

Understanding the Furniture Design Process in Ghana

- Kennedy Newton Nutassey¹ Isaac Agyei-Boakye² Ebenezer Quayson³
1.Accra polytechnic School of Engineering Department of furniture and production
Email: knnutassey@aploy.edu.gh
2.Accra polytechnic School of Engineering Department of furniture and production
Email: iagyei-boakye@aploy.edu.gh
3.Accra polytechnic School of Engineering Department of furniture and production
Email: equayson@aploy.edu.gh

Abstract

The transformation of information technology now make more employees transacting business indoors this make the use of furniture pieces for longer periods of time and demand complex furniture design. However, complexity could be solved if furniture pieces are well designed through well structured furniture designing process in Ghana. But, little attention is paid to it until just before it is needed. Design process in general is a link of actives involved in solving problems, creating something new, or transforming less desirable situations to preferred situations. To do this, the furniture designers must know how these process work and why. Understanding how furniture design process work and why it is important for furniture designers. This is the purpose of the study. The paper outlines a standard framework for furniture design process. These frameworks clarify the meaning of theory and outline the process. It explains the nature and uses of theory as a general concept to solve complex furniture designing problems. It proposes five potential stages which gives sufficient information for furniture design process, with typical examples.

Keywords: furniture design process, understanding, complex, framework,

1. Introduction

1.1. Design process

Design process can be classified as systems that are created by human effort or are improvements over existing devices or systems. Designs do not suddenly appear from nowhere. They are the result of bringing together technologies to meet human needs or to solve problems. There are many different ways of designing a piece of furniture. (Natale C 2009 & SAMOA 2001).The nature of design is complex. Design is that area of human ideas, skill and knowledge which is concerned with ability to mould environment to suit its material needs (Seyyed Khandani, 2005) Furniture is an essential element that makes a space functional. Without it, people cannot work, customers cannot be served, and the equipment and tools of the business cannot be housed. It typically supports all of the functions and services that must occur on a daily basis. (Graham & Demmers 2001)

1.2. The importance of design process

Solutions to designing tasks are rarely reached in a disorganized way. It is really impossible to find good solutions by chance. The use of an orderly process always leads to better decisions or solutions. The design process helps ensure that key things are not overlooked. Designers are more likely to produce better results as they develop confidence, experience, and practice skills with designing process. (Pimapunsri & Tichkiewitch 2013)

1.3. What is the design process?

The several of activities that are followed to achieve a solution; the design process may take different forms, ways and approaches depending on experiences and the situation. Nevertheless, design that relies on trial-and-error processes or empiricism based on human experiences and skills seems not adequate to solve today's complexity. These experiences and knowledge must be improved by systematically approaches. A good solution requires a methodology or process (SAMOA 2001) & (Scott Opensha , Taylor, 2006)

1.4. Where does the process start?

The design process starts with programming, which means understanding the client's needs and identifying any possible problems. The first step is to listen to clients and decipher their ideas, wants, or needs. The designer brainstorms ideas with the client so that everyone is on the same page from the beginning. Sometimes clients may be vague in what they want or they may have so many ideas and styles that the designer will need to edit into a clear vision. (Ivelic, 2002); &(SAMOA 2001)

All designing or problem-solving tasks start with a need. However, different tasks may require the designer to enter the designing process at different points.

2. The structured furniture Designed Process

The structured furniture design process is in circular forms, which sieves the problem and give good solution which solve complex and difficult once. There are lot of designing process which are relatively quick and simple and can solve complex and difficult problems, but does addressed furniture design tasks precisely and is affecting the information processing society of today.

2.1. This study posses five main stages that is suitable for furniture design process

- 1) **Situation;** New design, repaired, modified, improved product
- 2) **Investigation;** brief, analysis, concept, and information gathering
- 3) **Possible solutions;** schematic, components, models, working drawings.
- 4) **Realization;** constructional methods, the final solution.
- 5) **Evaluation;** solution (outcomes.)



