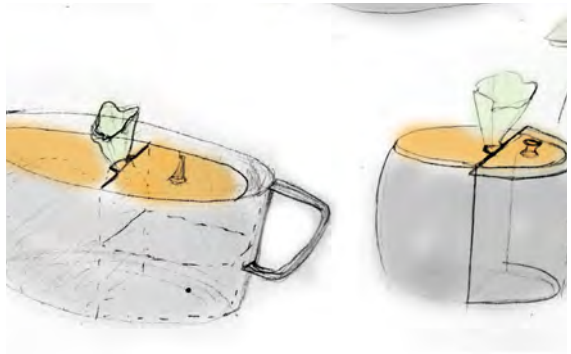
TOILET POT FOR SLUM AREAS INDUSTRIAL DESIGN RESEARCH, SKETCHES AND CONCLUSIONS.



By A Segtnan Industrial Design in collaboration with Deutsche Gesellschaft für Technische Zusammenarbeit (GIZ) GmbH. Dhaka, Bangladesh 2010.

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1. ABSTRACT

The industrial designer Annamaja Segtnan, the industrial design student Mona Mijthab and the researcher Ashley Wheaton, were contracted by GIZ principal Alexander Jachnow to design a toilet pot. The group of three will from here on be referred to as "The Team". The objective of this project reads:

I: Through industrial design and cooperation within sanitation community present toilet pot solutions that are culturally acceptable to the community.

II: Create an integrated urban toilet pot that is easy to use, maintain, and viable in practical and economic terms. The toilet and/or the collection system should preferably destroy pathogens in faeces before they are returned to nature in an environmentally sustainable way (observing a previous attempt by Peepoo with biodegradable bags).

2. INTRODUCTION

According to the United Nations, 2600 millions people in the world do not have improved sanitation facilities. 72 percent out of the 2600 millions live in Asia. According to statistics from UNICEF (2010) 11 % of the Bangladesh population still defecate in the open. The report phase ran from 15 th August-10 th September 2010.

Word list

Ecosan (ecological sanitation) systems enable the recovery of nutrients contained in feces, urine and household wastewater and promote their safe reuse in agriculture. They contribute to preserving soil fertility, whilst minimizing the pollution of water resources.

Faeces – the same thing as stool, poo and shit. In this report we talk about human faeces.

Pathogens - something causing sickness, e.g. bacteria and virus.

FIG 1. WHAT IS A TOILET POT?
This is a Japanese toilet pot from Rakuten. com. The team purposely tries to keep the definition of what a toilet pot is, not to ignore possible product solutions close to a toilet pot.
Photo: Rakuten.com

3. DESIGN BRIEF

A well-defined design brief is central for a good industrial design result. During the future industrial design process the team will glance back at the design brief and make sure we're moving in the right direction. To whom are we designing and which functions are most important? Which are the "musts" regarding functions, practical use and the design?

Initially when the project was started the design brief was to make a mobile toilet pot culturally acceptable for poor people. We're still keeping the toilet pot in mind, but below in the design brief it's described without telling exactly that it has to be a toilet pot. The reason for this is to keep the definition of the solution open. We're keeping it open not to loose good ideas around or ideas close to the definition of a toilet pot (Fig. 1). The design brief is based on "4. Documentation of Research" as well as "5. Analysis of findings".

3.2. DESIGN BRIEF - MAJOR ISSUES

Offer ecological (destroy pathogens in faeces before they are returned to nature in an environmentally sustainable way) and durable toilet visits with privacy by going at home or outside (mobility), hold feces, urine and anal cleansing water, avoid smell and flies. User price affordability: approximately 60-100 thaka/Month. Culturally acceptable.

3.3. DESIGN BRIEF GENERAL LIMITATIONS

A biodegradable bag will hold the faeces and the bag fits best into a round or almost round cylinder. The cylinder and the biodegradable bag must offer the ability to avoid causing smell and attracting flies. Urine and faeces will be separated. The target group is hinting that the purpose of the product could be hidden (as toilet visits is

FIG 2. SORTING GARBAGE *in one of the slums of Mymensingh, Bangladesh.*

FIG 3. (4.4.3. DOCUMENTATION OF RESEARCH - FOCUS GROUP INTERVIEWS, *page: 10) . We're visiting this family at their home in one of the slums of Mymensingh, Bangladesh.*

described as an embarrassing subject) but others are at the same time mentioning that they would be proud to be owner of a real toilet.

Biodegradable bag limitations

• The biodegradable bag must be allowed to be carried 2-20 meters (this effects the maximum size as we of course don't want the bag with the faeces to break).

• Communicate the function of the biodegradable bag in a discrete way and at the same time hide the content (faeces).

