Design Methodologies Guide

Methodologies and methods for industrial design projects

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Design Methodologies guide.

The aim of this guide, is to provide to both, the designer and the student, with a reference he can consult when developing their projects. In this guide you will find different typologies of projects that can be given both in an academic and professional field. These types of projects are determined by the inputs, in other words, the initial information available for the designer to start a project.

Each type of project comes with a recommended methodology with the most relevant and important steps for this project. Also an explanation of how it should be developed is provided.

These methodologies have been obtained through a broad study of the design process and working methods of different universities and relevant authors.

At the end of this guide the reader will also find a number of methods with which develop the methodologies divided on the same three types: "Creating a design goal", "Creating product ideas" and "Decision and selection".

How to proceed?

It is completely necessary to know the kind of project we are dealing with. In order to know that, we should check the inputs we count with. Once we have categorised the project, we have a starting point so we can easily get the diagram that we need. When we are in front of the diagram and it is the first time that we are going to try this methodology, we should carefully read its explanation. If we still have doubts once the explanation has been read, we can check the examples from the thesis work. To sum up, these are the steps to follow:

1. **List the inputs that we have.**
2. **Categorise the project we are dealing with.**
3. **Look for the corresponding diagram.**
4. **Read the explanation.**
5. **Start with the guidelines**

INDEX

Methodologies

Kind of project

Methods

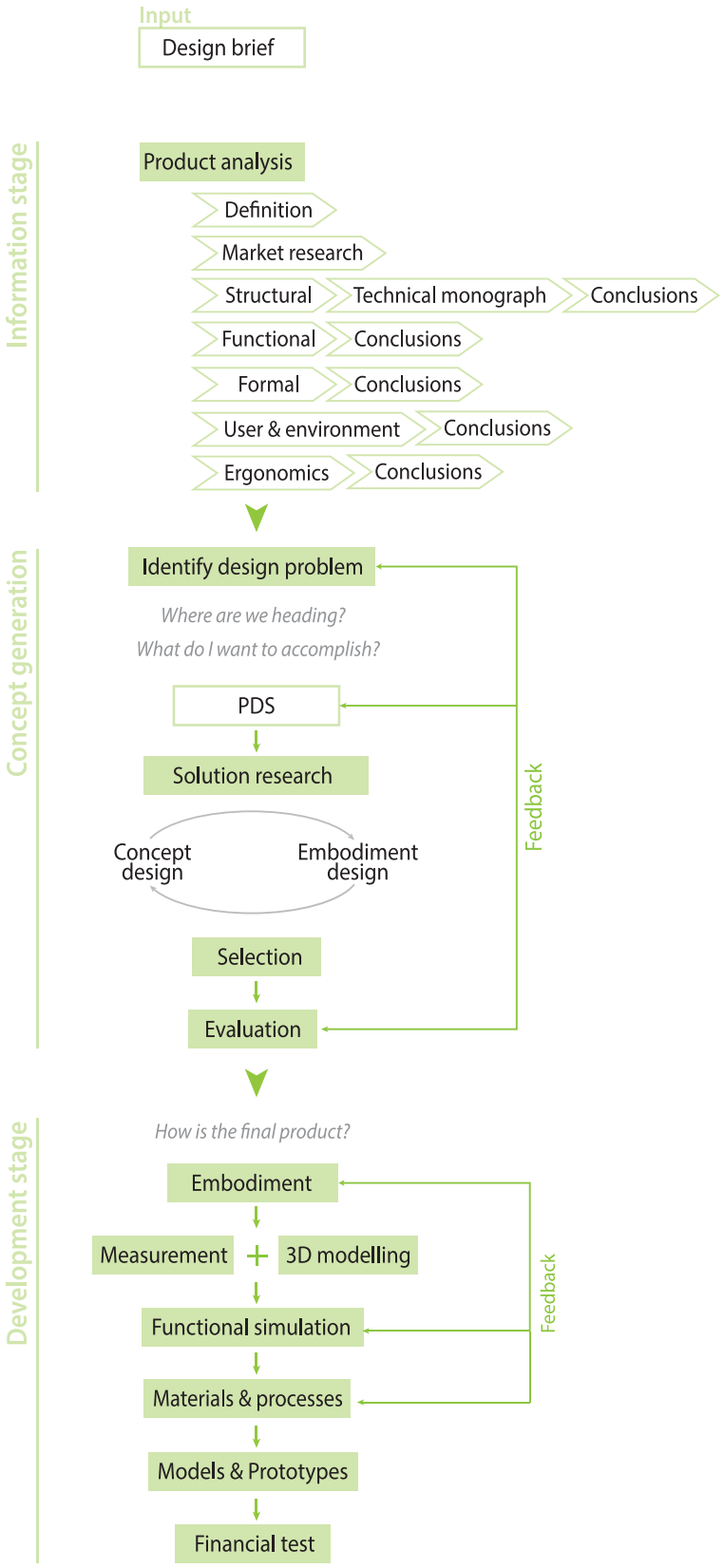
Creating a design goal

Creating products ideas

Decision and selection

1. Providing directly the product

This projects may arise in an academic environment when the students are given the design brief with all the specifications that a project has to accomplish. When a student has to develop this kind of projects he/she does not count with any company or brand so he/she is free to give the product the characteristics which are more interesting for him/her. Thus, he/she has no boundaries so he/she does not have to meet the needs from a company, manufacturing process, etc.
For instance, one statement for this kind of projects could be: ***"Design a new kind of tent."***



Explanation

We need a **design brief** to start to develop this kind project with all the specifications that it is necessary to accomplish. It is divided in the three stages that we are used to: information stage, concept generation and development stage.
Concerning the **information stage,** we must be focused on the product analysis in order to start a deep research which will help us to know where we are heading with our design. This analysis consists of different studies:
- **Product definition**: in order to know what the product is, what are its main characteristics and a first layout of how it works.
- **Market research:** to know how the product and its competitors work and to get knowledge about the product market to determine if it is possible to insert it into other market field.
- **Structural**: thanks to this analysis we are able to know the pieces a product has, as well as their functions, materials and other characteristics. The aim is to understand the product from a syntactic view. We suggest here using a technical monograph, where all the components of a product are analysed in depth allowing the designer to come up with conclusions which may help to improve the future design. In this study the designer will analyse materials, assemblies, measures...
- **Functional**: in this study the designer must define clearly the main function of the product as well as its sub-functions establishing a hierarchy if needed. By doing this the designer will be able to implement new solutions which accomplishes the same functions.
- **Formal**: studying the connection between shape and function to understand how the physical appearance of a product influence on the buyer attitude and to apply the conclusions to our future design.
- **User and environment**: it studies the product into d environment and with the user, not as an isolated issue. It also studies the way that the product is used.
- **Ergonomics**: it analyses how to maximize productivity by reducing user's fatigue and discomfort.

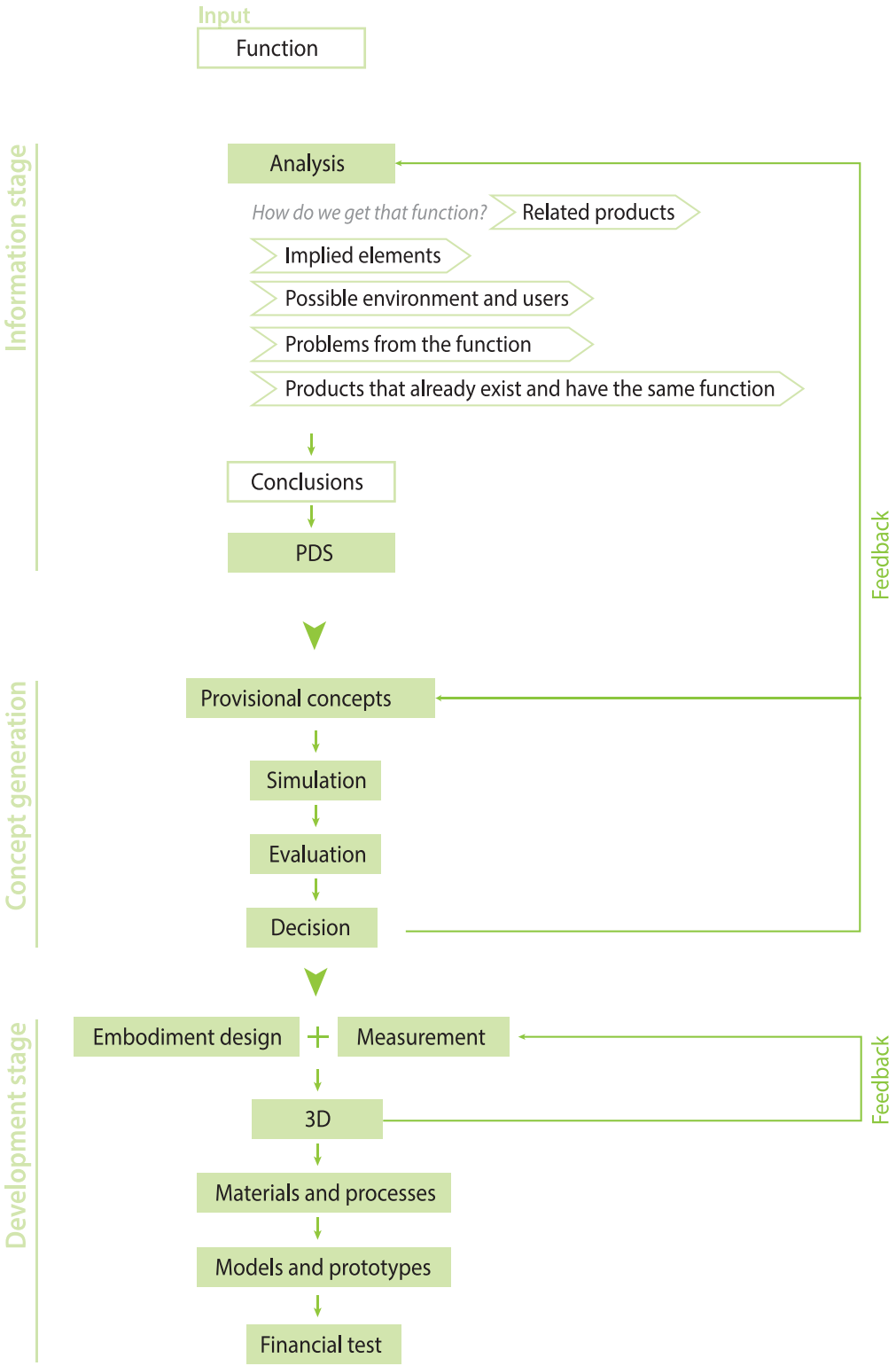
This analysis allows us to get some conclusions which will be used to develop the project. It is necessary to carry out this studies carefully because they are the first step where all our project will be based on, so the step of getting conclusions is essential.

The second stage is the **concept generation**, where we first **identify a problem** thanks to the conclusions that we obtained previously. This conclusions will show different problems or needs. The designer will choose which one he wants to solve according to his criteria. He must choose where its product will be focused on in order that it becomes as profitable as possible. For instance, the designer could choose reducing a product price, placing the product into a new environment or changing it to make it more attractive for a new potential user.
Once the problem is identified and defined it will be necessary to answer these questions: Where are we heading? What do I want to accomplish? These answers will constitute the design product specifications (**PDS**). They will settle the requirements and the objectives of our product. The next logical step is the **solution research**, there the designer will start to formulate solutions. A parallel work must be carried out here with the proposed concept and the embodiment design. This parallel work allows the designer to check if his concepts proposals also fit the structural part and making its development easier in further steps. The designer must compare the different concepts and **select** the one which best fits the PDS. The chosen one will be **evaluated** to check its feasibility before developing it.

The third and last stage is the **development stage** which answers the question of how the final product is. The first step is to create a more detailed **embodiment design.** After having it the designer must add **measures** taking into account different needs (user, structural information, environment...). At the same time, the 3D model will be developed so that it can incorporate spontaneous changes. Once the **3D model** is ready a **functional simulation** must be carried out. By doing this we can check if the design is progressing as we expected. If not, there is a **feedback** possibility which takes us to the embodiment step to check our work.
When the project is finished the designer is able to choose the **material and the manufacturing processes** of the product, being still possible to come back to the embodiment stage (due to a material or process requirement) and change whatever the designer may consider necessary.
Once everything is set, it is time to start with the **models and prototypes** which will show the appearance of the final product. And finally, a **financial test** must be carried out in order to check if the product fits the initial budget (in the case it was specified).

2. Providing the function

The designer is told the function that a product has to accomplish. It might be only the main function of the product or the main function and a secondary one.
This projects may take place both in a professional environment and in an academic one.
In both environments the designer is required to design a product whose characteristics satisfied a function which has been detailed previously.
For instance, one statement for this kind of projects could be: ***"Design a product whose function is: allow the user to sleep outside protecting him from the weather "***



Explanation

A function is provided as input in this kind of project.
We start the **information stage** by carrying out a detailed **function analysis.** This means that we have to know how this function is achieved and how it could be achieved. To do that it is necessary to study existent products which accomplish this function an analyse them. It is also helpful to study the elements which are implied in the process of getting that function, if there is something that is essential to get it. Besides, the environment of users must be studied as well, by doing this we can come up with new ways to accomplish a function. Doing an action usually implies an effort, and an effort might imply some problems; due to this, it is also necessary to study the problems that a function implies and split them up if necessary, since solving sub-problems is easier in order to solve a whole.
After this deep function analysis the designer obtains some **conclusions**. These conclusions will be used to write down the **PDS** which will define the final design. In the PDS the designer must specify what he/she wants to accomplish and how he wants to accomplish so the first decision step is done here.

