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APPROPRIATE TECHNOLOGY FOR LIGHT ENGINEERING INDUSTRIES AND RURAL WORKSHOPS

LIGHT ENGINEERING WORKSHOPS FOR RURAL AREAS Beckground Paper

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Prasanta K. Das UNIDO consultant The description and classification of countries and territories in this document and the arrangement of the material do not imply the expression of any opinion whatsoever on the part of the secretariat of UNIDO concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries, or regarding its economic system or degree of development.

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LICHT ENGINEERING MORKSHOFS FOR RURAL AREAS IN DEVELOPING COUNTRIES

I. DEFINITION OF SCOPE

1.1. The rural sector is variously defined in different countries and definitions also differ within countries depending on the purpose for which the definition is meant. As far as population census definitions go, the rural sector in a large number of countries consist of localities with a maximum of 2,000 to 5,000 residents in each. In a few countries, this limit goes up to 10,000 residents. In some countries, urban localities are not only defined in terms of a minimum quantitative criterion of population of the locality, but in addition certain qualitative criteria are super-imposed such as "provided that at least (75)^a percent of the labourforce is engaged in non-agricultural occupations and the density of population is at least (400)^a per square kilometer". In a few other countries the types of urban amenities and local administration are determining factors. All this means that larger size localities beyond a size of (5,000)^a residents, can also be classified as rural if these qualitative criteria are not met to bring them into the urban category. Thus, in examining the industrial needs and possibilities of rural localities the basic characteristics of these localities in terms of their limited size and the preponderance of primary sector activities need to be kept in mind.

1.2. For the purpose of this paper it would be necessary to go up to and include "<u>rural market towns</u>" which serve largely a rural hinterland, and may have as much as 25 - 30,000 residents so as to take into account the whole range of rural possibilities. On the other hand, while for purposes of statistical classification, a suburban locality may be classified as "rural", all its industries and services are geared to urban needs, it being a physical spill-over of the city itself, and the industries possible in these localities are not dealt with in this paper, excluding however those which may fall under a common category to both rural and urban sectors.

a These percentages or numbers vary from country to country

1.3. The term "rural industry" within which the component of "light engineering workshops" are to be considered, needs also to be defined. While rural industry has often been considered to include decentralized industry, this paper will not deal with decentralized large or mediumlarge industry in a rural setting, particularly those which require a workforce in terms of size and variety of skills, more than what a rural "community" can provide, and this requires the setting up of a new township or enclave community in a "green fields" area. The term "rural community" here does not mean always the confines of a single village, but an integrated labour-market area which may include several contiguous villages from which labour can be drawn easily on a daily basis. The exclusion of decentralized large industry is necessary from consideration in this paper because the technology levels, markets, managerial requirements, sources of finance, mechanics of planning and promotion, are vastly different to those required or used in "rural industries". Thus, rural industries will be largely those which are based on rural/ local raw materials (agricultural, forestry, horticultural, coastal, mineral, etc), and/or largely supply to a local or regional market or meet the local requirements for engineering service, and depend on local labour and management availabilities. As the process of industrialization deepens, the use of non-rural raw materials in rural industries grows, such as use of metal semis and intermediate products either imported from larger plants in urban areas or from abroad, or scrap generated in a region. These industries will come within the scope of the paper, provided the other characteristics of manpower sources and markets are met.

1.4. The term "<u>light-engineering workshops</u>" will be used within the above definition of rural industry and include the <u>manufacture</u> of metal or wood based final or intermediate products (i.e. exclude textile or fibres, chemical, food, leather, clay or ceramics products), <u>or</u> provide an <u>engineering service</u> such as in repairs and maintenance of equipment, machinery, appliances and tools. The term "light" specifically excludes heavy engineering products and activities within the "engineering" group.

1.5. This term "light" in the rural context will also have a special significance in regard to technology levels of these workshops and their sizes. In terms of technology they will largely fall within the category of upgraded-traditional technology and/or intermediate technology and not involve "advanced" technology, i.e. whereas they will involve mechanization or powerization of traditional manual processes and activities, they will not involve complicated mechanization or automation. The higher the capital intensity of these industries, the greater the need for multi-shift working. Rural ereas with little industrial traditions are not used to the discipline and rythm of multishift working, and this gradually emerges during high activity seasons in some food processing industries located in rural areas. In terms of size they will include the artisan workchops as well as small-to-medium sized workshops. Thus generally it may be said that the artison workshops will be in the upgraded traditional technology group^a, and the small-to medium sized workshops will have a mixture of both i.e. upgraded traditional and intermediate technology. It is not the intention to deal with artisan engineering workshops in the traditional technology group here/as the general objective in a process of industrialization is to upgrade technology of low productive and low income activities so as to reduce the burden of physical work, improve productivity and incomes and also improve the quality of products to enlarge their markets. It is however realized that in some rural communities, because of the existing situation in regard to lack of adequate rural infrastructure, or isolation, or lack of sophistication in demond, or lack of any other alternative, the choice is to promote workshops with traditional or slightly improved traditional technology levels.

1.6. In terms of <u>production organization</u>, depending on the product, light engineering workshops in rural areas may be organized on a job shop, batch production or semi-continuous production bases, but largely they will be of the first two categories excepting for a selected range of products serving large regional markets. Workshops may also be set up or grow into providing a combination of engineering service (repairs, maintenance) as well as for production of components.

^a Some modern trades at the artisanal level such as automobile repairs will be in the mixed group of upgraded traditional and intermediate.

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II.STRUCTURAL FEATURES OF DEMAND AND POSSIBILITIES

2.1. Before dealing with specific demand features for products and services which such workshops can meet, it is necessary to examine the <u>structural features of demand</u> from which certain policies and parameters of action arise. Firstly the rural spectrum is to be seen not as consisting of a single type of "village" with a standard demand structure for products or services, even within a cohesive ecological region. Localities vary in size and vary in respect of the roles they play as between villages. Some are small, some are large, but there is a system of inter-dependance between them, economic, social and cultural. In economic terms, certain localities have various levels of "central" functions in respect of other localities, and since industrial activities are sensitive to centering tendencies, it is necessary to identify the central functions they perform, and then consider the type of industries which can be developed in them first, before a wider scanning or unstructured scanning of most localities in an area is attempted.

2.2. These central functions of certain localities very often depend on the size of the locality, the size of the hinterland for which it performs these central functions, the type of communications network serving it. the types and range of economic activities of the area and the level of incomes of the area. Higher and lower order centres are interconnected in terms of the types of functions they perform in a continuum, and generally functions at lower orders are less differentiated (or less specialized) than those at higher order centres. For example, in respect of a single service function like servicing of agricultural machinery, the lower order centres are multipurpose and undertake simpler and routine tasks, and higher order centres perform more complex and specialized tasks. This understanding of the level of "central" function that certain localities in the rural spectrum perform, is necessary not only in regard to the location of engineering service industries, but also in the location of engineering production industries, because the latter will also have to depend on obtaining adequate engineering and other services from the locality in which it is placed.

2.3. It is also to be understood that the hinterland concept of a locality having central functions is not confined to <u>concentric spatial structure</u>.

i.e. a series of circles enclosed by larger circles.

There may be regions where a <u>linear or axis structure</u> may exist or may be found appropriate particularly in marginal resource areas, and the axis may be stretched along a highway or railroad with higher and lower order centres strung along such an axis, or it may be a combination of concentric and linear arrangements. The location of light engineering industries will be most sensitive to the type of spatial pattern existing, as the size and range of local inputs and the reach to raw materials and markets will be determined by it. For example, a motor vehicles service workshop in an axis arrangement, located strategically in a small village along a main highway, may have to deliver a fairly complex range of services, compared to a motor vehicle workshop in a similar sized village under the concentric pattern. On the other hand the central function of say servicing agricultural machinery may be reversed in terms of the level in the two villages described above.

2.4. An understanding of the number and levels of existing localities performing central functions is not only important, but also an understanding of the <u>role of governments in identifying and developing these localities</u>. All programmes of rural development have ingrained in them basic components of urbanisation, i.e. the placing of certain urban related amenities and facilities such as schools, hospitals, recreation centres, administrative offices, and economic infrastructure such as electricity, roads, banks, etc. These not only create a demand for engineering goods and services, but also in turn facilitate their emergence/development and improved performance. In fact, a feeling is growing that inadequacy of a wide network of urbanized localities has a dampening effect on the rate of industrialization. Urbanization and industrialization go hand in hand (urbanization not confined to development of 2 or 3 large cities or metropolitan areas). Greater the thrust of government policies towards urbanization on a dispersed basis, the greater is the likelihood of an increase for engineering goods and services from dispersed production units.

2.5. Over and above the spatial structure of localities, it is necessary to understand the <u>ecological conditions</u> of a region which determine the structure of the main economic activities carried out in it and the level of technology used in these economic activities. A region might be:

(a) a highly irrigated agricultural region with a variety of foodcrops, fibres and oilseeds, or plantation crops like tea, rubber, etc., and where the needs of the main productive sector will range from agricultural machinery, to various food processing industries and engineering goods for infrastructural works like sluice gates and valves; or

(b) a rangeland or pasture area with rainfed farming and animal husbandry, where the types and intensity of agricultural machinery used is different, and sheds and structures are associated with feed lots, diarying, wool and leather industries, etc., or

(c) a coastal belt with coastal exploitation of marine resources, boat building, fisheries industries and the like.

Thus the light engineering manufacturing or servicing industries in rural areas will very much depend on ecological factors of the area. Factors of traditional and emerging technological traditions also enter the picture. For example an area having buildings with wooden vertical structures and sloped roofs will have need for different types of supporting engineering industries than an area having brick walls and flat roofs.

2.6. Then again it is necessary to have an understanding of <u>rovernment's</u> <u>plans for a region in respect of other sectors</u> of the economy, i.e. other than the industrial sector, <u>or</u> even understand the natural growth tendencies of a region in order to examine the most viable light engineering industries possible. For example, a region selected for intensive multipurpose development under a regional development project (e.g. a backward area or a river valley), would have considerable prospects for developing light industries compared to similar regions going through a normal pace of development. An area in the process of development in the form of a string of hamlets for touristic purposes along a sea front or a mountain region will have different requirements in terms of building materials and fittings than an area being developed for intensive agriculture.

2.7. We have largely discussed light engineering industries based on markets and services needed in an area, but when we consider rural engineering-goods industries for exploiting larger regional markets or engineering-components industries linked to larger parent firms under sub-contracts, the general experience is that they are seldom drawn into "virgin territory", i.e. to areas which have no traditions of such industries for local or limited markets. If they are drawn to such areas for other advantages (e.g. convenience of the proprietor), they normally start small and gradually grow. Skills and attitudes to work in particular types of engineering activities (not necessarily in the manufacture of the same product, nor also at the same level of technology), are important to success of the industry. Small industries and artisan workshops have a high tendency to multiplying through what is known as demonstration effect. A study of Japanese industry some years back indicated that the highest percentage of heads of small enterprises were those who were skilled workers or supervisors in a similar enterprise. Therefore industrial traditions of an area have a bearing on the type, size and level of sophistication of a light engineering industry it can nurture. Sometimes however proximity or easy access to large urban localities has certain spillover effects in terms of entrepreneural and technical skills on some rural localities.

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III. BROAD PROMOTION POLICIES

3.1. Having seen that rural light engineering industries have a prime role in terms of meeting local or regional markets, their development should therefore be entrusted to <u>government agencies</u> entrusted with <u>area or regional development</u> as in this way not only a more sympathetic understanding of their problems and prospects would be ensured, but also co-ordination of other elements of regional development would be taken care of. The reason why a sympathetic understanding is necessary, is that the economic strength of these industries lies largely in the local and regional markets they serve. Once intensive and wasteful competition develops, and these units have to compete in wider national markets, their economic strength will be jeopardized unless they change technologically and sizewise.

3.2. Certain promotional tools for such engineering industries are worth discussing. Just as concentration by localities as discussed earlier was shown to have advantages, similarly, concentration in selected sites within a locality would enevitably carry some advantages. Industrial estates have been found to be an effective promotional tool for small and medium industry development particularly in urban areas, The same advantages of concentration, ease of access to premises, power and advisory services, and possibilities of inter-servicing between units exist for such estates in rural areas also (possibly organized on a smaller scale), though they have for several reasons met with limited success. There are two distinct types of industrial units which require two patterns of concentration. The first is the artisanal units (with upgraded traditional or partly mixed with intermediate technology) which perform useful industrial functions and can best be concentrated in <u>rural workshop clusters</u> located physically contiguous to a central village (i.e. the lowest level of $c \in tral$ function). On the other hand small and medium sized rural light engineering industries can best be organized in mini-rural estates or have an axis errangement on, or in parallel with, road arteries.

3.3. In addition to the industrial estate and workshop cluster tools for promotion, light engineering industries would need a <u>full range of</u> <u>promotion services</u> suitable for small-to-medium scale industries, such as for <u>credit</u>, <u>technical muidance</u> through <u>extension services</u>, <u>supply</u> of controlled materials and <u>marketing</u> advice. In addition they may require formation of <u>co-operatives</u> in specific type of industries, largely service co-operatives to facilitate raw materials supply for instance. The details on such services are well known not covered in this paper.

