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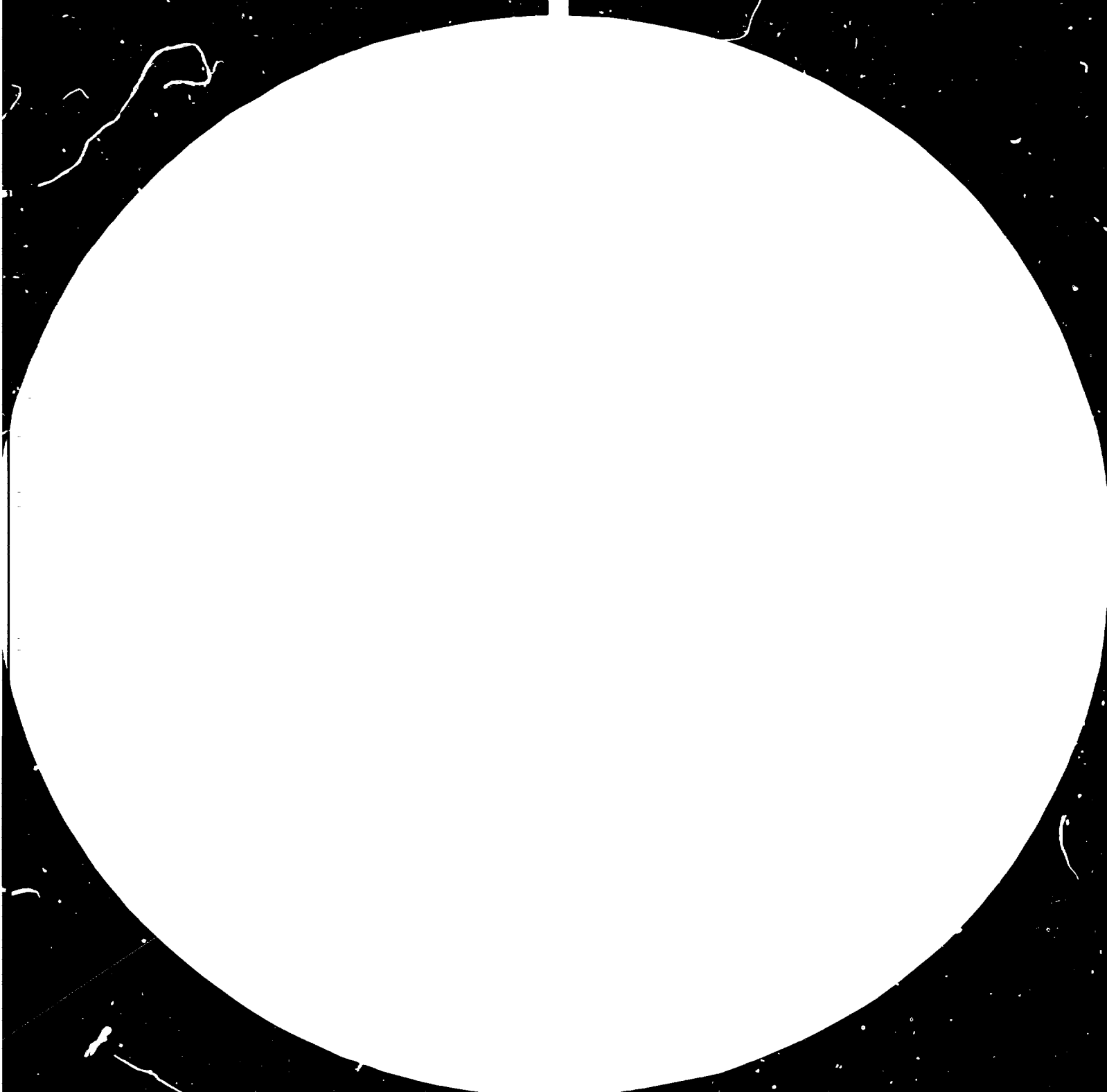

