Review Article

An overview of the state of industrial design education in Nigeria: The limitations and prospects

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ABSTRACT

Industrial design involved solving a problem through designing products that can be mass produced. Despite the relevance of industrial design in many countries considering the fact that it plays a significant role in the success of world-leading companies, it was sad to note that, in Nigeria, relatively little is yet known about this significant professional field. Therefore, this paper reviewed the industrial design in Nigeria from a broad perspective, with a view to shedding light on the current context of industrial design in the country as well as recent advances in the concerns of the discipline globally. It reviewed into the limitations and opportunities of industrial design in Nigeria. The future benefits of industrial design on the success and sustainability of Nigerian economy, as a case study of developing economies, were also reviewed.

Keywords: Education, industrial design, limitations, prospects, recent advances, sustainability

INTRODUCTION

The Nigerian concept of industrial design embraces the creation of functional designs with intrinsic esthetic satisfaction.[1] Design in Nigeria arose from the need to bring ideas and thoughts into reality through drawing, sketching, molding, and creating objects. In other words, design in Nigeria started out as an art. Over the years, design had cut across different fields of study ranging from art to the more industrial aspects of design, architecture to mechanical engineering, and medicine among other professions. Likewise, many individuals had used the term design religiously in various contexts to suit their professions such as design of business plan, design of a financial plan, or the design of organization which its main aim is to follow a design process.[2] This is not out of place as design cuts across various fields of practice and research. The diverse and systematic stages that inter-engage to arrive at a final outcome can be described as a design process since it covers stages from idea conception to product generation, evaluation of product success/ sustainability, and finally, necessary innovations. Therefore, it is safe to state that design is not just an evolving process but also an outcome.[2] However, considering the different fields of study, design process may vary.

Design, to the vast range of professions, has almost similar meanings as they are all guided by the principles and elements of design toward having an effective and beautiful outcome. It enables the combination of art, technology, and science for solving problem by creating products or artifacts for consumers' use. Thus, design engages visual principles and esthetics in which the principles and elements of design are the same with other professions, although the audiences and the messages may differ.[3] Theory, practice, and production are core elements of the design discipline.[4] One significant field of design is industrial design. Industrial design is viewed as a synergy between applied art and science aimed at creating and developing esthetic, ergonomic, and functional values in produced artefacts.[1] Industrial design is a process applied to products intended for manufacturing, adopting flow or mass production techniques.[5] Furthermore, it is viewed as the infusion of design activities into a business enterprise devoted to creating artefacts as a part of wealth creation.[2] Therefore, industrial design can be viewed as creative activities intended to engineer new or innovative mass-producible products or services for esthetic or functional purposes. A number of literatures exist on the evolution and developmental stages of Industrial design in Nigeria, various problems it has

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encountered over the years as well as its future prospects.[6-9] However, this study reviewed the prevailing state of industrial design in Nigeria (as at the time of the study), recent advances, and the prospects of industrial design products with a view to recommending ways of improving industrial design education and its contributory capacity for economic development and sustainability.

EVOLVEMENT OF INDUSTRIAL DESIGN

The design discipline began to emerge in the early 20th century as the complexity of technology and products increased.[4] Before industrial design education, products created were basically handcrafted as there were no machine and technology to ease the design development process.[10] Here, a single craftsman is responsible for every stage in the development of a product, that is, conception of idea, product creation, and marketing products produced which lowered the rate of production as well as increase the cost of such product. However, innovations in form of glass making, textile production, transportation, paper making, pottery, and several others emerged as machines were used to assist the design process.[10] Furthermore, the new innovations leveled the standard of living but did not do justice to the physical appearance of products, prompting the need to add esthetic values to it. Hence, different individuals selected some creative ways such as decoration and packaging to make the outer appearance of such products appealing which resulted to the establishment of industrial design school.

