IDC

Proposal for Setting Up of

REGIONAL DESIGN CENTRE

(SOUTH-EAST ASIA)

at Industrial Design Centre, I.I.T. Bombay
under the UNESCO/UNDP Assistance Programme

Submitted for the Approval of the
Government of India
Ministry of Education and Culture

March, 1983

Industrial Design Centre
Indian Institute of Technology
Powai, Bombay 400 076 (INDIA)

INTRODUCTION

The proposal is prepared in response to the recommendation of Tripartite Meeting held at IIT Bombay on 16th September 1982 between the representatives of Ministry of Education and Social Welfare, Government of India, UNESCO, UNDP and IIT Bombay.

It is felt by all members that the time has come to extend the facilities and expertise of IDC to other countries in South East Asia where the subject of Industrial Design and its role to upgrade the industrial product environment is little known and not well understood. IDC faculty, during the past four years have had an opportunity to interact with various schools of design philosophies. Discussions with various design pedagogical stalwarts have taken place at IDC about design methodologies and the educational contents which are appropriate to the needs* of developing countries. It has been realised that difference between approach towards design education in developed and developing countries is the difference of priorities. The areas where design becomes necessary to solve problems of immediate needs have to be emphasized in education. The difference in use of production methods ranging from manual fabricatiion, low level production etc. to high quantity mass production has to be tackled without compromising in design excellence, in developing nations.

It is heartening to note that the IV Extraordinary session of UNESCO General Conference has accepted the draft resolution aiming at introducing the design discipline in the UNESCO Medium Term Plan (1984-1989). (Refer Annexure No.1)

Professor A.K. De
Project Director

* Refer to the report by Prof. Gui Bonsiepe of Brasil, Unesco Consultant - Annexure No.2.

Industrial Design Centre (IDC) - A brief History

Industrial Design Centre was started in 1969 at Indian Institute of Technology which is one of the premier technological institutes in the country, to offer postgraduate training facility in Industrial Design (Product Design). The course was designed for 15 months for candidates who had a degree in engineering or architecture, on the successful completion of which was awarded post-graduate diploma (DIIT). It was an experimental situation. This type of programme had no precedence in India nor anywhere else in the world. It was not usual to train engineers for product design work. It was felt at that time that because of the low acceptance of other professionals like applied artists, graphic designers by the industry in India and their low level of technological background inherent in such education in India, it would be appropriate to train engineers and architects with an aptitude for design. Each year the courses were revised and updated to suit the needs of the industry through a feed back from the past students and through consultation projects undertaken by the members of the faculty. This programme lasted for 10 years.

In 1979 this programme was upgraded and enlarged to 2 years and Master of Design (M.Des) degree is awarded to successful candidates. This was done to make the programme fit into the regular academic structure of I.I.T. Bombay, and to attract better quality of students which had dwindled lately. IDC continues with the regular revision to upgrade the course contents and structure and other infrastructural facilities.

From 1975 onwards, IDC started conducting short term exposure courses on Industrial Design aimed at executives from the Industry. Encouraged by the response of these, it conducted short term courses on specialised subjects related to design like Creativity, Innovation, Design Methods, Product Planning and also courses for specialised industries like a workshop on Electronic Instrument Design and short in-house courses for industries and training institutiions.

IDC has now fairly well developed metal, wood, plastics, ceramic and photographic studios. Besides IDC is developing an ergonomics laboratory to meet product design needs. IDC has well developed library of its own with a subscription to large number of international magazines on design and also a 10 year collection of these magazines. IDC has good seminar and conference facilities. Some of these facilities were developed with the assistance of UNDP/UNESCO and are comparable to the best in the world.

IDC has eight full time faculty members with specialisation in various areas related to product design. IDC faculty is highly exposed to various design philosophies, methodologies and technologies. They also have wide academic as well as field (industrial) experience.

IDC - A Regional Centre for Design Education

Why Regional Centre?

During the last twelve years, IDC's educational programme has gone through a continuous change and has reached a state of maturity where it has become quite relevant to the needs of the country. International Council of Societies of Industrial Design, which gives much attention to the education of industrial design has recommended IDC's education programme as a model for other developing countries.

Having been recognised nationally and internationally, the faculty at IDC now feels confident that they can cooperate and share the experience gained during the last decade and a half, with the other countries of the region who have similar economic climate and industrial infrastructure; and where not enough attention has been paid to the profession of industrial design and industrial design education. Besides being of some help to the countries in the region for taking advantage of our facilities here, it would be a chance to broaden horizons and experiences of IDC.

Proposal for regional Cooperation in Design Education

The following programmes for mutual cooperation between IDC and various countries in the region is hereby proposed for consideration and acceptance of the Government of India, UNESCO/UNDP and the representatives of various countries of the region.

1. For countries where tnere are no facilities for postgraduate industrial design education.

1.1 IDC can admit every year 4 or 5 students from these countries to our 2-year M.Des programme

1.2 The students would be sponsored by UNESCO to cover all their expenses.

1.3 The students should have a degree or its equivalent in engineering or architecture.

1.4 The selection will be based on the criteria and guidelines prescribed by IDC and will be done by UNESCO or its agencies in the respective countries.

2. For candidates already working in the areas of industrial design in the respective countries.

2.1 IDC could offer its facilities to the above candidates with experience of 2-3 years to enrich themselves by working on projects at IDC for a duration of one year.

2.2 These projects could be chosen either by IDC faculty who is to guide the student or mutually by the candidate, the guide and the parent institution of the candidate.

2.3 The project should be such that it has some relevance to the socio-economic realities of the region.

2.4 The project should be of such complexity/simplicity that it can be completed in one year.

3. For countries where they would like to develop facilities for post-graduate education in industrial Design (Product Design)

3.1 IDC could help to initiate and develop centres for teaching industrial design at Post-graduate level at universities or set up independent institutes based on our present programme with variation to account for local needs of the country and its industry.

3.2 Initially these institutes could be managed by faculty and technical staff from IDC and other industrial design institutes of the region till faculty from within the country is developed, by special faculty development programmes or through programmes set up in proposals 1 and 2.