- **Situation/need**
 - .1. This is the general statement of the problem: (background of the situation) to Identify problem (problem statement).either by;
 - .1.1. New product
 - .1.2. repaired, modified product
 - .1.3. improved product
- **Investigation**
 - .1. Clarify the problem (design brief)
 - .2. Explore issues about the problem
 - .2.1. Investigate ideas for solutions (analysis)
 - .2.2. Specify the solution (design concept)
 - .2.3. Find information about ideas (gathering information)
 - .2.4. Examine and analyze document
- **Possible solutions**
 - .1. Identify the most likely idea in a specific form
 - .1.1. Develop and refine the idea in schematic drawings
 - .1.2. Devise the proposed solution
 - .1.3. Model or trial the proposal of the solution
 - .1.4. Make working drawing
 - .1.5. Examine and analyze document
- **Realization**
 - .1. Produce the solution that can involve any 'making' activity

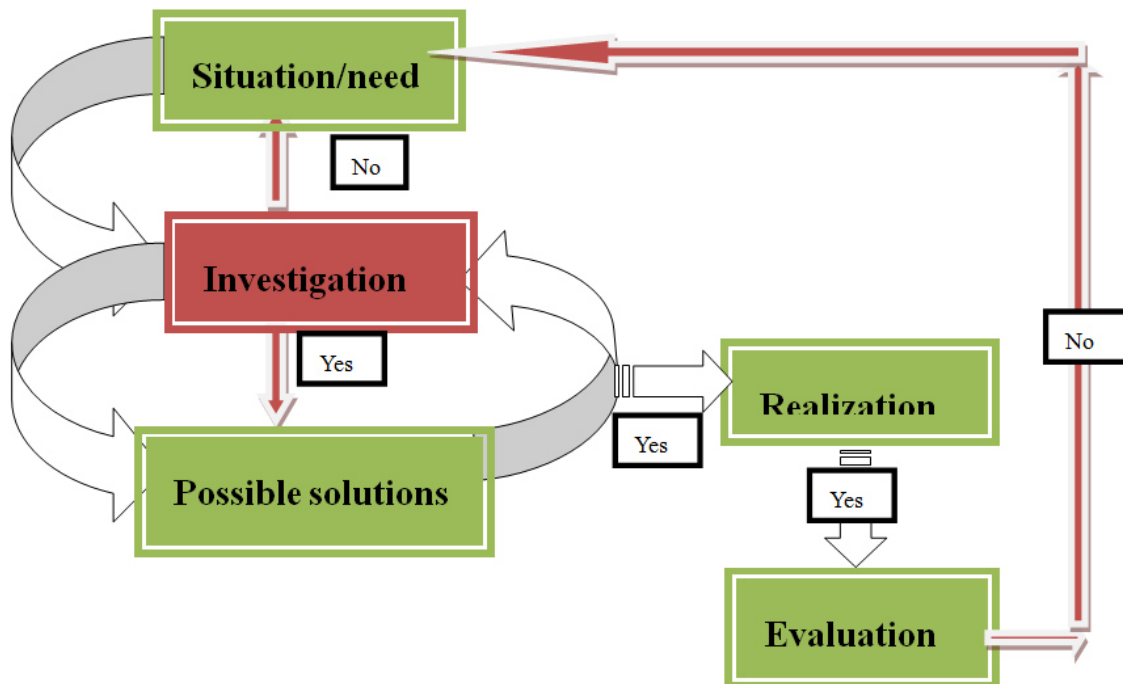
- .1.1. *Build and test a prototype*
- .1.2. *Implement a decision*
- .1.3. *Construct, establish, build etc.*
- .1.4. *Repair tasks*
- .1.5. *Contract specification*
- .1.6. *Examine and analyze document*

• **Evaluation**

- .1. Think about the outcome
 - .1.1. *Does it meet the design specification?*
 - .1.2. *How well does it work?*
 - .1.3. *Could it be improved?*
 - .1.4. *What remains to be done?*
 - .1.5. *Examine and analyze document*

The flow chart outline of the furniture design process

To use this process the designer has to work through each stage. The large arrows in the diagram show the main flow of the designing process. The small arrows indicate the revisiting of stages that is necessary normal and expected in the process.