The first curriculum of industrial design was founded for an industry based on mass accessibility of products and standardization for efficiency.[11] According to a previous study, industrial design education was established in Germany over a century ago, which was later adopted by universities and colleges in Europe and USA, with developing countries recently growing their original design quality through international recognition.[12] At the end of 19th century, industrial design was introduced into the industry which was not clearly defined as it incorporated the activities of architects, engineers, craftsmen, and inventors among others until the beginning of the 20th century when it was described as activities incorporating, esthetic, functional, technology, and business.[10]

ORIGIN OF INDUSTRIAL DESIGN IN NIGERIA

Industrial design started out in Nigeria as a form of craftsmanship and was introduced into the educational system in the late 70s in Ahmadu Bello University with graphic design, textile design ceramic design, glass design, and technology as areas of specialization.[13] The advent of industrial design in Nigeria has its foundation in applied arts. Hence, its students studied ceramics, painting, textiles, and sculpture, among others projecting a blend of art and craftsmanship in the forms of prototypical art. The concept of design was, however, introduced as time went by with the reproducibility of designs created varying from two-dimensional designs to three dimensional designs. Industrial design education went through a series of practical training to combine both functionality and esthetical values in creating a product.

CURRENT STATE OF INDUSTRIAL DESIGN IN NIGERIAN INSTITUTIONS

As the Nigerian society changed, few universities introduced the industrial design education into their course of study such that new curriculums were established, creating the likes of graphic design and computer-aided design courses. However, 43 years down the line, the current state of industrial design in Nigeria had seen no much changes from the initial stage, as art still had a very strong hold on the discipline. Universities offering industrial design within the country majorly specialized in three sections, that is, graphic design, ceramics, and textile design. All these courses enabled the creation of a product for human use.

Graphic design allows the representation and beautification of design before the final production, although this now forms one of the basics of industrial design. Graphic design can lead to product design from the basic knowledge of designs engaging the principles and elements of designs which is important and essential in creating and rendering designs intended to stand out among other designs. Ceramics which were one of the oldest industrial design specializations were known for various forms of 3-dimensional designs, mostly pottery using materials such as clay, rocks, minerals, and porcelain. Ceramics design deals mainly with products that serve for both esthetics and functionality.

Interestingly, ceramics, which have a strong foundation in art, as well as good electrical and thermal insulators, are becoming useful products in the engineering field and holistically in science and technology.[14] The new curriculum introduced computer-aided design to enhance creating graphics, ceramics, and textile designs and guiding the design process. The basic areas of textile design include but not limited to pattern making, sewing and tailoring, weaving, dyeing, fabric printing, and computer-aided textile product development.

Despite computer-aided design introduction into the industrial design education to meet up with the world requirement for effective design delivery, the course was yet not widely known and embraced within the country as a profession. This, perhaps, justified why only six universities of 153 universities

in Nigeria as at 2017 offered industrial design as a course.[15] The six universities were:

1. Ahmadu Bello University, Zaria
2. Abubakar Tafawa Balewa University, Bauchi
3. Federal University of Technology, Akure
4. Godfrey Okoye University, Urgwuomu, Nike
5. Plateau State University, Bokkos; and
6. Modibbo Adama University of Technology, Yola.

Majorly, in Nigeria, when people heard the word "Industrial Design," they pause to process the word and then ask the most frequently asked question, "What do you do?" As a result, few candidates apply to study the course because the poor publicity affects the expected career of some students by leaving them with uncertainty of the future (that is, where they will eventually end up after graduation). The majority of students who eventually studied industrial design as at the time of this study in Nigeria did not deliberately choose industrial design as a course of study. It was usually offered to them as an alternative to their original choice. Many of them had to make the best out of what they ended up with. Consequently, for determined industrial design graduates, their creativity helped to break through the labor market and due to the training received through the experimental approach adopted in the course of study, allowed some students the privilege to set up a design outfit. Yet, the spate of expression of discontentment among industrial design students and graduates was not ignorable.

RECENT ADVANCES IN THE CONCERNS OF INDUSTRIAL DESIGN

Industrial design is broadly concerned with creativity and esthetics which are often translated into the development of functional products. However, the concerns of industrial design are not limited to local crafts such as bags, figurines, pottery, and others. More technical/functional products have been developed such as bathtub or sanitary wear, in general, with the horizons of research expanding. Recent advances in the field of industrial design tend toward the implementation of "think globally and act locally; think locally and act globally" sustainability philosophy. While this slogan originated in the 1970s as an environmental protection and preservation campaign as coined by Rene Dubos,[16] it has been found relevant to the concept of design for sustainability. With respect to design for sustainability, it also focuses on life-cycle thinking in product design which is most needed for developing economies,[17-19] Nigeria inclusive.

