South-Asia, East Africa, and, more recently, also West-Africa. The plant provides for two useable harvests, generally, about one and half and two years after planting. Compared with other fruits it has therefore a relatively short leadtime for agricultural development. Total world production of fresh pineapples (all varieties) is for the mid-seventies estimated at about 4 million tons. The greater part is consumed fresh, a factor to which the fruit's relative durability contributes. The portion used for canning corresponds with a total world production of a billion standard cans [2] in the mid-seventies. Nearly sixty percent of this production enters the world market; due to the relatively high rate of US home consumption of Hawaiian production. To a lesser extent a similar situation exists in Japan (supply from Ryukyu) and in Australia. For the producers in the developing world, the mid-seventies situation represented an exportmarket of about 450 million standard cans.

The variety of the canned products ranges from full-, half-, quarter-slices, bit-sizes, special diabetic qualities to juices and pineapple-crush. This range permits possible use of labourintensive methods for quality grading and selection of the incoming materials. Moreover, in areas where small contractfarming is practiced more land-intensive planting methods and selective handpicking could rate as relative advantages compared to areas where mechanized plantation farming predonimate.

1/ The Cayenne variety derives its name from Cayenne in French Guinea, where it is believed to have been brought, via Venezuela, from the Parana region in the south-brazilian, north-argentinean and paraguayan area.

2/ 1 standard can corresponds with approx. 1.875 lbs (850 grams)

Packing operations also permit use of labour intensive methods. Sterilization and vacuumsealing are, however, necessarily machine-controlled ones. Hygienic conditions and quality standards meeting export market requirements need strict control.

Close interindustry linkages are distinguishable. In the first place this concerns the use of syrup (from the sugar industry) and other auxiliary materials. Another major interlinkage concerns the supply of cans and packaging materials. These auxiliary and packing materials may often amount to a third or more of the off-factory costprice. Also, factors further remote, such as the availablity of tinplate (supplying the canmakers) could exert determining influences on the industry's viability; and this incidence may be illustrative for the industry's sensitivity to various basic materials supply factors.

Seasonal influences and world market conditions are other major risk factors. It is in this connection noted, that for the developing countries, 85 % of the canned pineapple is produced for export to the industrially advanced countries, and for various countries this proportion may approach practically a 100 percent. These export relationships are to a not insignificant extent influenced by preferential arrangements and state trading by centrally planned economy countries. The remainder, i.e. the volume transacted without preferential bias, is estimated at about a third of the world trade. Under these conditions pricelevels leave the producers in the developing countries concerned very little dimensions of economic freedom. For these countries efficacy and quality considerations are vital and strict criteria for the choice of technology to be deployed.

region	F %	C %	E %	North America	Western Europe	Japan Austral.
asia	40	38	± 100	x	x	x
africa	10	10	80		x	
lat.america	20	7	65	x	x	
total devel. cntr.	80	55	85	47	50	3
					100	

notes: - F and C = approx. shares in world production of fresh and canned pineapple respectively (mid-seventies)
- E = perecentage of canned pineapple exported
- Last three columns indicate main export relationships and relative market size of industrialized countries for canned pineapple products from developing countries

data derived from official production and international trade statistics

Annex V

Brief Background Annotation on Rural Electrification

The following text is quoted (or excerpted in condensed form) from a 1975 publication "Rural Electrification" prepared by the World Bank, Washington, D.C. :

Most countries have some degree of rural electrification, but are in different phases of developing it, depending on the level of demand for electricity. Before public supplies from the main grid are introduced into an area, it is common to find business enterprises and communities producing their own electricity from small diesel or hydropowered generators (autogenerators). The costs of such sources of electricity are high (typically from 9 cents to 21 cents per kilowatt-hour, compared with 3 cents in urban areas). Nevertheless, such enterprises are often profitable.

As the demand develops and as load factors improve, public supplies from the grid (which are more capital-intensive, but less fuel-intensive, and are very expensive if used to meet small demands) become cheaper. It is then economical to replace autogeneration in the main demand centers by extending public networks to them. Once the main demand centers are connected, the final phase of electrification can begin. Many of the smaller demand centers, which may be the smaller villages or the farm and agro-industrial consumers outside the villages, are now close to the networks and can be connected at low marginal cost. Broadly speaking, African countries are in the early phases, using autogeneration and bringing some public supplies to the larger demand centers. Asian countries are in the midst of bringing public supplies to the main demand centers. Latin-American countries are concluding this phase and beginning the final one of marginal extensions to the smaller centers.

In other words, electricity is introduced into rural areas in three ways :

(1) autogenerators serving single customers,
(2) autogenerators serving several consumers on a local network, and
(3) public supplies from the main grid system.

The term autogeneration, as indicated above, refers to isolated generators powered by diesel engines, small steam turbines, or microhydro turbines. They range in size from 5 kilowatts, sufficient

to meet such minor needs as refrigeration and lighting on a farm, to 1 500 kilowatts, sufficient to meet the motive power needs of a large sugar processing plant. Public supplies from the main grid consist of medium-voltage (about 50 kilovolts) subtransmission links to transmit electricity from the grid to the larger demand centers of an area, plus low-voltage distribution within the demand centers.