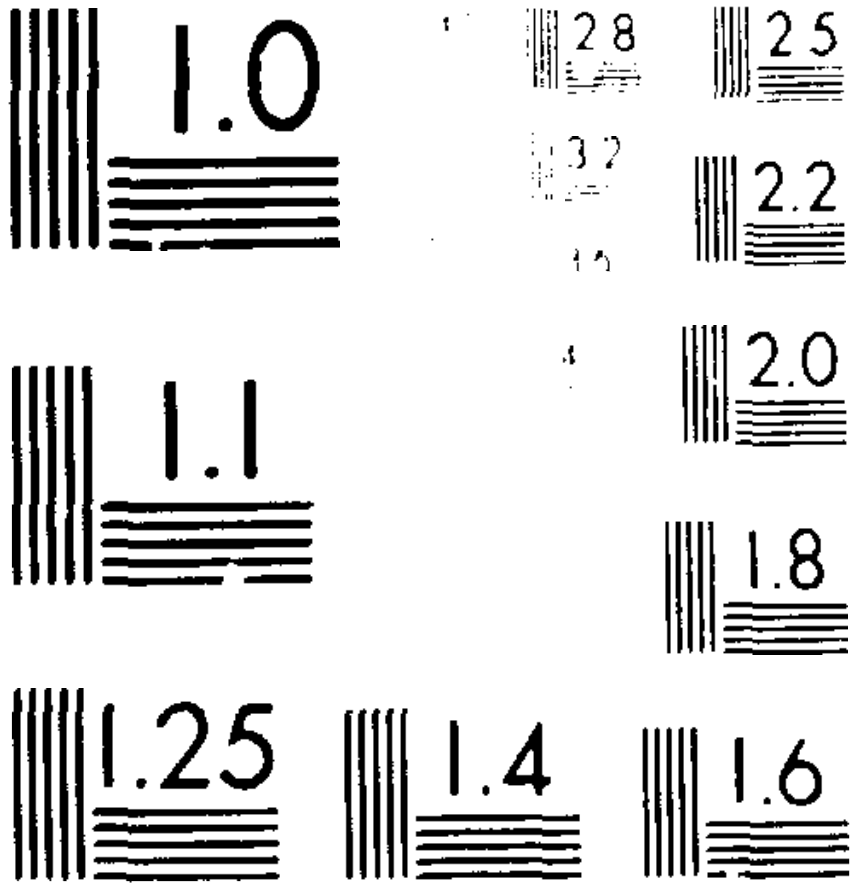
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COUNTRY MONOGRAPH - NEPAL*

by

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CEMENT AND CONCRETE PRODUCT

CEMENT:-

Himal Cement Factory with an authorised capital of around U.S.$. 0.67 million and with a daily production capacity of 100 MT is the only cement plant so far established in Nepal. The vertical shaft kiln cement plant, located in the capital city of the country, went into production around the close of F.Y. 1975-76. Unfortunately the factory is not running to its capacity and is even unable to meet the cement demand of the capital jurisdiction of the country. As such, the country has to depend upon India, Korea, Japan, Thailand and China for the cement imports.

The under-construction dry processing cement plant, located in central Nepal and with a daily production capacity of 750 MT and costing arond U.S. . 50.4 million, has been targetted by the government to be completed and brought into operation with the Current Sixth five year plan covering (1981-86) to fulfill around 22% of the total cement requirement likely to be faced by the country during this very period. The total requirement of cement is likely to reach about 17,42,600 MT, out of which 65% is expected to be consumed by govt. sector and balance 35% by private and other fields 78% of the balance deficit will have to be met through foreign imports.

Execution of a preliminary investigation for the establishment of a third cement factory in the eastern development region of Nepal is further planned by the government. This cement plant project which will be undertaken in collaboration with India is expected to cost around U.S.$. 100 million and shall possess a daily production capacity of 1500 MT of cement and 1500 MT of clinker.

A small scale industry in the capital city itself is further noted to produce 25 Bags of Puzzolana cement per day since two years aback. This cement is prepared by burning Rice husk under control temperature of around 700°C and mixing the resulting ash with lime in 1:3 proportion. The mixture is, thereby, grinded in ball mill for about 3 hrs to get Rice husk cement. This cement when mingled with sand and stone chips in 1:2:4 ratio is found to attain an average crushing strength of 50 kg/cm^2 and thus has been recommended for use only in the plastering works.