With the vast movement tending toward technology, the world embraces the digitalized world and the field of industrial design expands; hence, the industry sees its need to merge management, engineering, and marketability involving a strategic involvement in design.[11] As such, internet and digital technologies allowed a unified society that is connected, produce, and share their resources among themselves. Hence, industrial designers serve as a bridge between the manufacturer and the users. Products design created are embraced due to the relationship established between clients and producers by affording them the ability to state what and how they want it.

The activity of industrial designers in developed countries is linked to product development, engaging engineering knowledge. However, it is not totally the same case with Nigeria because the profession and discipline are still very much rooted in art. Product designs such as phones, watches, cars, textiles, furniture, jewelry, and other luxury items are created, opening way for packaging products. Interestingly, some graduates of industrial design have been able to find their feet in the industry as they are found in various sectors such as advertising agencies, fashion design outfit, packaging agencies, and film industries.

Industrial design, especially in developed countries, keeps changing with new knowledge and skills gained from digitalization and technology in solving a different problem. Adopting new technology, production technique, and materials used made way for mass production, standardization, modularity, and diversification of designs for users.[10] Productions are made easier with the adoption of new technologies. An accurate example is the emergence of 3D printing which demonstrated that time could be saved with the lesser effort involved while checking the functionality, esthetic, and every other necessary thing before the production of the final product.

People are finding ways to live a life of ease by reducing the time spent on less relevant things in order to be more productive. Designers as well see a need to that, and interestingly technology has allowed intelligence with a high level of creativity to avail different product designs and due to this, there are smart cars, smartwatches, and 3D television among several others. With this, one can see that industrial design has a lot of potentials through solving humans' problems. With such development coupled with wide publicity, hopefully, it will get to the point when there will be little or no more confused faces when industrial design is mentioned in Nigeria.

LIMITATIONS OF INDUSTRIAL DESIGN IN NIGERIA

Development of Industrial Design in Nigeria had so far been handicapped in diverse ways by a few limiting factors including but not limited to the following:

Lack of Information about the Field
The first major limitation of industrial design in Nigeria is the lack of substantial information about the discipline and

the opportunities that come with it. Many industrial design graduates in Nigeria were well acquainted with the succinctly embarrassing question, "What exactly do you people do?" when introducing themselves as industrial design professionals. There was a confirmable considerable lack of societal knowledge or awareness about the field as at the time of review.

Art Base Limitation

Industrial design education in Nigeria, as at the time of this review, was still mostly art/craft based,[20] as it had not totally embraced technology and science. Product design should be as a result of problem solving, but in prevailing cases of craft creation or esthetically driven motive for object creation, then prospective candidates or individuals might lose interest and zeal for the field. Perhaps, this trend accounted for a major reason why many trained industrial designers go for a change in career after graduation or a change of course of study while still undergoing studies.

Lack of Recognized Regulatory Agency

Lack of a recognized body/agency regulating the education, practice, and development of industrial design in Nigeria is another key challenge hampering the development of Industrial Design in Nigeria. While other professions such as engineering, medicine, architecture, and town planning have professional bodies or associations, there is no existing professional body in Nigeria as at, the time of this review, covering Industrial designers. Many practicing industrial designers have had to hide under other professional regulatory bodies (which do not necessarily partly or fully represent the field's true nature, content, and interests) to have some professional sense of belonging.

Domination of the Field by Art-based Professionals

Industrial design education in Nigeria was at the time of this review being handled, regulated, and taught predominantly by professionals, technologists, researchers, and instructors who were almost completely art-based. Trainings and instructions were predominantly art-based. This went a long way in limiting the transition of Industrial Design from being 100% art-based to a perfect blend of applied art, science, and technology as it holds in other parts of the world. Of course, the transition is gradually taking place as there have been researches in industrial design relating to agriculture,[21] environmental sustainability,[22,23] metallurgical, glassmaking, and optimized ceramics processes,[24] water processing technology and resources,[25] waste management,[23,26] developmental communication,[27] 3D design/printing,[28] and so on. However, these advances in research have not comprehensively translated into design practices and teachings as at the time of review.