3.4. In regard to <u>training</u> in rural light-engineering skills, a special consideration is necessary for rural industries. At the artisan level with upgraded traditional technology, what is needed is not specialized

industrial trade skills common to large-scale industries, but certain broad-spectrum skills. At the lowest level of central function where a light-engineering workshop may come into existence in a rural area, a specialized trade of welding or turning or machining will not make it viable as there will not be enough rural jobs in such specializations. On the other hand what is needed is a combined "metal-work" tradesman or a combined "wood-work" tradesman (instead of separate joiner, furniture maker, polisher, etc.). Training institutions to meet such a requirement for rural areas need to be set up in rural areas. As regards training requirements for light-engineering work in small-to-medium rural industries in the modern sector are concerned, their training requirements are more or less common to those in other engineering industries in urban areas.

3.5. The technological policies for rural light engineering industries should be such that this group is given a positive role in innovation. A general policy would be not to be too restrictive in refard to higher levels of technological use in this industrial group, because that is a lead group. The general concept that all research and innovation starts at a Central Research Institute or F&D institution and percolates down to machine building industry and user industry is giving way to an understanding of the innovative capacity of the repair and servicing workshops and small engineering workshops. Their role is in respect of readily recognizable and priority problems rather than long-term problems, and often their ensuers are practical and readily applicable at a level of technology understood generally in a given milieu. Therefore a useful promotional tool for such workshops would be to have a small highly technical advisory service to assist in developing innovative ideas and encourage such development. From such ideas a new product or a modified product is derived with considerable market possibilities. Quite often though rural engineering industries may be equipped to manufacture a product or a part, they do not have the drawings or specifications, or they do not have the skills to understand these technical details. One of the responsibilities of such an advisory service is to provide training in the reading of engineering drawings, and also provide drawings and specifications of easy-to-make products in rural workshops.

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IV. A SKELETON DEMAND MATRIX

4.1. Earlier discussions have indicated how complex demand considerations can be in terms of levels and sizes of localities, ecological and regional considerations, government development programmes and industrial traditions. The whole range of possibilities is quite large, and therefore a skelcton matrix of demand is presented to facilitate selectivity and detailed consideration.

4.2. The demand matrix is divided into sectors from which the demand arises irrespective of whether the demand is for an engineering product or service. However, this matrix is discussed largely from the rural (and urban) sectors from which these demands arise. But as will be discussed later, rural industrial enterprises in light engineering will not necessarily be divided on the basis of whether they serve agriculture or animal husbandry or rural construction sectors, but on complimentarity of technical processes and equipment.

4.3. The <u>skeleton matrix</u> will be presented to cover the <u>demand sectors</u> of agriculture, rural crafts and manufacturing, transportation, rural construction and infrastructure and rural household needs. A brief elaboration of urban-linked rural light engineering industries will also be presented. A second component of the matrix will be whether it is an <u>engineering service</u> or an <u>engineering product</u>. A third component of the matrix will be the type of service (general or specialized repairs), or the type of product (hand tools, equipment, machinery or its components or spareparts, infrastructural items, packaging items, etc.).

4.4. The needs of the <u>agricultural sector</u> may be classified as follows in a skeleton form:

- (a) for Engineering Services: This will depend on the technology of agriculture in the region. It may be traditional, semi-modern with 2-wheeled tractors and related equipment, or it may be modern with various sizes of 4-wheeled tractors, and related equipment. The services for the latter two categories may be organized in various ways, such as for the
 - (i) engine and transmission systems,
 - (ii) electrical and instrumentation systems, and
 - (iii) mechanical and metal parts of a tractor, plough, cultivator, mover, combine harvestor, picker, baler, etc. etc.

These workshop categories may also cover other agricultural equipment such as pumps, sprayers, egg incubators, etc. Workshops may also specialize further depending on the density of tractor use in a given area.

- (b) For Engineering Products and Components: These products and components may be divided into several groups:
 - (i) Making of <u>agricultural handtools</u> such as sickles, knives, spades, pickaxes, hoes, forks, pruning hooks, scissors, etc. It may also be related to making of items like Persian wheel chains and buckets for lift-irrigation, or feed trays for chicken farms, etc.etc.
 - (ii) Making complete items of <u>agricultural machinery or components</u>, involving technologies of welding (of plates and hot rollad sections), casting, forgire, etc. The specific items may be agricultural trailers, disc harrows and ploughs, ditchers, cultivators, mowers, seed drills, shovel/bulldozer blades, other components and parts of agricultural machinery, pumps and pump parts (e.g. rotors and blades), sprayers, etc.etc.
 - (iii) Making of <u>items</u> required <u>for infrastructural works</u>, e.g. barbed wire and wire net fencing and poles, chicken wire mesh, sluice gates, guides and valves for irrigation systems, sectional or tubular railings and gates for feed lots and pens, etc.
 - (iv) Making of <u>packing materials for agricultural products</u> such as light wooden boxes and crates for vegetables and fruits. This normally uses rejects from log sawing plants.

This is not an exhaustive list, but representative of what may be considered for development.

4.5. The needs arising from the <u>rural crafts and manufacturing sector</u> may also similarly be large, and will depend what exists or are being develped or promoted. These may similarly be divided into (a) Engineering Services and (b) Engineering Products and Components.

- (a) <u>Enrineering Services</u> may similarly be divided into whether it relates to an engine (or prime-mover) or to the wooden and metal parts of the equipment or electrical systems.
- (b) <u>Engineering Products and Components</u> will vary greatly depending on the craft or industry. The following is a representative sample:
 - (i) Small hand tools for crafts and industrial processes, e.g. combs and beaters in textile and carpets weaving, hammers, flaying and shaving knives for skins and hides, etc.;
 - (ii) Wooden equipment such as looms for cotton and silk weaving, spinning, winding and reeling; wooden trays for silk worm feeding, grading of cocoons, deflossing, etc; carved wood hand printing blocks; pallets for transmission of loads;
 - (iii) Sheetmetal equipment for dyeing of yarn and textile materials (vats), storage drums and bins for various industrial processes; reflectors for solar heaters; brickmaking moulds (could also be in wood); ductwork for coolers, heaters, and solar heat transmission in rural industrial processes; bread making trays, trays for hot air dryers for tea, cocoons, etc.etc.;
 - (iv) Equipment and major components involving welding, forging, cesting, for the making of looms for textiles and carpets (could be combination of wood and metal parts and made in separate workshops), disintegrators, pugmills, screw presses, screens and graders for clay, ceramics, bricks and store products, rice hullers, rice shellers, wheat grinders or parts thereof. Other multi-purpose devices for rural industry, and agricultural or transportation or construction sectors will be small mobile gantry A-frames; chain hoists, tackles and pulleys for water, bricks, materials lifting or moving, etc.

As rural industrialization increases in variety, the needs of equipment and parts for them will increase.

4.6. The <u>needs prising from the transportation sector</u>, including moving of men and materials from farm and factory to the village centre or a marketing centre will depend on the communications infrastructure available and

volume of movement. Normally the bullock cart or a similar device provides a multipurpose means of transportation in most developing countries for the movement of men, materials and products, from farm to village and from village to village. The making of the bullock cart or improved versions of it, by more productive means is a useful village industry. But as affluence grows, personalized transport such as the bicycle and motorcycle have come into use, and specialized transport such as wheel barrows, trolleys, trucks, pickups, dumper trucks have come into use. A variety of wheel barrows, hand trolleys and push carts are being introduced for activities such as transport of bricks in a brick kiln operation and transporting materials in the field instead of the usual head or back load. In addition to the need for repair establishments for bicycles, motorcycles, motor cars and trucks, the making of wheelbarrows and hand carts of various types is a fairly easy rural industry to introduce, and in coastal regions, or regions having extensive waterways, traditional boat building industry exists which can be easily upgraded. Such upgrading not only helps improving manufacturing processes and their productivity, but also helps improving fish catch as improved boats are able to venture further out to sea or remain in inland waters under difficult weather or tidal conditions, than crudely constructed country craft.

4.7. The needs from the <u>rural construction and infrastructural sectors</u> will depend largely on the type of buildings being constructed in the locality and type of infrastructure being developed. Normally land development contractors or contractor firms engaged in implementing large irrigation or road works, bring in their own machinery and have their own mobile or demountable workshops for maintenance and repairs and these are not dealt with here as types of workshops to be promoted in rural areas. They are ingrained in the nature of the contract activity. In this demand sector, there are two types of engineering workshops. One type engages in <u>installation and servicing on site</u>, and the other <u>manufactures products and components</u>. A representative list of activities of these two types of workshops is as follows:

(a) <u>Installation and on-site-services</u>: e.g. electrical workshops engaged in housewiring, installation of small switch boards and panels, installation of motors, blowers, pumps (electrical connections), etc. testing of earth fault in systems, etc. or plumbing and pipe fitting workshops, ongaged in pluching, conitary peaks, pure is tall time.

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testing and repairing services, etc.etc. Quite often such workshops stock their own electrical or plumbing stores, spare parts, etc. and undertake repairs to motors, electrical apparatus, pump mechanisms, etc. as are brought to the workshop.

- (b) <u>Manufacturing Workshops</u>: for the manufacture of a variety of building hardware suitable or needed in rural areas, or rural and urban areas, e.g. steel welded doors and window frames, and shutters, rolling shutters for shops, garages and workshops; sheet retal products like drain pipes and spouts; large or medium sized metal or wooden trusses, purlins, cleats etc. for agricultural stores and workshops; wire products such as nails, screews, hooks, etc.; flat steel products such as hinges, L and T stiffners; pipe fittings made by the weld method such as T and L joints, bends; village type door knobs, clasps, door rings, chains, etc. by forging method; etc.etc. In addition to building hardware, rural workshops may be able to produce a variety of hardware for electrical and telephone transmission lines such as pole brackets and fixtures, stay wire fittings, junction boxes, etc. As described earlier they can also make items for rural construction activities and infrastructural activities such as ladders. pulley wheels, chains and chain hoists, teckles, whell barrows and trolleys, etc.
- 4.8. The household needs sector as a demand category from rural engineering workshops, will depend largely on the existing and emerging life styles in rural areas. In traditional societies the need for services may be for sharpening of knives and scissors, and the need for manufacture of products from engineering workshops may be for example in the making of simple kerosive stoves, or sheet steel buckets and mugs. As sophistication grows, the needs become more complex and urban-rural differences narrow down. In this developed stage, the repair services may cover repairs of sewing machines, knitting machines, radios, televisions, cooking stoves, refrigerators, coolers, electric or kerosive room heaters, etc.etc. Manufacturing possiblities could cover a fairly large variety, involving simple sheet metal or welding jobs for the making of oil or coal grate heaters and stoves, simple evaporative (or what are called desert) coolers, household furniture of wood or metal, containers for water, grain and other household needs, etc. Sometimes such work involves incort of

motors, gears, etc. from urban industry and using them for the assembly of some of these products such as room coolers.

4.9. The sky is the limit in regard to listing the possibilities of manufacture of urban-linked rural light-engineering industries, but each product has to be carefully considered. The product groups which are found to be viable for taking up in rural engineering workshops are those which are not too bulky for transportation to urban areas, or where the stringency of urban environmental regulations (smoke, noise, dusk, etc.) can make a considerable difference in capital costs, or where rural labour is found to be fairly skilled and less costly, as housing, transportation, etc. would not be required for them. In these respects, products of large and small foundries (ferrous and non-ferrous), or sheet metal spinning (cooking vessels, pots and pans) where the products can be easily stocked and packed, are easy to introduce in small localities. Some countries have set up more sophisticated engineering industries in rural areas such as instrumentation industry (water meters, gas meters), wall clocks and time pieces, etc. For such a development, specialized training is required, and a better educated workforce necessary.

V. A SKELETON PATTERN FOR RURAL LIGHT ENGINEERING INDUSTRY

5.1. As stated earlier, workshops will tend to be more multipurpose performing simpler functions at lower-order village centres and will tend to become more specialized at higher-order centres and perform more complex functions. This general principle will give us the basis for developing the pattern of light engineering industry. Taking into account the physical, raw material and human resources likely to be available in an locality or community and the markets they will serve. For the purposes of this paper not all types of light engineering workshops can be described in detail, but a selection shall be made and a skeleton pattern developed.

5.2. The pattern presented here distinguishes between two types of localities, viz:

(a) The workshops possible in small communities. The lowest order of such small communities for our consideration may be what is

called a "central village", i.e. they are the lowest point of concentration and have a service role for about 10-15 villages on a easily (daily) accessibility basis. This service role need not be necessarily an officially designated role. The central village may have about a maximum of 5-6,000 inhabitants.and including its service area, the population reach will be about 20-25,000. Since initial efforts of governments to promote rural industries will not cover the whole country, nor even all "central villages" (sometimes called "development centres" or "service centres", or "growth focii"), there will be some degree of selectivity in regard to the centres at which such rural industries will be promoted. Therefore it is assumed that prior attention will be given to those centres which offer best prospects for sustained growth. Hence, we shall assume that centres already provided with electrical power will be selected for prior attention. If such a situation does not exist because no electrical grid is available nearby, then arrangements will be made for a generator to be provided.

(b) The workshops possible in localities which are "rural market towns", i.e. they are the highest order of locality which services rural areas. The locality itself may have a population up to 25,000 inhabitants, and the service area will cover about 3-4 central villages and its periphery villages, plus several unlinked villages, giving a total reach of the market town in terms of its service role to about 100,000 - 200,000 inhabitants spread over 50-100 villages. The market town will be expected to have electricity, and in terms of its social infrastructure it should have at least a middle-school if not a highschool, a hospital or day clinic, and some form of local administration.