During the **conceptual stage**, the designer comes up with **provisional designs or concepts**, different possibilities which solve the problems defined previously and of course which accomplish the function that we are dealing with. To make sure that it certainly accomplishes the function we go through a **simulation** stage. This simulation does not need to be physical, real; we can just take information from our own experience to prove it. After simulating all the possibilities (concepts proposals) it is necessary to **evaluate** them, according to a criteria (eg. how they follow the PDS). After evaluating them a **decision** is made so that we can continue with the 3rd stage. The decision is revocable, in other words, it is possible to come back to the provisional concepts stage or even to the analysis step if needed. This **feedback** assures that the results will have gone through some filters to make sure that they are proper enough.

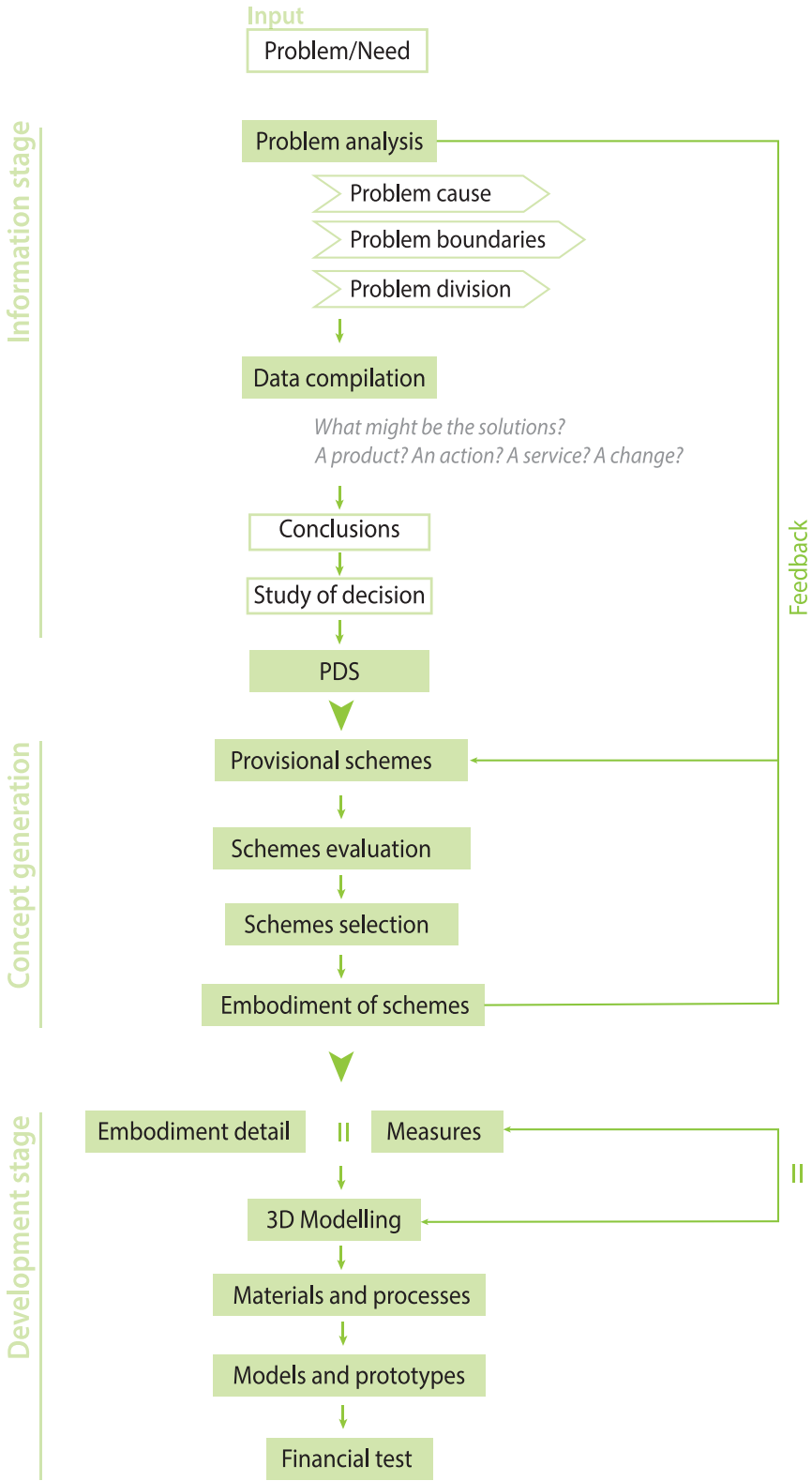
The **development stage** starts with the concept **embodiment design.** This step constitutes the bridge between the conceptual stage and the detail design stage. In the embodiment stage of the design process a more detailed analysis of the selected concepts is undertaken. It usually includes a definitive layout, preliminary component shapes and materials, design for manufacture and assembly and industrial design.
To develop the embodiment design we must count with the concept we have selected and the PDS (Product Design Specifications). The output is a definitive scheme drawing accompanied by documentation (calculations, required dimensions and tolerances, suggested materials and manufacturing processes...)
Embodiment design is not solely the achieving of technical solutions but also creating useful products, which satisfy and appeal to the users. The major working principle of the embodiment design is simplicity. For each functional element, there should be a clear relationship between cause and effect. Moreover, it has to simplicity of function and shape for analysis and manufacture in the embodiment design. It also considers how to minimise the parts and integration of components. The embodiment design must be worked simultaneously with the **measurement** stage. Likewise, the **3D** model is made by checking constantly the embodiment design and measures.
Once having the 3D it is possible to specify the **materials and the manufacturing processes** as well as starting the **models and prototypes stage.** The last step during a design process is a **financial test** where the designer must analyse how profitable the product will be for the company as well as showing costs of the whole process.

3. Providing a problem or need

The designer or the company identify a need or a problem which needs to be solved. This problem establishes the beginning of the project giving the designer the keys to create a new product. The result should be a product so that the problem does not exist anymore.

This project may be ordered by a company or it may be the designer who notices the need and who decides to start this project himself.

Ex. ***"If I sleep outdoors and it rains, I get wet "***



Explanation

The input for this kind of project is a problem or a need that is provided or the designer him/herself notices and wants to solve.
The **information stage** will be based on this **problem analysis** then. The designer must study the cause of the problem because knowing where it comes from it will be easier to understand it and therefore, to solve it. It is necessary to define the boundaries of the problem, defining how far we can get into. Eg. maybe the problem is that a product is too heavy and the solution is to replace the material for one lighter; but if we are working for a steel manufacturing company this change is not possible. Likewise, a small problem is easier to solve than a complicate one, that is why the problem must be divided into sub-problems and solve them. After this problem analysis the designer must **collect all the information** and start to think about solutions. This is the point where the designer must consider what kind the solution would be possible and accepted. In other words, if the problem would be solved with a product, a service, by changing the way of using an existent product... Having this knowledge, **conclusions** must be written down. If the conclusion opens a new path, it means that an extra-information stage should be done, looking for information to complete that conclusion. Once having all the necessary information, the **PDS** based on them will be written.

The **conceptual stage** starts by creating some **provisional schemes** which collect all the conclusions obtained in the previous stage. Having several of those, the designer must **evaluate** them and according to some criteria he must make a decision of which one he wants to develop deeper. Now, a first approach to the **embodiment design** comes, It has not to be a detailed embodiment, just a first approach about how pieces should go, first suggested materials and manufacturing processes...
Of course that after making this decision is possible to come back to the creation of schemes in the case the designer considers he should change his election.

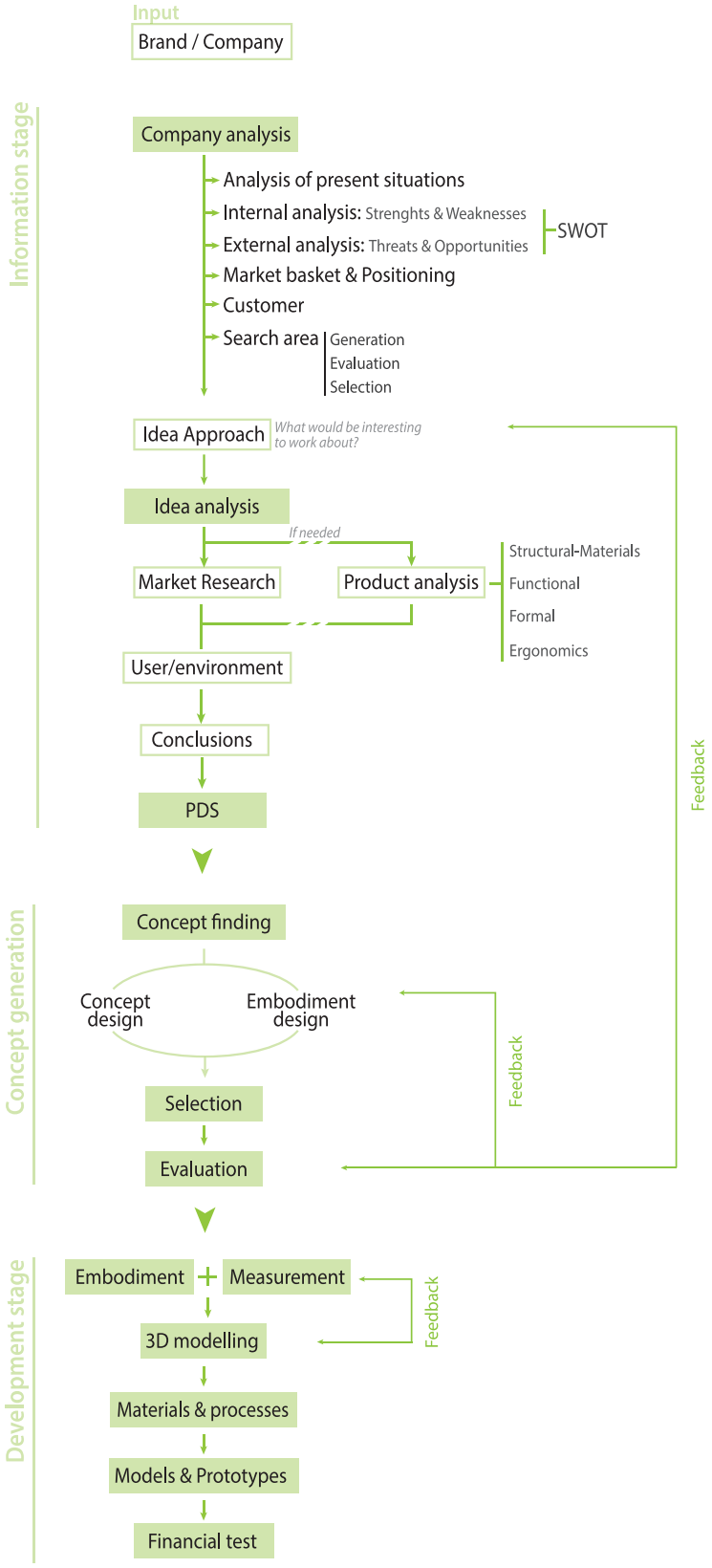
In the third stage we start with the **development** of the scheme or concept that we have selected before. Now a more **detailed embodiment design** is carried out; it means that, as the previous case, the designer will have to indicate clearly the placement of the pieces as well as their function, calculations if needed, suggested materials and processes... Likewise, the **dimensions** of the product must be settle down here, working simultaneously with the embodiment design since it is necessary to check it constantly. Having the embodiment and the measures the designer is able now to start with the **3D**, being always possible a feedback to modify measures if needed. After the modelling, we have eventually to choose the **materials and manufacturing processes** based on all the information we already count with. Similarly, the **models and prototypes** stage is the next logical step since we will have everything settled to start with them. In the end, as in other sort of projects, a **financial test** will be done in order to check the profitability of the project as well as a calculation of the costs.

4. Providing the brand

The designer only counts with a brand to start to develop a project. Therefore he will have to take into account all the company information and characteristics.

A company asks a designer to create a product for its brand, whatever the category of the product is. In other words, it could be said as an extension of the catalogue or a product's line. Many of the design product contests do not have any boundary but the brand the contestants have to design for.

For instance, one statement for this kind of projects could be that North Face said: ***"We want to extend our products catalogue"***



Explanation

The main important step in this kind of project is the **information stage** because the initial point is so wide that it is necessary to focus on something and to do that it is needed to carry out different studies. There we have to take into account both the company's and the product's information. Firstly, the **company** is studied , as it can be inferred from our scheme we analyse the present situation of the company as well as an internal and external analysis. In that step, a SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) is defined.

- **Internal analysis:** Strengths and Weaknesses. The designer will use the strengths to know which products are the most profitable ones and which aspects (available departments, resources, technologies...) of the company we could use for our product. The weaknesses will be seen as the limitations of the companies, points that the designer will try to improve or solve with his/her ideas.
- **External analysis:** Opportunities and Threats. Opportunities are seen in the company's surroundings, the elements that the project could exploit to its advantage. One of the tools that has to be used is the market consumer needs. The threats are the elements in the environment that could cause trouble for the design project.

Thanks to the conclusions from the SWOT analysis, the designer will start with the **"search area"** points. The search area generation combines a strategic strength and an external opportunity to come up with an idea that could be the base of a future product. After this, an evaluation of these ideas has to be done according to different aspects like experts' interviews, patents research, potential users study... By comparing the evaluated ideas the designer must make a selection. The selected search areas form the starting point for the next step: **the idea approach formulation**. The **idea approach** step constitutes the initial idea of the design project. There the main idea about what the designer wants to develop is defined. It is also specified the user and environment as well as the main aspects to take into consideration. The idea might be abstract or specific, defined as a product or some features.
It is also helpful to study the company's **customers** in order to know and get more familiar who we are working with.