3.3 The funding of these institutes could be undertaken by the respective governments or jointly with the help of UNESCO and/or Government of India.

3.4 The would-be-faculty in these institutes could work as faculty assistant/associates in IDC for a period of one year. This could form part of special faculty development programme.

4. For countries where there are centres offering training in industrial design at postgraduate level.

4.1 Faculty exchange programme - Under this programme the faculty from IDC will teach at the corresponding institute in the other country for a period of one year or one semester, and the faculty from the other institute can come to IDC and teach here for a corresponding period.

4.2 Every year two faculty exchanges to take place so that the respective faculty strength in the centre is maintained.

4.3 IDC has a good experience conducting short term intensive courses in industrial design for professionals and teachers. This service could be availed of by the institutes during faculty exchanges.

4.4 Joint seminars and workshops to be conducted for third countries to increase the awareness of industrial design.

4.5 Information to be exchanged regarding the methodology for teaching and upgrading of the courses of study.

4.6 Joint research programmes to be undertaken by the respective faculty members.

4.7 Student exchange - Each year two students from IDC could work on their final projects lasting 5 months (one semester) in the Centre of the other country. Similarly IDC could accommodate 2 students from other centres to work for one semester on a project. This would be part of their respective degrees.

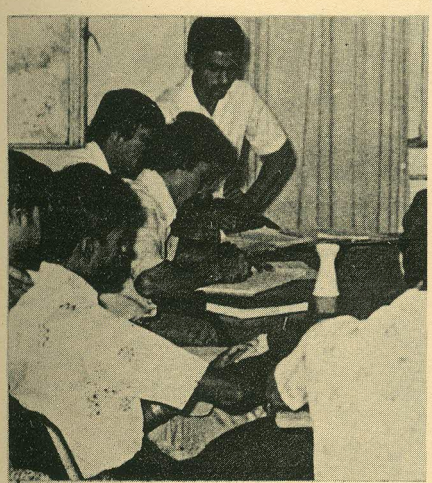
4.8 Exchange of craftsmen and skilled personnel engaged in service centres of the institutes i.e. Model making Studios, Prototype Building Shops, Photography, Printing etc.

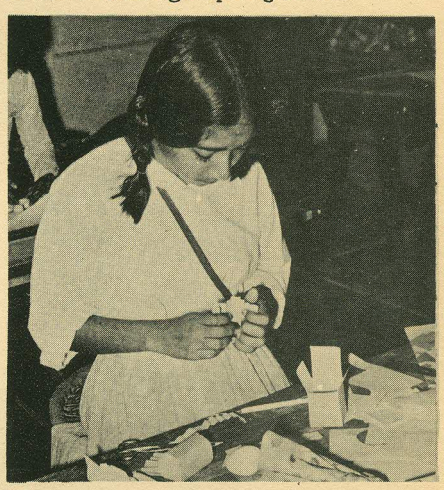
Model Making and Studio Facilities at IDC

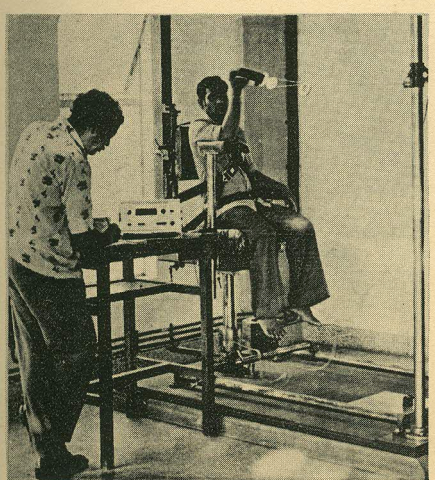
One of the main assets of the Centre is the workshops-studios. The workshops-studios for wood, metal, plastics, ceramics and photography are equipped with wide-range of machines and skills to make mock-up models, trial models, and prototypes. The selection of machines range from a watch maker's lathe to a vacuum-forming machine enabling the designers to handle variety of materials with ease. Emphasis is laid on simulation techniques to project the correct image and performance of the end products.

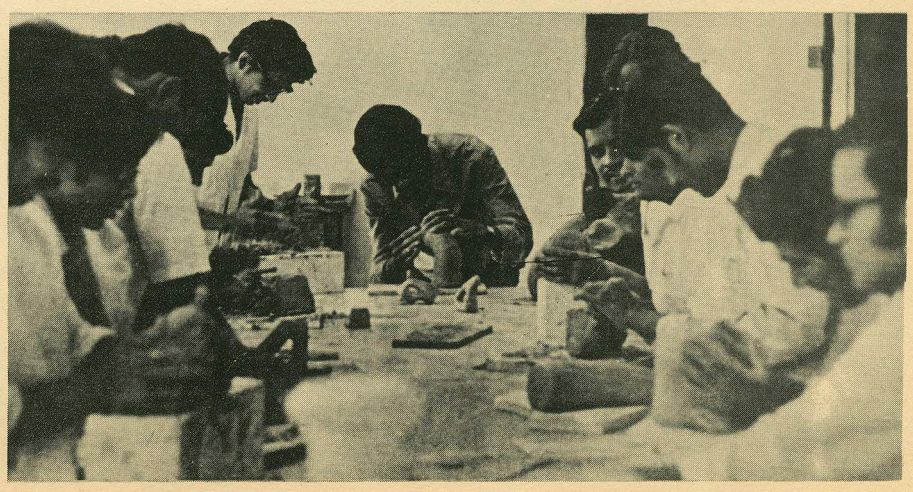
Full benefit of workshops-studios is realised by the faculty in their consultation projects and experimental projects of social relevance. The proposed product development cell further enhances the importance of workshops-studios.

Applied ergonomics laboratory has sophisticated instruments, where any type of applied/basic ergonomic research can be carried out. It is integrated with product design programme, students are trained to use these sophisticated instruments, so that they can make use of the facility in their product design projects.





