THE ROLE OF AN INDUSTRIAL DESIGNER IN LOCAL PRODUCT DEVELOPMENT IN A DEVELOPING ECONOMY

Dakyes Samaila Unman

Abstract

Everything in life has its advantages and disadvantages. One of the disadvantages of globalization is, Africa will be reduced to a ready market for products of technology from the advanced nations. Africa needs to look inward with a view to developing its local technology if it must benefit from the advantages of global cohabitation and free trade. The paper analyses the concepts of globalization as it affects Africa, the concept of product design and development (industrial design). A modified prototype of catapult/ bow and arrow is developed and tested, the object of which is to stimulate responses from relevant areas in respect of the development of local technology in Nigeria.

Introduction

Globalization is a Western concept that seeks to adopt social institutions at global scale, orit is a process by which a business or company becomes international or operates at an international level. The concept also aims to convert the world into what the West would call a "global village" or.a "global market. This global village is divided into two, the industrialized nations on one side producing and the less developed nations at the other end consuming. The political, economic, and educational efforts of the later are touted by the advanced nations to ensure a steady market for their products.

The World Bank and other monetary agencies serve as an interface between the technologically advanced nations and the third world countries. It controls and detects to the later retrogressive economic, political, and educational polices particularly to Africa who according to the west should remain a consumer in the context of the global cohabitation.

The African nation should therefore, look inwards with a view to developing its local technology by intensifying efforts in the area of research and development (R & D). Product design and development provides a readymade solution to the problem of technology in the African continent. The study looks at the scope and concept of product design and development; the role of the industrial designer and the step by step production process by modifying the local catapult Bow and Arrow.

Scope and Concept of Product Design and Development

The systematic process of product design and development has to resolve the often conflicting demands that arise in the development of products. These might include considerations of manufacturing, marketing, aesthetic appeal, protection of the environment, ergonomics, financial cost, ease of maintenance, and safety. It follows that, for anything but the simplest product, many specialists, (for example), marketing staff, ergonomics, industrial designers, and engineers) will play their parts in the product design process /development.

These specialists use their own forms of product modeling to aid the design and development process. Initial concepts may be developed and evaluated by designers and engineers using quickly produced sketch models in two or three dimensions. More formal aids may then be used, such as full engineering drawings non-working models to represent appearance and working prototypes, to further test the feasibility of the emerging product.

Ail the design and engineering specialists now use a more advance modeling extensively in product design and development. This is computer-based modeling known as Computer Aided Design (CAD), and is popular with industry because it enables new procedures and technologies to be employed that shorten the time it takes to develop a new product.

The Three Fundamental Sources of Product Design and-Development

As it was earlier stated in the discussion above, product design and development is a functional process of development of the three fundamental sources below:

a) Design;
b) Industrial Design; and
c) The Development of Industrial Design.

b) Design

Several views have been expressed about design. To a layman, design could be the act of. creativity and production of art forms. Design in this case is viewed by professionals in the act of design and creativity:

According to Philips (2000), design is a process of purposeful visual creation and definitely, a creative act of art, which is different from painting and sculpture. His definition of design, was on the argument that many individuals view design as a fine art aspect of specialization. He further argued that, painting and sculpture are mostly the motion, emotion, and dream of the artists, whereas design is production of functional products that must meet customer's requirement.

Hornby (2000) sees deign as a general arrangement of art elements such as line, colour, shape, tone and texture, which are guided by design principles (harmony, balance, proportion, perspective, rhythm, variety and contrast). He concluded that, these art elements and design principles must be put together in an agreement to produce a functional design, which will be useful to the society. A good design is a functional design that speaks to the people by illusion, aesthetic and practical function. In fact, design in a broader view engulfs all aspect of conception of ideas, creating, and development of thoughts in connection to problem solving in the society.

Lastly, a more acceptable definition of design was given by Anderson (1961), in his book titled "Elements of Design. He said, "Design is a process of accomplishing the end product of the arrangement of a manipulated sets of raw materials as clay, wire, paper, pigment, sound, data, word, numbers which are further transformed into cohesive structures on higher level of significant illusion of space.

b) Industrial Design

Industrial Design is a form of design which involves the process of analyzing, creating and developing products for manufacture at a price permitting wide spread distribution at affordable or reasonable price.