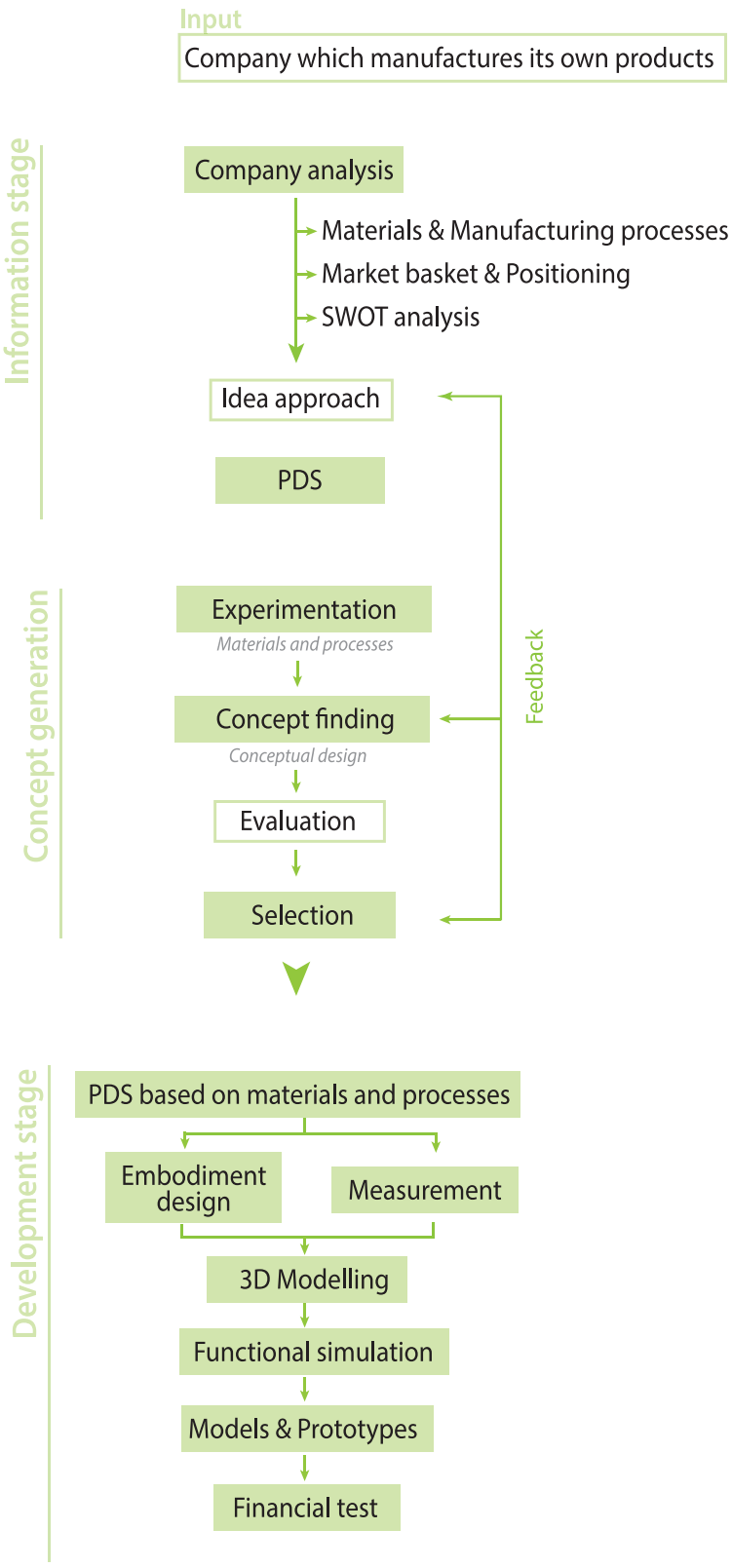
Once we have obtained conclusions from the company's study, we start with the idea development. Having a basic idea of what we want to develop we will carry out a **market research**, even if it is accurate (directly a product) or more abstract (some features that we want to achieve). Here, the user and the environment must be also studied. After it, a product analysis should be developed if needed, similar to those that have been developed for other kind of projects, including structural, functional, formal and ergonomics analysis. As usual, some **conclusions** result from these analysis and these conclusions will help the designer to write down the **PDS.**

Then the designer starts with the **concept generation stage.** Firstly with the concept finding, working in parallel with the concept and embodiment design, allowing the designer to check if his concepts also fit in a structural view of the product making the future development easier. The different concepts are compared and the one which best fits the requirements is **selected**. We check the selected concept and **evaluate** it according to the requirements or by using some recommended methods. There is a feedback possibility in the case that we find that the concept is not good enough.

The **development stage** is similar to the previous one. It is begun by a **detailed embodiment design** working in parallel with the product's **measures**. Likewise, the **3D** modelling is carried out more or less while these stages to allow the designer to make changes. Once the 3D is finished, **materials and manufacturing processes** are selected and **models and prototypes** are made afterwards. Finally, a **financial test** is done to check the product feasibility.

5. Providing the company which manufactures its own products

The designer is requested to design a product for a manufacturer company which develops its own products.
He will have to take into account the brand philosophy but also the manufacturing process that the company has available and the materials that it is used to work with. If it is a wood company we could not design a plastic component by injection molding.
A company asks a designer to create a product for its brand, as an extension of the catalogue which can be manufactured by itself.
For instance, one plastic fibre manufacturer could say: ***"We want a new product in our catalogue"***



Explanation

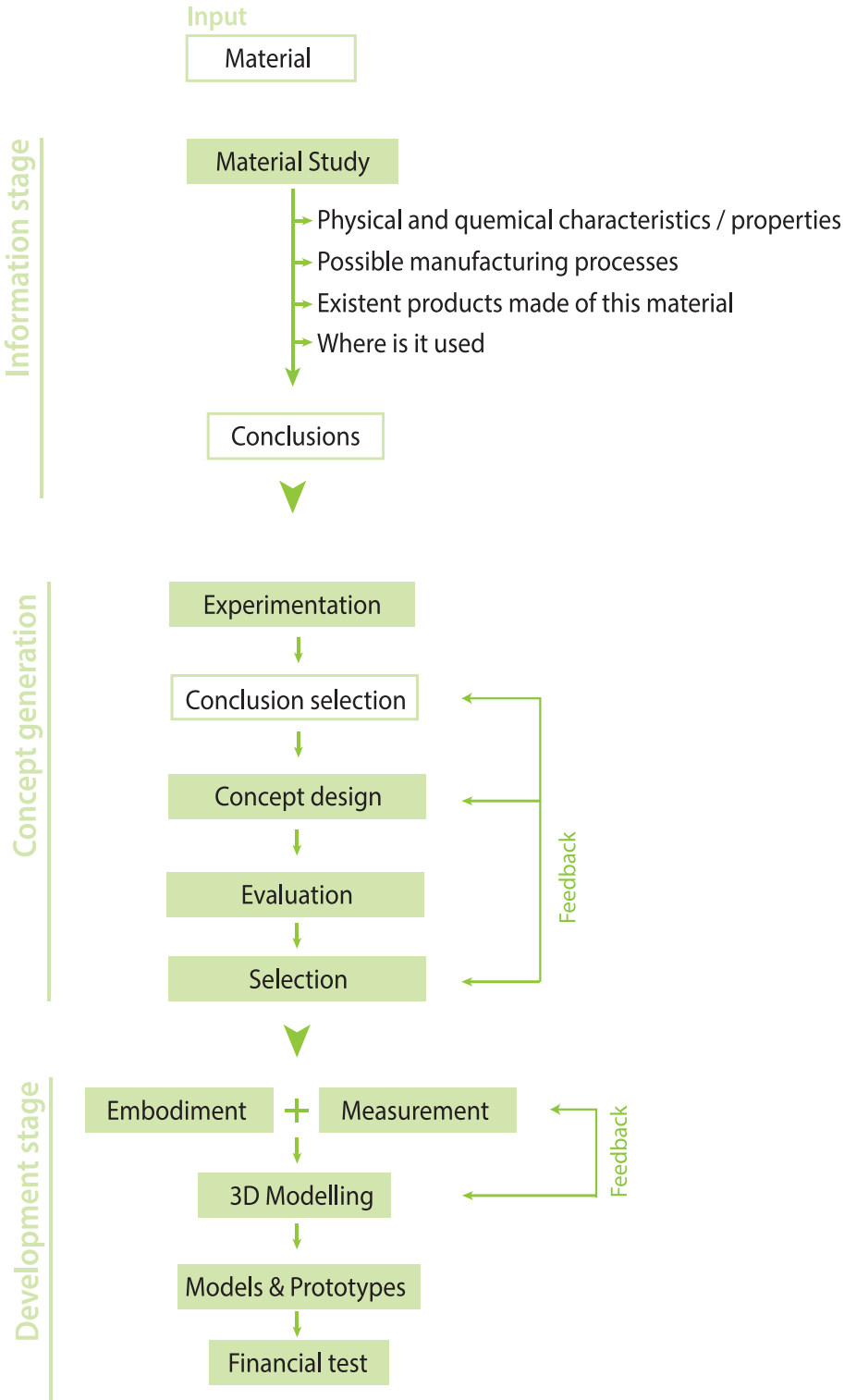
The **information stage** is based on analysing the company's information. Since the designer is told to design something for a manufacturing company it is essential to study the technology that this company is upgraded with; the **materials and manufacturing processes** as well. By doing this, the designer will acquire a deeper knowledge about the company's activity and he will be able to better carry out a **SWOT** analysis. Before writing down the SWOT, the designer must study the company's **market basket** so that he can study the kind of products the company is able to manufacture and the users these products are oriented to. As in the previous case, the SWOT (Strengths, Weaknesses, Opportunities, Threats) which will help the designer to identify possible points where applying his ideas.
Thanks to all this information the designer will be able to create the **idea approach** where all the Design Product Specifications (PDS) will be explained. With this, the designer will have some basics aspects to apply on the future design, making sure that these characteristics will cover the company's needs.
Opposite to other kind of projects, here the design brief has more boundaries since we are limited by the product's material and the manufacturing process.

Concerning the **concepts generation stage**, the most different and important step is the experimentation. Before coming up with new concepts it is useful to experiment with the materials and processes that the company count with in order to better understand their properties and potential possibilities. The experimentation of materials and techniques allows to collect information on new uses of a product. After this, the concept finding is the next logical step, followed by an evaluation and a selection of the one which best suits our requirements. As usual, there is the feedback possibility in the case that the designer considers the selected concept is good enough. It would be possible then to go back until the design brief writing if needed.

The **development stage** is probably the one which most differs from other projects. First, the designer should create the **PDS list based on the materials and manufacturing processes** conclusions in order to make clear and specify the possibilities of creating the product. Taking into consideration these PDS and the selected concept the designer can start with the embodiment design. As usual, this **embodiment design** works simultaneously with the **measurement** step and followed by the **3D modelling stage**. From there, it is possible to come back to the measurement so that the product' characteristics can be constantly checked. Since we are dealing with materials and manufacturing processes the designer should carry out a **functional simulation** to check the material properties on his product. After this there is only left the creation of the **models and prototypes** and the **financial test.**

6. Providing the material

The designer is requested to design a product made of a specific material.
This is a classic project in an academic context, where the student learns how to focus on a material experimenting manufacturing processes, material states and searching all the possibilities that it provides.
In a professional context, it could be that a manufacturer company has the need to extend its catalogue or it wants something in a specific material.
For instance, a bioplastics company demands: ***"A new product which shows the strength of our bioplastics"***



Explanation

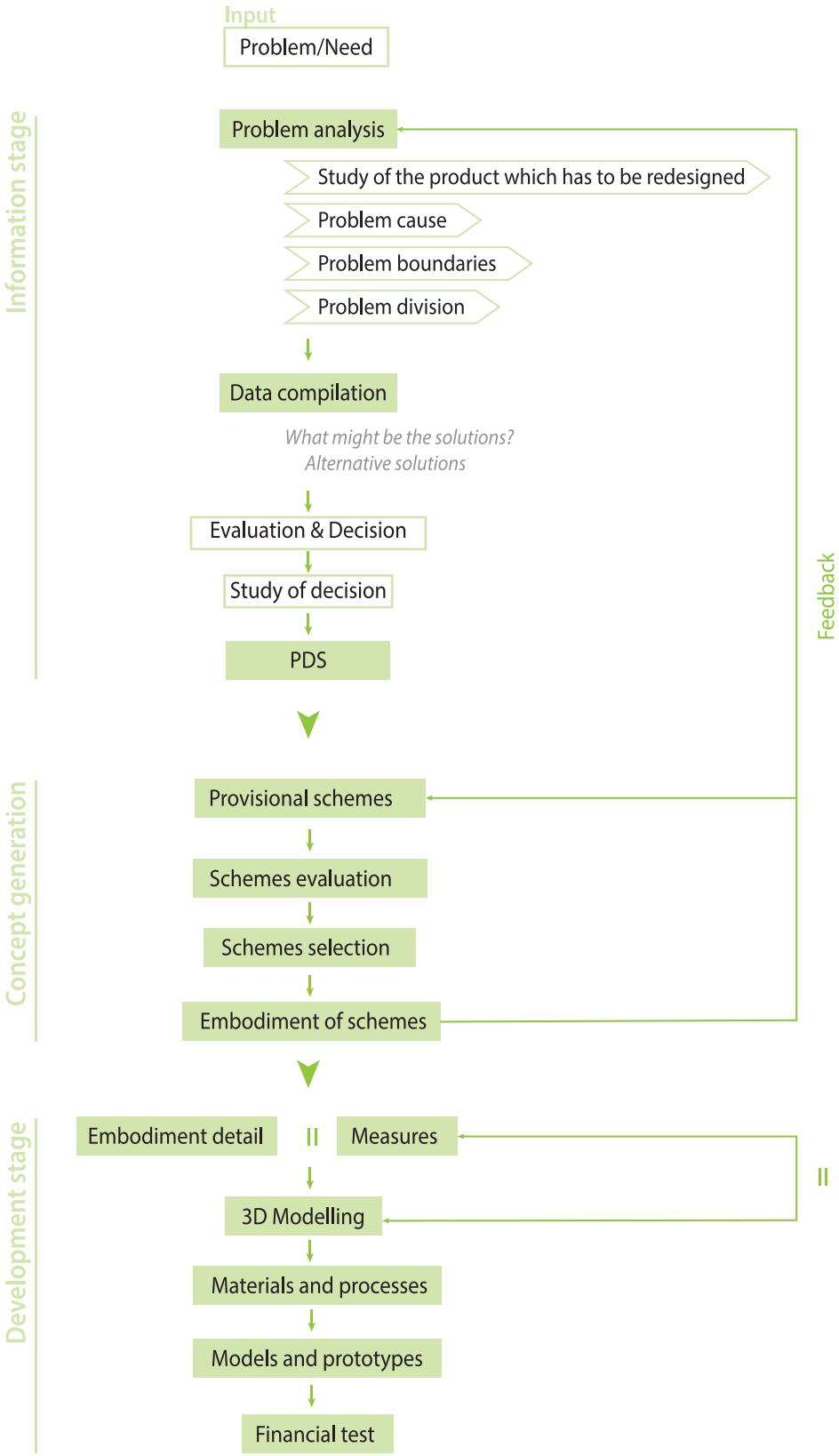
The **information stage** begins by doing a **material study.** We have to study different aspects of the material we are dealing with, physical and chemical characteristics and properties to later see where the designer might be focused on. Also it is important to make a research about the possible manufacturing processes, studying how each of them works and seeing if we can optimize it. To have a wider perspective it is also necessary to study all the products that already exist made of this material. It is also useful making a classification of this products attending, for instance, to a properties criteria. It would be helpful as well studying the environment where these products are delivered and the elements they have contact with. After all this analysis the designer must come up with **conclusions** which will influence the future design. The conclusions can come up as one good property of the material that has the potential to be exploded in a new product.