Are all stages of the process necessary? Yes

All stages of the designing process are important, and each stage should be included in any designing task. In most cases some stage may take more time than other in the process. Testing and verification are important parts of the design process. At all steps in the process, you may find that your potential solution is flawed based and have to back up to a previous step to get a workable solution. Without proper evaluation at all the stages in the process, one may find one self making costly mistake later

1. Situation /Need

The design situation should be backed up with evidence of the need. The design situation availed the problem and helps the designer develop the problem or need statement. The problem formulates the need in clear and unambiguous terms. Defining the problem is not the same as recognizing a need. There are many ways of finding need. The most common one is to examine activities undertake in a work environments. Anything that is created and built to help life is said to be a design. Design is to solve a problem for where there is life there is a problem (Scott Openshaw, Taylor E, 2006)

1.1. Example: problem statement (new design)

Ghana’s middle income earners mostly live with their Children in apartment buildings. These apartment

buildings are without playgrounds for children to exercise; this inversely makes them inactive in their physical work environment. This affects children especially between the ages of three to five years

1.2. Example: problem statement (repaired, modified product)

Occasionally it is necessary to open the top of a soft drink bottle at home before consuming the contents. Examination of variety of bottle openers are sold in local shops but have found them to be either too expensive or unattractive in their design.

2. Investigation

2.1. Clarification of the problem (design brief)

Design brief set up the basic solution of the problem or it describes shortly what have been assumed to be the solution. At times design brief leaves the designer a lot of scope, as there are no expectations or limitations stated (open), some gives few clues about a solution (close). The designer ought to investigate and analyze the brief, establish a set of outcome expectations. This can involve discussion and negotiation with the client. In other words, the designer establishes a detailed design specification from the original situation.

The design brief describes the need for the problem to be solved, it should state just enough, but it should not attempt to solve (Scott , Taylor, 2006)

2.1.1. Example of typical design brief

Design and build a piece of play furniture structure for children aged between three and five years (open). These words have been chosen carefully. it describe the general area of the problem without being too specific. The problem could have been written Design and build a rocking play furniture structure for children aged between three and five years (close). This suggests the solution to be a unit for swing.

2.1.2. Clarification of the design brief (analysis).

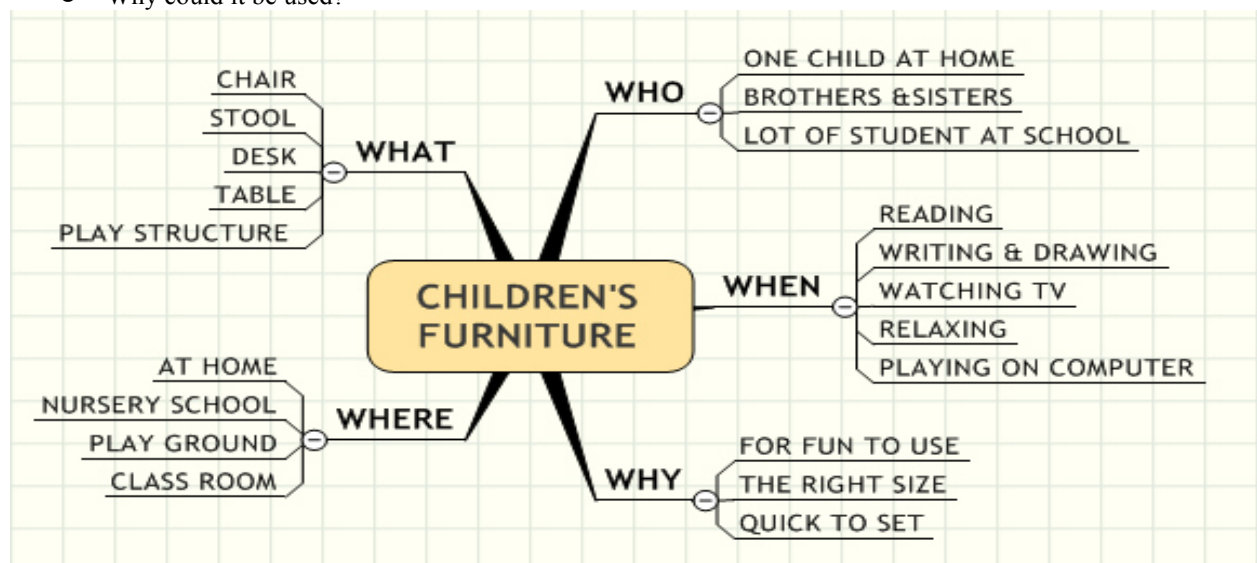
Before proceeding with this stage, one has to ask oneself the following questions;

- a) Have you identified your promising ideas?
- b) What information do you need about these ideas?
- c) What sources of information will you explore?
- d) Have you thought about the factors you can use to analyze the ideas?