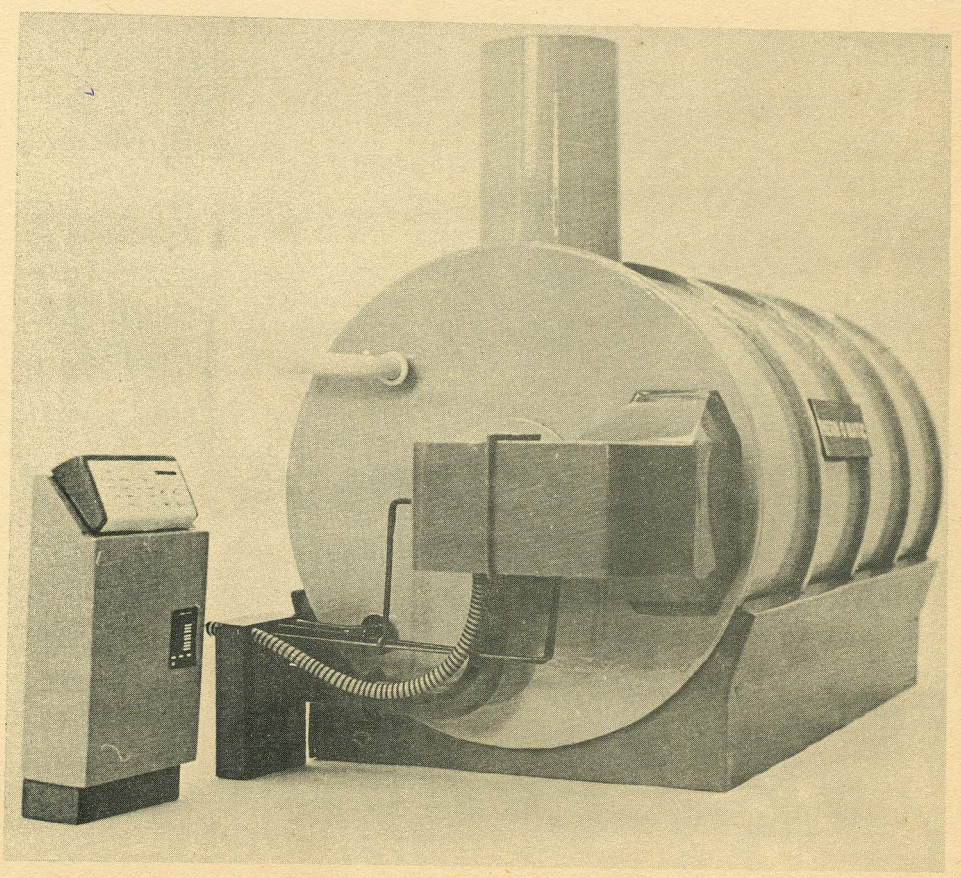




Case Study 1

Thermomatic Boiler

The problem in the existing design of the boiler was mainly seen as that of 'looks' by the client while assigning the project. The two ducts (shown on left side page-top) feed the hot air from the boiler, back to the burner. To reach the burner for maintenance the ducts have to be opened resulting in three openable joints. The basic question 'Why two ducts?' raised by the designer led to a single duct with larger inlet size. The resulting design eliminates one duct completely and reduces the joints from three to one resulting in manufacturing economy and ease of maintenance. The control box has been redesigned with improved proportions and comfortable height to be made in standard size sheet with least wastage. The controls are organized for better performance.

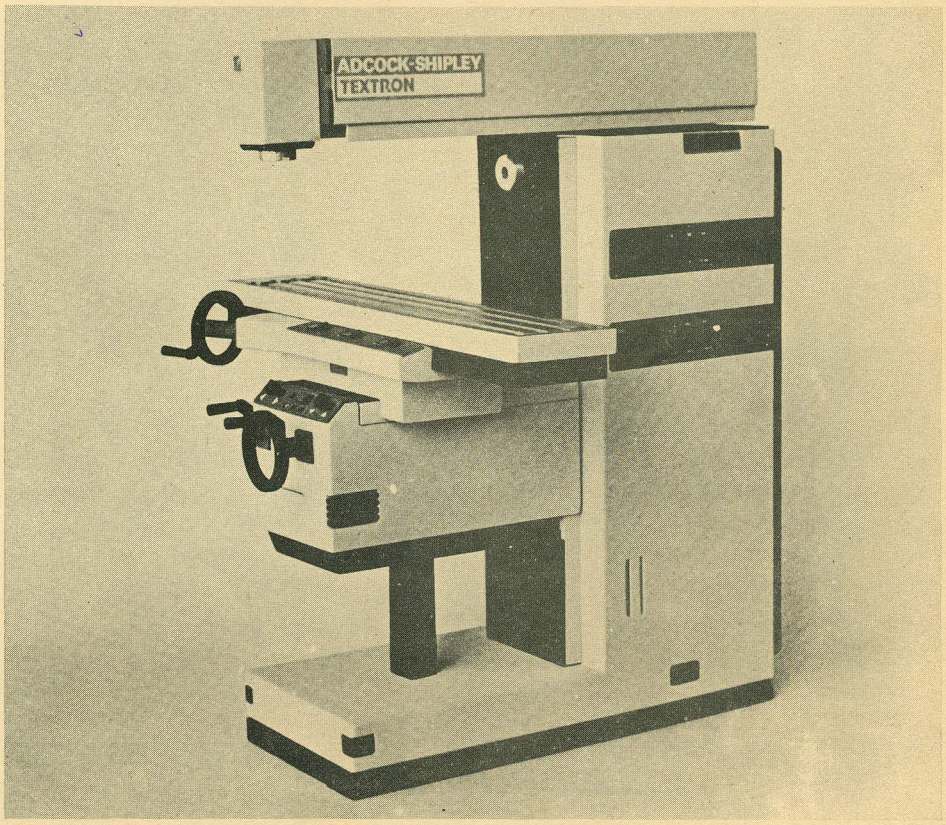


Case Study 2

Milling Machine

Indian machine tools in many cases are technically advanced enough to compete with machine tools aboard to some extent. With relatively cheap skill labour available machine tools have vast potential for export market at competetive costs. Most of the machine tools manufactured today lack in proper human consideration, coherence of overall design and product communication.