The **concept generation** stage begins with an **experimentation** stage. This literally means experimenting with the material: see all its possibilities when its state is changed, when I apply weight on it, how flexible it is... Thanks to this experimentation the designer will be able to check all the information that he wants to obtain about the material by first-hand. This information might be used to improve the design.
Having the conclusions from the information stage and those from the experimentation, the designer must now **select one characteristic** to be focused on. By being focused in one characteristic the **concept generation** is more accurate and the results will be better. Anyway, thanks to a **feedback** it is possible to change this choice (characteristic that the designer wants to be focused on) if the designer feels that the obtained result is not good enough or it does not fit the project requirements.

Regarding the **development stage,** the work flow is similar to the previous projects. We will start the stage by making the **embodiment design** at the same time that applying the **measures**. After this, it is necessary to develop the **3D** of the product and checking constantly if the measures fit. After this, the **models and prototypes** should be made, followed by a **financial test.**

7. Redesign

The designer is requested to redesign a product in order to solve any problem or need.
A company could need to solve a technical problem, to improve the usability, to change the product appearance, to make it cheaper, to improve the manufacturing process, to change the material, and all changes it considers necessary.
For instance, a company asks to: ***"It takes so long to set up a tent, try to improve the way it is done"***



Explanation

As mentioned before, a redesign is taking a product which already exists and make the convenient changes to solve a problem which has been noticed. By this token, the input of this kind of project is a need or a problem since it is necessary to notice a problem to ask for a redesign. Besides, there might be different kind of redesign projects, such as:

· A structural problem which could be solved by removing some pieces, decreasing the product's weight, changing some component...
· A financial problem which could be solved by changing materials, optimizing the manufacturing process...
· An interaction problem which could be solved by improving the ergonomics of a product or the way to use it.

We have dealt with this kind of project before so the scheme will follow similar steps, varying the content of the problem analysis though.

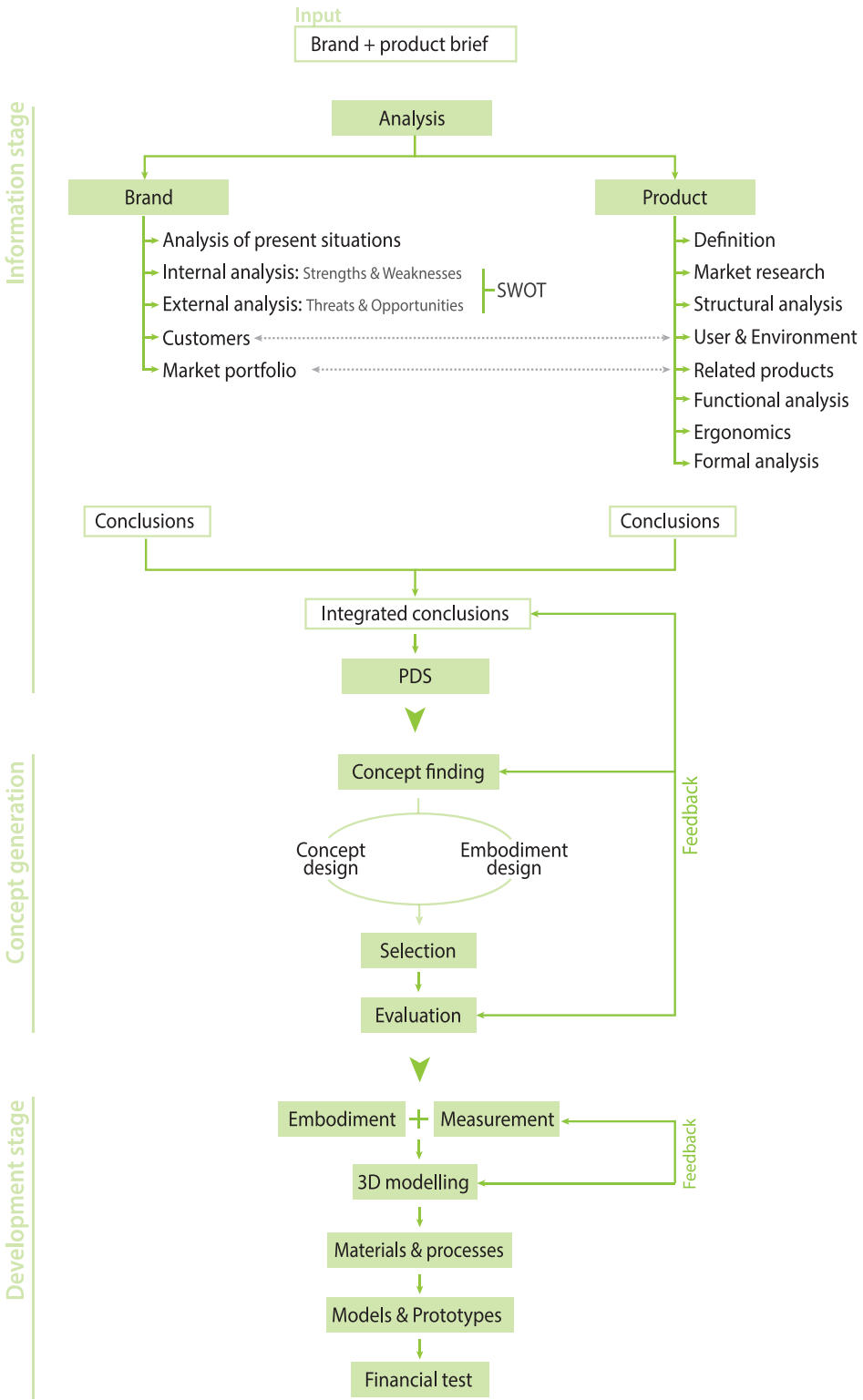
The **information stage** starts with the **problem analysis** . First, it is necessary to carry out a detailed **study** into the product that we have to redesign. We do this because we need to understand how it actually works and how it tries to solve the problem we are dealing with. It is also necessary to find out the cause of this problem as well as to define its limits. We have to be aware of the problem's boundaries, how far we can get into it. As an useful tool to solve problems we can split the problem into sub-problems so the complexity is reduced. By solving these sub-problems the designer will be able to solve the main one.
After the problem analysis there is the **data compilation** step. Here the designer has to come up with possible solutions to the problem, possible solutions could be: changing a feature of the product, the material, a measure...
Having different proposals to solve the problem, the designer must now compare them and **evaluate** them so that he can make a **decision** based on which one better solves the problem. Once we have a potential solution it is necessary to **study** it carefully so that we can obtain the convenient information to start with the redesign. This could be for example, if we decide that the solution to a design problem would be reducing the thickness of a casing, we will have to make a study to know how much the minimum thick has to be to comply with the product requirements. With this specific data the designer will be able to write down the final **conclusions**. Likewise, with these conclusions the PDS will be written.

Both the **concept generation stage** and the **development stage** are similarly developed to the "Providing a problem or a need" project.

8.1. Brand + Product

This situation occurs when a company asks a designer to create a particular product. By this token the designer will have to consider all the company's information and corporate identity. The fact that a user is not specified might happen due to two reasons: maybe the brand wants a product that every customer can use, establishing a general target; or maybe the brand just leaves on the designer the decision of choosing a potential user that according to him/her is the one which can provide more benefits to the company, because a market niche has been found. This is the typical project in a professional environment when a company feels the need of launching a new product to the market.

An example of this situation could be: ***"Design a tent for North Face"***



Explanation

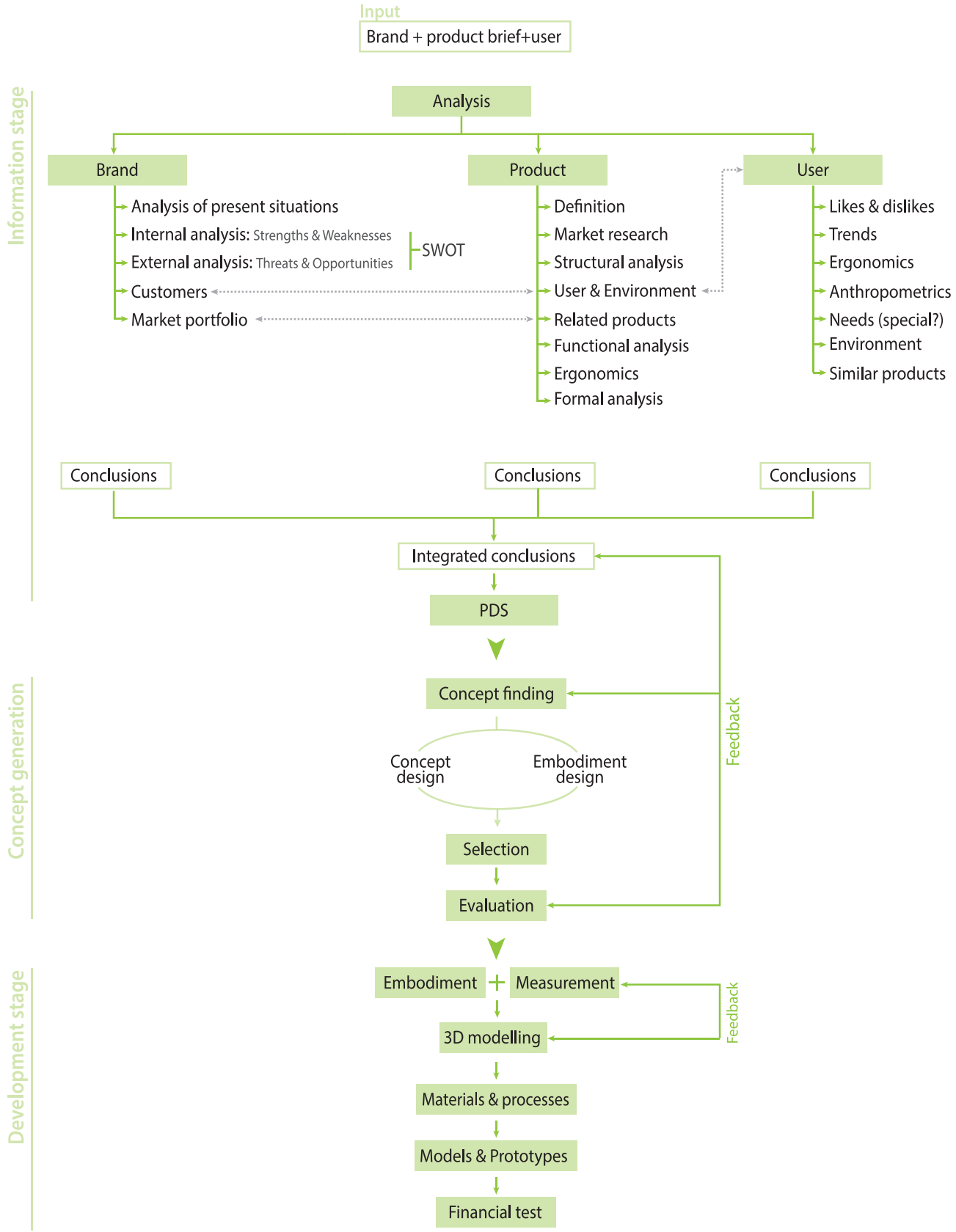
The inputs of this sort of project are the brand and the product itself.
In the **information stage** it is necessary to study both inputs deeply. Thus, we will be making a parallel analysis.
On one hand, the brand is analysed: its present situation, how the company is working now; its external and internal situation; SWOT analysis to come up with the ideas for the next stage; its market portfolio, to know all the products the company offers as well as their features; and its current customers, to know them and be able to identify future potential users.
On the other hand, the product is also studied. As in the project when a designer is only told the product itself, it is necessary to analyse all the aspects related to it: product definition, market research, structural analysis, functional, formal, user and environment, related products and ergonomics.
After these analysis some conclusions will be extracted. It is necessary now to integrate both conclusions, from the brand side and the product side. By doing this integration the designer will be able to connect some important points which may help to the future design. Thus, the integrated conclusions will be likely oriented in one direction so it will be possible to draw the PDS from them.