We shall not consider light-engineering industries which may be set up in individual small villages not having a service role in respect of neighbouring villages. In between these two extremes, there will be villages performing intermediate roles and of sizes varying between the two. No doubt industries can come up in them also, commensurate to their role and size. 5.3. The skeleton pattern that is presented here confirms to the following structure:

(a) Light-engineering workshops in central villages

- for multipurpose services
- for special-purpose production
- (b) Light-engineering workshops in rural market towns
 - for multipurpose services and some production
 - for special purpose services
 - for special purpose production.

Technical Profiles for selected workshops in each of these categories will be presented in this paper.

5.4. Industries have a greater chance for survival when they are linked to the community in which they are located by providing the products or services they need, or by using local inputs, or both. In the small communities the workshops will be small, and their scattering in a village in the backyards of the homes of proprietors will not be conducive to growth. Moreover the provision of adequate infrastructure in a scattered manner will be costly. Therefore the small multi-purpose workshops in these communities should best be organized in terms of workshop clusters, which in its simple form may be low cost workshop buildings arranged in a row on in the form of an open square, as may be found convenient. As the size of the locality increases, these workshop clusters will become more complex and tend to become like mini-industrial estates.

5.5. The pattern of organization of rural light engineering industries at rural market towns, often called "rurban" (rural-urban) centres, follow a different pattern than the one at the central village level. Here there will be <u>multipurpose workshops</u> performing a variety of manufacturing and repair work but of a heavier and more complicated nature, with equipment of a wider range and heavier, for example a multipurpose metal workshop will be able to repair metal parts of agricultural equipment, and also make to order some components or items like trusses, sluice gates, etc. Secondly, there will also be need and possibilities for <u>special purpose service</u> <u>workshops</u>. For example, tractor service will become much more specialized at this level. There would be need for special workshops for calibration of injectors and pumps of diesel engines, or for workshops to deal with electrical problems of agricultural and road transport machinery, or for separate workshops to deal with body work, panel beating and painting of motor cars, buses and trucks, etc. Thirdly there would be <u>specialized production workshops</u>, and since these are larger communities, the possibilities for industries at this level to cater to regional needs, rural and urban, does exist. Some of these specialized workshops will provide specialized production services to other industries in an area, such as electroplating shop, or heat-treatment shop, or for small parts manufacturers, and for specialized workshops producing wire nails, or chicken wire mesh, looms for weavers, etc.

5.6. In respect of the last category, i.e. rural light engineering industry linked to urban needs, it is not necessarily true that these urban needs are only those of a neighbourhood urban market. They could be based on a wider regional market. In such a case three sub-patterns of organization are known to exist. Firstly, they could be single units producing a final product which is retailed through various retail stores in a region, such as nails and hinges of various kinds. The second sub-pattern is when an area acquires a specialization in the making of a product, but the components are made is separate small workshops in a group of villages, and there are enterprises which do the final assembly. This is an interlinked subcontract pattern where all units are located in a rural area and each unit supplies its parts to several others. This pattern of organization has developed in the making of padlocks, bicycle parts, etc. Different small enterprises develop specialization in casting, drop forging of blanks and shapes, press-work, making of tubular parts, machining, clectroplating and painting. The third sub-pattern is for a large parent firm in an urban area to sub-contract to one or several small enterprises in rural areas. This has also happened in cycle parts, sewing machine parts and similar products. In the second sub-pattern, a government agency takes the initiative in technology transfers, training, and generally assisting. In the third sub-pattern, the parent firm takes on this role.

5.6. There could be an infinite variation of the pattern of small and large workshops and service and production workshops that can be promoted in different countries. What has been proposed in the paper as generalpurpose service workshops for "central villages" can in some countries be promoted in individual medium-sized villages not having much of a service role for neighbouring villages, and in some other countries can only be sustained in "rural market towns". Therefore the size and technological levels of workshops proposed in this paper are suggestive only. The application of such a pattern will require a proper assessment of the spatial and economic structure of rural areas in a country and the design of a rural industries structure most appropriate to it.

5.7. The profiles presented in this paper are "Technical Profiles" only and not "Techno-economic Profiles". The economic side of these proposals can only be examined in relation to a given specific situation. Costs of fixed assets, market size, the product-mix, costs of materials and labour and the prices of products and services which the market can bear will all have to be examined in relation to a specific situation. Such an examination may lead to combination of 2 or 3 workshops sugrested here as separate workshops, or splitting up the activities of large multipurpose workshops into several smaller ones. The technical profiles are therefore suggestive and indicative and not definitive. They are no doubt based on situations which exist in selected courtries, or proposals made for selected ones.

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VI. WORKSHOPS AT THE LEVEL OF THE CENTRAL VILLAGE

- 6.1 The locality characteristics of a Central Village are:
 - Village with a population of about 5+6,000 having a service area covering 10-15 villages, and a total population of 20-25,000.
 - About 40-70 per cent of the labour force will be engaged in agriculturel and allied occupations and the balance in non-farm occupations.
 - Adequate infrastructure will have to be created for light engineering workshops in such a locality by means of a workshop cluster.
 - Electricity will have to be available from a grid or provided by a generator set. Other central depots for fuel, oil and/or gas will have to be established if not already available.
 - Training and advisory services should be available on a regular basis nearby.
- 6.2 Whereas the repair and maintenance services of these workshops will be intended for the villages covered by the hinterland, the volume of production will not be confined to the markets of these villages. Therefore, the size of these workshops will differ considerably from country to country.
- 6.3 The Central Village will normally not have adequate infanstructure for the establishment of workshops of this category. Therefore, a Workshop Cluster will need to be established. The details of such clusters is given below.

<u>Description</u>: The size of the cluster and the number of workshop units to be constructed will depend on a market evaluation of needs and entrepreneurial abilities of the community. Entrepreneurial abilities can be increased by suitable technical and entrepreneurial training programmes. The two main functions of the units of the cluster will be: (a) comunityoriented services and some related production activities, and (b) specialised production on a small scale. A minimum of 6 workshop units and a possible maximum of 12-15 units should be aimed at. The workshop cluster need not have all units engaged in light-engineering industry, but there could be other industries in the field of textiles, food processing, leather products, etc., but not units which have problems of smoke (e.g. timber drying plant or brick kiln), or smell or effluent (e.g. leather tanning).

<u>Ownerchip Pattern</u>: As far as practicable, ownership of the entire cluster shall be at the community or at best at the next higher level of government administration. A village council or a broad-based rural co-operative union are best suited for such ownership. Lend should be donated or government land allotted or private land purchased at minimum cost. Costs of development and construction of workshop buildings should be loaned by a development bank or the government on soft loan basis and actual construction costs supervised. Allotment of premises, management, rent collection and repairs should be at the local level. Units could be sold outright, but right to take back the premises if not used or if not used for the particular purpose intended shall remain with the local body. Working units in a cluster can suffer if a number of neighbouring units remain closed or are used as store houses, or offices, or for social or commercial purposes.

Location and Sizes: Since a large number of units will provide services to the community the cluster shall be located close to the central village or in it. About 0.5-1.0 hectare of land should be set aside for present and future development. Part of the land should be made available to construct workshop buildings on basis of user specifications.

Assistance Required: A government agency will have to provide initial assistance in selection of site, preparing the site layout and building designs and specification.

Layout and Building Specifications: There could be a variety of arrangements possibly depending on the village layout, shape of land available, approach roads, etc.

The layout should take into consideration the need for units which will service motor vehicles or tractors to have a protected yard. Two sizes of buildings are proposed. The smaller units of standard size, but the larger units shall be constructed in such a manner that the separating walls between units shall be put up after clients have been selected and their requirements known.

The buildings should be of light but permanent construction using local materials and labour as far as possible and the roof shall be gabled with light roofing materials if weather conditions permit and if possible not sharply in contrast with local architectural features.

<u>Costs</u>: No estimate of costs or economics are given as construction costs vary considerably from country to country and region to region. The rent structure and conomics will depend largely on government policies in regard to rural industrialization. TECHNICAL PROFILES FOR LIGHT ENGINEERING WORKSHOPS AT CENTRAL VILLAGELEVEL

SPECIAL PURPOSE PRODUCTION WORKSHOPS

- 1. Multi-Product Cast Iron Foundry.
- 2. Multi-Product Forge Shop.
- 3. Nulti-Product Metalworking Shop.
- 4. Production Shop For Fruits and Vegetables Crates.

VII. WORKSHOPS IN A RURAL MARKET TOWN

7.1. The locality characteristics of a <u>"rural market town</u>" are as follows:

- The market town will have about 15 25,000 population (in some countries, it may even be more) having a service area covering 3-4 central villages and periphery villages, and unlinked villages, totaling 50-100 villages and a population of 100,000 - 200,000.
- Lesser percentage of labourforce engaged in agriculture than in a central village, but most non-farm activities will be rural oriented rather than to a major metropolitan city.
- The natural market flows of materials and products through the market town should be such that an expansion of trade arising out of new products and services generated by new industries can be taken care of.
- While some infrastructure for such industries will exist in the market town, more adequate infrastructure will have to be created in the form of larger workshop clusters and mini-industrial estates.
- Electricity for town supply should be available, but additional supply will be required for such small industry complexes.
- Training and advisory services should be readily available nearby.

7.2. While the service industries will serve the markets of the market town and its hinterland, but the production units may serve a larger regional market, rural and urban.

7.3. The specific infrastructure needed for such a rural industrial development would be of two kinds, viz. the service group of workshops, whether multipurpose or s_{1} ecial purpose, will need to be close to the market town or be within it. There should preferably be arranged in the form of a workshop cluster. The production group of workshops, which are larger units should preferably be outside the town, arranged in a mini-industrial estate, or arranged along the side of a main highway (but off it) and provided with most of the infrastructure required in an industrial estate. The size of such an estate will depend on the growth potential of the town and its hinterland. Most of the details on a workshop cluster are to be found in chapter 6, and most of the details on industrial estate may be found in a variety of publications of the UNIDO, or from country experience.

7.4. Multipurpose services and some production.

(a) Lulti Product Cast Iron Foundry in Smell Community

Product Description

The foundry will be capable to supply small parts and components up to 20 kg weight of Carey Cast Iron grade 14 to 17.

Overall Evaluation

Such type of small foundry will be required by the workshops and establishments at village level producing simple metal working products. It is possible for a foundry of this nature can expand the activities of related metalworking establishments of 10 to 25 villages. The viability of this type of foundry depends on the local demand and trained manpower availability at village level.

Market Aspects

- 1. Users: Small Workshops manufacturing metalworking products in villages.
- 2. <u>Method of Sales</u>: Job order basis varies from single unit casting to mixed product batch castings
- 3. Market Potential: For local markets et village level
- 4. Requirement of Feasibility Study: Necessary before investment
- 5. Expert Assistance: Required in the following areas:
 - (a) Foundry Management
 - (b) Pattern Making
 - (c) Foundry Metallurgy
 - (d) Core and Mould Making
- 6. Joint Venture: Not required
- 7. <u>Linkege with Other Industry</u>: Multi Product Metalworking Establishments at village level, woodworking establishments, Repair shops for tractors, automobile and agricultural implements
 - Material Specification: Grade 14 to 17 grey cast iron. Maximum casting weight 20 kg
 - Production Volume: 1-ton per hour cupola furnace to be charged 2 to 3 times a week depending upon the work load. Output per week will be 12-tons liquid metal
 - Machinery and Equipment

-	29	
	67	

ITEN	DESCRI PTION	NO.OFF.	PRICE UCA Estimated
1.	1-ton capacity per hour cupola furnace for melting liquid cast iron. Inside dia of cupola - 12 inch, Height of cupola - 10 ft. with blower and motor, roof board, cupola lining,	l set	5,000
2.	Charging Hoist and Structure. 1-ton capacity	1	300
3.	Core Oven and Sand conditioning equipment	l set	2,000
4.	Mounding Machine with maximum casting capacity - 12" x 12" x 12" steel	1	2,500
5.	Core Boxes for floor moulding (various sizes)	40	1,000
6.	Platform Scale O-l ton reading	1	1,000
7.	Ladles - 500 kg capacity	1	300
8.	Ladles 100 kg capacity	2	300
9.	Hand shanks and ladles 20 kg, 10 kg	6	200
10.	Crane System with 1 ton Hois:	l set	2,000
11.	Shovel, Riddles and Screens	lot	500
12.	Double Ended Grinding Machine - 12" wheel Dia	1	500
13.	Tumbler, 2-airgrinder, Chipping Hammers	lot	800
14.	Wheel barrows	4	200
15.	Exhaust Fan end Air Compressor - 100 cu.f/min 120 psi	l each	2,500
16.	Pattern Laking Shop		
	(a) Band Saw - [‡] " blade	1	800
	(b) Wood Working Tools	lot	500
	(c) Belt Sander	1	300
	(d) Hand Operated Cross cut Saw	1	400
	(e) Drilling Machine - 📩 in MS	1	500
	(f) Wood Working Lathe up to 2" dia turning	1	1,000

Total

The are det

22,600

Supplies for Running the Cupola

Pig Iron, Scrap, Coke for Casting, Wood for Pattern Making, Moulding Sand, Fire Bricks, Fire Clay, Flux, Core Sand, Core Oils, Wires, Rods, Chaplets.

Floor Area

The following floor area is required: oovered - 24 m x 30 m = 720 sq. m. open - 30 m x 30 m = 900 sq. m.