Toilet pot limitations

- Squatting position is preferred by the majority of the interviewed women. Maximum height from floor to top of pot-part under rump: 20 cm.
- Communicate the usage and the features of the toilet pot intuitively (semiotics). This means that it should be possible to use the product without for an example arrows and symbols on the product. Designing in such a way that education is needed for how-to use the product should also be avoided. The product should seek to be designed in a way that the user can learn to use it intuitively.
- Maximum price to buy: approximately: 100 thaka/1 € (According to documentation of research - field studies interviews among women in Mymensingh.)
- If the toilet pot easily breaks, it will be useless for the target group. A durable material has to be chosen.

Risks

- Too many user moments can make the user unmotivated to use the product.
- The users might start to use other bags than the biodegradable bags, such as plastic bags. Using plastic bags will remove the fertilizer aspect and also make the toilet visits non-ecological.

3.4. DESIGN BRIEF - TARGET GROUP

The team proposes to target urban slum users, mainly women and children. The team wants to preferably focus on a solution for a family, meaning of 4-5 members (we can't assume that men and older young boys will use the product). An added reason to focus on women and children are that they're disproportionately burdened by poor water and sanitation facilities, compared to men and older boys.

3.5. DESIGN BRIEF - GOALS

A successful product would be reaching these goals:

- Minimize danger - distance to the toilet is shorter. An effect of this would be reduced stress for women as well as increased frequency of toilet visits.
- Minimize danger associated with toilet visits for women (sexual abuse while walking far alone looking for a private place in early morning or late night)
- Reduce the risk of different diseases spreading through open defecation
- Personal cleanliness
- Increased privacy
- Odor free environment
- Produce fertilizer
- Save time, money
- Gained respect

3.6. DESIGN BRIEF - TIME PLAN

1. Research 15/8-1/9 -2010
2. Interviews (field trip to Mymensingh interviewing women living in slums)
3. Research of prototyping/production material (field trip to Mymensingh, re-

search in Dhaka, web research)

4. Research existing products on the market (web research). Participants: Mona
   Mijthab, Ashley Wheaton, Annamaja Segtnan
5. Inception report 15/8-1/9-2010. Participator: Annamaja Segtnan
6. Presentation (Inception report/research) 1/9-2010. Participants: Mona Mijthab, Ashley Wheaton, Annamaja Segtnan, Alexander Jachnow.
7. Defining the design brief 25/8-2010. Participants: Mona Mijthab, Ashley Wheaton, Annamaja Segtnan
8. Sketching 1-9/9-2010. Participants: Mona Mijthab, Annamaja Segtnan

4.DOCUMENTATION OF RESEARCH FINDINGS

The documentation of the research has been mainly compiled on paper boards. It has been part of the team's work place at the office in Dhaka, Bangladesh. In this section some photographs of the research paper boards are presented. Please note that the photographs enclosed were not intended for the report. The author of this report was not in Dhaka at the time of writing the report and could therefore not take new, better photographs than these, which are shoot with a mobile camera.

4.2. DOCUMENTATION OF RESEARCH - EXISTING PRODUCTS

- Ecosan toilets (western standard and Asian standard – squatting position, Fig. 8 and 11)
- Toilet pot for kids (Fig. 14)
- Toilet urine pots (Fig. 17)
- Mobile toilet products for women (Fig. 13)
- Camping toilets (mobile) (Fig. 6)

FIG 4. (4.4.3. DOCUMENTATION OF RESEARCH - FOCUS GROUP INTERVIEWS, *page: 13).* "My home is small, *I don't want to show openly that I have a toilet because it's embarrassing." Young woman living in Mymensingh slum, Bangladesh.*

FIG 5. (4.4.3. DOCUMENTATION OF RESEARCH - FOCUS GROUP INTERVIEWS, *page: 13) People and especially kids, were curious about the the team interviewing the women about their toilet habits. We tried to keep some privacy as we find the topic, toilets, private.*

- Re-using PET bottle products (Fig. 18)
- Biodegradable products (Fig. 9 and 18)

4.3. DOCUMENTATION OF RESEARCH PRODUCT FUNCTIONS

The research within product functions has the role of being an inspiration for the sketching process. By glancing at existing form solutions for functions such as holding liquid, material and closing mechanisms, the team might come up with new function combinations useful for the toilet pot design.

4.3.2. Documentation of research – forms that can hold liquid and material

This is forms which can hold liquid (urine) or material (faeces). Interesting is also the combination with this function together with a handle, as our product might have to be carried. Please refer to Fig. 15.

4.3.3. Documentation of research – closing mechanisms

Research of forms that can hold the biodegradable bag. Also research of lid function for closing the container (the material, faeces might smell and then attract flies, therefore should be closed). Please refer to Fig. 16.