Industrial design is an aspect of a wider area of professional design practice, which involves the activity of art and science in the creation of machine-made products. It is a wide range of creative and systematic process, concerned with appearance as well as with efficiency. The success of a design is measured by the profit it yields its manufacturer and the service and pleasure it affords its users.

The Application of Industrial Design

Emerging and established technology provide numerous opportunities to address and re-evaluate human needs and designs. Such technology may even stimulate unrealized needs desire. Technology needs to be "packaged" if it is to be used safely and reliably, and industrial design is the art and science of packaging technology for the mass market. Mass production requires that a product will sell in high volume. In order to sell, a product must appeal to a sufficient number of people (a market group) by having the requisite attributes, advantages over other products, to induce purchase. Such advantages may include the saving of time and energy in a particular task, financial savings, increased user safety compared with previous models or the imparting of status through ownership. An experienced product designer is often called upon to act as an interpreter of contemporary culture, in addition to other manufacturer oriented roles.

It is worthwhile for a manufacturer to invest in careful product development before a product is launched in to a particular market. Not investing in product development that can result in very expensive failures, such as a product recall because of safety defects, or a general lack of sales. Industrial design is one aspect of product development and has close links with manufacturing, materials science, marketing packaging, and ergonomics. The whole product development process is increasingly multidisciplinary.

Industrial designers are rarely required to develop new products. Typically, they work with other specialist to develop household appliances such as (toasters, cookers, television sets, computers, and

furniture) sports equipment (sailing dinghies, specialists clothing, and racquets); technical equipment (camera and CD players); research equipment (for technical measurement and analysis); and vehicles (buses, trains, cars, and bicycles). They can also be involved in some areas of interior design (such as shop fitting and exhibition design). It is a sign of the importance of the discipline that a wide spectrum of manufacturers seek to employ industrial designers within a development team -either on consultancy basis or as staff members. As a general rule, the more direct the contact a product has with its users; the greater is the opportunity for industrial design to make a contribution. Thus, the design, development and production of consumer products and their packaging fall within the remit of the industrial designer, while car gearbox design or the development of aircraft components is the province of engineers. Increasingly, industrial designers work at the "interface" between people and things, and at the interface between disciplines. Computer software and instruction manuals are good examples of products on which industrial designers may work alongside computer scientists, and graphic designers, to develop clear, logical, and usable displays and instructions - that is, the interface (interaction) between users and products.

The profession of industrial design is not new, since 1945, there has been a trend towards specialization. In the motor industry, for example, an industrial designer may be limited to producing concepts for body styling or interior. In other fields, however, and especially in small companies, a manufacturer may expect an experienced industrial designer to coordinate a wide range of responsibilities, including the design, production, packaging, and display of a product.

Methods of Industrial Design

It is obvious that industrial designers operate with many conflicting demands hence the methods of the industrial design practice are varied. A product may require an expressive form to embody its idea, or particular texture or colouring (conveying, ruggedness or delicacy, for example); it may have to be suited to the physical size of a wide range of people, and it may need to communicate information (such as feedback during use); it is likely that it will need to be easy to maintain and repair, it must be capable of being manufactured economically and at the lowest possible ecological cost: and *it* needs to be attractive in appearance and price after transported to shops and stores. The working approach and method of the industrial designer must inevitably address a diverse range of interests and concerns, and therefore, competing criteria. As a consequence, the industrial designer must embody something of the knowledge, sensibility, and competence of the engineer, the artist, the scientist, the economist, and the sociologist

Industrial design is a process of compromise. While those engaged in it will attempt to define a specific problem., or "brief," their skill lies in being able to build appropriate knowledge within a broadly creative strategy and within realistic deadliness. Questioning assumptions can be as important as identifying requirement, since this may lead to genuinely innovative resolutions. This in turn can lead to significant advantages for one company over its competitors. Many designers, including industrial designers, refer to this process as "modeling."