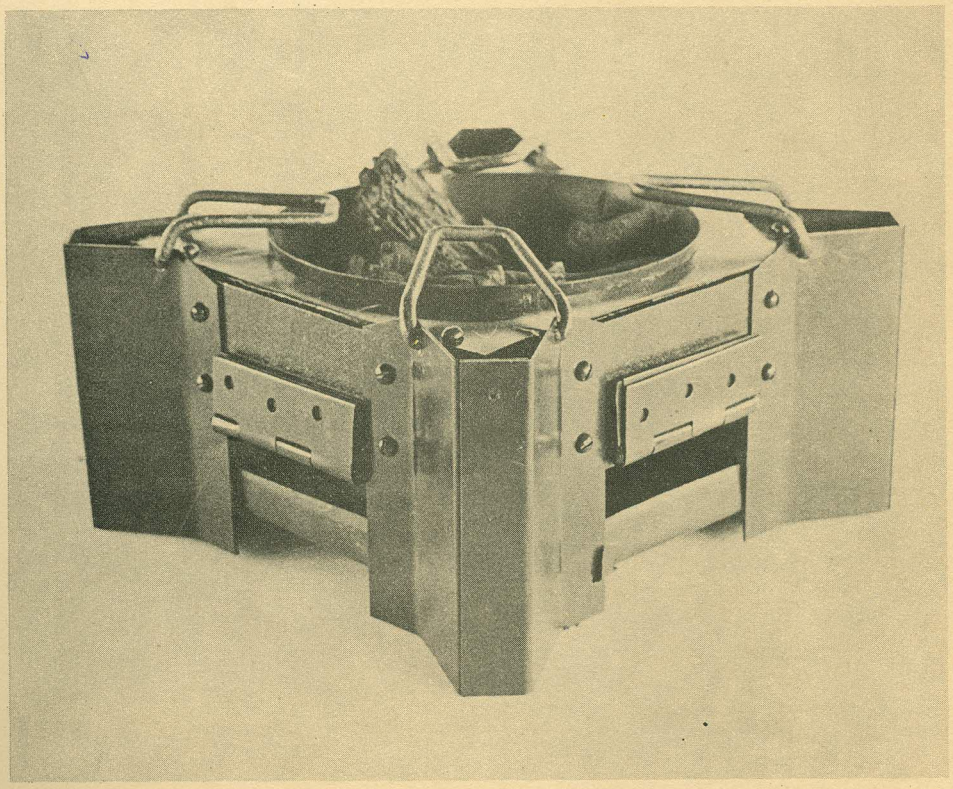
Effort has been made during this project to improve man-machine relationship, organize controls and for improving overall aesthetics so as to project the image of futurastic machine tool.



Case Study 3

Coal Chula

Portable coal stove (Chula) is traditionally made with a bucket and thick cement or mud insulation. A competition announced by Coal India provoked the designers to go into the basics of the problem. The new design arrived at, is for semi-urban use. Air gap between the outside asbestos insulation and fire pot is introduced which acts as a light weight insulator and also supplies hot air. The fire pot, has several holes to supply air evenly through out the coal to avoid smoke formation. The ashes can be cleaned easily as the whole bottom plate is hinged on one side. The two ducts help in getting controlled burning. The height of the 'chula' is kept low to increase stability. The unit can be made by a small industry with very little skills.



Case Study 4

Bicycle for Carrying Loads

Load carrying on bicycles is a typical Indian rural phenomenon. People carry grain bags, vegetables, milk, hay, eggs, fruits etc. of weights upto 90 to 100 kgs. The present cycle has not been designed for such use.

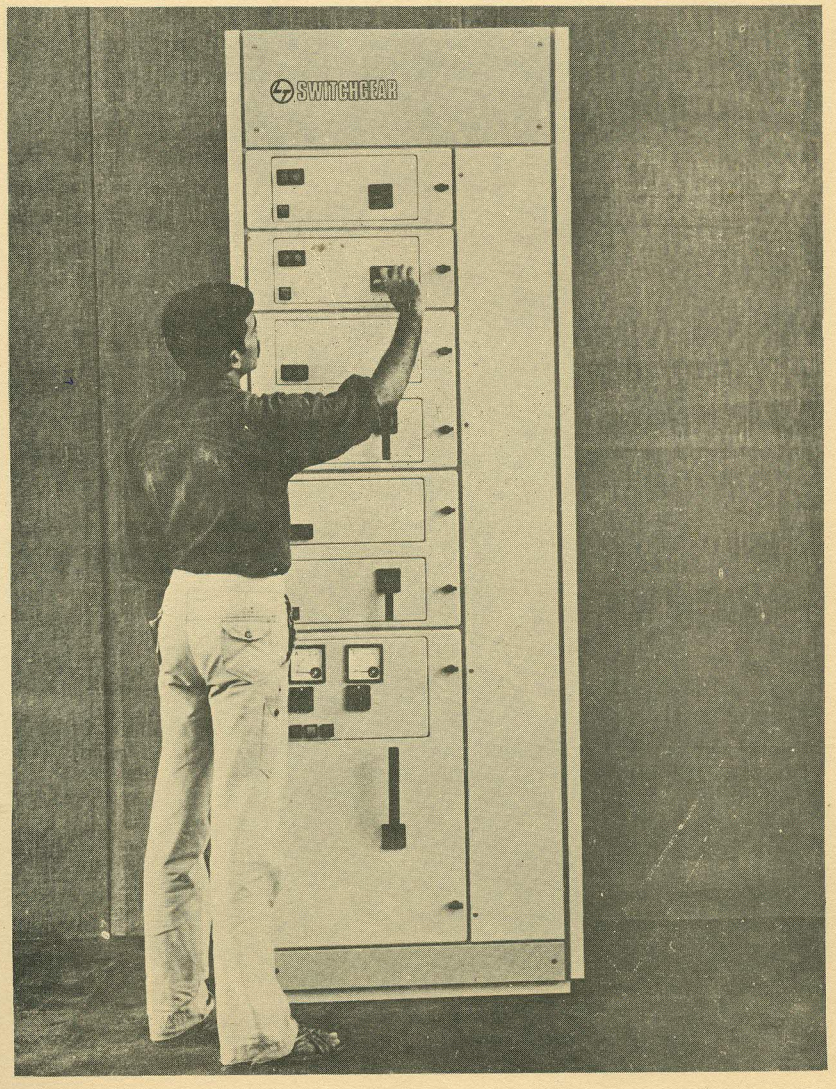
This project is an effort to look at this problem in an integrated manner with experts from various disciplines like Energy, Aeronautics, Ergonomics and Industrial Design come together and solve the problem.