4.3.4. Documentation of research – biodegradable products and re-using PET bottles

Biodegradable products presented on paperboard. Peepoo is a Swedish innovation - a one time use toilet which is a biodegradable bag. Biodegradable bamboo pots for gardening. Haxnicks 2010. Biodegradable urn from mainelyurns.com. PET bottles are recycled into products such as a stool, lamps and a base for the peepoo toilet bag. Please refer to Fig. 18.

FIG 6. (4.2. DOCUMENTATION OF RESEARCH – EXISTING PRODUCTS). *Camping toilets are mobile & light weight.*

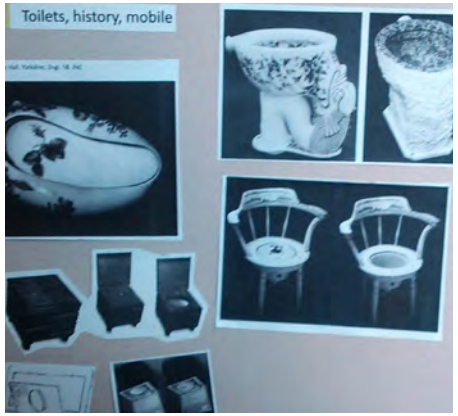


FIG 7. (4.2. DOCUMENTATION OF RESEARCH – EXISTING PRODUCTS.) *Toilet pots from the history were often combined with a chair as well as mobile.*

FIG 8. (4.2. DOCUMENTATION OF RESEARCH – EXISTING PRODUCTS) *ecosan toilet products: (ecological toilets) in European (sitting) and Asian (squatting) style and design. An ecosan toilet separates urine and excreta for better composting functions, less smell and less flies. Also toilet pots for kids.*

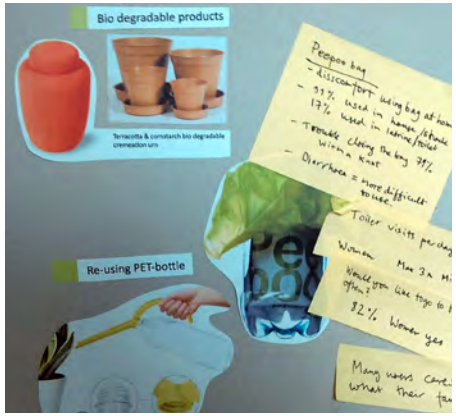
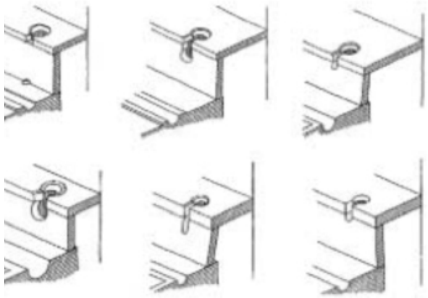


FIG 9. (4.3.4. DOCUMENTATION OF RESEARCH – BIODEGRADABLE PRODUCTS.) *Peepoo - biodegradable bag as a toilet. Biodegradable bamboo pots for gardening. Haxnicks 2010. Biodegradable urn from mainelyurns.com.*

FIG 10. (4.2. DOCUMENTATION OF RESEARCH - EXISTING PRODUCTS). Camping toilets *Below: a camping toilet has to be mobile and ligth weight. Above - a model of an ecosan toilet made in cardboard and the simple urinal: Water lily. Water lily is a funnel (here made out of a cutted PET-bottle) connected to plastic tank. Photo: different internet sources.*

FIG 11. (4.2. DOCUMENTATION OF RESEARCH - EXISTING PRODUCTS). *Ecosan toilets (ecological toilets) in European (sitting) and Asian (squatting) style and design. An ecosan toilet separates urine and excreta for better composting functions, less smell and less flies. Photo: different internet sources.*



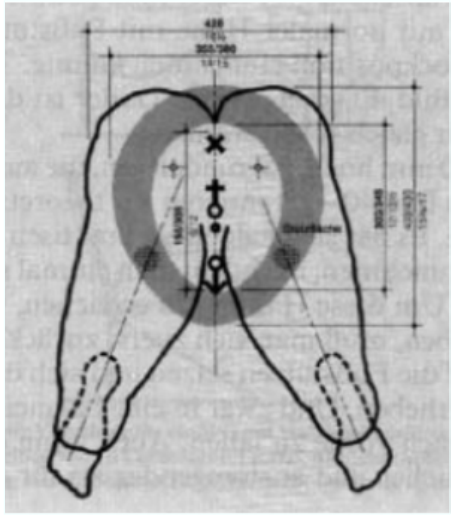


FIG 12. (4.2. DOCUMENTATION OF RESEARCH - EXISTING PRODUCTS). *Toilet ergonomics How-to direct pee the best way middle age latrine Europe. Positions of containers for urine and faeces separation indicated by anatomy of bottom. Photo: different internet sources.*

FIG 13. (4.2. DOCUMENTATION OF RESEARCH - EXISTING PRODUCTS).
Mobile toilet products for women.