To clarify design brief is the important step along the path to a solution. For this you need to think about and discuss the brief, and perhaps do some background analysis. You may do a ‘needs analysis’. Some industrial designers undertake market research activities before starting design work. (SAMOA 2001)

The designer needs to examine the brief into details by asking questions on constraint factors; Example: This could be application of the **five Ws**. - what, where, who, when, and why.

- What could it do?
- Where could it be used?
- Who could use it?
- When could it be used?
- Why could it be used?



2.2. The Design concept (specification)

The design specification outlines the expectations or the outcome of the solution. A design specification is like a contract between the designer and the client; it sets the outcome and limitations of all the conditions that applied to a situation (primary & secondary). It addresses the problem or the need; the task expected to be undertaken; any information for the solution, and any special conditions. In most cases, the design specification will list the essential outcomes that must be met. (Natale C (2009))

2.3. Example of typical design specification

We/I will design indoor play structure that can be used for jumping, climbing, hopping and running when exercising and also study.

The design specification should take into account of the **primary** and **secondary** functions of any solution, as primary functions are the main task of the solution (jumping, climbing, hopping running) while secondary functions should be, if it not performing the main function (study) and considering the (safety, maintenance, and transport). Designing task is easier to tackle if the design specification is clear and precise. If the design specification is not clear, design work may be misdirected. (Natale C 2009) &k)

2.4. Factors that affect designing process

In most cases they are unbearable conditions that are set, and are beyond the designer's control. These normally place limitation on the designing process. These factors include

- a) **Time:** the solution may be needed by a certain date.
- b) **Processes:** the equipment available may influence the processes to be used.
- c) **Materials:** the choice of materials may be defined, or be limited to those available.
- d) **Cost:** there may be a limited budget.
- e) **Performance specifications:** the solution may have to satisfy some performance requirements.
- f) **Operational requirements:** where and how the solution will be used.
- g) **Legal requirements:** safety regulations,

2.5. Checklist - The design specification

- a) Do you know what is expected of you?
- b) Do you know Details about the folio required?
- c) Is the design specification clear?
- d) Has the need or problem been described and solved?
- e) Are instructions about the primary function clear?
- f) Are instructions about the secondary function clear?
- g) Do you need to investigate the problem further?
- h) Are requirements about the task clear?
- i) Due dates for drafts and final drawing or report?

2.6. Information gathering

These could be any relevant literatures that are related to that set up the design specification. These information's could be gathered by cuttings off picture of similar design ideals from magazines and newspapers, copy diagrams, data of similar products from books, as well as writing to manufacturers for trade literature. By gathering information you could find many different ways to solve problem such problem. And discover new types of materials. Note there is nothing wrong with borrowing ideas, as long as you rework an item to fit your design specification. It is unlikely that anyone has worked to exactly the same requirements as your set up design specification. So other ideas, no matter how good will need to be modified. (k)

2.6.1. Human factor

For a furniture piece to attain it full functionality and comfort, the piece must relate to basic human ergonomics. Ergonomics is the science of designing objects for human use by maximizing efficiency and quality. Anthropometric data varies considerably between regional populations. For examples, Scandinavian populations tend to be taller, while Asian and Italian populations tend to be shorter; these particular measurements are necessary because of human ergonomics and because of the way one object affects another. (Natale 2009), & (Scott , Taylor , 2006)

2.6.2. Choice of Material

All designers are limited by the materials which are available. Some time the client may specify the materials for

the projects. They can also choose reasonably priced materials with the correct properties. When to choose materials for project you have to think about physical materials properties. Physical materials properties should be considered based on; cost, colour, texture, size, weight, style, shape, strength, durability, and stability. The most prime factor for material is its availability to the designer. There is no point in designing something to be made of brass sheet if there is none available, this may seem obvious, but it is often forgotten. (SAMOA 2001) & Graham, C & Demmers L 2001)

2.6.3. Properties of materials

Each material has good and bad points. Mild steel is strong, but it rusts. Plastics are waterproof, but will not stand too much heat. Chipboard is cheap, but it cannot be used in wet situations. When design problem is understood you should be able to specify the properties of materials. To help you select the best materials for your design project.