STEEL:-

In Nepal so far there has been no major steel producing plant. At PARWANIPUR - south-east of the capital city, a rerolling mill is in operation which produces various sized ribbed cold twistad deformed bars from imported billets. This hot rerolling mill commenced its production in 1964 and though the installed capacity is 20,000 MT per annum, production was much less than the rated capacity due to nonavailability of billets which have to be imported from India.

According to the tests of the sample undertaken in India, the reinforcement is found to possess a yield strenght of 4250 kg/cm2 and an ultimate tensile strength of 5000 kg/cm2.

A scrap based second rerolling mill located in eastern Nepal and possessing an annual capacity of around 7500MT of mild steel plain bars has also been running into operation since about two and a half years aback.

Whatsoever, the major steel requirements of the country has to be met through imports. The total steel requirement of the country during the current five year plan period, is estimated to reach about 2,88,649 MT, out of which 70% is likely to be consumed by government sector and balance 30% by other sectors. The govt plans to achieve about 48% of the aforesaid requirement fulfilled through domestic manufacture by granting the maximum possible help to the existing rerolling mills so as to enable them to run to their full respective capacities. A review pertaining to the establishment of a small scale steel industry in Nepal based upon the iron ore deposit on the southern slopes of the Phulchowki hills located about 26 km south-east of the capital city constitutes the furthur programme of the government.

AGGREGATES:-

a) Fine aggregate:- Nepal is endowed with about 6000 rivers, the total length of which exceeds 45000 km. As such, river sand is predominantly used for cement mortar and as fine aggregate to the cement concrete mix. At certain places where river sand is not available use of lime surkhi mortar and lime concrete are resorted to. The high mica content present in most of the river sand is a problem encountered by builders in Nepal. Suggestions subject to its rectification is indeed desirable.

b) Coarse aggregate:- 83% of the total land area of Nepal (1,45,302 sq.km.) is covered by mountains and it contains many rivers, rivulets and small streams which carry abundant volume of natural gravel. Prevailing practice of making concrete in most of the locally funded projects, is to use the crushed stones having angular or roughly shaped stone fragments as coarse aggregates with a common belief that angular or rough shaped stones have more bond or grip and help to produce a better strength concrete. On the contrary, most of the foreign aided road projects have extensively used natural gravels for minor as well as major structures.

Scattered crushed stone industries are fluorishing all over Nepal. Industries located in the foot hills of SIWALIKS export railway ballast to India. In the capital valley of the country, there are altogether THREE stone quarries producing machine crushed stone chips-

of various sizes. Quarries supplying hand crushed stone chips, in small scale, are further scattered throughout the country.

LABORATORY TESTING:-

The sole aforesaid cement factory running in Nepal has a laboratory of her o[illegible]. Furthermore, a central laboratory at the Engineering institute within the capital city of the country is equipped with various ILC financed foreign made laboratory equipments worth around U.S.$.0.67 million. Due attention to the laboratory tests of the raw materials or products are not given by the concerned in private construction fields of Nepal. People are found to use the construction raw materials immediately following its procurement simply based upon eye estimation and past experience. However, in foreign aided projects of the govt., reverse is the case.

QUALITY CONTROL:-

H.M.G of Nepal established the Nepal Institute of standards in 1974 under the new Industrial Policy. The responsibility assigned to this institution is to test to create standards and to control the standards of raw materials and finished goods and to implement certification marks in the products for its quality assurance. The Institute has todate formulated minimum standards for as many as fifty items including consumer goods, exportable items, food stuffs and construction materials like Brick and lime. Finalisation of the standards for additional sixty items has been scheduled to be completed within the five year period of the current plan. The standards for sand, cement and reinforcement steel are expected to come out sooner or later.