Planning and project management are also vital skills. Large corporations such as Sony, the Japanese electronics giant, may have hundreds of industrial design projects running simultaneously. Design ideas are quickly modeled in two dimensions (by drawing and sketching) and in three dimension (in wood, plaster or rigid form) by industrial designers. Such models facilitate examination and evaluation by other specialists, by managers or even by the public (in special "user trails"), as well as by the design team. Following this sketch modeling, further material, casting, or production' research is incorporated into the creative development in order to assess the feasibility of the most promising ideas. Only then can robust models or prototypes be built for final evaluation by the client or senior management. A full specification and costing of the product will precede manufacture.

The Development of Industrial Design

Industrial design is a living and dynamic phenomenon. At any meeting of industrial designers it would be possible to hear very different opinions as to the beginnings of the discipline, the. influences on it, and the priorities for it. Nevertheless, two major roots are clear. One has its origins in marketing and the exploitation of industrial design to increase product sales and company turn over. The other, providing a more suitable historical starting point, is more abstract: it concerns the debate regarding human being's role in a manufacturing society, including the search for appropriate aesthetic forms in a rapidly developing "machine age."

Design and Social Reform: The Industrial Revolution of the $18^{1,1}$ century and beyond saw a move away from individual production to the division of labour in factories. For the workers the conditions were often dangerous and dirty, and failed to encourage any sense of pride in the output. As for the products, which included furniture, cutlery, and textiles, they were meant to appeal to a new urban middle class, who provide a ready demand for cheap, highly decorated products.

Among the British and European reformers the growing belief was that design for industry was a fundamental social insure for government policy and education. The earnestness of the belief characterizes the "design for industry" debate in the late 19^{th} and early 20^{lh} centuries.

The establishment of schools of design (such as the Central School of Arts and Crafts in 1896 in London) was an early attempt to develop critical awareness of artifacts and architecture. The German government encouraged cooperation between applied artists, manufacturers, and retailers through the Duetscher Wekbund (the German Association of Craftsmen, founded in 1907), and one of the members of this organization, Peter Behrens, may be viewed as one of the first true industrial designers, as a result of his work with the German corporation AEG, The heated debate in the Werkbund, which continued in the Bauhaus School of Design (founded in Weimar in 1919), concerned the relationship between art and craft sensibilities, the exploitation of the machine, new materials in architecture, and design for industrial production. The International Style, with its uncompromising forms of architecture (best seen in the work of architects such as Le Corbusier and Ludwig Mies Van der Rohe), was an important influence on the emerging profession of industrial design.

Inexhaustible developments of industrial design are also with the Scandinavian countries who blend modernist ideals concerning mass production, appropriate decoration, and directness of forms with subtle human factors, a knowledge of materials and marketability. Alvar Aalto (Finland) and Bruns Mathsson (Sweden) are notable for their deceptively simple, functional designs. Scandinavia Style was a major influence in international industrial design during the 1950s.

Hunter's Kit - A Modification of the Catapult/ Bow and Arrow Statement of Problem

This hunting weapon has been modeled after the 'catapult' and is also having some of the functions of a 'bow and arrow[1]. In fact, it is a combination of both. Over the years, especially in these parts of the world, the handling of the bow and arrow has not been easy so hunting has been restricted to only a handful of people. More so the bow and arrow as we know it, is very big in size which makes it very difficult to carry. Targeting requires a lot of energy to pull, there are risks involved e.g. the risk of the breaking of the bow or cutting the elastic rubber. And as regards the catapult, the rubber wears off with time or also stands the risk of breaking. Often when not fired property, it hits the hand of the user.

Objectives

Some of objectives that prompted, the modification of the Bow and Arrow weapon include: • (i) to have a more portable hunting equipment, (ii) to provide a means of self defence that this affordable and easy to use (as in the case of guns which are quite expensive and not too easy to manipulate), (iii)to have a simple, durable and effective hunting equipment.