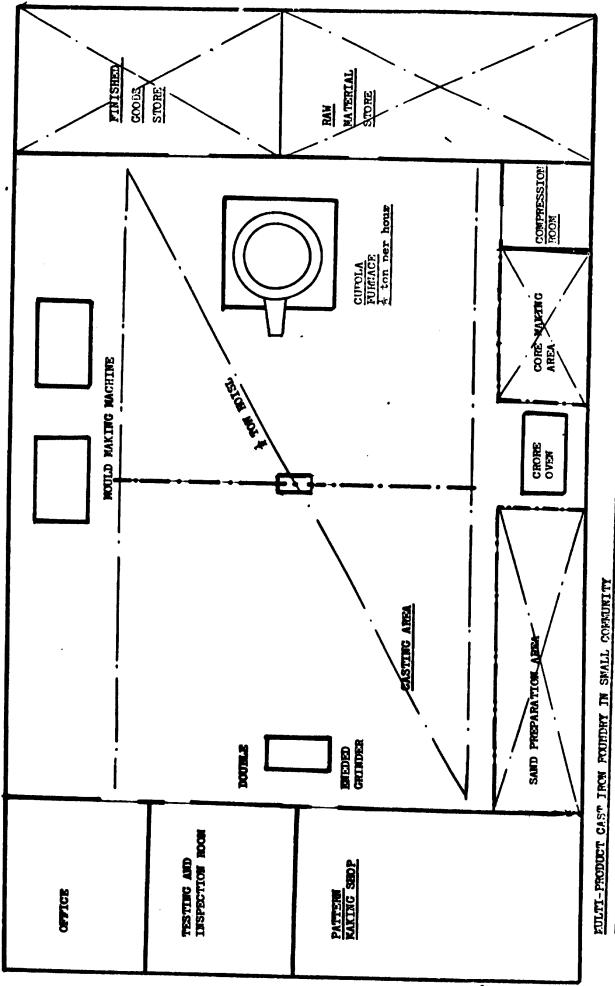
Mannower Requirement

Direct Labour - Skilled	-	6	
Semi skilled	-	5	
Unskilled	-	12	
Indirect Labour - Manager and Foreman	-	2	
Accounts Clerk	-	1	
Pattern Maker	-	2	
Office and Sales Clerk	-	1	
Watchman	-	1	
Total		30	

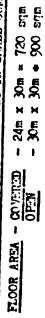
Training Aspects

Particular consideration is required to train personnel on the following activities of the foundry.

- Nould Maker
- Cupola Charger
- Pattern Maker







(b) Multi Product Forging Shop in Small Community

Product Description

This type of small forging shops will be capable of producing simple agricultural hand tools and implements. Hand Spades, Digging Fork, Hand Hoes, Hand Cultivator, Sickles, Scythes, Harvesting Knives, Lifting Hook for well.

Overall Evaluation

These simple hand tools for agricultural operations are mostly used by the small farmers in the developing countries. In urban areas these are used for gardening work. It is rather difficult for the plant: of this size to market their products in urban areas; prospects depend on potential demand at village level. Local market requirement possibilities should be carefully surveyed.

Market Aspects

- 1. Users: Small farmers holding up to 2 hectars of land or for garden work
- 2. <u>Method of Sales</u>: Sales can be organized through village hardware shops or directly to the farmers
- 3. Market Potential: The product can be marketed to about 25 villages
- 4. <u>Requirement of Fessibility Studies</u>: Nay not be required. But a realistic market demand can be carried out before investment on plant and machinery.
- 5. Expert Assistance: Initial assistance will be required for various forging techniques. Expert assistance on heat treatment will improve the quality of tools.
- 6. Joint Venture: Not required
- 7. Linkage with other Industries: Woodworking industry or local carpenters for the procurement of wooden handles

Material Specification: Hand Tools material must conform to SAE-1078.Carbon0.72 to 0.85Manganese0.30 to 0.60

The material is suitable for forge and heat treatment.

Production Volume: Based on 250 working days - 1 shift basis

(Annual Basis)	
Hand Spades Digging Fork Hand Hoes Hand Cultivator Sickles Scythes Harvesting Knives	 2,500 units per year 1,500 - " - 1,500 - " - 2,000 - " -

Total - 13,500 units per year

Machinery and Equipment

Contraction of the local division of the loc

ITEM	DESCRIPTION	NO.OFF.	PRICE USS Estimated
1.	Power Shear for $\frac{1}{4}$ steel plate	1	500
2.	Oil fired or coal-fired furnace, HP motor, Size 24" x 24" x 18"	1	5,000
3.	Quenching Tank (steel) 36" x 36" x 36"	1	500
4.	Anvil with pedestal, 500 kg weight	4	250
5.	Double Ended Pedestal Grinder 9 1 HP, 12" wheelsize	1	400
6.	Double Ended Polishing Machine	1	400
7.	Manual Roll Bending Machine for $\frac{1}{2}$ " thick rod (Hot)	1	250
8.	Manual Plate Bending Machine - for $\frac{1}{2}$ " thick plate (Hot)	1	300
9.	Electric Arc Welding Machine, 250 Amps	1	400
10.	Blacksmith's tools, $\frac{1}{2}$ " portable drill, paint can and brushes. Standard tools etc.	lot	600
11.	Miscellaneous		500

Total

9,100

Floor Area

Covered area required for a plant of this type

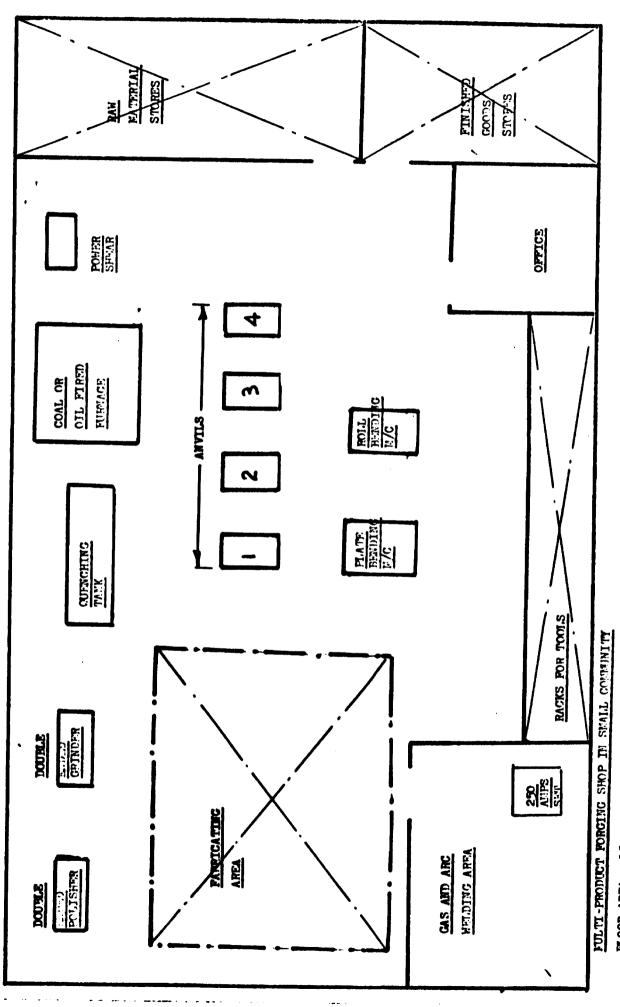
-15 m x 12 m = 180 sq. m.

Manpower Requirement

Direct Labour - Owner/Worker	- 1
Skilled	- 5
Semiskilled	- 2
Unskilled	- 2
Indirect Labour - Accounts Clerk (Fart-time)	- 1
Storekeeper cum	- 1
Production Recorder cum	
Sales Clork	
Total	12

Training Aspect

Particular consideration is required to train personnel on heat treatment.





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- A. <u>Requirement of Wensibility Study</u>: It is not essential, but a detailed market survey must be carried out before the investment is made.
- 5. <u>Expert Assistance</u>: Expert assistance in design and menufacturing technique will improve the quality of products. As this plant will handle diverse type of products, an introduction of production management is essential.
- 6. Joint Venture: Not required
- 7. Linkage Mith Other Industry: Moodworking, Hardware, Transport, Building Contractors, Agricultural Co-operatives.
- 8. <u>Haterial Specification</u>: The following materials are essentially required: Mildsteel - EN 1 series Sheetmetal - 12 SWG to 22 SWG with or without galvanised Plate - Mildsteel up to 1.5cm thick Section - Mildsteel - Round, Square, Hexagonal Channel, T, I. Z-sections are required for door and window frames.

Production Volume: Based on 250 working days

(Refer Product Description) - 1-shift basis

Tor Product Scherption / - 1-shirt basis	units/year
1. Steel Joinery and Fabrication	400
2. Steel Containers	200
3. Household use (Product mix)	5,000
4. Agricultural Implements	100
5. Textile Machine	100
6. Products according to customer order	within the limit of plant capacity

Machinery and Emiloment

ITEI:	DESCRI PII ON	NO.OFF.	PRICE USS Estimated
2. 3. 4.	Power Hack Saw, Max.round bar up to 7.5 cm dia Hand Shear up to 3mm thick plate Pedestal grinder, 30 cm dia, double ended Upright drilling machine, 2.5 cm dia in MS Lathe. Max.bore 7.5 cm Swing - 45 cm Max. length - 1.0 m	1 1 1 1 1	1,100 250 800 5,000 6,000

(c) Vulti Product Netal Marking Shop in Small Community

<u>Product Description</u>: The plant of this type will be capable to produce diverse sheetnetal welded products and fabrication of simple agricultural implements and textile equipment, steel joinery and many other metal base products, e.g.

- Steel Joinary: Steel	Racks, Small Steel Cupboard, Steel Door and
and Fabrication:	Window Frames, Steel Gates, Sluice Gates and Guides.
- Steel Contriner:	Steel Tanks, Small Silos, Hopper Dying Vats.
- Household Use:	Sheet Netal - Nurs, Funnel, Cans, Buckets, Steel
	T-joint and elbowpipes.
- Agricultural	Assembly of Harrow, Tillers, Plouchs, Small
Imloments:	Trailers (two wheel), Screw Conveyor.
- Rural Textile	Dying Machines, Simple Textile Parts for Hand Looms,
licchinery:	Carpet Looms.

Overall Evaluation

This type of multiproduct metal working shop plays an important role in village industry level. It produces and provides diverse products and parts from agricultural to household sector and interlinks many other industries at village level. Improvement in transport facilities will enlarge the activities of this type of industry at village level. Viability of this industry at village level greatly depends on ptential demand at village level. Local market requirement possibilities should be carefully surveyed.

Market Asnects:

- 1. Users: The prospective users of the product from this type of plant are: formers, villagers, textile and hand loom weavers, small contractors for building, irrigation channel etc. shop keepers.
- 2. <u>Method of Sales</u>: Directly to the customer, often products are manufactured according to the customer's order.
- 3. <u>Market Potential</u>: These products can be marketed at an wider area, covering about 25-30 villages.

1453	DESCRIPTION	NO .OFF.	PRICE UNC Estimated
11. 12. 13.	Electric Arc Welding Mechine - 250 Amps Gas Welding Set and Brasing Set Welding Fixtures and Tool Flyball Press - 3ton Manual Roll Bending Machine up to 4 cm dia Nod in Hot Portable Hand Drill Gun up to 1.25 cm dia in MS Portable Grinder with wheel dia up to 15 cm Furnace oil fired or coal fired size 60cm x 60cm x 75 cm	1 1 ot 1 ot 1 1 1 1 1	1,000 1,000 500 1,000 300 150 200 4,000
15. 16. 17.	Anvils with Pedestal 500 kg Quenching Tank 1.0 m x 1.0 m x 1.0 m Various Small Tools Hand Nibbling Gun for 1.5 thick MS Paint Brushes, Nixing Tank etc	4 1 1 ot 1 1 ot	600 300 300 300 200

Total

23,000

Floor Area

The total area required for plant of this type will be as follows:

- 1. Covered Area: 48m x 30m = 1,344 sq.m
- 2. Open Area for Fabrication Work: 30m x 30m = 900 sq.m

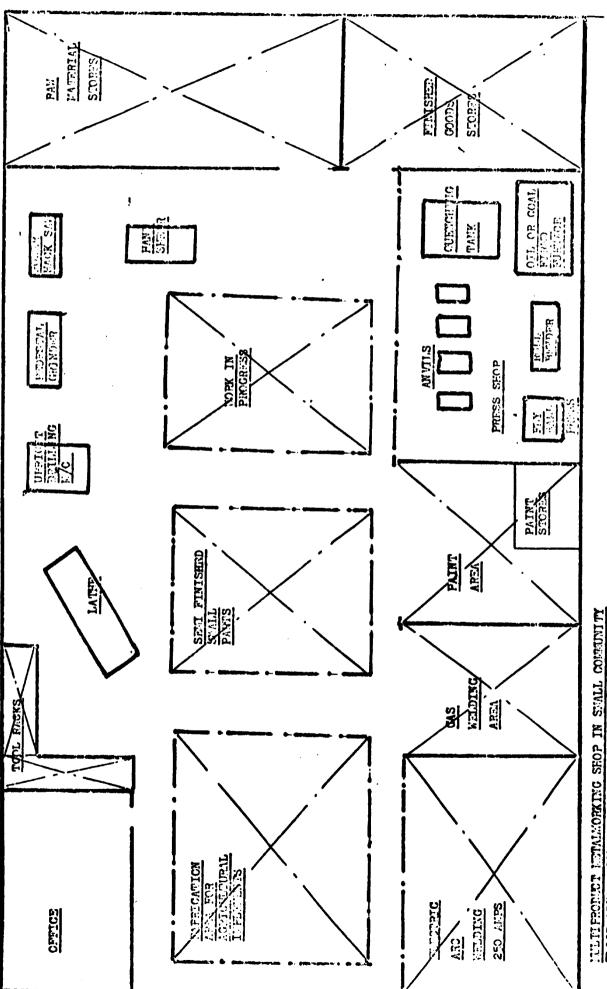
Manpower Requirement:

Direct Labour - Skilled Semiskilled Unskilled		12 5 6
Indirect Labour and Staff - Manager Accounts Clerk Draughtsman/Foreman Inspector Watchman Labourer		1 1 1 1 1 2
Total	•	30

Training Asnect:

Particular consideration is required to train the following personnel:

- 1. Weldors
- 2. Fitte
- 3. Turne
- A 17, F F 4



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(d) <u>General Fruits and Vocetable Mooden Crates Manufacturing Shops in</u> <u>Small Community</u>

Product Description

- This type of small shop capable of producing the following items:
- wooden crates (vegetables) sizes: 12" x 24" x 12" and 18" x 30" x 12"
- wooden crates for fruits, sizes: 10" x 18" x 4" and 18" x 30" x 6"
- wooden pallets 36" x 24" x 10" or according to customer's specification
- wooden racks
- wooden ladders

Overall Eveluation

These products are essentially required by the farmers and the shopkeepers. The products can easily be produced from any type of cheap wood or even from the waste wood from large factories in urban or rural areas. The crates can easily be fabricated from wooden strips by fixing with nails. The installation of this type of plant should be in areas where inténsive vegetable and fruit production takes place.