Then the designer starts with the **concept generation stage.** Firstly with the concept finding, working in parallel with the concept and embodiment design, allowing the designer to check if his concepts also fit in a structural view of the product making the future development easier. The different concepts are compared and the one which best fits the requirements is **selected**. We check the selected concept and **evaluate** it according to the requirements. There is a feedback possibility in the case that we find that the concept is not good enough.

The **development stage** is begun by a **detailed embodiment design** working in parallel with the product's **measures**. Likewise, the **3D** modelling is carried out more or less while these stages to allow the designer to make changes. Once the 3D is finished, **materials and manufacturing processes** are selected and **models and prototypes** are made afterwards. Finally, a **financial test** is done to check the product feasibility.

8.2. Brand + Product + User

This situation comes from the previous one; it adds more boundaries when designing since it also has to be focused on a particular user. This may occur when the company has already made a research whose results come with information about the user that a project must be focused on.
An example of this situation could be: ***"Design a tent for North Face focused on children"***



Explanation

The inputs of this sort of project are the brand and the product itself.
In the **information stage** it is necessary to study the three inputs. Thus, we will be making a parallel analysis.

First, the **brand** is analysed, as we did in the previous case, we study its present situation, external and internal circumstances (defined by the SWOT), its market portfolio to make a first approach and its current customers that we will later relate to the target of our product.

Secondly, the **product** itself is analysed. It is necessary to collect information about its definition, market research, structural analysis, functional, formal, user and environment, related products and ergonomics.

Thirdly, the provided **user** is analysed. It is really important to know the target we are designing to in order to cover their needs as good as possible. Their likes and dislikes will be analysed, using a psychological standpoint; the trends that the user follows, the culture he/she is involved and the determining factors; the ergonomics aspects as well as the anthropometrics; the user surroundings and similar products that the user already uses. The information of the target will be related to the characteristics of the brand's current customers and with the general user of the product we are designing.

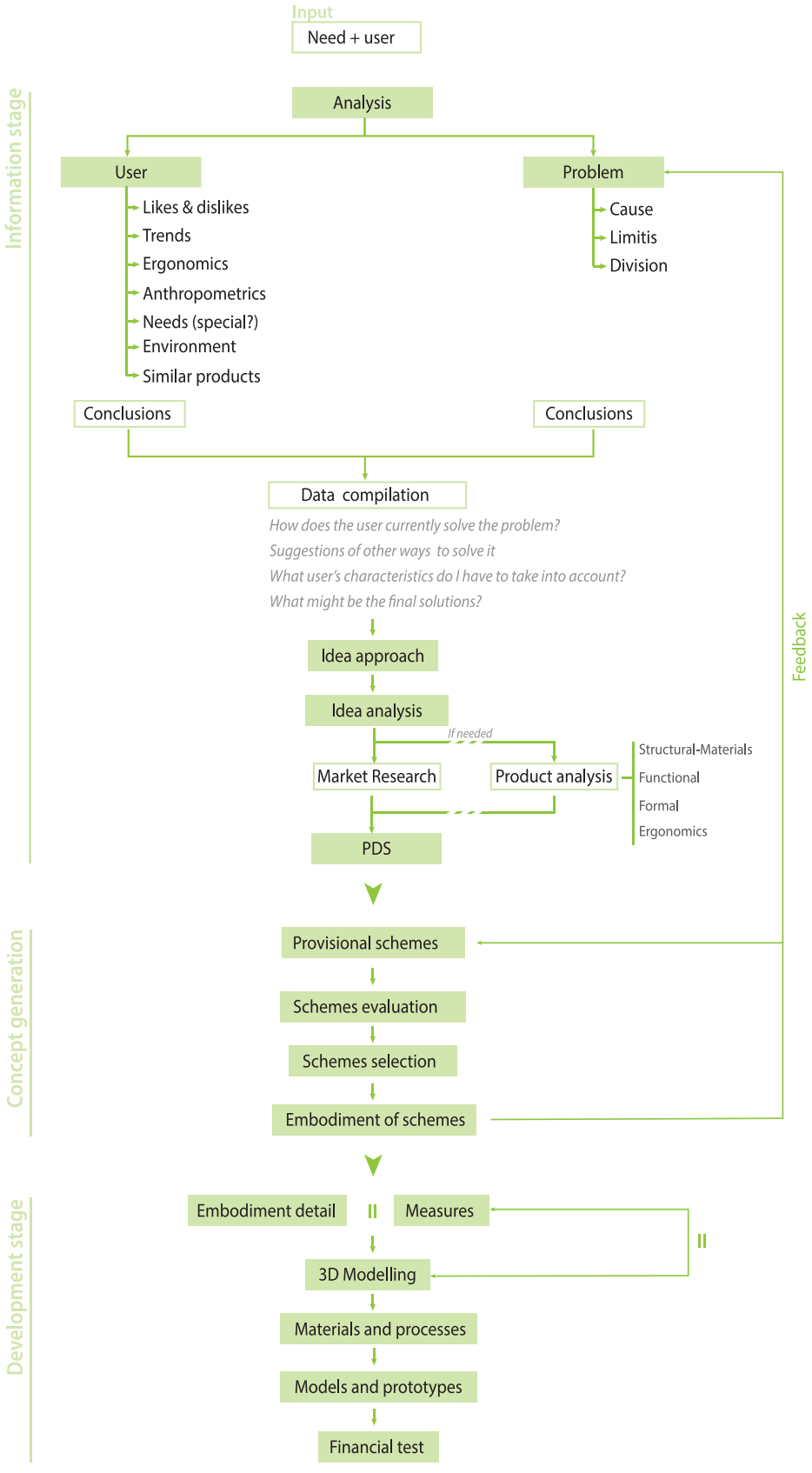
Summing up this information some **conclusions** will be extracted. As in the previous case, the conclusions must be integrated to identify new design possibilities. These integrated conclusions will be likely oriented in one direction so it will be possible to draw the PDS from them.

The **concept generation** stage begins with the concept finding. The correct way to work here is simultaneously with the concept and the **embodiment design.** By this way the designer can constantly check if his concepts are structurally correct. There will be different options and the one which best fits the PDS will be **selected**. Then, an **evaluation** will be carried out to check all the concept possibilities and if it is feasible. As we have mentioned previously, in this step there is a **feedback** option to start the stage again.

During the **development stage** the **detailed embodiment design** that we have already explained is carried out. As in previous cases, it is developed at the same time that the **measurement** of the product and the **3D,** in order to be able to change whatever the designer may consider necessary. Once the 3D is finished, **materials and manufacturing processes** are selected and **models and prototypes** are made afterwards. Finally, a **financial test** is done to check the product feasibility.

8.3. Problem + User

Here the designer is lacking in a brand specification. This order can come from a particular designer who finds a need in a user and decides to solve it by creating a new product or concept. This is the main example of a freelance project.
A thought that could inspire this kind of project could be: ***"I have known that handicapped people have difficulties when setting a tent"***



Explanation

This kind of project provides the designer with a need or a problem and the user as inputs.

Logically, the **information stage** starts with two simultaneous analysis of that need and that user. Depending on the kind of project it might be more proper to start by the user analysis or the problem analysis. The designer is the one who must decide this.
About the need, a general **problem analysis** is carried out, focused on detecting the cause of the problem which will help to suggest ways to solve it; the limits of the problem, to know how far we can solve it and if the designer counts with some boundaries; and the division of the problem into sub-problems, because, as we have already mentioned, solving small problems is easier that trying to solve a big one.
Concerning the **user**, the same analysis than in the previous project will be carried out: Their likes and dislikes, using a psychological standpoint; the trends that the user follows, the culture he/she is involved and the determining factors; the ergonomics aspects as well as the anthropometrics; the user surroundings and similar products that the user already uses. The information of the target will be related to the characteristics of the currents brand's customers and with the general user of the product we are designing.
We will separately obtain **conclusions** from each analysis and then we will compile them. By integrating them in the data compilation step the designer will be able to identify new design opportunities to explode in further stages. The questions that we suggest to write down this **data compilation** are:

· How does the user currently solve the problem?
This question is oriented to see how the user manages to overcome the existing problem. By knowing this, the designer will better understand the problem and it will help him/her to find new solutions.

· Suggestions of other way to solve it
Here, a list should be written down. This list should contain all the ideas that the designer come up with, even non-sense ideas because they may have a right background that he/she can use in further steps.

· What user's characteristics must the designer take into account?
A deep user analysis is taken, and a lot of information will be collected. In this step, it is necessary to sum up that information and to select what we need for our future design.

· What might be the final solutions?
Once we have answered the previous questions the designer may launch some possible solutions which will be later evaluated and selected.

Thanks to the last question we will end with a solution that, according to the designer, is the best one to solve the problem according to the user needs. This possible solution will be explained in the **idea approach** and later it will be deeply analysed in the **idea analysis** step, looking for some extra information if needed. Once we have all this clear enough, we proceed with the **PDS** writing, requirements that helps to focus our efforts on one direction and make the further development easier.

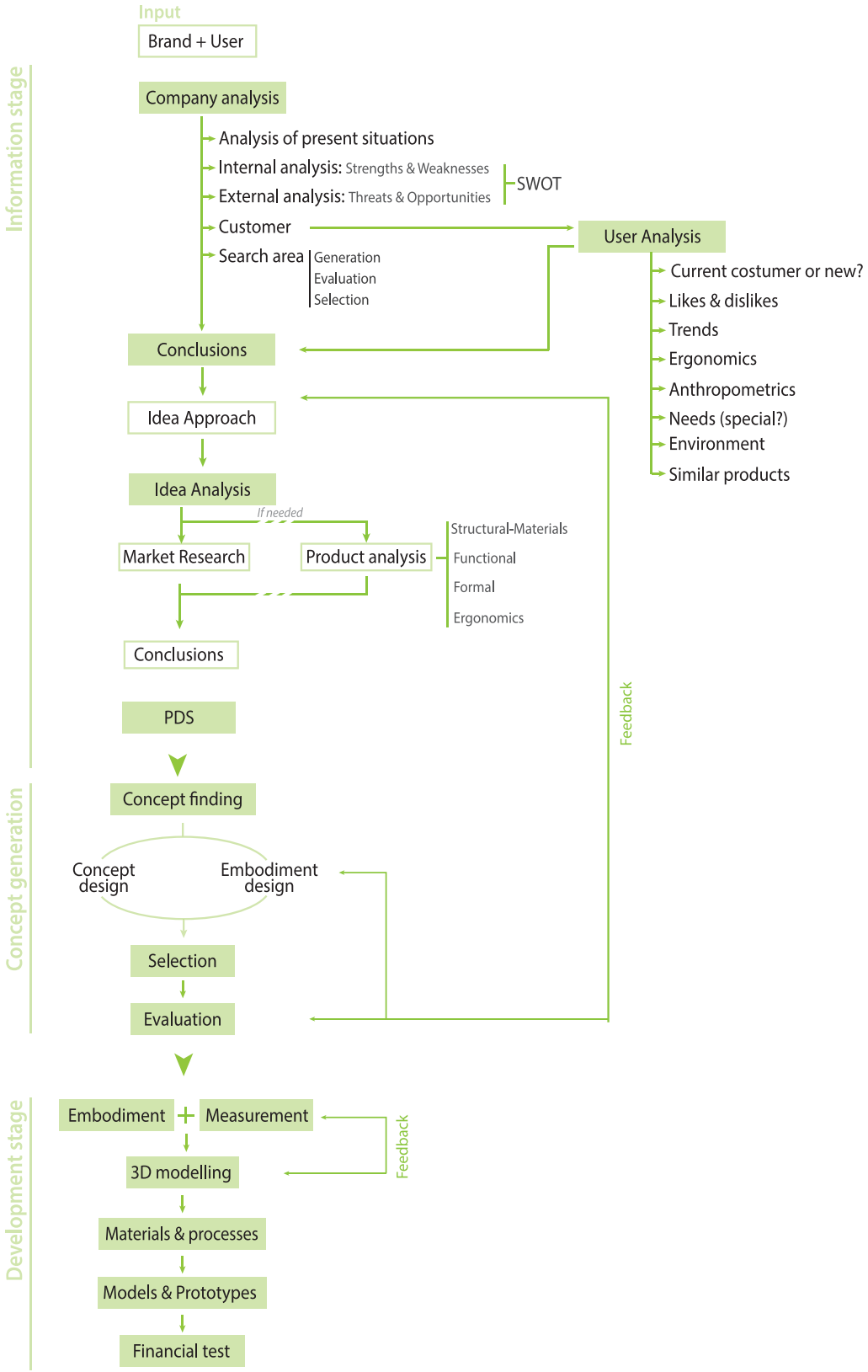
Regarding the second stage, **the concept development**, we start by **generating** new concepts based on the previous idea approach. This concepts will be listed, compared and **evaluated**. The schemes that the designer considers that best fit the project requirements will be **selected**. Then they will be taken to the **embodiment** step; and once the embodiment is validated it is possible to start with the third stage of the project.

In the **development stage**, a more **detailed embodiment design** is carried out; it means that, as the previous case, the designer will have to indicate clearly the placement of the pieces as well as their function, calculations if needed, suggested materials and processes... Likewise, the **dimensions** of the product must be settle down here, working simultaneously with the embodiment design since it is necessary to check it constantly. Having the embodiment and the measures the designer is able now to start with the **3D**, being always possible a feedback to modify measures if needed. After the modelling, we have eventually to choose the **materials and manufacturing processes** based on all the information we already count with. Similarly, the **models and prototypes** stage is the next logical step since we will have everything settled to start with them. In the end, as in other sort of projects, a **financial test** will be done in order to check the profitability of the project as well as a calculation of the costs.

8.4. Brand + User

This kind of project might come from a company which is highly focused on a particular user. Thus, we have all the information that the brand offers and also an specific user where we can apply this data. An example could be that the company needs an extension of its catalogue. Likewise, a brand could be interested in creating new products for new users in order to increase its market area.