MIXING AND TRANSPORT:-

Hand mixing of volumetrically measured ingredients of concrete, added with eye estimated quantity of water, on the site, near the dumping spot, over a suitable clean temporarily prepared platform, is popular in almost all private building construction works in Nepal. carriage of concrete in steel head pans is performed by queues of unskilled labours arranged accordingly. If the dumping spot is at a level higher than the mixing spot, temporary staging with timber, consisting of a series of platforms, constitutes the medium used for the manual carriage of concrete up to its destination. On the contrary machine mixing is acquired in almost all construction works pertaining to govt or semigovt organisations. The concrete from the mixer is transported through an engine driven minirdad dumper or through a manually handled wheel barrow up to the destined spot or to its nearest possible spot depending upon the situation. In the latter case, passage of concrete up to the destined spot is further executed manually after remixing of the concrete on a suitable platform. In rural areas of the country wherein use of wheel barrows or dumpers are not feasible, unskilled labours brought specially from India, are employed. They possess the stamina to walk from the mixing place right up to the dumping spot by carrying steel pans filled up with concrete over their heads. Normally this distance lies within a radius not exceeding half a kilometer.

PRECAST PRODUCT INDUSTRY IN NEPAL:-

The country of Nepal is still in its infancy pertaining to the field of precast products industry and it has to make considerable head way before it can hope to meet even a tithe of the vast requirements of the building industry. Turning to the present status of preeast products industry within the country there are only about TWELVE total industries running commercially among which FIVE units undertake the manufacture of hollow concrete blocks, concrete paving tiles, screen blocks, foundation blocks, pillars and lintel blocks, SIX units produce R.C.C. pipes and fittings and ONE unit make A.C. pipes and fittings, ventilation couls and terrazo cum nonskid tiles. FIVE more industries in precast field are expected to come out in near future. Industries manufacturing large precast units like slabs, beams etc in commercial field have not flourished so far within the country. However, production of slabs panels and supporting beams are accomplished by a semi government construction company in Nepal according to her requirements only. Those precast slabs possess a thickness of around $1\frac{1}{2}$" and are made in three sizes measuring around 3'x6'$\frac{3}{4}$x9' and 3'x12'. Beams of lengths 9' and 12' in case of single spans and of consecutive span lengths of 15'-7" and 4'-4" in case of double spans are also the simultaneous productions of the company. These dimensions are based upon the room sizes normally adopted in the buildings of the country. In general, the vee-shaped joint formed between consecutive slabs is sealed with cement concrete mix thereby embedding the protruding reinforcements from both sides of the slab.

In electric field, precast concrete lampposts have dominated the timber and steel poles in the capital city of the country. These are managed by the concerned authority by special arrangements and are erected with the help of ropes and manual force.

There are no tramways in Nepal and being a mountaineous country there is only about 106 km. of length in total covered by railway tracks in the plain regions of the country. The rails are narrow gauge (2'-6" wide) with 30 lb steel rails on wooden sleepers.

HOLLOW BLOCK MASONRY:-

Hollow concrete blocks with 38% carity are manufactured by ROSACOMETTA machine imported from Italy. Vibrocompression of semidry concrete mix packed in the oiled steel moulds followed by natural curing for about three weeks forms the main principle of production adopted by the industries. Blocks having width of 4", 6" and 8", height commonly about 8" and length about 16" constitute the varieties

of production. Cement, sand and 10 mm graded stone chips in 1:3:4 proportion are mixed with water to form a semidry mix in case of load bearing units possessing 40 mm to 50 mm web thickness whereas cement and sand in 1:4 ratio with water is adopted for nonload bearing units with smaller web thickness. The blocks are reported to attain an average compressive strength of around 15 kg/cm2 on the total section. Though the daily production capacity of the machinery installed is 800 nos for 8" thick blocks, 1600 nos for 6" thick ones and 2400 nos for 4" thick ones, the factories are reported to be running at about 40% of the aforesaid capacities because masonry with brick or stone with mud mortar or with cement mortar is still preponderant within the country inspite of the economy exhibited by the concrete blocks, as declared by the manufacturers.

CEMENT CONCRETE PIPES:-

Concrete pipes of various sizes are manufactured by the existing plants of Nepal adopting centrifugal process and following I.S.I. specification. Normally, cement, sand and 10 mm graded stone chips are mixed in 1:2:4 ratio by volume with water. The pipes are jointed with similarly manufactured R.C.C. collars. The fabricated reinforcement constitutes of 6 mm dia m.s. circumferential reinforcement welded or tied by 12 gauge wires with 6 mm dia longitudinal reinforcement so as to form a cage.