Market Annocts

- 1. Users: Small farmers, Vegetable and Hoticultural Growers, Fruit Growers and Suppliers
- 2. Method of Sales: Direct sales to the consumer
- 3. <u>Market Potential</u>: The product can be marketed to about 10 to 15 villages. Transport of empty crates to long distance customer is not economical
- 4. Requirement of Feasibility Study: May not be required
- 5. Expert Assistance: Not required
- 6. Joint Venture: Not required
- 7. Linkage with other industry: Large woodworking Industry, Packaging Industry, Hardware Industry, Vegetable and Fruit Co-operatives

Material Specification

Any soft or hard wood and particularly the waste wood form large woodworking or packaging industries. Production Volume: Pased on 250 working days - 1-shift basis

Vegetable Crates	-	150,000	pieces/year
Fruit Crates	-	150,000	nieces/year units/year
#Wooden Pallets	-	800	units/year
*Racks	-	20 0	units/year

* According to customer's order and specification

Machinery and Eminment

ITH	DESCRIPTION	NO.OFF.	PRICE USS Estimated
1.	Stationary or hand operated cross cut saw	1	500
2.	Planer and Thickness Planer	1	2,000
3.	Band Saw	1	1,000
4.	Assembly Table	1	100
5.	Vice	1	50
6.	Hand Drill gun, ¹ / ₂ " dia in MS	1	100
7.	Small tools, hammer etc.	lot	250

Total

4,000

1

Floor Area

The total area required will be as follows:		
- Covered Area for manufacture of crates etc.	 '	30m x 21m = 630 sq.m.
- Open area for storage of crates prior		
to delivery	-	$30m \ge 15m = 450 \text{ sq}_{\circ}m_{\circ}$

Mannower Requirement

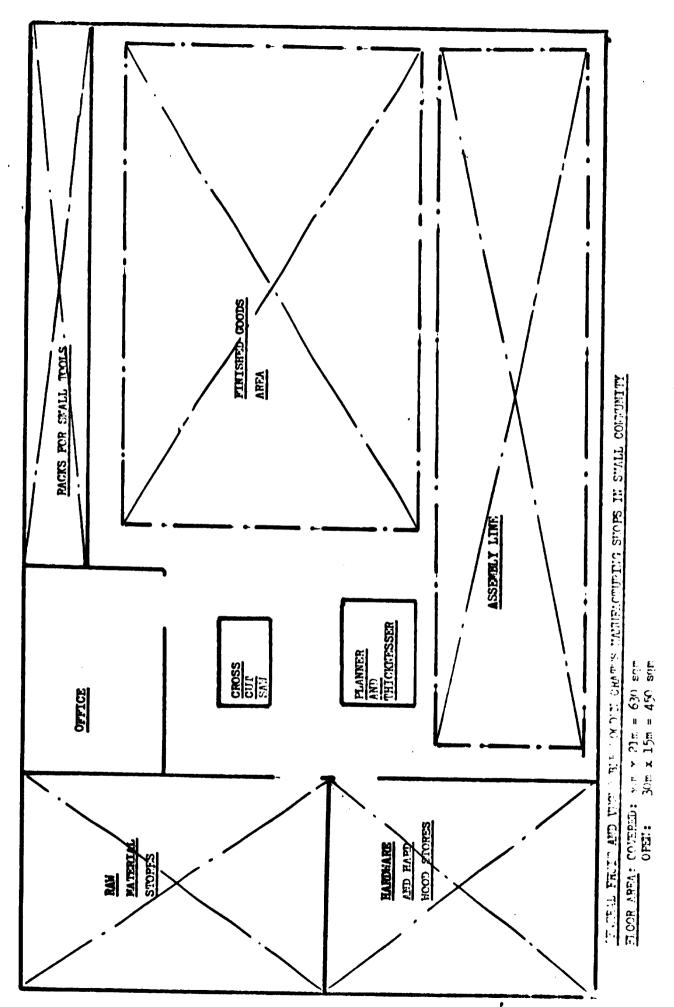
Direct Labour - Skilled		2
Semiskilled	-	8
Unskilled	-	2
Indirect Labour - Accounts Clerk (part-time) Sales/Supervisor Clerk	-	1
Labourer	-	ī
Total		15

Training Aspect

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Training or simple joinery is adequate.



TECHNICAL PROFILES FOR LIGHT ENGINEERING INDUSTRIES AT CENTRAL VILLAGE LEVEL

GENERAL PURPOSE SERVICE WORKSHOPS

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- 1. Upgraded Artisan Level Metal Workshop.
- 2. Upgraded Artisan Level Sheet Metal and Pipe Fitting Workshop.
- 3. Upgraded Artisan Level Joinery Workshop.
- 4. General Electrical Workshop.
- 5. Workshop for Servicing and Simple Repairs to Agricultural and Road Transport Equipment.

1. Upgraded Artisan Level Metal Workshop

Product or Service Description

The workshop will perform a variety of maintenance services for agriculturists, craftsmen and others in respect of their equipment, and produce some quantities of regular tools, implements and hardware regularly required locally. The products will be of improved varieties than those of traditional blacksmiths as improved materials and tools will be used, and trained skills applied on the job. A representative list of products and services is given below:

- Sharpening, tempering, hardening, agricultural (and artisan) hand-tools and implements such as knives, sickles, chisels, ecissors, mower blades etc.;
- Making of such tools, and hardware such as rural narts, rivets, hingers, wall brackets;
- Simple repairs to metal parts of agricultural machinery and tools, which require welding, rivetting, herding.

Overall Evaluation

In terms of all simple machinery and toole used in the area, the workshop must be able to provide a complete service not requiring them to go outside the area. In respect of more complicated items such as broken gear wheels, or bearings, this service should be obtained from the next higher level of village.

Market Aspects

All sales and services will be at the workshop premises. Capital of the owner should permit him to store sufficient quantities of common materials e.g. profiles and sections, plates, sheete, ready made rivetts, bolts, muts, screws, etc. When a number of units are set up in a cluster, or similar units are set up in different, the possibilities of pooled purchase through a supply service cooperative should be examined.

Expert Assistance

Initial assistance will be required for layout of the shop, installation of the machinery and laying out electrical connections.

Linkage with Other Industries

As the unit will be in a workshop cluster, the other units in the cluster will provide mutually supporting services.

Machinery and Equipment

Total

ITEM NO.	DESCRIPTION	NO. REQD.	ESTIMATED PRICE USS
1.	Fitters Work Bench, 60 x 200cms. With 2 jaw- vices, 140mm and drawers	1	700
2.	Drill stand for use with portable heavy duty drill	1	100
3.	Pedestal Grinder, 20cms, double ended	1	500
4.	Transformer type arc welding, machine accessories, 120 - 150 amps		2,500
5.	Portable Electric Drill-cum-Grinders	2	500
6.	Anvil, forge with femblower and sledge hammer	1 set	250
7.	Set of measuring and marking tools, and) holding devices (scales, colipers, dividers,) ganges, angles, clamps, V-blocks, etc.)		
8.	Set of metal working hand tools and cutting () tools, for machines (hammers, wrenches,) chisels, pliers, srewdrivers, hacksaws,) files, drillbits, srew tops and dies etc.)		2,000
9•	Protective equipment, e.g. welding goggles) and shields, gloves, firstaid kit, etc.		
10.	Office table and chair		300

6,850

Say 7,000

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Covered Floor Area Required

Approximately 70-80 sq. meters. Larger items of assembly and welding jobs could be done outdoors if climatic conditions permit. Therefore an enclosed yard should be available.

Manpower Required

Direct Labour	-	Owner/superviser/worker	- 1
		Welder	- 2
		Blacksmithy and Fitter	- 2
		Semiskilled hand	- 3
		Total	8

Possible need of a part-time accountant.

Training Required

- The owner operator should preferably be trained in a vocational training centre in metal trades, and skilled workers in rural vocational training centres.
- This workshop could be used by government agencies for on-the-job training programmes after an initial period of basic training, and the on-the-job training to be linked with related instruction programmes.

Phased Development

The workshop may start initially without a lotte which may be acquired later on.

2. Upgraded Artisan Level Sheet Metal and Pipe Shop

Product of Service Description

The workshop will perform a variety of jobs of repairs, maintenance, and small-quantity production for rural needs. A representative list of products and services to be rendered is given below:

- Tinsmiths work such as repairs to lanterns and oil burners. Tinning of vessels;
- Locksmithy work;
- Making or repairing of simple containers, bins etc. for grains, water, oil. Making of medium sized water tankes
- Making or repairing of Persian wheel buckets and chairs where such lift irrigation systems are in use;
- Making or repairing brick moulds, bread baking trays, winnows, trays for drivers of fruits, tea, coccons;
- Making of ductwork, rainwater drain pipes and sponts, where such items are used with sheet metal;
- Undertaking pipe fitting in pumps, overhead tanks, community water taps, and in public buildings such as village bath houses, etc.;
- Making of wheel barrows with sheet metal and pipe bending and use of wheel and bearings as purchased components;
- Spray painting and brush painting jobs.

Overall Evaluation

Not all these products or services will be required in all central villages in every country. Much will depend on the traditions of the area and evolving lifestyles and needs. This combination of two separate trades has been made to obtain viability of the occupation.

Market Aspects

Most of the production and services will be rendered at the workshop premises except the pipe fitting jobs to be done at user premises. It will be useful to stock some sheet metal and pipes and pipe fittings, washers, taps, etc. A supply cooperative among units in a cluster can be an advantage.

- 40 -

Expert Assistance

Not required if the owner/entrepreneur is a trained hand.

Linkage with Other Industries

As the unit will be in a workshop cluster, the other units in the cluster will provide mutually supporting services.

Machinery and Equipment Required

ITEM NO.	DESCRIPTION	NO. REG	111 1	TIMATED ICE USS
1.	Hand shear up to 3mm sheets and plates	1		250
2.	Gas Welding Machine with cutting, brasing set, oxygen and acetylene cylinders	1		750
3.	Portable Electric Drill	1		250
4.	Soldering Irons, electric and furnace types	4		50
5.	Spray painting set with compressor with 6 atms rating	1		200
6.	Plate bending machine (manual) up to 3mm plates	1		75
7.	Roll bending machine (manual) for hot and cold bending			
8.	Straight edges, mollets, hammers, clamps, snips and cutters, punctes, etc. for sheet metal work			-
9.	Simple measuring and marking devices) (scales, colipers, scriber, pangles, gange))			
10.	Tools for pipe work (leg vice or pipe vice,) hacksaws, pipe cutter adjustable, pipe threading dies, files, pipe bender, etc.)			1,500
1:•	Soldering, brazing, tinning tools and) blow lamps etc.			
12.	Table and chair			200

Covered Floor Area Required

Approximately 40-50 sq. maters. Most of the work can be done inside the workshop.

Manpower Required

Direct Labour:	Owner/worker	- 1
	Tinsmith and sheet metal worker	- 1
	Gas welder and spray painter	- 1
	Semiskilled worker	- 1
	Total	4

Training Requirements

- The owner should prefereably have received training in a vocational training centre in sheet metal work and the skilled workers in rural vocational training centres.
- The workshop could be used by government agencies for on-the-job training of trainees who have received basic training.

Phased Development

Nil.

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3. Upgraded Artisan Level Joinery Workshop

Product of Service Description

The workshop is intended to meet all the requirements of wooden items of furniture, fixtures, building components, agricultural implements (where wooden ones used) etc., both in terms of production and repairs. A representative list of products and services is given below:

- Making or repairing of wooden ploughs where such items are used. If an improved plough is proposed to be introduced, such a workshop would be an institution to produce and propogate it;
- Making and repairing of bullock or horse carts, cart wheels etc. by improved methods of turing;
- Making of institutional furniture e.g. school benches, chairs, study tables, furniture for government offices, clinics, etc.;
- Naking of household furniture as are used in the region, e.g. beds, baby-cribs, chairs, tables, etc. Polishing and painting;
- Making of wooden door and window frames, shutters, simple roof truss components for assembly on site;
- Making or repairing of wooden textile looms, carpet looms, winding devices, etc.