In this project, types of loads and the distances carried on bicycle and energy involved were systematically studied. Extensive scientific analysis of stability of bicycle and human comfort was carried out, which gave many clues for an improved new design. The new design has an optimised wheel base that facilitates easy carrying of loads upto 120 kgs under rough road conditions.

Case Study 5

L & T Switch Gear Unit

L & T Switch Gear Unit is used as a process control unit in many industries like chemical, fertilizers, etc. The project sponsored by L & T envisaged improvements in operation problems of the operator and overall aesthetic improvement. Detailed ergonomic studies were made to suggest best positions of different controls taking into account the convenience of people of different height. The modifications in the process of manufacture of the panels and knobs are intended to bring out the 'visual order' and 'appeal' of the unit with a clear communication. The new design helps to project the Company image.

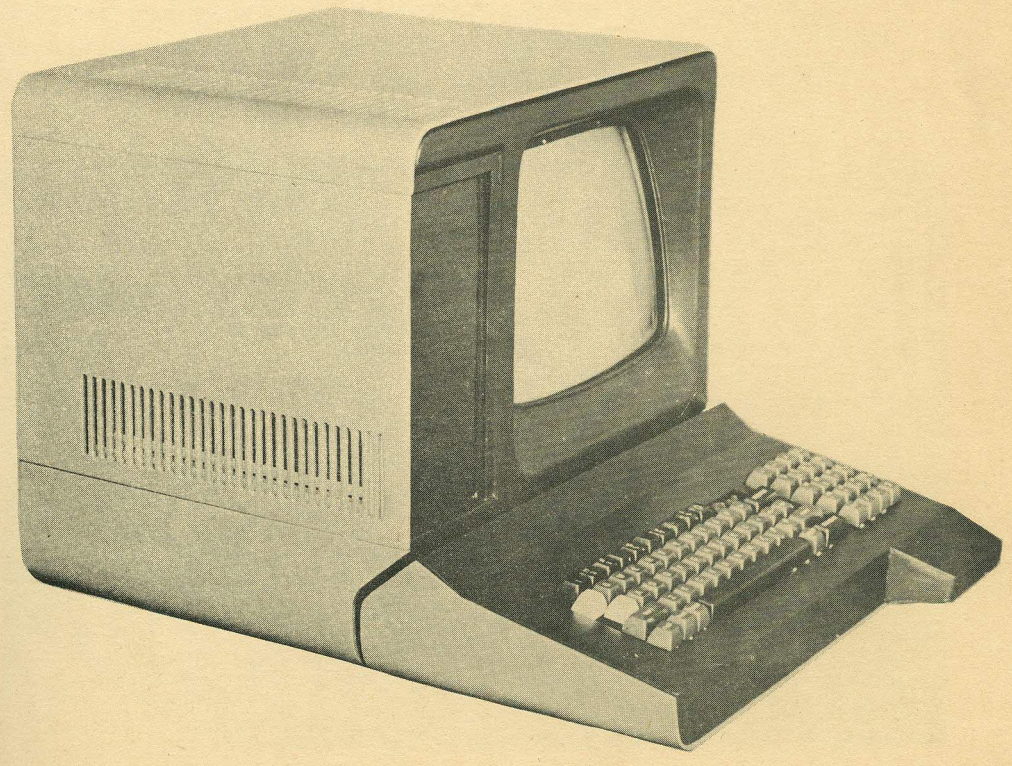


Case Study 6

Micro Computer

Manufacturing of Micro Computers in India, is a new activity started only couple of years back. Production is still in batches and rather crude, hand fabrication techniques are used. The new design involves standardised parts and fabrication is done in a conveyer belt fashion i.e. in sequential operation with simple jigs and fabrication methods, resulting reduction in cost and quality control in production. Card storage is hinged on one side of the body to have an easy access for maintenance.

On the key board, the letters or alphabets are usually on one side and the numbers on the other side. As the numbers are typed only by one hand, operator experiences stress as he cannot rest the other hand. In the new design an extra projection is provided for hand rest which is the new feature in the keyboard display.



Case Study 7

Hospital Furniture

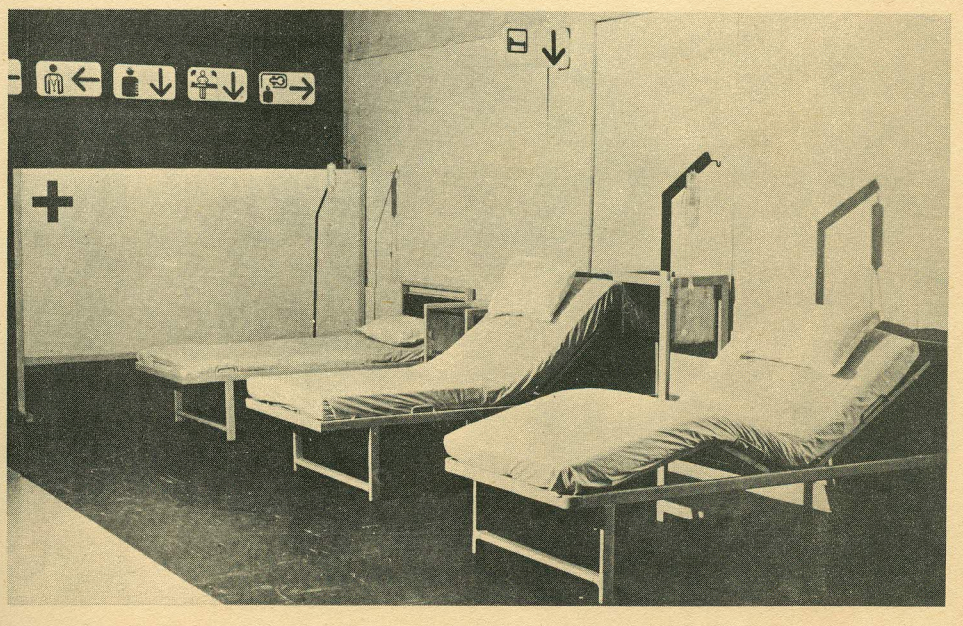
Hospitals in India are not designed for growth and adaptability to new developments. This has resulted in over crowding and an acute need for space. There are problems in patient and hospital environment, in transportation of patients, medicine and food, in communication with staff and patients and in general hygine.