Justification

The new hunters kit is a modification of both the catapult and the bow/arrow (CBA) with the elimination of all the shortcomings of CBA. Some of the advantages of the hunter's kit include:

(i) Portable and easy to carry,
(ii) It is durable,
(iii) Tolerance for error. There is safety in handling due to the presence of chamber which helps in guiding the arrow or whatever the hunter chooses to use, iv. It is multi-purpose in the sense that it performs the functions CBA.
(iv) Low physical effort is required to fire the weapon,
(v) It is simple and intuitive such that special hunting skills are not required to be able to use it.

Materials
Metal sheet (2mm black)
Round pipe
Metal tip arrow
Flexible metal sprint
Leather
Welding electrodes

Production Process

The processes of product design and development utilized in the production of Hunters Kit include:

(i) Thumbnail sketches,
(ii) Transformation,
(iii) Forming of metal sheet and pipes.
(iv) Cutting.
(v) Joining and Assembly, (vi) Finishing,
(vii) Packaging.

(i) ***Thumbnail Sketches:*** This is the first stage of the process of product design and development after conception of the idea of what is to be produced. Drawings are made in two or three. dimensions from rough sketch to finished product. The product designer makes the sketch and analyse it together with the production engineer to further produce the technical drawing, measurement and dimensions.

(ii) ***Transformation:*** Transformation is a general procedure for manufacturing product. For" example, metal has to begin with its ore in its natural state and send it through some processes to improve its usefulness. This is the process of getting the raw material from its source and refine it for production e.g. steel is extracted as iron ore, sent through a blast furnace to produce pig iron and finally into steel.

(iii) *Casting:* Casting is the process of forming objects by pouring liquid materials into a mould and allowing the material to solidify. This is an old process, but frequently it is still the most economical and effective method for obtaining a desired shape. The mould is one of the most, important parts of casting and the correct design of the mould is both a science and an art. Although many types of moulds exist, by far the most predominate is a sand mould, especially for iron and steel.

(iv) ***Forming:*** Instead of casting in some materials like metal work, a sort of metal forming is preferable. Forming include rolling, drawing, forging, extruding, bending, stretching and squeezing materials especially metal in its molten state.

(v) ***Cutting:*** This is the process of cutting and shaping of materials and removal during forming to desired shape, to obtain preconceived shape, close tolerance and specific surface finishes.

(vi) ***Joining and Assembly:*** This is the process by which the various parts and sub-assemblies are brought together to form a complete assembly or product. Methods of assembly include less permanent bonds, gluing, riveting, screwing, and force fitting.

(vii) ***Finishing:*** Finishing is a set of processes in which the material, either as a completed product, sub assembly, or component part is made more effective or presentable through the external application of energy and /or other materials. Finishing operation includes polishing, buffing, brushing, tumbling, surface chaining the two of the most common coating techniques.

(viii) ***Packaging:*** This is the last phase of production in production design or manufacturing design. Hence, the packaging of the finished product must be designed to protect it during transit and to insure that the product will arrive undamaged. The package designer must be familiar with the various materials for packaging, its techniques and the cost of various types of packages (Karl & Steven, 2003).

Product Testing

The catapult/bow and arrow prototype was taken to the physical and health training centre of Ahmadu Bello University, Zaria where it was tested by fifteen able bodied men.

Findings

- The product was found suitable for hunting; a target was used to ascertain its precision,
- It was also found suitable for exercising the muscles around the arms, chest, waste and leg.
- The product could be used for indoor exercises after work,
- The product could also be used for action-packed local movies.

Recommendations

- The National Board for Technical Education (NBTE) should come up with new education policies with a view to improving the quality of technical education in Nigeria.
- Emphasis should be laid on Polytechnic education as the bases for a sound technological take off.
- Polytechnics, Junior/Senior Technical Schools and Vocational training centres should be properly equipped with modern facilities and well trained teachers to enhance quality technical education in Nigeria.
- The curriculum of industrial design departments should be reviewed to a product based course structure and our Universities should be properly funded for an effective and sustainable technological take off.
- Government should provide incentives to both technical education teachers and students as 3 way of motivating interest in the area of technical education.

Conclusion

The technological advanced countries did not stumble over technology; they started from the most basic, to simple then the complex, sophisticated and high tech. The African nation must also started somewhere hoping that sometime in the near future Africa will be technologically self reliant.

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