Course Content Disparity

Industrial design in foreign countries and that of Nigeria were quite different. An example is a difference in course contents of industrial design taught in foreign countries and the course contents of industrial design in Nigeria.[29] Unless priority is given to utility/functioning products and processes that could gain international recognition and promote the discipline, industrial design in Nigeria may remain obscured. To achieve this, product design within the industrial design discipline could infuse more high technology for a better and effective outcome. Thus, the mode of education system, the instruction way, and the evaluation of the design principles need to adapt to change[9] by learning from countries such as China, Japan, South Korea, and United States of America design education system.

Preference for Foreign Products

According to a previous study, two of the basic consumer behaviors noticeable in Nigeria included: Ethnocentrism and preference for foreign product with the latter attributed various factors, including the "dis-credibility" of local products.[30] This due to the fact that many products introduced into the market in Nigeria had not gone through the full design funnel[31] with limited professional industrial design input. This has consequently caused a questionably low preference for local products. This approach to the consumption of local products by the members of the public needs to change if the Nigerian economy is to develop. If the immediate members of the public do not trust their local products enough to purchase them on the bases of being inferior to their foreign alternatives, then there is a problem. This is because it will be difficult for foreign investors to appreciate the products as well.

Dwindling Investment in Product/Industrial Design

Poor funding is a key challenge faced by industrial designers and design researchers in Nigeria. For instance, while researchers from other design fields have better access to research funding, the same may not be said of industrial design in Nigeria as at the time of this review. Poorly researched products/designs have greater chances at failing. Design failures result in poor investment rates. No sane investor puts his/her money where it will accumulate no viable gain. A key purpose of investing is to make a profit. Design sponsors and product manufacturers will be discouraged to create new innovations from fear of product fiasco. This ultimately has been a key reason for the dwindling investment in product/industrial design in Nigeria.

OPPORTUNITIES IN INDUSTRIAL DESIGN IN NIGERIA

The opportunities in industrial design are increasingly significant, including but not limited to the following:

Entrepreneurial Development and Job Creation

Unemployment, which is closely related to poverty, is a major challenge in most developing countries of the world. Industrial

design has the capacity to alleviate this problem as industrial design education does not only breed employable graduates but also breeds potential entrepreneurial minds. It provides the platform to look inward and solve problems creating patterns, products, and processes that can be recognized internationally. Due to the gradual shift from craft creation to creative solutions (though a regrettably sluggish transition in Nigeria), designers after graduation may earn as much as they desire. Based on the experimental knowledge gained while in school, graduates of industrial design could set up a design studio where designs such as graphic images, animation, film production, other motion graphics fields, and two and three-dimensional design such as painting, sculpture, pottery, fashion, and several others. However, some industrial designers could decide to work in an organizational setup where they can be placed on salary. Here, they may work with advertising agencies, branding companies, fashion houses, and so on.

Awareness Creation Effectiveness

Industrial designers now combine their art and design skills to curb the ills in the society by raising awareness on racism, alleviation of tribalism,[27] environmental degradation,[23] poverty alleviation, disease prevention,[32] and rape among several others.

Design Solution Consultancy

Designers can serve as consultants to large firms or companies in need of strategic planning and marketing professionals while they could go as far as conducting researches by analyzing and understanding patterns, processes, and products.

Educational Opportunities

Furthermore, some designers with interest in education may work as design lecturers or instructors as such they can consult in private firms and can as well operate in design studios and institutions (primary, secondary, and tertiary) like any other professional in other fields.

Interdisciplinary Product Design

The field of industrial design is unique in that it is relatively intertwined with many other fields including engineering (e.g., electrical, metallurgical/material engineering), media and films production, agricultural product design and packaging, chemistry and bacteriology, management, production, and so on. Some of the closely related fields to industrial design are as shown in Table 1. Employment opportunities also exist for designers in the listed fields or in fields related to the under listed.

Interdisciplinary Research Opportunities

Designers may also conduct interdisciplinary design-based researches to decrypt patterns, create inventive designs, unearth innovative designs, products and processes (improving on existing designs), proffer design solutions, and so on.