Information about an ideal material before you can consider it to be a likely solution, the information must be up-to-date and accurate, and the information must be analyzed and sorted using the design specifications.

a) Factors for analyzing materials could include:

Cost, availability, durability, ease of use, environmentally sustainable, attractiveness.

b) Factors for analyzing tools could include:

Availability, ease of maintenance, cost, appropriateness, simple, skills required, elaborate skills required.

c) Factors for analyzing processes could include:

Efficiency, industry standard, practical, simple, complex, fast, slow.

2.7. Examined and analyzed document

a) Have you got all the information you need?

b) Was enough information available for making decisions about using the idea?

c) Is the information opinion or fact?

d) Is the information detailed enough?

e) Have you cross-checked important information?

f) Do you need more information?

g) Is the information useful?

h) What evidence supports the information?

i) Is the information up-to-date?

j) Have you used a variety of sources?

k) Has the information found led to reject some ideas?

l) Have you selected a range of factors to help in analysis?

3. Possible Solution

The possible solution is the schematic part of the process, is about developing rough ideas of the design specification by creating quick sketches so that the designer and the client can start to visualize the design specification instructions. Sketching is a quick way to create and modify ideas. The designer's folio will compile with various possibilities that are recorded in different ways. Some of the drawings are finished, solid looking three dimensional objects, some are part drawings some are exploded views and some are flat plans and elevations. These various types of drawing explain different aspects of the solution.

The three dimensional drawings give some idea of how the completed object will look. Use the cut away and exploded drawings to work out how the parts might fit together, and flat drawings to refine shapes.

3.1. Building confident

In most cases, client and designer find it difficult seeing a three dimensional object like furniture as a flat, the designer also find it difficult to justify the object. It is necessary to develop models (mock-up) to test the proposed solution for appearance and function, to test materials and construction ideas. In most cases, you may need to carry out more development work, and develop new skills or processes. For some task you may need depth understanding of materials and processes. This could involve further reading, practice, and experimentation. Larger designing tasks could involve considerable development work or pilot studies.

Sometimes, the designer may be asked to justify decisions or provide documented evidence to support the decisions made. It is important to complete the drawings and notes that will enable the actual production of the solution to proceed.

3.2. Development of working drawings

Drafting is a great way to transform freehand sketches into a measured working drawing which involved sectional drawing, part drawing (elevation, plans, and end views). This is where the need to adjust your proportions based on human ergonomics and how they may affect the piece. Once the sketching is done in the designer folio; it is time to develop the solution into workable scale drawings (scale 1:5 or 1:10) either manually drafting the image or by using the computer. The details technical drawings and other graphics are always produced by printing, these would enable the producer to prepare the bill of quantities (cutting list), bill of materials (materials list)

3.2.1. Details of drawing

The solutions developed by the designer are drawn to either to larger or small scale (1:1) or (1:2) showing all the complicated parts of design, its location, composition and correlation of the elements and materials shown. These detail drawings engineer the producer to identify and understand component and work according to design specification. Without the details drawing a product cannot meet design specification.

3.3. Examine and analyze document

Before proceeding on this stage, check and examine the proposed solution

- a) Does the proposed solution meet the design specification?
- b) Why have you accepted this solution?
- c) Have you tested, modelled, or simulated the proposed solution?
- d) What were the results of these tests?
- e) Were any changes required?
- f) How readily can the solution be produced?
- g) Document and prepare report.