Overall Evaluation

The meeds of regions in terms of furniture, housing, agriculture and crafts will wary considerably from region to region and country to country. An area poor in forest resources and where wood is costly, will go in more for steel products, tools and components. A proper assessment is therefore necessary.

Market Aspects

Almost all the production will be carried out and services rendered at the workshop premises. Arrangements would be needed for supply of good wood, properly seasoned naturally or in a kiln. Suitable log sawing establishments must be available nearby for obtaining sized wood.

Expert Assistance

No assistance is required if owner/entrepreneur is a trained hand, excepting in the initial installation of electrical equipment.

Equipment Required

ITEM NO.	DESCRIPTION	NO. REQD.	ESTIMATED PRICE US\$
1.	Electrical Bank Saw 1.0 m with 1.25 cms blade	1	8 00
2.	Multipurpose wood working machine (planer, circular saw, groover, mortiser)	1	2,000
3.	Woodworking lathe	1.	1,000
4.	Portable Electric Drill	1	150
5.	Woodworking workbench with with 2 vices	1	500
6.	Measuring, marking, holding tools and fixtures		_
7.	Normal range of woodworking hand tools) (chisels, files, saws, hammers, mollets,) drill bits, mitrebox with saw, etc.)		1,000

Total

5.450

Say 6,000

Covered Foor Area

Approximately 70-80 sq. meters required. In addition an open type covered area of about 25-30 sq. meters, required for stacking of sized wood for seasoning and normal storage.

Manpower Required

Direct Labour:	Owner/worker	- 1
	Joiner and band saw operator	- 1
	Cabinet maker, universal wood machine operator	- 2
	Semiskilled hand	- 2
	Total	6

Training Requirements

The owner/worker needs to be trained at a vocational training centre in joinery and cabinet making. The other skilled workers should be trained in rural vocational training centres in general woodwork.

The workshop could be utilised by government agencies for on-the-job training of trainees who have completed basic training. The on-the-job training period should be linked with related instruction programme.

Phased Development

Nil.

12

4. General Electrical Workshop

Product or Service Description

The workshop is needed in all "<u>Central Villages</u>" which have electricity. It will provide all types of services for households, rural industry and agriculture of the central village and its hinterland, such as:

- House wiring in private houses and institutional buildings, including meters;
- Wiring and small switchboard installation for motors and other apparatus such as in agricultural pumps, small industry fans, agitators and blowers;
- Installation of radio and television aerials and earthing in homes and institutions, as well as refrigerators, coolers, stoves and such other domestic and institutional electrical apparatus (including those in hospitals, clinics, schools and offices) as have come into use in rural areas;
- Simple repairs and maintenance of motors and electrical apparatus such as testing of faults in motors, cleaning of commutators and sliprings and changing of brushes, changing or repairs to heating elements in room-heaters, toasters, water heaters, etc.

Overall Evaluation

In many rural areas, while electricity has been provided, no facilities for house wiring, simple installation, repairs and maintenance of electrical apparatus has developed. Such a workshop is intended to meet such a dire need.

Market Aspects

Part of the services will be provided at user premises and part will be provided at the workshop. The workshop needs to store general used electrical hardware such as bulbs and tubelights, switches, tubelight starters, fuses and fuse wire, wiring, condnits and condnit fittings, etc. for sale and use. Not required if the owner/entrepreneur is a trained hand.

Linkage with Other Industries

As the unit will be in a workshop cluster, the other units in the cluster will provide mutually supporting services.

Equipment Required

1 tem No.	DESCRIPTION	NO. Reqd.	ESTIMATED PRICE US\$
1.	Workbench with small jaw-vice 90 mm and drawers	1	400
2.	Portable Electric Drill with vertical drill stand	1	300
3.	Nultimeter, voltmeter, amp. meter, ohm meter, energy meter, insulation tester. All to be mounted in a switchboard (except multimeter) with switches, fuses and small transformers.	1 set	150
4.	Wire strippers, wire cutter, insulated pliers, line tester, nose pliers, rubber bloves, etc.	1 set	50
5.	Common hand tools (hacksaw, screwdrivers, chisels, hammers, pipethreader die, spanners, wrenches	1 set	100

Total

1,000

Covered Floor Area Required

Workshop need not be bigger than a room of $3m \times 3m$ for both the retart store and repair work.

Manpower Required

Owner/worker	- 1
Semiskilled hand	-1
Total	2

Training Requirements

The owner operator should have received training in a vocational training centre, urban or rural, in a broad based electrical course covering both house-wiring and apparatus repairs. The semiskilled hand should preferably have received training in house-wiring only.

Phased Development

Nil.

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5. <u>Workshop for Servicing and Simple Repairs to Agricultural</u> and Road Transport Machinery

Product or Service Description

Such a workshop is intended to perform a function of what a firstaid station or day-clinic does in relation to the role of a hospital. It shall perform the functions which are too costly for individual tractor, truck or car owners to have in their own premises, and also too costly for them to go to a distant market town to obtain such services. The types of services to be performed are as follows:

- Cleaning, oiling, greasing, oil changing, oil and petrol tank draining and cleaning, oil and air filtres changing, spark plugs checking and changing;
- Providing a complete battery service, i.e. checking, fluid topping, charging and recharging and leakage testing;
- Providing a complete tyree and tubee service, i.e. pressure testing, changing of tyree and tubee, vulcanising, etc.;
- Brakee testing, changing of brake pads and liners, bleeding of the system, adjusting;
- Simple electrical faults testing and correcting. Distributor and contact points cleaning and changing;
- In collaboration with metal shop, repairing any structural parts of vehicles.

Overall Evaluation

The need for such a service will depend on the tractor density in a central village and ite hinterland. Also on the other materiale and personnel transport vehicles in an area. Sometimes if the village is on a highway, it will depend on the density of traffic and the distance from the last unit providing such services. In the latter case, it could be combined with a petrol filling station.

Covered Area Required

About 60-70 sq. meters plus a covered ramp and trench for under-body work.

Manpower Required

Owner/worker	- 1
Skilled worker	- 2
Cleaner	- 2
Total	5

Training Required

The owner/worker should have been trained in diesel and petrol engines in a regular vocational training centre course, and the skilled worker in auto-mechanics or agricultural machinery engines in a rural vocational training centre.

Phased Development

Nil. Such a workshop may grow in range of service if provides as the clientele grows.

Market Aspects

All the services will be provided at the workshop premises. Items such as oil, grease and common types of oil filters, contactors, fuses, etc. could be kept in stock for sale.

Expert Assistance

Nil, if the owner/worker is a trained hand.

Linkage with Other Industries

If the unit is part of a workshop complex, or near it, considerable amount of inter-servicing could be facilitated such as in welding and fitting jobs, electrical jobs, painting jobs, etc.

Machinery and Equipment

ITEM NO.	DESCRIPTION	NO. REQD.	ESTIMATED PRICE US3
1.	Workbench with one jaw-vice 140mm and drawers	1	400
2.	Electric water pump with hose and nozzle (assuming that water to be obtained from well or similar source)	1	250
3.	A-frame with chain hvist	1	150
4.	Portable electric drill with drill stand	1	300
5.	Battery charger	1	150
6.	Garage jack	1	500
7.	Tripod axle stands	4	200
8.	Pedestal grinder/buffer	1	400
9.	Diesel Engines Nozzle Tester	1	300
10.	Coils and condenser tester	1	200
11.	Gearoil dispenser	1	250
12.	Voltmeters, ammeters, plugs	1	150
13.	Switches and switchboard, brake-lining machine	1	500
14.	Vulcanising equipment	1	50
15.	Tyre mounting stand	1	150
16.	Hand-tools, drillbits, files, hammers, wrenches wheel pullers, grease gun, spanners, screwdrive pliers, taps and dies	-	400

Say 4,500 TECHNICAL PROFILES FOR LIGHT ENGINEERING WORKSHOPS AT RURAL MARKET TOWN LEVEL

SPECIAL PURPOSE SERVICE WORKSHOPS

- 1. Diesel Engines Pumps and Injectors Testing and Calibration Workshop.
- 2. Road Transport Vehicles Body Repairs, Panel Beating and Paint Shop.

General Note

Such a highly specialised work can be made into a viable occupation for one person, having a workshop in a fairly small room and doing nothing else than such work, only if certain conditions are met. Some of these conditions are:

- a. There is a high density of tractors, diesel road vehicles and diesel stationary engines in the area serviced by the market town;
- b. Owners of such engines are concious of the need for such testing, adjusting and calibration in order to avoid fuel waste, pollution, etc.;
- c. There are strict government regulations on highways passing through the town regarding pollution arising from diesel fumes.

In such a case, servicing 3-5 pumps a day for 250-300 days a year could be quite viable.

No detailed profile for such a workshop has been provided as this section has been included in the Technical Profile of the Large, Repairs, Maintenance and Components Manufacturing Workshop.

2. Road Transport Vehicles Body Repairs, Panel Beating and Paint Shop

Product and Service Description

The workshop will provide a specialised service in regard to body work of automobiles, trucks and busses. The main types of service will be:

- Removing dents on body, panel beating, shaping and smoothening;
- Applying prime coat of paint, finishing coat and polishing;
- Repairing or changing of upholstery, door linings and beadings, seats etc.

Overall Evaluation and Market Aspects

Such a specialized service can become viable if there are sufficient motor cars and busses in the area served by the market town. Tractor density of an area will not be important for this purpose, though they do require some body work at times. The flow of traffic on a highway passing through the town will also not be important as highway users passing through a town do not use such a service.

Expert Assistance

Not required if owner/worker is a trained hand.

Linkage with Other Industries

As this is a specialised work, linkage with other service units necessary. Even before dent removing starts, sometimes electrical wires or instrument connections near the dent will have to be removed or disconnected. Therefore existence of such specialists nearby would be a help. A cluster arrangement is ideal.

Machinery and Equipment

ITEM NO.	DESCRIPTION	NO. REQD.	ESTIMATED COST USS
1.	Portable Electrical Drill and buffer with vertical stand	1	250
2.	Portable electrical or pneumatic nibler	1	150
3.	Pedestal grinder, 20cms, wheels, double ended	1	500
4.	Angle bender	1	-
5.	Workbench with one jaw-vice 140mm	1	400
6.	Garage jack	1	500
7.	Tripod axle stands	4	200
8.	Large screw expander (adjustable)	1	7 5
9.	Spray paint set with spray gun	1	200
0.	Set of handtools	1	500

Say	3,000

Covered Floor Area Required

Approximately 50-80 sq. meters. Part of this space will be secluded out for spray painting jobs. Preliminary jobs can be done in an open yard provided climatic conditions permit.

Manpower Required

Owner/worker	- 1
Panel beater	- 1
Semiskilled hand	- 1
Total	3

Training Required

The owner/worker should have received training in sheet metal work and spray painting and finishing, and apprenticed for at least a year in a good garage. The panel-beater should have apprenticed in such work for 1-2 years.

Phased Development

Nil. The work can expand in range into signboard making and painting, and making of and painting of sheet metal products provided such items are in demand. TECHNICAL PROFILES FOR LIGHT ENGINEERING WORKSHOPS AT RURAL MARKET TOWN LEVEL

SPECIAL PURPOSE PRODUCTION WORKSHOPS

- 1. Foundry and Forge Shop.
- 2. Household Metalware (Holloware and Tubular) Manufacturing Workshop.
- 3. Large Repairs, Maintenance and Components Manufacturing Workshop.

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(a) Large Foundry and Forging Shop in Warket Town

Product Description

This type of plant will be capable to produce:

- <u>Grey Cast Iron Shape Castings</u> (Grade 14 to 17) up to 100 kg weight e.g. Manhole Covers, Brackets for Agricultural Implements, Various parts for Sugar, Cil Seed, Rice Mills, Various Parts for Drainage Cystem, Checker Plates, Electrical and Telephone Transmission Brackets, Junction Box, Cable Box, Supply of small castings to small metal working shops in village and urban areas.
- Brass Shape Castings (Cu-40% to Zn-60%) up to 1 kg weight for Pump Impellers, Gland Body for Valves, Taps and Water Fittings, Bush Bearings.
- Aluminium Shape Castings (Duraluminium) up to $\frac{1}{2}$ kg for Al-Pulleys, Wheels, Brackets, Electrical Claddings, Junction Box etc.
- <u>Steel Forging Shop</u> will produce shovels, Pronge and Tines, Cultivators, Electrical Bracket for high-tension transmission, Small tools e.g. hammer, chisel, shear blades etc.

Overall Evaluation

Such type of large foundry and forging unit in a market town of rural areas can act as a launching pad for greater industrial activities particularly in wider metal working sector. On one hand such a plant will produce parts and objects for capital goods industries and on the other hand, it will promote subcontracting system for many small industries. Without the existence of such a basic industry, the rural industrialization cannot be extended. It is possible for a foundry of this nature can expand the activities of related metal working establishments to 200 villages. The prospect of viability depends on potential demand both in rural and urban areas. Market requirement possibilities should be carefully surveyed before the investment on plant and machinery.

Market Aspects

 <u>Users</u>: Metal Working Shops, Building Contractors, Contractors of roads, water supply, telephone and electrical transmission structures, agroindustries manufacturing machinery and implements, automotive industries etc.

- 2. Method of Sales: Directly to the customer on job order basis
- 3. Market Potential: For local and wider rural areas including urban market
- 4. Requirement of Fersibility Study: Necessary before the investment is carried out
- 5. Expert Assistance: Required in the following areas:
 - (a) Foundry Technology
 - (b) Pattern Making

 - (c) Metallurgy (d) Core and Mould Making
- 6. Joint Venture: Required for technical know-how
- 7. Linkage with other Industry: Multi Product Metal Working Industries. Coal Industries, Wood Industries, Agricultural Machinery Industries, Contractors of Construction Industries etc.