For instance, a toy company like "Toys R us" could say: ***"Design a new product for our multi-adventure line"***



Explanation

The brand and the user are provided now as inputs.

The **information stage** starts with the inputs analysis. Firstly, the brand is analysed: its present situation, how the company is working now; its external and internal situation; SWOT analysis to come up with the ideas for the next stage; its market portfolio, to know all the products the company offers as well as their features; and its current customers, to know them and be able to identify future potential users.
Thanks to the conclusions from the SWOT analysis, the designer will start with the **"search area"** points. The search area generation combines a strategic strength and an external opportunity to come up with an idea that could be the base of a future product. After this, an evaluation of these ideas has to be done.
A study of the current costumers of the brand allow the designer to know the features of the actual clients, and to identify they buy behaviour.

Then, the provided **user** is analysed to know the target we are designing to, in order to cover their needs. Their likes and dislikes will be analysed, using a psychological standpoint; the trends that the user follows, the culture he/she is involved and the determining factors; the ergonomics aspects as well as the anthropometrics; the user surroundings and similar products that the user already uses. Also it will be studied the experience that the given user has already had with the brand, if he is currently a consumer or if he has had any experience with it. The information of the target will be related to the characteristics of the brand's current customers.

After these analyses, conclusions are written down. They will be the start point of the idea approach which specifies what the designer decides to study. An idea analysis will provide extra information about the market and the product.
These will be likely oriented in one direction so it will be possible to draw the PDS from them.

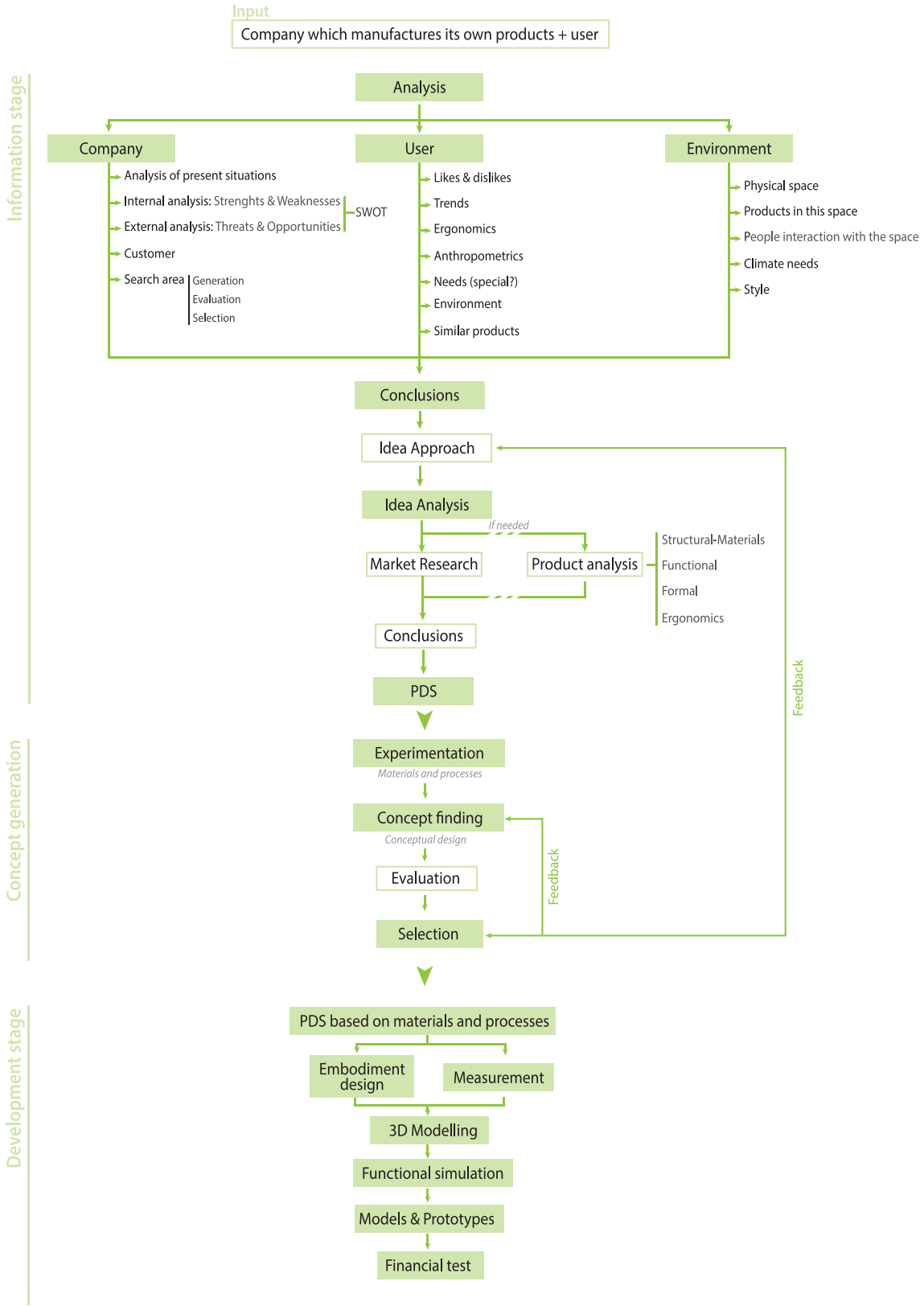
Then the designer starts with the **concept generation stage.** Firstly with the concept finding, working in parallel with the concept and embodiment design, allowing the designer to check if his concepts also fit in a structural view. The different concepts are compared and the one which best fits the requirements is **selected**. We check the selected concept and **evaluate** it according to the requirements or by using some recommended methods. There is a feedback possibility in the case that we find that the concept is not good enough.

The **development stage** is similar to the previous one. It is begun by a **detailed embodiment design** working in parallel with the product's **measures**. Likewise, the **3D** modelling is carried out more or less while these stages to allow the designer to make changes. Once the 3D is finished, **materials and manufacturing processes** are selected and **models and prototypes** are made afterwards. Finally, a **financial test** is done to check the product feasibility.

8.5. Company which manufactures its own products + User/Environment

There are many companies which manufacture their products in one specific material because they count with that sources. In this case, it is the company itself which asks the designer to create a new product based on a material and specifying an user and an environment. Then the designer will have to take into consideration all the characteristics of the company as well as the necessary information to accomplish the user's expectations.

An example of this situation could be that a company which makes their products of plastic says: ***"Design a plastic product for outdoors festivals"***



Explanation

The inputs which are provided in this kind of projects are the company (brand) and the user. In this case the company manufactures its own products so the material can be inferred from this information.

The **information stage** starts with the analysis. It is necessary to study the company, the user and the environment simultaneously.
Firstly, the **company** is analysed. The present situation and how they work; an external and internal analysis by using the SWOT tool, checking their current market portfolio to get a perspective about their current products and to be able to study their customers.
The SWOT analysis will provide with some conclusions that the designer may use to start the "search area" step in order to start to generate basics ideas, evaluate them and select them.

In addition, a **user** analysis is carried out. We analyse all the aspects that the designer considers useful for the project. Their likes and dislike, using a psychological standpoint; the trends that the user follows, the culture he/she is involved and the determining factors; the ergonomics aspects as well as the anthropometrics; the user surroundings and similar products that the user already uses.

Eventually, the **environment** must be studied as well. Concerning the environment, it is necessary to study the environment itself, understood as a physical space where the product will be used; also the products where are used there as well as their appearance; how the people interact there, which actions or activities they do there and how they do them (ergonomics); the climate factors must be taken into account; and also the general style of the place.

With these three analysis some **conclusions** will be generated. Thanks to them, the designer will have his/her first **idea approach.** A more detailed study of the idea is carried out in the **idea analysis** step where the designer will explain the direction he wants his design to take. As we have explained above, there are sometimes that an extra information research is needed, in the case that this idea analysis suggests it or the designer considers it necessary. Finally some **PDS** are written down so the requirements of the project are clear enough to start with the second stage.

Concerning the **concepts generation stage**, the most different and important step is the experimentation. Before coming up with new concepts it is useful to experiment with the materials and processes that the company count with in order to better understand their properties and potential possibilities. The experimentation of materials and techniques allows to collect information on new uses of a product. After this, the concept finding is the next logical step, followed by an evaluation and a selection of the one which best suits our requirements. As usual, there is the feedback possibility in the case that the designer considers the selected concept is good enough. It would be possible then to go back until the design brief writing if needed.

In the **development stage** the designer should firstly create a **PDS list based on the materials and manufacturing processes** conclusions in order to make clear and specify the possibilities of creating the product. Taking into consideration these PDS and the selected concept the designer can start with the embodiment design. As usual, this **embodiment design** works simultaneously with the **measurement** step and followed by the **3D modelling stage**. From there, it is possible to come back to the measurement so that the product' characteristics can be constantly checked. Since we are dealing with materials and manufacturing processes the designer should carry out a **functional simulation** to check the material properties on his product. After this there is only left the creation of the **models and prototypes** and the **financial test.**

Methods

Creating a design goal

Creating products ideas

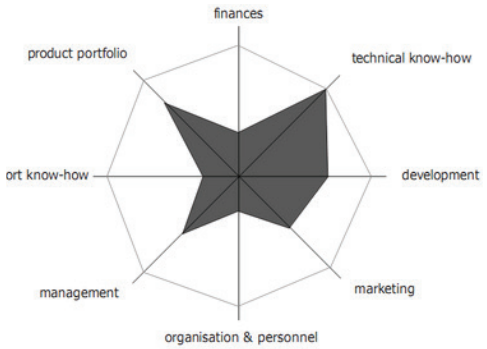
Decision and selection

CREATING A DESIGN GOAL

1. Strategy wheel

What is it?

A visual representation and a quick tool to review a company's strengths. It presents the company's competencies on the axes, and the scores of the competencies on those axes. By using the diagram, you obtain a quick understanding of the company's strategic strengths.
A thorough analysis of the current situation of a company yields an understanding of the company's strategic strengths (for example: technical know-how, product portfolio, development, financial position, export know-how, marketing, organisation and personnel, management).



When?

It is usually applied in the beginning of a new product development process in order to present the strategic strengths of a company.

How to?

Starting point
The results of an internal analysis: a clear understanding of the company's strategic strengths in relation to its direct competitors.

Expected outcome:
A visual representation and a better understanding of the company's strategic strengths.

Possible procedure:
1_ Determine the company characteristics that you want to evaluate.
2_ Determine a value for each of the characteristics. Comparing the company with its direct competitors.
3_ Create a diagram, a strategy wheel of the scores on the characteristics.
4_ Optionally, put down the values of the competitors on the same characteristics in the same diagram.
5_ Analyse the diagram, to assess the company's strengths and weaknesses (in comparison with its direct competitors).

2. Trends analysis

What is it?

Trends are an important source of inspiration for thinking up new product ideas. Trends are used to identify customer/market needs, which a company can meet with new products or services.. Trends analysis could be a rich source of inspiration, but could also determine the risks involved when introducing new products.
Trends analysis tries to find answers to the following questions: what developments in the fields of society, markets and technology can we expect over the next 3 to 10 years? How do these developments relate to each other? Where do they stimulate each other and where do they block each other? What are the resulting threats and what are the opportunities? Which ideas for new products and services can we think of now on the basis of the trends?.
For an analysis of the trends, a trends pyramid can be used. In a trends pyramid, four levels are distinguished at which one can look at trends:
The microtrend is on a product level and has a time horizon of 1 year.
The miditrend is on a market level and has a time horizon of 1 to 5 years.
The maxitrend is on a consumer level and has a time horizon of 5 to 10 years.
The megatrend is on a societal level and has a time horizon of 10 to 30 years.

When?

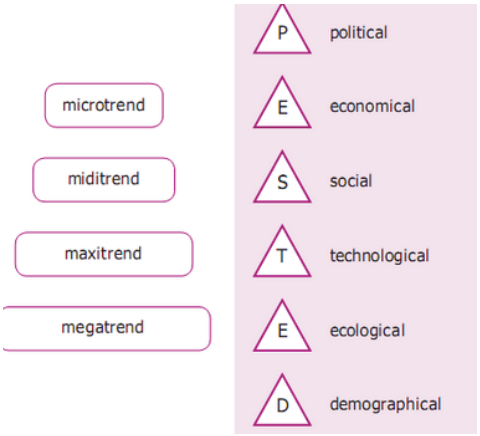
In the beginning of a design project or in the strategic planning process. With a trends analysis you can identify new business opportunities or new product ideas. You can also use it to identify preferences of the target group.

How to?

Starting point
Corporate/strategic vision.

Expected outcome:
Potential customer/market needs for which new products and services can be thought up.

Possible procedure:
1_ List as many trends as you can think up. Identify trends from magazines, television, the Internet, etc.
2_ Determine a value for each of the characteristics. Comparing the company with its direct competitors.
3_ Remove trends which are similar; identify hierarchy in trends. Identify whether trends are related and define this relationship.
4_ Place the trends in a trends pyramid. Set up various trends pyramids according to the PESTED structure: P = Political; E = Economic; S = Social; T = Technological; E = Ecological; D = Demographic.
5_ Identify interesting directions for new products or services based on trends.



3. Collage techniques

What is it?

A visual representation made from an assembly of different forms, materials and sources creating a new whole. A collage may include newspaper clippings, ribbons, bits of coloured or hand-made papers, portions of other artwork, and pictures. Making collages you make visual representations of the context, user group or product category. A Mood Board displays typical lifestyle elements (such as brand preferences, leisure activities and product type preferences) of the users, but also their dreams and aspirations.

When?

The use of collages serves different purposes in the design process:
Determining the colour palette of the product ideas and concepts.
Presenting a particular atmosphere or context that you want to capture in the form of the new concepts.
Determining and analysing the context in which the product will be used.