4. Realization of Solution (prototype)

The first stage of testing and implementation of a new product is mostly termed as prototyping. The purpose of the prototype is to test the design solution under real conditions, to determine the production problems, man hours involved, cost of materials, functions. This involved of building the model of the product, this is first fully operational production of the complete design solution. (Opensha, Taylor, 2006)

4.1. Devising the 'Realization' stage:

- a) Are any new techniques needed?
- b) Is there enough time to make the solution?
- c) Is the available equipment adequate?
- d) Are the materials needed, available?
- e) Are any special materials needed?
- f) Are any special fittings needed?
- g) Have you prepared the necessary documentation, working drawings, jigs, and templates

4.2. Built prototype of the solution

A prototype is a full-scale operational product that gives the designer a chance to check, test, and perhaps, modify, the solution before final production begins. The prototype must be well built so that it gives a correct impression of the final product.

For some tasks, you may need to make various jigs, templates, or tools so that production is easier and you can maintain a consistent standard. For example, you may have to make a jig so that parts can be cut to the correct lengths, be pre-drilled identically, and fastened together at a certain angle.

Similarly, you may need to prepare a page layout template for a document production task. For more detailed or complex tasks a 'production procedure' may be needed. This should describe the way in which the product will be produced.

- a) Use production methods that minimize costs and waste.
- b) Carry out many small designing tasks within the main task. For example, the production of an assembly jig may involve several minor designing tasks.
- c) You need to do some problem-solving to overcome production difficulties.
- d) With larger construction projects because of cost, a prototype may be the final product because of limited resources.
- e) In some cases only certain parts of the project will be built to full size. If the project is a team task, each member of the team may be required to become a 'specialist' in certain tasks.
- f) Ongoing appraisal of your work is important, for no matter how carefully you have planned, unexpected

- situations may arouse that need attention.
- g) For successful outcomes at the producing stage you usually have to use the correct tools and equipment. If you use high standards in the various processes you will be able to achieve near-commercial standards of quality, performance, and presentation.
 - h) The producing stage also involves managing time and resources. Plan carefully and keep to a timetable.

4.3. Produce the solution that can involve any ‘making’ activities e.g.:

- a) Build and test a prototype
- b) Implement a decision
- c) Construct, establish, build etc.
- d) Repair tasks
- e) Evaluate and document

At this stage, the solution that has been devised is produced. Work in a careful and logical way. Strive for excellence. You should build and test a prototype before implementation or production.

4.4. Examine and analyze document

- a) Have you built and tested a prototype?
- b) What were the outcomes of the tests?
- c) Were any changes needed?
- d) Are any new materials or processes needed?
- e) Are the necessary tools and equipment available?
- f) Are any jigs or special tools needed during the producing stage?
- g) Are any new skills needed to produce high standard outcomes?
- h) Are the necessary materials available?
- i) Are the necessary systems available?
- j) Are the processes effective and safe?
- k) Is everything ready for production to start?

5. Evaluation

The evaluation process is the last stage before the client takes possession of the piece. The designer should inspect the final piece to make sure that it was built according to the design specification. The designer must ensure that it functions the way it was designed as well as checking that the finishes match. It is a good idea for the designer if the design cannot build the prototypes, should make sure to see the piece when fabrication is done and before the finish is applied. It is easier and quicker to fix any problems and keep the project on schedule at this point rather than waiting until the end. (Natale C 2009)

5.1. Evaluation of the manufacturing stage

Has the realization stage been successful?

What comments should make about; Materials used? , Processes used? , Techniques used? , The time taken? , Standards reached? , Quality control? , Waste management?

5.2. Evaluating the Outcome

This is the basic question that you have to answer when you have realized or implemented the ‘solution’. How successful is the outcome?

You need to consider three things:

- a) Does it work?
- b) Does it fully meet the design specification?
- c) Will modification improve its performance?

The answers to the first two questions ought to be ‘yes’ if you have followed the furniture designing process. If the answer to these questions is ‘no’ or ‘maybe’, you may have to go back to an earlier stage of the designing process to reconsider or redevelop some part of the solution. When you are thinking about the success of the outcomes, it is important that you consider both the processes used and the product.

For example, a disappointing end product may be due to inadequate ideas, incomplete information about the ideas, wrong materials selected or poor processes.

In some cases, the solution may create new and unexpected problems. The designers have to go back to the situation, investigation, possible solutions, and realization stages to adjust the solution.

Wherever possible, involve others in the evaluation or review process. Discussion with other people may identify factors that you have not considered.

It is important to be sensitive about the ways technology affects other people and the environment.