Material Specification

Foundry will be capable to produce Grey Cast Iron from 14 to 17 grade weighing shape castings up to 100 kg and Brass and Aluminium Castings up to 1 kg - $\frac{1}{2}$ kg respectively.

Production Volume

 $1\frac{1}{2}$ tons per hour cupola furnace to be charged 2 times of a week depending upon work load. Output per week will be 30 to 40 tons of liquid metal of Crey Cast Iron.

Machinery and Equipment

ITEM	DESCRI P'FION	NO.OFF.	PRICE US® Estimated
	1 ¹ Ton per hour Cupola Furnace for melting liquid grey cast iron. Inside diameter of cupola = 24 inches Height of cupola = 15 feet with blower and motor, roof board, cupola lining etc. Charging Hoist and Structure -1 ton capacity	1	10,000
		l set	700
3.	Core oven and sand conditioning machines	l set	3,500
	Noulding Machine with maximum casting capacity 18" x 12" x 12"	2	5,000

19,200

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ITEN	DESCRIPTION	NO.OFF.	PRICE US [*] Estimatori
			19,200
5.	Cope Boxes for floor moulding (various sizes)	100	2,500
6.	Platform Scale 0-2 ton reading	1	1,500
7.	Ladles - 1 ton capacity	2	1,200
8.	Ladles $-\frac{1}{2}$ ton capacity	2	600
9.	Ladles - 100 kg capacity	2	300
10.	Hand Shanks and Ladles 20kg, 10kg, 5kg	6	200
11.	Crane System with 1 ton Hoist	1 set	2,000
12.	Shovel, Riddles and Screens	lot	5 00
13.	Double Ended Grinding Machine - 12" wheel dia	2	1,000
14.	Tumbler, 2-air grinder, chipping hammer	lot	800
15.	Fettling Machine Pneumatic	1 .	7 00
16.	Wheel Barrow	3	300
17.	Exhaust Fan	1	150
18.	Compressor Set, 200 cuft/min, 120 psi	1	3,000
Patter	n Vaking Shop		
19.	Woodworking Lathe up to 3" dia workpiece	1	1,200
20.	Band Saw - $\frac{1}{2}$ " Blade	1	800
21.	Belt Sander	1	300
22.	Hand Operated Cross Cut Saw	1	400
23.	Drilling Machine - $\frac{1}{2}$ " in MS	1	500
24.	Woodworking Tools	10 t	500
Foundr	y Testing Ecuipment		
25.	Core testing equipment	l set	300
26.	Sand testing ecuipment	l set	200
27.	Laboratory equipment	l set	2,000
Non-Fe	rrous Brass Foundry		
28.	Crucible Furnace indirect oil fired capable to produce liquid Brass 300 kg per charge, complete with pyrometer ladles, hand s etc.	l set	8,000
29.	Resin Core making machine and Oven	l set	3,000
30.	Fettling Machine (Pneumatic)	l set	500

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1 1547	DESCRIPTION	NO.OFF.	PRICE USS Estimated
Non-Fo	errous Aluminium Foundry		
31.	Crucible Furnace indirect oil fired capable to produce liquid Aluminium 100 kg per charge, (other facilities can be obtained from the main ferrous foundry)	l set	3,000
Formin	<u>r Shop</u>		.
32.	Power Shear du thick steel plate	1	500
33.	Oil or coal fire and furnace Size 24" x 24" x 18"	1	5,000
34.	Mechanical spring forge - 10 Ton capacity for hot forging, 3 HP motor	1	8,000
35.	Quenching Tank, 36" x 36" x 36"	1	500
36.	Anvil with pedestal 500 kg weight	4	250
37.	Double Ended Polishing Machine ½" HP 12"-wheel dia	1	400
38.	Manuel Roll Bending Machine for 3/4" thick rod (Hot)	1	250
39.	Namual Plate Bending Machine - $\frac{1}{2}$ " thick plate (Hot)	1	300
40.	Electric Arc Welding Machine 150 Amps	1	300
41.	Blacksmiths Tool	- lot	500 600
42.	Niscellaneous		250

Total

74,000

Floor Area

Covered area required for foundry: 1275 sq. m. Covered area required for pattern making: 15m x 10m = 150 sq. m. Covered area required for forging: 25m x 20m = 500 sq. m. Total area required = 1925 sq. m. Total covered area = 19255 sq.m. Total open area = 900 sq. m.

Supplies for Running the Cunola

Pig Iron, Scrap, Coke for Casting, Wood for Pattern Making, Houlding Sand, Core Sand, Fire Bricks, Fire Clay, Flux, Core Oils, Wires, Rods, Chaplets

Supplies for Forging Shop

Steel Specification - SAE 1078 - Carbon 0.72 - 0.85 Manganese 0.30 - 0.60 Carburising Steel - EN 32, 32A, 34 Quenching Oil, Oil for furnace etc.

Supplies for Non-Ferrous Foundry

Brass Ingots: (Cu-40% - Zn 60%) or Cu 30% - Zn-70%) Aluminium Ingots: Pure or Duraluminium Ingots Core Sand (50 meshsize), Moulding Sand, Resin, Furnace oil, Charcoal etc.

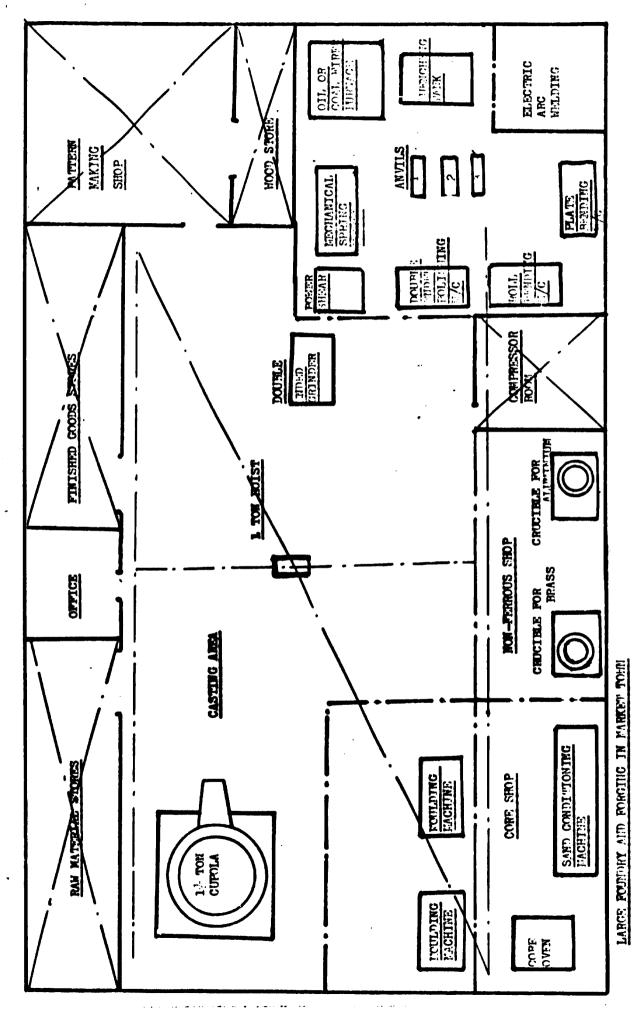
Manbower Requirement

Direct Labour -	Skilled Semiskilled Unskilled		18 10 15
Indirect Labour	- Manager	-	1
	Foreman	-	2
	Patternmaker	-	2
	Accountant	-	1
	Clerk	-	2
	Sales Clerk	-	1
	Inspector	-	3
	Production Recorder	-	2
	Stcrekeeper	-	2
	Watchman	-	1
			60

Training Aspect

Particular consideration is required to train personnel on the following activities in foundry and forging:

- Foundry Technologist (Ferrous and Non-Ferrous)
- Mould Maker
- Cupola Charger
- Pattern Maker
- Heat Treatment Operator



HJOOR ARMA: COVERED: 55m x 35m = 1,925 cm OFFU: 30m x 30m = 900 cm

(b) Multipurpose Household Netalware Shop in Market Town

Product Description

This type of multipurpose household metalware workshop will be capable to produce:

- Aluminium Kitchenware e.g. pots, pans, cooking vessel, spoon, saucepans etc. up to 18" dia
- Aluminium simple lamp sheds up to 9" dia
- Aluminium Corrugated Roof Sheets from Aluminium sheets up to 1/16" thickness, size 8ft x 4ft
- Kerosene Farm Lanterns (MS. Sheetmetal)
- Kerosene Stoves (Brass Sheetmetal
- Tubular Furniture (Steel simple table, chairs etc.)

Overall Evaluation

Such type of multipurpose metalworking shop will cater the need for household requirement of rural areas. The products of this industry can even be marketed in urban areas. The prospect of viability depends on potential demand both in rural and urban areas. Market requirement possibilities should be carefully surveyed before the investment on plant and machinery.

Market Aspects

- 1. Users: Village, town and oity inhabitants for domestic use. Interest can be extended to the hotel and catering services.
- 2. Method of Sales: Directly from the factory and also through the egents, distributor and wholesellers.
- 3. Market Potential: For local and wider rural and urban market areas.
- 4. Requirement of Feasibility Study: Important before the investment is considered.
- 5. Expert Assistance: Required in following areas:

 - (a) Design, Development and Adaptation
 (b) Metal Spinning and Flow Forming
 (c) Welding and Brazing Technique in Sheetmetal.
- 6. Joint Venture: Recommended
- 7. Linkage with other Industry: Hardware, Galvanizing Plant, Wick Industry, Rubber Industry, Foundry, Sheetmetal Industry for Ferrous and Non-Ferrous.

Material Specification

Aluminium Kitchen Mare Products

- (a) Aluminium Circles 3", 5", 7", 10" sizes 1/32" to 1/16" thick with "Zero" anneled condition for spinning.
- (b) <u>Aluminium Roof Sheets</u>
 Aluminium Sheets up to 1/16" thick 8ft x 8ft to give resultant product 8ft x 4ft size.
- (c) <u>Kerosene Farm Lanterns</u> Galvanised Sheet Mildsteel. 18 SWG 8ft x 4ft
- (d) <u>Kerosene Stoves</u> Brass Sheet 20 to 22 SWG 8ft x 4ft
- (e) <u>Tubular Furniture</u> Mildsteel Tuble - Standard <u>1</u>", 3/4" and 1" sizes.

Product Volume: 250 days and hours shift

(a) <u>Aluminium Kitchenware</u> - Mixed	product - 150,000 per year
(b) Aluminium Roof Sheets -	- 100,000 -"-
(c) Kerosene Farm Lanterns -	- 10,000 -"-
(d) Kerosene Stoves	- 10,000 -"-
(e) Tubular Furniture	- 10.000 -"-

Machinery and Equipment

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ITEM	DESCRIPTION	NO.OFF.	PRICE USC Estimated
1.	Hand Shear - 1" thick in MS	1	500
2.	7" Spinning Lathe complete with 3/4" x 90° revolving centres, Two speed motor, Two speed starter, 10-spinning tools, Trimming and Beading Slide	1	2,500
3.	12" Spinning Lathe with above specification	1	5,000
4.	CostiSoda treatment vats with electrical heating	l set	1,000
5.	Roll Corrugation Machine 10ft width with variable profile corrugation system	1	10,000
6.	Tube Bending Machine to bend 1" dia MS tube up to 270	1	2,500
7.	Tube expanding and narrowing machine	1	2,500
8.	Hammer Rivetting Machine to rivet up to 1/4" dia in brass or aluminium	1	3,000
9.	Lathe. Max. Bore 3" Swing 18" Max. Length 24"	1	5,000

I TEM	DESCRIPTION	NO.OFF.	PRICE US! Estimated
10.	Upright Drilling Machine to drill up to $3/8"$ in MS	2	7,000
11.	Pedestal Grinder Double Ended - 12"dia wheel	2	1,600
12.	Double Ended Polishing and Buffing Machine	4	2,500
13.	Capstan Lathe with hex. turret and attachment Swing 6", Gap 12"	1	7,000
14.	Electric Argon Arc Welding for Aluminium 100 Amp	s 1	1,000
15.	Electric Arc Welding Machine 250 Amps	1	1,000
16.	Fly Ball Press	1	250
17.	Portable Drill and Grinder	2	250
18.	Roll Bending and Flat Bending Machine	2	500
19.	Compressor Set, 125 psi, 200 cuft/min with spraying equipment	1	3,000
20.	Spinning dies	lot	4,000
21.	Welding Fixtures etc.	lot	2,000
22.	Small Tools	lot	1,000
23.	Bins, Stillage, Racks, Pallets	lot	3,000
24.	Delivery Van	1	4,000
25.	Miscellaneous		900

Total

71,000

Floor Area

Covered Area - 60m x 30m = 1800 sq. m. Open Area - 60m x 30m = 1800 sq. m.