Manufacturing Sector Development

Without the sustainable conception and generation of effective, innovative product designs, the manufacturing sector will be grossly underserviced.[33] Generation of new products and innovation of existing ones are germane to ensuring the sustainability of manufacturing and so on. The sustainable economic development of any nation with a viable manufacturing sector is assured. Leading world economies such as the United States of America, Japan, and China thrive partly due to their sustainable manufacturing sector development. Developing economies such as Nigeria and Ghana should borrow a leaf from these developed economies' developmental strategies.

PROSPECT OF INDUSTRIAL DESIGN IN DEVELOPING THE NIGERIAN ECONOMY

As at 2020, the Nigerian society and, indeed, the world at large have been faced with various challenges ranging from health, political, social to environmental, and most significant economic challenges threatening the core of human existence. An obvious example is a COVID-19 pandemic which ravaged various countries, crumbling various economies since the close of 2019[33] even beyond the time of this review. The Nigerian economy was not spared in the meltdown. Of course, studies have revealed that the overdependence of the Nigerian economy on petroleum resources was a risky economic strategy that was eventually going to run the economy into a serious crisis.[30] Nigeria had barely recovered from an economic meltdown when the COVID-19 pandemic that threatened to completely shut down what was left of the economy surfaced, further crippling an already crumbling economy. A nation whose national income was mainly dependent on natural resources witnessed the price of its precious crude oil fall drastically in 2020. The repercussions were so strong that the country had to go borrowing. Based on occurrences like the above, it is clear that Nigeria cannot afford to continue to depend on crude oil alone. There is a need to explore other non-oil dependent areas of the economy for the purpose of economic sustainability.

Product design, the most vital aspect of industrial design, is one of such avenues that should be exploited to develop the economy of a country. This is definitely not an uncommon strategy as economies such as China thrived on it. China boasts of a good economy due to her open market to competition, product innovations, product development, and exportation.[34] Development of products, especially those with high technology components, if encouraged within Nigeria, will help boost the economy of the country. Therefore with a solid system that encourages industrial design products, more innovative ideas that could be internationally recognized will be generated. Investing in the development of industrial design,

Table 1: Industrial design and some of its closely related fields

S. No	Industrial design sub-sections in Nigeria and their related fields			
	Graphics design and technology	**Ceramics design and technology**	**Textile design and technology**	**Others**
1.	Media/films production, Multimedia/advertising	Material/metallurgical engineering	Chemistry	Sculpture
2.	Mass communication	Product design	Bacteriology	Painting
3.	Physics	Electrical engineering	Product design	Printing technology
4.	Product design	3D-printing	Fashion design	Tailoring
5.	Branding		Branding	Metal art/design
6.	3D designs, animation, and 3D printing	Pottery	Environmental protection	Ivory carving
7.	Manufacturing/production/packaging technology/engineering	Interior decorations	Interior decorations	Printmaking
8.	Entrepreneurship	Entrepreneurship	Entrepreneurship	Entrepreneurship
9.	Information architecture	Health	Health and health product design and developments	Brass and bronze works
10.	Creative design	Industrial engineering	Research	Grass and cane weaving
11.	Web/mobile design, development, and management	Research	Screen printing	Glass and metal works
12.	Sustainability	Sustainability	Weaving	Leather and calabash design
13.	Layout and print design, publication	Manufacturing	Industrial engineering	
14.	User interface and user experience (UX) design	Quality control	Engraving	
15.	Photography/photographic technology	Education	Textile production/production technology	

Source: Authors' compilation (2020)

with a view to strengthening the manufacturing sector, has the prospect of boosting the economy in the long run.

If the government and other relevant stakeholders could have a training exercise outside universities' walls to test peoples' abilities and creativities in design and design process, with experts in industrial design invited to teach and coach on how to manufacture a standard product that could stand the test of time, this has the potential of spurring healthy competitive resolves to develop new and innovative products among existing and upcoming designers provided the reward system is persuasive enough.

RECOMMENDATION

The study recommends the following as measures for the sustainable development of industrial design practices, research, and education in Nigeria:

Establishment of an Appropriate Regulation and Industrial Design Development Agency
As at the time of this review, industrial design in Nigeria was yet grossly unregulated. Lack of a recognized body overseeing the education, practice, and development of Industrial Design

in Nigeria has been identified as a key challenge hindering industrial design development in Nigeria. Having a viable recognized body in place will not only give industrial design professionals and educators a sense of professional belonging and boost their integrity so as to attract better research funding. It will also help regulate industrial design practices in the country. For example, in any effective system, necessary authorities are supposed to monitor the activities of designers and product manufacturers, taking into consideration the safety of products before they are introduced to the public.