How to?

Starting point
First, is to determine what the collage is used for. What will be displayed in the collage: the user's lifestyle, the context of interaction, or similar products?

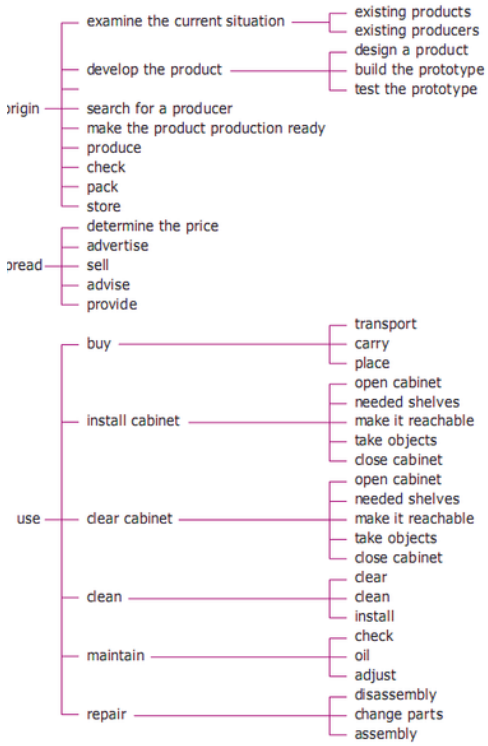
Expected outcome:
A visualisation of an aspect of the problem context, e.g. the lifestyle of users, the context of interaction or the product category.

Possible procedure:
1_ Determine which magazines and/or imagery will produce the most suitable material.
2_ Group together the imagery that concerns the target group, environment, handling, actions, products, colour, material and so on. At the same time, make a selection according to usable and less usable images.
3_ For each collage decide the orientation of the background.
4_ Try by means of small sketches to set down the structure of the composition.
5_ Make a provisional composition of the collage with the means at your disposal.
6_ Paste the collages once the picture meets your expectations and contains most of the characteristics and they are identifiable.

4. Process tree

What is it?

A schematic diagram of the processes that a product goes through during its life. Making a process tree forces you to think ahead: in which situations, places, activities will the new product turn up? Who is doing what with the product then? What problems are to be expected? What requirements do these situations necessitate? A process tree forces the designer to systematically think through all the subprocesses that a product goes through: production (including development), distribution, use and disposal.



When?

A process tree is preferably made in the beginning of the problem analysis..

How to?

Starting point
A product, or a product group.

Expected outcome:
a structured overview of the important processes that a product goes through. This overview helps in setting up requirements and defining functions.

Possible procedure:
1_ Define the product, or product group.
2_ Identify the relevant stages in the lifecycle of the product. Use the following stages as a start: production, distribution, use, maintenance and disposal.
3_ Describe all the processes that a product goes through in the determined stages.
4_ Visualise the process tree

6. Who, What, Where, When, Why, and How

What is it?

Analysing a problem means obtaining a thorough understanding of the problem. An important notion in problem analysis is deconstruction of the problem: by asking yourself a multitude of questions, you are able to deconstruct the problem systematically. Consequently, you can review the problem and set priorities.

When?

Define the preliminary problem or draft a design brief.

How to?

Starting point
A product, or a product group.

Expected outcome:
Greater clarity about the problem situation (the problem context), better understanding of facts and values of the problem, and more insight into problems underlying the initial problem.

Possible procedure:
1_ Write down the initial design problem.
2_ Ask yourself the following WWWWWH questions in order to analyse the initial design problem.
3_ Review the answers to the questions. Indicate where you need more information.
4_ Prioritise the information: what is important? why?
5_ Rewrite your initial design problem

7. Problem definition

What is it?

An expected situation in the future does not have to be accepted. You can try to do something about it, by acting now. For defining a problem this implies that it is not sufficient to describe the existing state. Therefore, we speak consciously of the situation that someone is or is not satisfied with. As a result, a description of the situation is a description of a state plus the relevant causal model(s), including the assumed patterns of behaviour of the people and organisations involved. A situation is only a problem if the problem-owner wants to do something about it.

When?

A problem definition is usually set up at the end of the problem analysis phase.

How to?

Starting point
Information gathered in the problem analysis stage. The different aspects surrounding the design problem have been analysed and should be taken into account in the problem definition.

Expected outcome:
A structured description of the design problem, with the goal of creating an explicit statement on the problem and possibly the direction of idea generation.

Possible procedure:
Answering the following questions will help to create a problem definition:
1_ What is the problem?
2_ Who has the problem?
3_ What are the goals?
4_ What are the goals?
5_ Which actions are admissible?

8. Product Design Especifications (PDS)

What is it?

The Design Specification consists of a number of requirements. The design of a product is 'good' in so far as it complies with the stated requirements. A requirement is an objective that any design alternative must meet. The programme of requirements is thus a list of objectives, or goals. Goals are images of intended situations, and consequently requirements are statements about the intended situations of the design alternative. Design alternatives should comply optimally with the requirements. Many requirements are specific; they apply to a particular product, a specific use, and a specific group of users. There are also requirements with a wider scope, as they are the result of an agreement within a certain branch of industry or an area of activity

When?

Normally, a design specification is constructed during the problem analysis, the result being some finished list of requirements. However, a design specification is never really complete. During a design project, even during the conceptual designing stages, new requirements are frequently found because of some new perspective on the design problem.

How to?

Starting point

The analyses that take place during the stage of problem analysis.

Expected outcome:

A structured list of requirements and standards.

Possible procedure:

1_ List as many requirements as possible.

2_ Make a distinction between hard (quantifiable) and soft (wishes) requirements.

3_ Eliminate requirements which are in fact similar or who do not discrimate between design alternatives.

4_ Identify whether there is a hierarchy between requirements. Divide between lower-level and higher-level requirements.

5_ Operationalize requirements: determine the variables of requirements in terms of observable or quantifiable characteristics.

6_ Make sure that the programme of requirements fulfils the following conditions:

- -Each requirement must be valid.
- -The set of requirements must be as complete as possible.
- -The requirements must be operational.
- -The set of requirements must be non-redundant.
- -That the set of requirements must be concise.
- -The requirements must be practicable.

CREATING PRODUCT IDEAS AND CONCEPTS

1. How to's

What is it?

Problem statements written in the form of "How to…" (How to carry luggage in the airport? How to transport deep-frozen food in a shop?) The idea is to create a wide variety of problem descriptions. In this way different perspectives are briefly shown, and the problem is described from these different points of view. The How to's are open questions that stimulate your creativity almost immediately.

When?

At the start of idea generation. With 'How to's' the problem is reformulated in many different ways and ideas come up easily.

How to?

Starting point

The starting point is the result of the problem analysis stage. Often it is a short description of the problem or a problem statement

Expected outcome:

Various problem reformulations in the form of How to's. The problem reformulations reflect different points of view towards the problem.

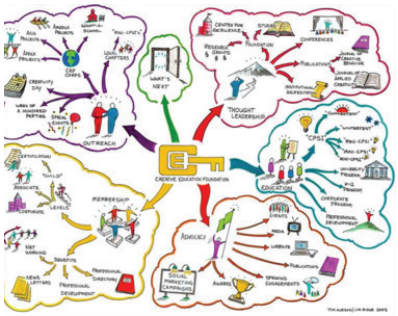
Possible procedure:

1_ Provide a short description of the problem and invite to name all important aspects of the problem.
2_ Invite the group to name as many 'How to's...' as possible, seen from the different points of view.
3_ Evaluate the most important common elements of the 'How to's..'
4_ Select a number of 'How to's...' that cover the different points of view.
5_ Formulate "one single concrete target"

2. Mind map

What is it?

A graphical representation of ideas and aspects around a central theme, and how these aspects are related to each other. With a mind map one can map all the relevant aspects and ideas around a theme, bringing overview and clarity to a problem. It is especially useful for identifying all the issues and sub-issues related to a problem. But mind maps can also be used for generating solutions to a problem.



When?

It is often used in the beginning of idea generation. Setting up a mind map helps one to structure thoughts and ideas about the problem, and connect these to each other. However, a mind map can also be used in the the problem analysis phase of a design project.

How to?

Starting point
Central theme, for example a problem or an idea

Expected outcome:
Structured overview of ideas and thoughts around a concept or a problem, represented graphically.

Possible procedure:
1_ Write the name or description of the theme in the center of a piece of paper and draw a circle around it.
2_ Brainstorm each major facet of that theme, placing your thoughts on lines drawn outward from the central thought.
3_ Add branches to the lines as necessary.
4_ Use additional visual techniques: different colours, circles around words that appear more than once, connecting lines between similar thoughts...
5_ Study the mind map to see what relationships exists and what solutions are suggested.
6_ Reshape or restructure the mind map if necessary.

3. Brainstorm method

What is it?

Brainstorming as a method prescribes a specific approach with rules and procedures for generating ideas. It is one of many methods used in creative thinking to come up with lots of ideas to solve a problem. This method consist roughly of the following steps:
-Diverging from the problem.
-Inventorising, evaluating and grouping ideas.
-Converging: choosing a solution.
Diverging from the problem
Brainstorming is done with a group consisting of 4-8 people. A facilitator leads the brainstorm session, and asks the group provocative questions. The group's responses (the ideas) are written down on a flipover. The stages that the group goes through in a brainstorm session are methods on their own, and different alternative methods are possible within a brainstorm session.

When?

In the beginning of the idea generation, with the goal of producing a large number of ideas with a group of participants.

How to?

Starting point
A problem statement

Expected outcome:
A large number of ideas.

Possible procedure:
1_ Develop a statement of the problem and select a group of 4-8 participants. Draw up a plan for the brainstorm session, including a detailed time line, the steps written down, and the methods used.
2_ Have a preparatory meeting together with the participants, whereby the method and rules are explained, the problem, if necessary, is redefined.
3_ Write, at the beginning, the statement of the problem clearly visible to everyone on a blackboard .
4_ The facilitator should ask provocative question to the group, and write down the responses.
5_ Once a large number of ideas are generated, the group should make a selection of the most promising and interesting ideas.

4. Syntetics

What is it?

Synectics concentrates on the idea generation steps with the use of analogies. Analogies allow for moving away from the original problem statement and making a forced fit to develop solutions on the basis of these analogie..

In the preparatory stages, there is a problem briefing, an extensive problem analysis phase through questioning by the participants, and definition of a problem statement into 'one single concrete target'. After this, a purging phase takes place in which known and immediate ideas are collected and recorded. From this point on, analogies are used to estrange yourself from the original problem statement and come up with inspirations for new solutions and approaches. These analogies can be:

-Direct Analogy: Starting from some aspect in the problem, one looks for comparable or analogous situations

-Personal Analogy: What if you were an element in the problem, e.g. a planning problem?

-Nature Analogy: What kind of situations in nature does this remind me of?

-Fantastic Analogy: Can you place the problem in a fairy tale or other mythical situation and develop it from there?

-Paradoxical Analogy: Characterise the issue in two words which are each other's opposites.

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When?

For more complex and intricate problems.

How to?

Starting point

An initial problem statement.

Expected outcome:

A limited number of preliminary yet surprising ideas

Possible procedure:

1_ Analyse the problem. Restate the problem. Formulate the problem as one single concrete target.

2_ Generate, collect and record the first ideas that come to mind.

3_ Find a relevant analogy in one of the listed categories of analogies.

-Ask yourself questions in order to explore the analogy. What type of problems occur in the analogous situation? What type of solutions are there to be found?

-Force-fit various solutions to the reformulated problem statement.

-Generate, collect and record the ideas.

-Test, and evaluate the ideas. Use the itemised response method to select from among the ideas.

-Develop the selected ideas into concepts.

-Present your concepts in a manner that is to the point.

5. Function analysis

What is it?

Method for analysing and developing a function structure. It describes the functions of the product and its parts and indicates the mutual relations. The underlying idea is that a function structure may be built up from a limited number of elementary functions on a high level of abstraction. In function analysis, the product is considered as a technical-physical system. The product functions, because it consists of a number of parts and components which fulfil subfunctions and the overall function. By choosing the appropriate form and materials, a designer can influence the subfunctions and the overall function. The principle of function analysis is first to specify what the product should do, and then to infer from there what the parts - which are yet to be developed - should do.

When?

At the beginning of idea generation.

How to?

Starting point

-A process tree, which can be drafted from scratch or based on an existing solution of the design problem
-A collection of elementary (general) functions.

Expected outcome:

Thorough understanding of the functions and subfunctions that the new product has. From functions and subfunctions the parts and components for the new product can be developed.

Possible procedure:

1_ Describe the main function of the product in the form of a black box.
2_ Have a preparatory meeting together with the participants, whereby the method and rules are explained, the problem, if necessary, is redefined.
3_ Make a list of subfunctions. The use stage of a process tree is a good starting point.
4_ Elaborate the function structure. Fit in a number of `auxiliary' functions which were left out and find variations of the function structure so as to find the best function structure. Exploring various possibilities is the essence of function analysis: it allows for an exploration and generation of possible solutions to the design problem.

6. Role-playing techniques

What is it?

They can help in developing and determining the interaction between user and product. In a role-playing technique, designers perform the tasks of the interaction by means of re-enactment. Role-playing is just like theatre acting: by acting out the tasks the user has to perform, you reach a better understanding of the complexity is reached, and different ideas for the interaction can be developed.

When?

Throughout the design process, for developing ideas about the interaction with a product idea.

How to?

Starting point
With a first idea about the interaction between product and user.
Expected outcome:
Good conceptual idea about the interaction, as well as visualisations or written descriptions of the interaction.