Manpower Requirement

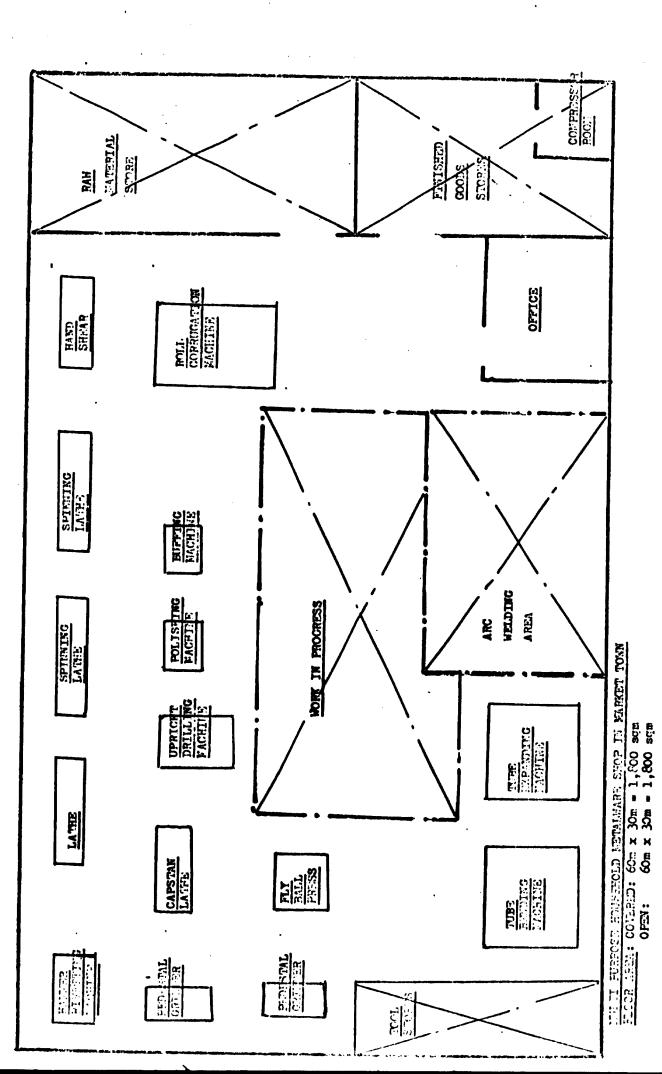
Direct Labour -	Skilled Semiskilled Unskilled	- 25 - 10 - 15
Indirect Labour	- Manager Supervisor/Foreman Accountant Accounts Clerk Sales Clerk Inspector Production Recorder Storekceper Driver Watchman	$ \begin{array}{c} - 1 \\ - 2 \\ - 1 \\ - 2 \\ - 3 \\ - 3 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ \end{array} $
	Total	65

Training Aspect

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Particular consideration is required to train personnel on the following activities:

- Design and Product Development
- Metal Flow Forming
- Welding



- 75 -

(c) Large Repair, Naintenance And Spareparts Manufacturing Workshops

Product Description

<u>Repair Work</u>: Automobile, Tractor, Electire Motor, Generator Compressor, Air Conditioner, Pumps, Hammer Mill, Agricultural Implements, all types of Machinery and Equipment for Agro-Industries including:

- (a) Sheetmetal repair (Panelbeating, painting)
- (b) Repair of Exhaust, Inlet Manifolds, Radiators, Pumps, Silencer etc. for Automobile and Tractor
- (c) Repaire of Transmission Parts
- (d) Repair of Hydraulic Parts
- (e) Repair of Engines

<u>Maintenance Work</u>: Preventive Maintence of Automobile, Tractor, Plant and Machinery of Small Factories, including testing of Diesel and Petrol Engines, Electric Motor, Generator, Wheel Balancing, Armature Winding

<u>Spareparts Manufacture</u>: Manufacture of Small Spare Parts e.g. Flanges, Couplings, Joints, Bush Bearing, Link and Rod, Stub Axel, Gears (straight and helical) Shafts, Splined Shafts, Keys, Pins, Special Bolts and Nuts, Pipe Joints, Silencer, Mufflers, Connecting Rod Pins, Crank Shaft Netal Spraying, Rear Axel, Impeller, Bush Bearing, etc.

Overall Evaluation

This type of large repair, maintenance and spareparts manufacturing workshops is an essential requirement for the smooth running of industrial activities in rural areas. This type of services and facilities will improve the productivity of the industrial plant and transport system in wider rural areas. A careful study on market requirement is essential before establishing such factories in market town of rural areas.

Market Aspects

- 1. <u>Users</u>: Private and Public Transport Establishments, Private Owners of Automobile and Tractors including Farmers, Domestic Users and Small Industries in greater rural areas.
- 2. Method of Sales: Direct to the consumers
- 3. Market Potential: For local and wider rural areas
- 4. Requirement of Feasibility Study: Necessary

- 5. Expert Assistance: Required in the following areas:
 - (a) Heat Treatment
 - (b) Welding
 - (c) Testing (Mechanical, Electrical and Hydraulic)
 - (d) Machine Shop Technology including diverse application of tools, jigs, fixtures etc.
 - (e) Preventive Maintenance.
- 6. Joint Venture: Nay not be necessary
- 7. <u>Linkare with other Industry</u>: Woodworking, Hardware, Automobile, Agricultural Eachinery Industry, Rubber Industry, Plastic Industry, Electrical Industry, Metal Industries in general.

Material Specification

- (a) Various Mild Steel Section Round, Hexagonal, Angle, Tee, Square
- (b) Sheet Metal 14 SHG to 22 SHG in standard dimension
- (c) Casting Ferrous Cast Iron 14 to 17 grade
- (d) Brass Casting Cu-40% Zn-60% ingots and seraps
- (e) Brass Sections Square, Round, Hexagonal, etc.
- (f) Aluminium Castings Duraluminium
- (g) Aluminium Sections Round, Hexagonal, Square
- (h) High Carbon Steel En 8, En 24T, EN-42 (spring)
- (i) Casehardening Steel EN 32 series

Machinery and Equipment

I PoN	DESCRIPTION	NO.OFF.	PRICE US: Wstimated
1.	Lathe for Turning and setew Cutting with all accessories - Max. Swing - 36" - Between Centre - 72" - Max.Length of thread - 8" - Max.Dia of thread - 6" - Max.Pitch - 5 thread /inch	1	15,000
2.	Capstan Lathe with Hex.Turret and all accessories - Dia of hole through spindle - 2 ¹ / ₂ " - Max.Swing of spindle under overhead support - 13 ¹ / ₂ " - Max.Distance of spindle - 33 ¹ / ₂ " flange to turret - Fax.Length of bar stock - 8"	1	12,000
3.	Universal Milling Machine with Compound Dividing Head and Vertical Filling Attachment with all Gear Cutting Accessories - Capacity - 30"x18"x20" - Speeds - 18 ranging 26 to 1250 rpm - Feeds - 18 from ½ to 30 ipm - 9½" dia Universal Head	1	20,000
4.	Knee type Milling Machine with accessories - 30"x48"x20" - Speeds - 18 ranging 26 to 1250 rpm - Feeds - 18 from $\frac{1}{2}$ to 30 ipm	1	8,000
5.	Horizontal Boring Machine with Sliding Head and Swiveling Work Table, with all accessories - Max. dia face and bore - 60" - Spindle traverse vert 7½"to65½" - Revolving Table - 48"x48" - Max. distance facing slide to boring stay - 140"	1	15,000
6.	Cylincrical Grinding Machine with Internal Grinding Attachment with accessories - Grinding wheel size 20"x8"x2"Bore - Max. dia. Ground - 10" - Max. length between centres - 72" - Roll. face length - 48" - Weight of Roll - 350 lbs (Max)	1	18,000
7.	Surface Grinding Machine with Magnetic Table and with accessories - Size of table - 20"x8" - Longitudinal travel - 22" - Transverse travel - 8" - Grinding Wheel - 8" dia	1	10,000

IJF.	DESCRI FIION	NO.OFF	PRICE US: Estimated
8.	Radial Arm Drilling Machine with Universal Table and accessories - 6ft spindle radius - Capacity - 3" dia in MS - Speeds 15 to 1500 rpm 17 steps - Feeds - 0.004 to 0.030 ips 6 steps		12,000
9.	Upright Drilling Machine - Capacity - 3" dia in MS - Speeds 15 to 1500 rpm in 17 steps - Feeds - 0.004 to 0.030 in 6 steps	2	10,000
10.	Heat Treatment Furnace, max. temperature up to 1200°C oil fired, 24"x24"x36"	1	8,000
11.	Quenching Tank, 36"x36"x36"	1	500
12.	Eccentric Press, Capacity 50 tons - Blank thickness up to 1/8" in MS	1	8,000
13.	Tube Bending Machine - Max. Tube dia - 2" in MS	1	3,000
14.	Nibbling Machine - Max.tensile strength of plate 50 tons/sq.in - Edge cutting up to 1/8" - No. stroke per minute - 2800 to 1400 - Max.circular cutting - 28" dia	1	5,000
15.	Shearing Machine - Shearing MS Plate - up to 15/32" - Shear length - 100" - Strokes per minute - 15	1	6,000
16.	Electric Arc Welding Machine - 500 Amps	1 set	2,500
17.	Electric Spot Welding Machine, Max. thickness of material 1/4" MS	l set	3,000
18.	Oxyacytilene Welding Set	l set	1,000
19.	Crankshaft Turning Machine - Length of Shaft - 36" - Pin dia up to - 6"	1	15,000
20.	Crankshaft Grinding Machine - Lenght of Shaft - 36" - Pin dia - 6"	1 .	10,000
21.	Crankshaft Metal Spraying Attachment - Nax. diposition - 1/4"	1	3,000
22.	Portable Tools and Equipment	lot	2,000
23.	Twist Drill Grinder, 1/32" to 3"	1	1,000

ITT	DESCRIPTION	NO.OFF.	PRICE US: Estimated
24.	Universal Cutter Crinder - Max.dia - 8" - Table - 12"x12"	1	8,000
25.	Small Lathe - Swing - 6" - Max. distance between centres - 12"	1	3,000
26.	Hydraulic Testing Equipment up to 3000 psi	l set	2,000
27.	Electrical Hotor Testing Equipment	l set	2,500
28.	Brake Load Testing Dynamometer of Petral and Diesel Engines with Coupling up to 250 BHP	1 set	5,000
29.	Wheel Balancing Machine	l set	2,000
30.	Electrically Driven Compressor, 125 psi, 300 cuft per minute		8,000
31.	Forklift truck battery operated with charger	1	12,000
	Fitters Bench, Cupboards, Tables etc.	lot	2,000
	Small Tools, equipment, accessories	lot	4,000
	Armature Winding Machine up to 10 HP motor	1	4,000 5,000
	Delivery Van (lton)	1	6,500
36.	2 ton Mobile Crane	1	17,000
37.	Fruck, 10 ton	1	15,000

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Total

Floor Area

Covered Area -	75 m	x	60m	-	4500	sq.	n.
Op en Area -	75m	x	30m		2250	8Q.	D.

Manpower Requirement

Direct Labour -	Skilled Semiskilled Unskilled		-	50 15 10
Indirect Labour	- Manager Designer Accountant Clerks Chesers Supervisor Inspector Foremon Chargehand Storekceper Driver Watchman			1 1 3 1 3 2 2 3 2 2 2
		Total		9 ⁰

275,000

Training Aspect

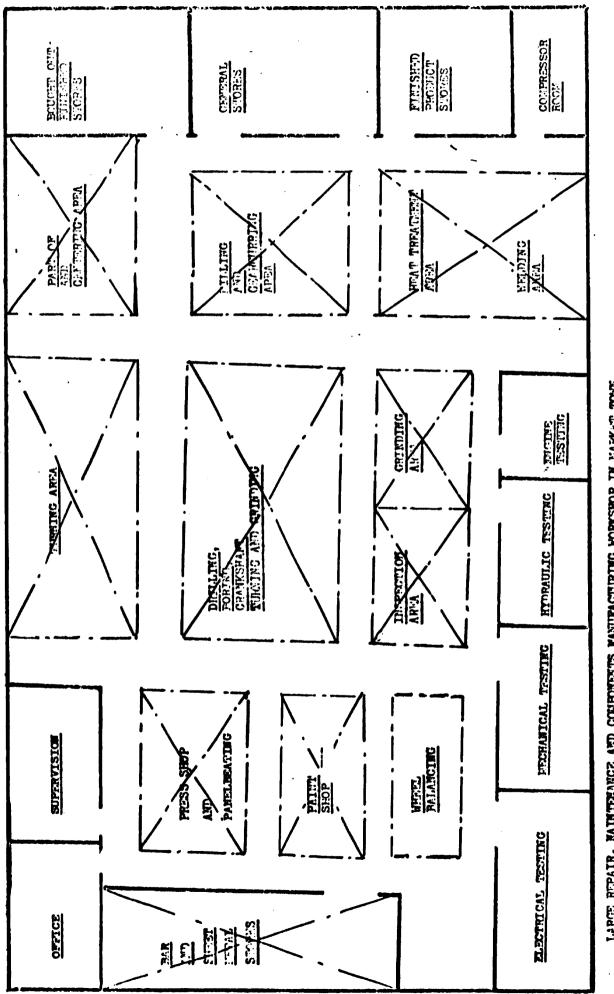
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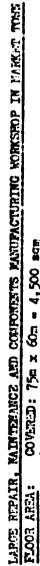
- Sheet metal work (panel beating)
- General machine shop
- Welding
- Electircal Winding
- Testing (Mechanical, Electrical and Hydraulic)
- Heat treatment
- Inspection

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00 VERED: 75m x 60m = 4,500 sem 0 FEE: 75m x 30m = 2,250 sem

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USEFUL REFERENCES

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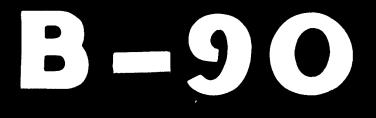
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