Generally, the demand stemming from "productive"uses is highe then that stemming from households. The relative demand pattern also change markedly from one area to another. Often the demand in an area may be dominated by one large consumer, as with irrigation or cotton processing. Although some areas may use electricity for a wide range of "productive"purposes, others may use it for little more than household and public lighting.

In addition to the various agro-industrial demands which develop from local agriculture, it is not uncommon to find demands developing from 20 or more commercial activities in a single village, such as for lighting and refrigeration in shops and services, and for lighting, heating, and motive power in workshops (carpentry, welding, and repairshops, for example). Community demands may include public lighting and demands from the local church, a water pump, a police station, schools, and health centres. Growth in local agriculture and wages, and improvements in complementary infrastructure can thus generate all kinds of uses for electricity.

Consumption levels in rural areas are much lower than in urban areas. But, often demand grows at a high rate once an area is electrified. During the seventies a rather substantial expansion is anticipated. The development is estimated to bring the overall figure of 12 % for rural population served in the early seventies to a level of about twentyfive percent in the early eighties. As indicated above, a regional differentiation is to be made: a figure of less than ten percent would apply for Africa, twentyfive percent for Asia, and in Latin America electrification is estimated to reach in the early eighties a third of the rural population.

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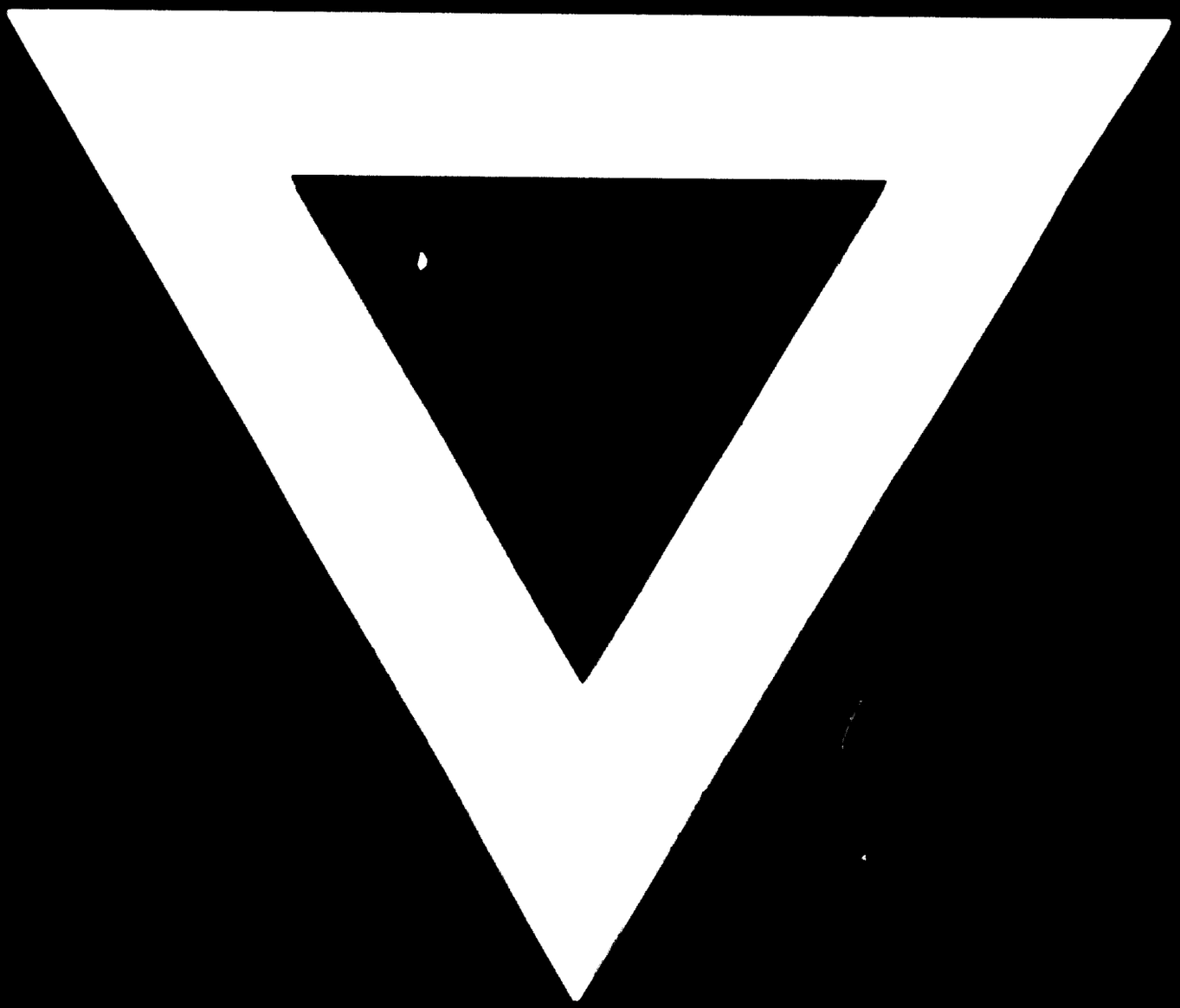

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