Possible procedure:
1_ Determine the actors and the goal of the actor or the interaction.
2_ Determine what you want to portray in the role-playing technique. Determine the sequence of steps
3_ Make sure that you record the role-playing.
4_ Divide the roles amongst the team members.
5_ Play the interaction, improvise. Be expressive in your movements. Think aloud when enacting motivations.
6_ Repeat the role-playing several times until different sequences have been enacted.
7_ Analyse the recordings: pay attention to the sequences of tasks, motivations and factors that could influence the interaction.

7. Story board

What is it?

It provides a visual description of the use of a product that people from different backgrounds can 'read' and understand. A storyboard not only helps the product designer to get a grip on user groups, context, product use and timing, but also to communicate about these aspects with all the people involved. With a storyboard the powerful aspects of visualisation are exploited. At a glance the whole setting can be shown: where and when the interaction happens, the actions that take place, how the product is used, and how it behaves, and the lifestyle, motivations and goals of the users.

When?

Throughout the entire design process, from ideas about the interaction with a product to ideas and concepts and also for product concept evaluations

How to?

Starting point
A first idea about the interaction between product and user.
Expected outcome:
good conceptual idea about the interaction, as well as visualisations or written descriptions of the interaction.

Possible procedure:
1_ Start from the following ingredients: ideas, simulations, a user character.
2_ Choose a story and a message: what do you want the storyboard to express? Limit your story to a clear message.
3_ Create sketchy storylines.
4_ Create a complete storyboard. Use short captions to complement (not repeat) the images.

8. Written scenario

What is it?

To write a scenario, you need a basic understanding of the tasks to be performed by the user. You also need to have an understanding of the users and the context of use.
It describe the interaction that needs to take place. You should also have the scenario reviewed by users to ensure that it is representative of the real world. Use scenarios during design to ensure that all participants understand and agree to the design parameters, and to specify exactly what interactions the system must support.

When?

Throughout the design process, for developing ideas about the interaction with a product idea.
Scenarios can also be used for presenting ideas and concepts, and are used in product concept evaluations and product usability evaluations.

How to?

Starting point
A first idea about the interaction between product and user.

Expected outcome:
Good conceptual idea about the interaction.

Possible procedure:
1_ Determine the actors. The actor has an active role in the scenario.
2_ Determine the goals the actor has to complete.
3_ Determine a starting point of the scenario: a trigger or an event.
4_ Identify stakeholders and their interests.
5_ Determine the number of scenarios that you will create, based on the number of actors and their goals.
6_ Write the scenario. Work from starting point towards completing the actors' goals. Be specific about tasks, subtasks, context and the actors' motivations to complete the goals.

9. Checklist for concept generation

What is it?

Checklists are a series of simple questions, which can be used either individually or in groups. The checklist aims to encourage a systematic development of concepts. The questions on a checklist need a point of focus, which could either be an existing solution or proposed concepts to a design problem. The questions should be taken one at a time, to explore new ways and approaches to the problem.

When?

Best applied when developing an idea into a concept. As stated earlier, the technique needs a point of focus. This point of focus should be a product idea, already with material features, shape and dimensions.

How to?

Starting point
A well-defined product idea, or existing product.

Expected outcome:
A well-defined product idea, or existing product.

Possible procedure:
1_ Define a product idea into detail, including material features such as shape, dimensions etc.
2_ Search for and select a checklist for concept development. Use more than one checklist.
3_ Systematically work through the checklist by answering the questions on the checklist. Note: this is a trial and error process; apply the question to the product idea and verify whether the product idea is improved. If not, try something else.
4_ Iteratively, improve you idea by answering the questions on the checklist over and over again.
5_ Present your developed idea in a explanatory sketch.

10. Context mapping

What is it?

Contextmapping is a user-centred design technique that involves the user as 'expert of his experience'. By providing the user with design tools and approaches, he or she can express a particular experience.
All the factors that influence the experience of product use, such as: social, cultural, physical aspects as well as goals, needs, emotions and practical matters. he acquired information should work as a guiding map for the design team.

When?

It should help designers to understand the user's perspective and to translate the user's experience into a desirable design solution..

How to?

1_Preparing:
Determine what you want to learn and the topic of study. Capture your preconceptions in a Mind Map. Start selecting participants. Make a planning

2_ Sensitising:
Some time before the session, users receive a sensitising package, which helps them to observe their own lives and reflect on their experiences of the study topic. It can consist of various elements derived from cultural probe packages, such as an exercise book, postcard assignments, fill-in maps and cameras.
The user is encouraged to spread the assignment throughout the week, which gives him or her the opportunity to generate memories and associations and sharpen their sensitivity to the topic.

3_ Meeting:
After the sensitising step, the researcher and user meet. This can be in a group session with typically up to six users, or an interview at the user's home or work location, whereby one of the researchers facilitates the process and the other makes notes and observes.

4_ Analysing:
Sessions and workbooks provide large amounts of data, which must be interpreted to find patterns and possible directions. Researchers sift through the material, make selections and interpretations and try to find patterns of similarities and differences. The researcher typically creates a rich visual environment of interpretations and categories which he or she then analyses.

5_ Communicating:
In practice, designers often do not meet the users. Therefore the researchers have to translate the 'user experience' to the designer and convey the user's perspective, needs and values.

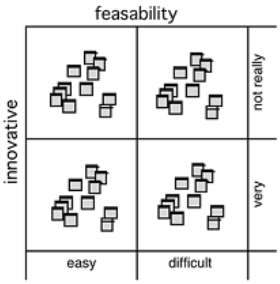
6_ Conceptualizing and beyond:
Communications often serve to improve idea generation, concept development and further product development. Users are often highly motivated to look at the results again and can build on the knowledge they generated many weeks after the original study.

DECISION AND SELECTION

1. C-Box

What is it?

We use a C-Box to generate an overview from a multitude of early ideas. The C-Box is a 2 x 2 Matrix. Two axes are determined that represent criteria according to which the ideas are evaluated.
In a C-Box usually the criteria 'innovativeness' and 'feasibility' are used. A C-Box has four quadrants based on these axes. You are able to judge quickly whether ideas are immediately feasible or not, and whether they are highly innovative or not.



When?

Used in early idea generation, in case of a surplus of early ideas (for example 40+ ideas) generated in a brainstorm session.

How to?

Starting point
The starting points of a C-Box is a multitude of early ideas (40-60 ideas).

Expected outcome:
An overview of the early ideas, clustered in four groups based on criteria set to the axes of the C-Box.

Possible procedure:
1_ Create two axes (innovativeness and feasibility) on a large paper and construct the 2 x 2 C-Box with those two axes.
-Functionality: one end is the familiar, the other end represents highly innovative.
-Feasibility: one end is not feasible, the other end represents immediately feasible.
2_ Make sure all ideas are written down, or drawn on a small piece of paper.
3_ With a group, review and discuss the ideas, and place the ideas in one of the four quadrants.
4_ Make sure that ideas in one quadrant are situated closely to the criteria they meet best.
5_ Working out the most promising ideas and dropping the bad ideas (not innovative and not feasible).

2. Itemised response and PMI

What is it?

The I**temised Response** method is used to judge ideas quickly and intuitively. For each idea, the positive and negative features are listed. These positive and negative features can serve to elaborate on the positive aspects. Also, the negative aspects can be evaluated and improved. This method is used to evaluate and work out a moderately large selection of ideas.
The **PMI** Method (Plus, Minus, Interesting) is used to evaluate early design ideas in a quick and systematic way. PMI is essentially a tool that helps to bring structure to a set of early ideas. Per idea the pluses, minuses and interesting aspects are listed:
Plus (+): positive aspects,
Minus (-): negative aspects, and
Interesting (I): interesting aspects and features.

When?

The Itemised Response method can be used to select ideas for concept developments.
The PMI method is essentially a technique used in a brainstorm setting .

How to?

Starting point
A limited number of ideas, resulting from the stage of idea generation (not more than 10).

Expected outcome:
Evaluation of ideas and a decision as to which ideas could go into concept development.

Possible procedure:
1_ For each idea, list the positive features and the negative features in the form of a list with pluses and minuses. Per idea, answer the following questions:

-What is good about the idea (Plus)?
-Which aspects would you need to improve (Minus)?
-What makes the idea interesting (Interesting)?.

2_ You now have per idea:

Plus: these are the good aspects of the idea, worth developing further (into concepts) or taking advantage of.
Minus: these are bad aspects of the idea, not worth developing further.
Interesting: these are interesting aspects of the idea, but they need more development in order to become good ideas. .

3_ Decide upon your course of action: do you develop the good ideas into concepts? Maybe combine certain good ideas?, or do you continue with the early idea generation.

3. vALUe

What is it?

The vALUe Method (Advantage, Limitation, Unique Elements) is used to evaluate a large set of early design ideas in a quick and systematic way. By explicitly writing down the ideas in terms of advantages, limitations and unique elements, the ideas have a common vocabulary which makes further selection easier.

When?

Because it allows ideas to be described in common terms, the vALUe method is best applied in the beginning of the design process, during early idea generation. The vALUe Method works best just after selecting from among a large number of ideas (20 to 50 or more back to 7 +/- 2)..

How to?

Starting point

A large number of early ideas or principal solutions (20 to 50 or more)..

Expected outcome:

A common description of early ideas. Better understanding of interesting and promising ideas, but also of bad ideas.

Possible procedure:

1_ Generate a large set of early ideas or principle solutions.

2_ Per idea, answer the following questions:

-What are the advantages of the idea (A)?

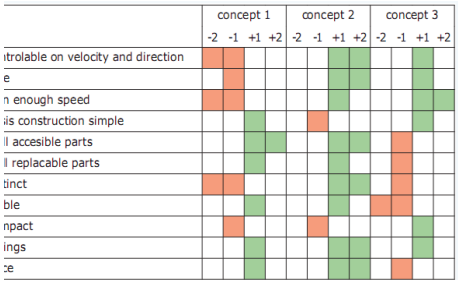
-What are the disadvantages of the idea (L)?

-What are the unique elements of the idea (U)?

4. Harris profile

What is it?

A graphic representation of the strengths and weaknesses of design concepts. Per design alternative a Harris Profile is created. A number of criteria are used to evaluate the design alternatives. A four-scale scoring is used for all criteria. The decision-maker should interpret the meaning of the scale positions (i.e. -2 = bad, -1 = moderate, etc.). Thanks to its visual representation, decision-makers can quickly view the overall score of each design alternative on all the criteria, and compare these easily.



When?

Whenever a number of alternatives of product concepts need to be compared and consensus/an intuitive decision needs to be reached.

How to?

Starting point

Alternatives for a product, in some stage of development.

Expected outcome:

One chosen/selected alternative from a group of alternatives. Overview of the advantages and disadvantages of the selected alternative.

Possible procedure:

1_ Criteria should be selected according to which the design alternatives should be compared.

2_ List the criteria and create a four-point scale matrix next to it. The scale is coded -2, -1, +1, and +2.

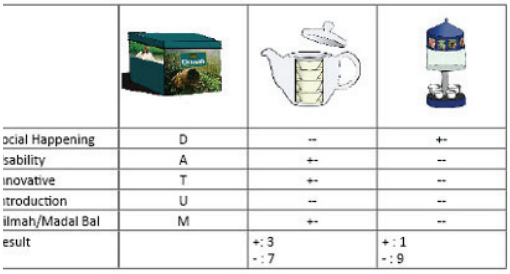
3_ Create a Harris Profile for the design alternatives you want to compare. Draw the profile by marking the scores in the four-point scale matrix for all the criteria.

4_ When the Harris Profiles of the design alternatives are completed, the profiles can be compared and a judgment can be made as to which alternative has the best overall score.

5. Datum method

What is it?

A method for evaluation of design alternatives. One of the alternatives is set as datum to which the other alternatives are compared for a range of criteria. Three judgements can be given: 'worse', 'same' or 'better' expressed in '–', '0' and '+'. The sum of each of these three values will then help to make a decision. The value of the alternatives is guessed on the basis of the 'intuitive' judgements of the decision-makers.



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When?

Whenever a number of alternatives of a product concept need to be compared to reach consensus in the evaluation or to make an intuitive decision.

How to?

Starting point

Product concepts, developed to an equal, and thus comparable, level of detail.

Expected outcome:

. One or more strong concepts for further development, confidence in the decision for the chosen concept(s).

Possible procedure:

1_ Arrange the concepts and criteria in a matrix

2_ Choose one of the concepts as 'datum'. Compare the other concepts to this datum and give a score for each criterium at the time (+ = better than datum, – = worse than datum and s = similar/same).

3_ Indicate ∑+, ∑S and ∑–.for each concept. Usually at least one concept will show more '–' and less '+'. Usually a few concepts have minor differences. Discussion can start.

4_ When the outcome does not distinguish enough, the process should be repeated until it does. Each time another concept should be taken as datum, leaving out the concept which was definitively worse.

6. Weighted objectives method

What is it?

Evaluation method for comparing design concepts based on an overall value per design concept.
The Weighted Objective Method assigns scores to the degree to which a design alternative satisfies a criterion. However, the criteria that are used to evaluate the design alternatives might differ in their importance.

When?

Best used when a decision has to be made between a select number of design alternatives, design concepts or principal solutions.

How to?

Starting point
A limited number of concepts.

Expected outcome:
A chosen concept.

Possible procedure:
1_ Select the criteria according to which the selection will be made.
2_ Choose 3 to 5 concepts for selection.
3_ Assign weights to the criteria. The criteria should be appointed weights according to their importance for the evaluation. To determine the weight factor of the criteria it is recommended that you compare the criteria in pairs to attribute a weight factor. Rank each of the weights on a scale from 1 to 5. Make sure you discuss the trade-offs between the criteria. Trade-offs will have to be made when weights are assigned to the individual criteria.
4_ Construct a matrix, with the criteria in rows, and the concepts in columns.
5_ Attribute values to how each concept meets a criterion. Rank the scores of the concepts from 1 to 10.
6_ Calculate the overall score of each concept by summing up the scores on each criterion.
7_ The concept with the highest score is the preferred concept.