Some designing solutions can have unexpected and unwanted side effects that can damage the environment, or offend or disadvantage some people in our community. The evaluation stage in the structure furniture designing process ensures that unwanted outcomes are found and remedied. If the designing task is being undertaken for somebody else, they may want to carry out their own evaluation to ensure that the proposed design specification meets their expectations.

5.3. Contract document specification

In this part of the process the designer documents the piece of furniture while explaining the dimensions; materials finish, details of the piece, expected time of completion and cost of designing work. This documentation, along with drawings, is sent to the client or custom producer for bids on the fabrication of the piece.

The contract specification should also comprises of the cost of construction, materials cost, service charges, delivery cost, and profit margins, are then added to the documentation so that it can be sent to the client for approval before the construction begins.(Natale 2009)

5.4. Examine and analyze document

Evaluation of the solution;

- a) Did the solution fully meet the design specification?
- b) How well did the solution work?
- c) How do others feel about the outcomes?
- d) What is the best feature of the solution?
- e) What is the least satisfactory feature?
- f) Are there any parts that can be improved?
- g) What improvements could be made?
- h) Are there any unexpected problems?
- i) Are there any unexpected benefits?
- j) Could it offend anybody in society?
- k) Is the solution cost-effective?

6. Conclusion

This study used design process as a tool to outline approaches in furniture designing process, which have been ignore for some time despite the rapid development of technology of today. The study undertake the capital issue in work environment in order to establish well structural furniture designing process, the structural furniture designing process is suitable for all complex furniture design problems. The achievement of the project is using process as a tool to address prevenient complex issues facing furniture designing in Ghana. This process could serve as platform for new furniture designers and furniture design training institution as a guild. The links of the process enable the designer to access all the relevant elements that borders the designing. And also enable the designer to keep in mind issues such as energy use, operational efficiency, and maintenance, operating costs, security, mobility, appearance, aesthetic appeal, ergonomics and environmental impact, the correct application, and using the process method to undertake the production issue, convenience for furniture industry. The evaluation stage is holding on next stage in order to exam the design achievement.

7. References

- Adupong R. (2011) Strategies for the Protection and Promotion of Local Manufactured Furniture in Ghana Commissioned by Wood Workers Association of Ghana-Western Region (WWAG-WR) For the Busac Project
- Archer B., (1996) "What is Design?" <http://atschool.eduweb.co.uk/trinity/watdes.html>
- Choodoung S. & Smutkupt U. (2012) Factors of Successful Wooden Furniture Design Process; World Academy of Science, Engineering and Technology 70 2012
- Graham, C & Demmers L (2001) Furniture for Libraries: Libris Design Project <http://www.librisdesign.org>
- Ivelic Ž., Grbac I., Ljuljka B. & Tkalec S. (2002); Office Furniture Design According To A Human Anthropometric Data Dubrovnik, May 14 - 17, 2002. International Design Conference - Design 2002
- Natale C (2009) Furniture Design and Construction for the Interior Designer 2009 rechild Books, A Division of Condé Nast Publications, Inc <http://www.designproject.co.uk/>
- Pimapunsri K, & Tichkiewitch S (2013) Integrated Design Approach for Solving Complexity of Design Problem American Journal of Operations Research, 2013, 3, 138-146 <http://dx.doi.org/10.4236/ajor.2013.31A013> Published Online January 2013 (<http://www.scirp.org/journal/ajor>)
- Seyyed Khandani, (2005) Ph.D. August Engineering Design Process education Transfer Plan
- Scott Opensha w, Taylor E,(2006) Ergonomics and Design A Reference Guide 2006 Allsteel Inc. www.allsteeloffice.com/ergo

SAMOA (2001) Design and technology ‘‘design process’’s:/DT Teacher Student notes. Doc.

Author: Kennedy Newton Nutassey (1)

- Member (M) of Association polytechnic teachers of Ghana in 1998,
- A Senior Member (SM) in 2008,
- Ghana 29/09 1973.
- M. Sci. Construction Engineering, University of Cantabria, 2008 Santander Cantabria Spain
- B. Sci. Constructing Architect, VIA University College, 2007 Horsens Denmark.
- HND furniture Design &production, Accra polytechnic, 1998

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