Construction of 35 km. of sewage line with cement concrete pipes within the capital valley was scheduled by the government, out of which 31 km of sewerline involving about 12400 nos of various sized pipes have already been laid therein. In the second phase, installation of an additional 9 km of sewer lines in sized from 200 mm to 500 mm within the capital valley itself, has been further targetted by the government.

A.C. PIPES:-

A.C. pipes are used mainly in house drainage works in the buildings within the country. The sole factory within the capital producing mechanically 6' long A.C. pipes of 3", 4" and 6" diameter with daily production capacities of around 90 Nos, 80 Nos and 25 Nos along with average 20 Nos of relevent manually prepared fittings like 45° and 90° bends, teas and collars, has gained a good popularity in the capital city of Nepal. The pipes are manufactured by pouring a slurry mixture of cement and A.C. powder in 1:2 ratio with adequate water over a rotating perforated steel pipe followed by its compaction with a simultaneously rotated steel pressure roll into a dense homogeneous structure. The water of the slurry is removed by certain suction arrangement. The pipes are normally jointed with 1:3 or 1:4 cement mortar. Use of imported A.C. corrugated sheets on the roofs of buildings are also popular within the country though it is not domestically manufactured so far.

CEMENT TILES:-

The sole factory in the capital city of Nepal manufacturing A.C. pipes also produce cement tiles in the form of Terrazo or nonskid tiles in sizes varying from a minimum of 4"x4" to a maximum of 12"x12". Though the daily production capacity of the equipments is around 700 to 800 sq.ft., it is reported to be running at about only 15% of the aforesaid capacity due to nonavailability of the ingredients of the tile regularly, intermittent load shedding problem prevalent in the country and an insatisfactory market scope of the product.

The terrazo tile is composed of a back layer consisting of dry mix of cement and sand in 1:3 ratio by volume and a face layer wherein cement and marble chips in 1:3 ratio by volume is mingled with necessary water and colouring agents if desired.

Nonskid tiles contain only one layer. A mixture of white cement and marble chips in 1:1 ratio by volume is mechanically mingled in a rotating drum along with desired colours in presence of steel balls for about an hour. The effluent is then mingled with necessary water.

The following principles of pressurizing, curing and ultimate grinding are similar in both cases. The tiles are normally laid in C.M. 1:6 or lime mortar 1:3 or gauged mortar 1:2:9. depending upon the place.

PROBLEMS:-

The problems faced by the country in the development of cement and concrete product industries are summarised as below;

a) Lack of adequate cement (b) Shortage of necessary reinforcement (c) Power shortage (d) unbalanced production and sale position (e) Nonavailability of economy sized machines and machineries like cranes for installing heavy precast products (f) Lack of enterpreneurship (g) Lack of capital or credit or banking facilities to mobilise the natural resources which are not fully monetized (h) Difficult to collect the scattered raw materials due to lack of communication and transportation facilities because 83% of the total area of the country is mountaineous. (i) Lack of skilled man power with technical knowhow. (j) Lack of proper and sufficiant training institution to train the labours.

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Development of Industry in Nepal

Decentralization and Government assistance.

Industrialisation in Nepal started in 1936 and it gained its momentum immediately after the end of isolationism in 1951 resulting which many industries, inclusive of a cement factory in Kathmandu, the capital city of Nepal, have come up. To facilitate the private investor, Nepal Industrial Development corporation was set up in 1959 and an industrial policy in the first time came into effect in the year. Financial aid such as credit facility and capital investments and nonfinancil assistance in the form of Industrial feasibility studies, managerial and technical service etc were made availabile to private investor through this corporation. According to the industrial policy formulated by His Majesty's Government of Nepal in 1974, the small industry has been defined as an industry having investment between N. Rs 2 Lacs (about US dollar 17000) to N. Rs 100 lacs (about US dollar 8,60000). During the third five year plan of the country, that is within (1971-74), three industrial districts one in Kathmandu (the capital city), one in Hetauda (Central Nepal) and one in Patan (about 5 km from Capital city), were established to decentralize the industries by providing them the essential facilities and utilities thereby avoiding formation of haphazard industries and growth of slum areas within the country. His Majesty's government of Nepal, thereafter, established various organisations to provide a more congenial atmosphere for the systematic and rapid industrial development in the country.