The present furniture is very bulky, oversized, noisy, inefficient resulting in discomfort for use. They are not designed with human engineering factors.

Maintenance and repair of these furniture is difficult because hospitals do not have maintenance staff and other facilities. This has resulted in piling up of scrap furniture at every free space in the hospitals.

The furniture designed, is based on a modular system such that the parts are interchangeable. They are flexible to suit the individual requirements of the patients and the staff of the hospitals.

Ergonomical studies were done in various hospitals on patient and staff requirements and the furniture was designed for maximum percentile of the population. This has also given rise to new standards being developed regarding patients, nurses and doctors.



Case Study 8

Hospital Graphics

Communications in India suffer from a major drawback becuase of the very diverse cultural, traditional, lingual and social backgrounds of the people. These factors force communications to resort to greater and greater generality and simplicity.

Consequently, there is a felt need for an alternative language, common to people with different languages, to literates and to illiterates. This being an impossibility, we have tried to evolve a system of symbols to help communications in specific areas.

Here are shown some symbols for use in Indian hospitals. Broadly, the approach was the creation/generation of a large set of possible solutions which were progressively narrowed down and retried till the final set emerged. The design solution also involved a diabetical movement between the designer and the user. Thus, at every stage, the process was modulated by the response of the public.

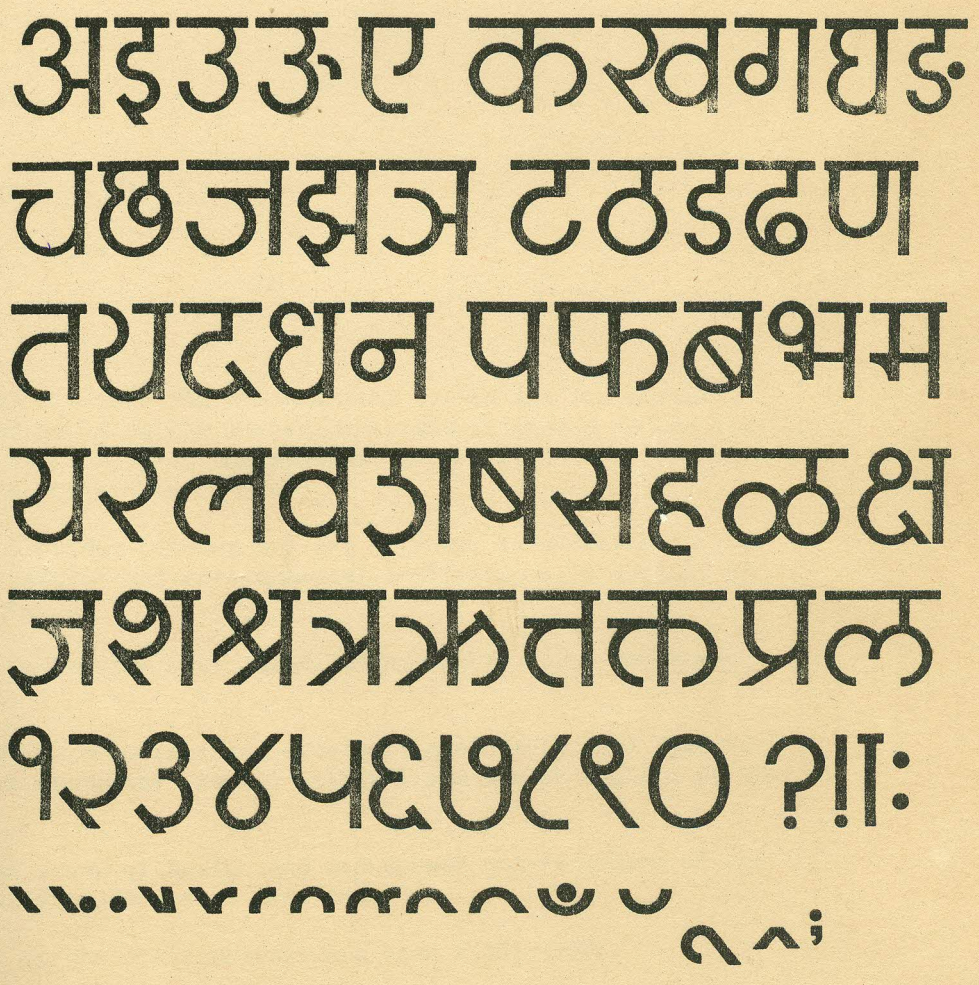
Devanagiri Type Redesign

At present, the devanagiri type face is similar to the traditional ones created with a reed pen.

These traditional forms are ill suited for reproduction in printing and thus the legibility gets affected.

Here the types were redesigned to make them more legible. Experiments were done on recognition of shapes and grey masses. Circularity of the letterforms were accentuated to bring in clarity.

The letters are designed mainly for use as display type-faces.