Introduction of Industrial Design into more Institutions in the Country
There is a need to introduce industrial design into more institutions in the country considering the fact that only a few numbers of institutions currently offered it as a course of the study compared to courses such as law, architecture, agriculture, and several others. Industrial design has too much developmental prospects to be limited to only a few specialized institutions.

Further Introduction of Science and Technology into Industrial Design Education in Nigeria
Unlike in more developed economies such as the USA, China and Japan, industrial design in Nigeria was still grossly art/craft

based. Arts and crafts beautify, but may not necessarily spur appropriate developments. Therefore, industrial design education needs to fully infuse technology, mathematics, and science into their program and not just craft/artefacts development program as it was being offered mostly in Nigeria as at the time of this review. A previous study indicated that the education approach had long migrated beyond the traditional product-centered discipline (a fit industrial design in Nigeria was barely struggling to achieve) to the more human-centered design focus and critical design creation.[35]

Improved Institution-company Partnership

Companies (both public and private) should partner appropriate institutions in research and research funding so as to improve on (inventive and innovative) design researches to ensure the sustainability of the manufacturing sector which will contribute immensely to the economic sustainability of the economy.[29]

Better-quality Industrial Design Funding

Poor funding has been one of the key limiting factors hindering the development of industrial design practice, research, and education in Nigeria. Due to the loopholes in industrial design education, some students graduate only to switch careers why some travel outside the country to where their services will be more needed and appreciated. To meet up with the standard of industrial design education outside of Nigeria, most especially in developed countries, then it is necessary to fund the design education. A good design background opens the way for exploring, creativity, and meeting up with trends leading to design graduates maximizing their design creativity and innovation. These well-equipped design graduates could give back by to society by serving as design instructors, professionals, and sustainable development catalysts while upgrading their knowledge and skills.

Recruitment of more Science/Technology-based Design Instructors

As long as instructors/trainers remain mostly professionals or teachers with majorly art backgrounds, the migration of industrial design education in Nigeria to the more scientific/technological level as it holds in more industrialized economies would be very difficult. Hence, the full potentials of industrial design education in Nigeria may not be achievable in the nearest future.

Appropriate Remunerations and Protection of Productive Industrial Designers

Workers tend to be more productive when properly rewarded.[36] Industrial design researchers, educators, and field practitioners are not exempted. Rewards in the forms of wages, payoffs, grants, (short and long term) investments, scholarships, and so on will go a long way in encouraging the development of the industrial design field. However, more important are recognition for original design/research innovative or inventive contributions as well as protection of intellectual/proprietary rights of design inventors/innovators.

Curriculum Redesign to Meet the Needs of the Latest Technological Era

The needs to meet demands of the latest technological era is urgent globally and an easy way to achieve this is to consider the restructuring of the curriculum of Industrial design education in such a way that will equip students with adequate design thinking required for mastering the skills and competence most needed to keep abreast of novel technologies and harness its gains. Many technological innovations during the first, second, and third industrial revolutions were driven by design thinking, thereby serving as a trigger for formal design education, and the implication of this is that more sophisticated design thinking is required in the fourth industrial revolution era.[37]

CONCLUSION

Industrial design has come a long way in Nigeria and has seen different transitions through the evolution of internet and technology which has brought changes to the initial ways of doing things as well as serves as an eye-opener to various achievable prospects. However, there is still a long way to go as industrial design in Nigeria was still developmentally crawling relative to the level of design development in more developed economies. Industrial design in Nigeria can be more than what it is today through improved research and creation of high quality, esthetic, and high-tech products with the combination of esthetics and more modern technology. This will increase the chances of made-in-Nigeria products gaining high recognition. Therefore, industrial design education in Nigeria could help make a difference if the approach to industrial design is adjusted and flexible enough to have more engineering, psychology, and computing courses imported into the curriculum to meet the standard of industrial design education in developed countries whose design products we largely depend on for survival.

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