First, the industrial service Centre, to conduct technofeasibility studies in industrial and subsidiary industies based on agriculture, forestry, mining, construction materials and others as well as to conduct industrial management training programmes and to look after all the seven industrial districts prevalent in the country now. The other institution. Corporation co-ordination Division under ministry of finance is also an advisory council to HMG in matters of different aspects of mangement which includes the small sector also.

Major function of NIDC has been thus transferred rendering the former an industrial investment concern only.

Secondly, the Security sales and purchase centr to mobilize the individual savings to the industries and to provide the financial assistance to the modernisation of existing industries.

Thirdly, the Nepal Institute of standards to provide various services to industries and trade in the field of quality control and standardisation for qualitative improvements of national production and productivity.

Fourthly, to avail the expanding small industries a wider market field, the government has set up Trade Promotion centre with the objective of designing and developing an effeccive trade infrastructure, conducting the research surveys to identify and develop domestic exportable products, organising international market research, issuing the journals and books so as todisseminate trade information and enquireies, and to increase the export volume by arranging Nepalese exporters' participation in the international trade fairs and exhibition.

Resulting such arrangements undertaken by the government of Nepal, the country has now around 750,000 cottage industries, about 155 small industries and 81 medium come large sized industries. Mostly agro-based industries are in operation at present in the country. Growth of small scale industries in several south east Asian countries confirms the idea that small industries in a small country like Nepal wherein the agriculture has a predominant role and where more than 90% population depends upon agriculture, has played an important role and the development of the small industries will be most suitable and feasible. As such, according to the new industrial policy announced by the government recently, top priority has been accorded for cottage and small industries and industries manufacturing essential consumer goods and export oriented industries. The policy has also opened the way for the private sector will also be given. The government, in consultation with the commercial bank, National bank and other financing institutions will attempt to privide easier credit to industries.

For the simplification of licences of industries and for promotion of the same, Industrial Promotion Committee will be set up. Revision of the taxes, tariff and exercise duties has also been undertaken. Nepal Industrial Development Corporation has the target of making available financial assistance amounting to 480 million n RS (eqvt US Dollar 41.38 million), in the form of loans and shares of the corporation, to the industries to be established in the private sector under the industrial promotion programme. Within the sixth plan (1981-86) Private sector is expected in invest about 3.50 million N Rs (eqvt US dollar 30.17 million) in the industrial sector during the sixth plan.

Some of the main constraints in the development of small enterprises in the country are:-

a) Lack of skilled and semi-skilled manpower and technical know-how.
b) Lack of proper and sufficient training institution to train the labours and other personnels for the small enterprise development.
c) Lack of capital or credit banking facitilities to mobilise the national resources which are not fully monetized.
d) Difficult to collect the scattered raw materials due to lack of communication and transportation facilities because 83% of the total area of the country is mountaineous.

As such, sufficient coltivation of raw materials in one confined area is difficult.

e) Lack of marketing facilities.
f) Lack of basic infrastructure like a shed because of shortage of cement, steel etc to build the same.
g) Non availability of economy sized machines and inadequacy of electricity for its operation.
h) Lack of enterpreneurship.

Conclusively, in a developing economy like that of Nepal, the rural sector, the sector in which most of the country's population live, plays a crucial role in the country's development. Due priority has to be given to the rural sector in agricultural as well as in industrial field for the overall development strategy. As there is little prospect of all rural people being absorbed in the agricultural sector, the promotion of rural industry appears to be an ideal solution not only to ensure a steady and dependable income sourced for the people but also to expand the country's domestic income. The decision of the government to expedite the setting up of small hydroelectric power plants in the rural areas can be deeply appreciated. Some fruitful results in the industrial development within the country can be expected following the recent declaration of new industrial policy by the government which undoubtedly reveals the efforts on the part of the government for the drastic industrial development within the country.

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