Annexture 1

General Conference
Fourth extraordinary session
Draft resolutions

Генеральная конференция
Четвертая внеочередная сессия.
Проекты резолюций

dr

Paris 1982

Conférence Générale
Quatrième session extraordinaire
Projets de résolutions

Conferencia General
Cuarta reunión extraordinaria
Proyectos de resolución

大会
第四届特别会议
决议草案

المؤتمر العام
الدورة الاستثنائية الرابعة
مشروعات قرارات

18 1 83

4 XC/DR.62+
(COM.I)
25 November 1982
Original: French

Item 7 of the agenda

DRAFT RESOLUTION

submitted by BELGIUM

Amendment to the Draft Medium-Term Plan (4 XC/4)

Unit 4 - XI. Culture and the Future

The General Conference,

Considering the importance of the role which Industrial Design and industrial designers play in shaping and moulding the environment, and in regard to the quality of life, through the design of industrial and consumer goods, buildings, communication systems, urban and rural planning systems, etc.,

Considering that Design, as a bridge between art and science, is necessarily, by reason of its deep social, cultural and environmental implications, a subject of legitimate concern for Unesco,

Considering the harm industrialization has caused and may still cause the human environment,

Considering that it is urgent to encourage and develop those disciplines that are capable of protecting and restoring the visual, cultural and social aspects of the environment,

Considering that the thorough study of Design and widespread understanding of its contribution may be universally conducive to this end,

Referring to paragraph 11090 of the Draft Medium-Term Plan (1984-1989),

Invites the Director-General, in implementing the Medium-Term Plan, to provide for appropriate action to promote the use and application of Design throughout the world, in particular by:

+ This proposal was received by the Secretariat on 23 November 1982.

developing research and building up a stock of theoretical materials for use in the teaching of Design;

developing curricula and teaching materials that can be used for giving school-children training in Design (at both the primary and secondary levels), for educating consumers and for keeping directors of firms and the relevant government officials informed;

compiling written and audio-visual information clarifying the various ways in which Design can be of service to the international community;

involving designers in major projects concerned with the planning and development of the human environment, in particular by including them in the multidisciplinary teams that are being organized today or will be organized in future with a view to achieving the objectives of Unesco;

organizing seminars and pilot projects aimed at ensuring that Industrial Design and industrial designers contribute to the development of a genuine twentieth-century culture reflected in the industrial products and systems that mould the environment not only in the developed countries but also in the developing countries, whose distinctive characteristics and endogenous resources will be an essential constituent of the process of industrialization.

Annexture 2

Industrial Design and its importance for developing countries

(Excerpts from a working paper prepared for UNIDO at the request of International Council of Societies of Industrial Designers (ICSID) by Gui Bonsiepe.)

Industrial design should be used as a tool in the process of industrialization of developing countries. As a matter of fact, industrial design constitutes an indispensable instrument for endeavours towards developments.

Its importance - and the necessity to formulate a design-policy in developing countries - is based on the fact that it can help solve the following problems:

(i) Dependant economies rely on the import of manufactured goods (capital goods, consumer goods and social service goods for hospitals and schools). These imports exercise a negative influence on the already distorted balance of payments. By developing and producing their own designs developing countries can use their hard currency reserves and incomes for productive purposes, i.e. direct these financial resources to the creation of a diversified technological infrastructure.

(ii) Products designed in developed countries do not necessarily fit the requirements and needs of the developing countries start designing their own products which correspond to their specific needs and which can be manufactured with the help of existing technology, or technology not requiring heavy capital investment and preferably local raw materials.

(iii) In developing countries one of the most urgent problems to solve is the creation of jobs in order to integrate the population in productive activities. Industrial design in developing countries could be directed towards the development of labour-intensive products, instead of capital-intensive products which characterize the tendency of industrialized countries. This is important since the local labour market will have a shortage of qualified labour force in manufaturing countries.

(iv) Developing countries suffer in general from the fact amongst others that their economies are not deversified and often existing productiion capacities of manufacturing industries are not fully used for the lack of innovative designs. Industrial design can help to promote full use of these production facilities and diversify industrial output.

(v) Industrial design as one type of technological innovation in a very effective means for export promotion. Internally developed designs with innovative character possess an export potential, especially in regions where trade arrangements between various countries have been established, particularly where the product design has been market oriented.

(vi) Industrial products, or in terms of anthropology, material artefacts constitute an ever increasing portion of the man-made environment. They are an expression of a culture. Every nation has to more or lesser degree its own cultural identity. As far as industrial products form a part of a culture, industrial design can help to create a cultural identity, overcoming the state of second-hand culture in developing countries.

(vii) There does not appear to exist a historical law or pattern that industrialization and development must follow. On the contrary, the ecological crises caused by technology of "developed" countries, raises the question whether it is justified to call these technologies "developed". Although industrial design is less concerned with the creation of new technologies than with the use of technologies to satisfy certain needs, it may nevertheless stimulate the development of alternative environmentally compatible technologies.

(viii) Income distribution is also one of the serious and explosive problems of developing countries. Often the majority of the population is excluded from access to industrial products because these lie beyond the range of their financial possibilities. Industrial design could find one of its nobles aims, and one of its very few really worthwhile justifications, in developing products for the needs of the poor majorities.

(ix) Developing countries need to utilize their limited resources in an optimal manner with the least waste possible. They are not well advised when they copy life-styles and product assortments of industrialized countries. Confronted with the undeniable scarcity of means, the formulation of product policies and the definition of priorities becomes necessary priorities which needs are to be satisfied first, and which needs are to be satisfied at a later stage of higher development, with a higher level of productivity. Rationalization and formulation of product assortment policies could become one of the chief areas of industrial design in developing countries.

Industrial design is thus important for developing countries because it can help to solve nine basic problems :

1. Relieving the balance of payment
2. Fulfill specific requirements and needs of the relevant market
3. Create new jobs.
4. Diversify the industrial output
5. Create export markets
6. Create cultural identity
7. Stimulate the development of alternative technologies
8. Respond to the needs of the majorities
9. Rationalize the output of industrial production.

Possible fields of activity of industrial design in developing countries.

Although in general public opinion industrial design is to a great extent associated with consumer goods. there are many products areas in which industrial designers can become, and already are, active.

These areas include for instance:

Passenger transport equipment (bicycles, buses, trains)

Cargo transport equipment (trucks)

Health equipment (mobile operation rooms for rural areas, surgical instruments)

Educational equipment (school furniture, kindergarten equipment, educational toys)

Agricultural machinery and tools.

Building components for low-cost housing

Machine tools for medium and light industry

Food packages as well as methods for food distribution and conservation

Low-cost housing furniture

Consumer durable goods of all types.

Some general rules for industrial design policy

When a developing country starts to work in the above-mentioned fields, the list of which does not pretend to be exhaustive, it might be useful to have in mind the following observations concerning a design policy :

(i) Industrial design activity in developing countries does not mean to develop cheap replicas or low quality versions of existing designs developed in industrialized countries. Rather it requires a definition and solution of the design problem in terms of existing (scarce) means and (abundant) needs.

(ii) Design activity in developing countries should not derive its standards of evaluation from industrialized countries ; but should take its points of reference from its own reality. Only that reality can yield standards of evaluation for design efforts made in developing countries.

(iii) Generally it would not be viable to aim at complete design autarch in developing countries. Therefore it becomes necessary to establish priorities of design projects or design areas according to their global social benefits and development potential (multiplier-effect).

(iv) When exercising design transfer as one type of technology transfer one can follow two strategies :

a) The imported foreign design is adapted to the technological possibilities of the developing countries, without sacrificing qualities of useability. This adaptation requires redesign taking into account technological resources and parameters. Machinery, materials, level of execution, possible tolerances, labour force, volume of production existing or attainable in the relevant country. The aim is to reproduce a foreign design with existing resources which requires modifications. Because of the redesign, the idea of fast and easy copying of foreign designs is an illusion.

b) The imported foreign design is adapted to the functional requirements and context-specific needs of the developing country. This adaptation implies a new formulation of performance specifications and may lead to major modifications of the existing design, and even to a development of a new product.

It is important to note that in both cases the foreign design serves as a starting point, and not, as in mere copying, as a terminal point. In adapting designs the adapting country needs to create a capacity for innovative work which helps to reduce its state of dependence. This practice is the opposite of reproductive technology transfer as in licenses or use of royalty schemes.

(v) Design transfer in the form of soft-ware or know-how, especially design methodology should be made in a flexible way, i.e. the software of industrialized countries should be adpated to the needs and contingencies of the developing countries, and not vice versa. Otherwise design know-how would tend to become superimposed on a reality which cannot assimilate the transferred knowledge. Design transfer both as hardware and software from industrialized countries to developing countries without modifications is hardly possible and would cause counter-productive effects.

(vi) Developing countries which want to use industrial as a strategy for de-elopment need to assign highest priority to the training of local manpower resources in the areas of

Design Management

Design research

Design projects.

The second priority refers to the logistical support especially equipment of prototype workshops and laboratories with adequate machinery and equipment of design offices.

The specific differences in the role of industrial design in developing countries and industrialized countries

(a) The situation of industrial design in industrialized Countries

Generally, industrial design in industrialized countries has at its disposal a sophisticated technology with a great variety of materials, manufacturing processes and skilled labour. Furthermore, there exists a highly diversified market structure, with a great variety of subtle consumer preferences.

The rate of obsolescence, both technological and psychological, is usually very high. In these "economies of abundance" industrial design has a decisive share in the creation of formal (aesthetical, visual) innovation, especially of consumer goods - a role which more and more gets criticised by a growing number of members of the profession. This critical attitude holds that formal innovation with its high turn-over of merchandise has to be checked because of ecological consideration, not to mentiion social considerations.

Thus enterprises and corporate organizations in industrialized countries use industrial design as an instrument in their comprehensive strategy of growth.

In corporate planning industrial design plays an important role, co-ordinating the many different manifestations of an enterprise in the market place and the general public. These components altogether create the so-called house-style or corporate style.

Industrial design in industrialized countries finds itself in a situation where the relation between means (technology) and needs (demand) is precisely the opposite of developing countries. In the former the volume of needs is smaller than the volume of productive forces or means, whereas in developing countries the volume of needs is bigger than the capacity of the productive forces.

(b) The different approach to industrial design in developing countries

The fundamental difference between the two opposite contexts implies, of course, a different approach to industrial design in developing countries. The different approach can be described as follows:

(i) Concerning the importance attributed to formal aspects:
though undoubtedly important, and hardly to be eliminated from any industrial design effort, formal factors play a secondary role in developing countries compared with industrialized countries which can efford to indulge in aesthetical innovation and sophistication. Thus "Good Design" has a secondary place in developing countries unless export marketing is envisaged.

(ii) Concerning costs: If industrial design is aiming at the satisfaction of needs of the poor majorities, it is exposed to heavy economical constraints. Therefore the problem is: How to get good, and not shabby, use value at low cost and low price! Generally the flexibility of the price range in industrialized countries is bigger than in developing countries.

(iii) Concerning technological resources: Due to the lack of a technological infrastructure, the range of materials, manufacturing processes and skilled labour force on the use of which the industrial designer can draw, is quite limited. Industrial design in developing countries is forced to work under "Imperfect" and restricted conditions.

(iv) Concerning the production volume: Developing countries often have rather limited markets whereas industrialized countries can count on enormous markets. The use of certain technologies is only economical when there is a great output and a market potential which can absorb the products. Industrial design in developing countries must therefore consider market limitations and possible economies of scale.

(v) Concerning use value: The scarcity of means imposes the search for a maximum of use value for a relative minimum of costs. That does not mean design of cheapest products. "Cheap" designs are not necessarily products with least cost. They result often from false economies.

(vi) Concerning utilization of resources: The restricted resources of dev eloping countries require a rational approach which guarantees their optimal utilization. Concern for total social benefit of design activities is a pre-requisite. Any error made in this field weighs much more heavily than in industrialized countries.

(vii) Concerning ecological implications: Countries not yet industrialized still have the possibility, at least theoretically, to opt for a different pattern of industrialization which pays attention to ecological compatability and which contains built-in preventive measures against environmental sell-out.

(viii) Concerning food problems. Populations of a great part of developing countries do not receive sufficient food, neither in quantity nor in quality, especially protein-rich food. Design imagination and design effort might focus on the solution of this basic problem; production and concervation of more and better food for hundreds of millions of people. Industrial design can contribute to the solution of this problem by development of adequate tools and machinery for agriculture, and in the future perhaps aquafarming or other such innovations.