FIG 14. (4.2. DOCUMENTATION OF RESEARCH - EXISTING PRODUCTS).
Toilet pots for kids.

FIG 15. (4.3.2. DOCUMENTATION RESEARCH PRODUCT FUNCTIONS - FORMS HOLDING LIQUID AND MATERIAL). *Forms that can hold liquid as well as a biodegradable bag.*

FIG 16. (4.3.3. DOCUMENTATION OF RESEARCH – CLOSING MECHANISMS.) *What is a form which is possible to open? Closing with a lid, closing with a string and some textile, closing by bending paper. A form that can hold a biodegradable bag. Earplugs are a form, which is made to fit into an other form – the ears. This is sometimes called an invert form. An other example of an inverted form. The lid for the sink is made to fit the sink hole.*

4.4. DOCUMENTATION OF RESEARCH - FIELD STUDIES

Field studies at the plastic bag factory All Plastics Bangladesh Ltd and urban slums in Mymensingh, Bangladesh.

4.4.2. Documentation of research – plastic factory visit

We visited All Plastics Bangladesh Ltd to learn more about the aspects of designing and producing plastic/biodegradable bags. Factory director Mr Mosharraf answered questions regarding increased/decreased price with different kind of handles, bag sizes, folding and number of plastic bag seams. Since producing biodegradable bags would require purchasing a new machine, he found giving the bag a string to drag as a closing mechanism (similar to biodegradable composting bags in Europe and US) not affecting the end cost of the bag. However he was not able to give us a price for the bag since they don't have this kind of machine yet. A general rule for the price is that anything that can be done by the plastic bag machine is cheap. Anything done by hand is expensive. Putting a thread to the bag would have to be done by hand and would therefore increase the price.

Plastic bags are made from a tube. It's possible to add striped decoration on the tube in another color than the bag color. This is cheaper than printing text with ink on the tube. Maximum number of seams are two. From order until the machine would be set up: around 150 days. Please note that plastic bags are not allowed in Bangladesh and we have to find out if biodegradable bags are.

This company is also producing plastic products such as the Bangladeshi famous "bottna" carafe. They have a CAD-development lab and a CNC cutting machine for producing moulds for plastic production.

FIG 17. (4.2. DOCUMENTATION OF RESEARCH – EXISTING PRODUCTS). *Toilet urine pots. Modern urine toilet pots as well as from the history.*

FIG 18. (4.3.4. DOCUMENTATION OF RESEARCH – BIODEGRADABLE PRODUCTS AND RE-USING PET BOTTLES). *A stool made of PET bottles, biodegradable toilet bag Peepoo using a PET-bottle as temporary toilet pot, tap with handle to creates a water jug out of any PET-bottle, plastic bottles as lighting.*

4.4.3. Documentation of research – focus groups interviews

The focus group interviews where performed with women living in slum areas in Mymensingh city, about 120 km north of the capital, Dhaka, Bangladesh. There are a few slum areas in Mymensingh which GIZ Dhaka earlier has collaborated with regarding testing of biologically toilet bags, namely Peepoo bags. The team visited some of the very same test users again for focus interviews regarding their views of using a toilet. Interviews were performed together with an interpreter. The interviewed didn't seem embarrassed to talk about the subject toilets. Though we tried to keep some privacy around the interviewed person. A crowd was easily gathered, curious of what was going on.

When it comes to using toilet in Asia and in Bangladesh, anal cleansing with water is much more commonly used than toilet paper. Many therefore desired a washing facility attached to the toilet facility. The team discussed the current toilet situation as well as what one can wish for in the future. Information was also gathered regarding available free materials such as: ashes and leafs, which can be used as compost material. All the women interviewed lived in slum huts. For the inhabitants of the river slum, a helicopter toilet in the river was the only toilet available. During nighttime open defecation was used. For the inhabitants of a slum close to the railway tracks, open defecation was used at nighttime; a shed toilet without drainage was also available. One of the women we talked to said that she could afford one toilet visit a day at the public toilets of the mosque (2 thaka). The women's husbands and sometimes their elder son's were using the mosque for their toilet visits.

When it comes to the way of body position when using any toilet, all the women asked were squatting and they rather did it with some leaning support (Fig. 11. Squatting toilets). One meant that she would prefer sitting totally, not just having a leaning support.

FIG 19. (4.4.3. DOCUMENTATION OF RESEARCH - FOCUS GROUP INTERVIEWS.) *Three of the women we interviewed in Mymensingh about their toilet habits. We talked about their current toilet situation and what one can wish for in the future.*

We got proposals from some of the women that a toilet pot in their home should be possible to hide – they felt ashamed of having a toilet in their home. While others said that they want it to be clearly visible as they would feel proud of having a toilet at their home. This fact could be further explored by testing different product designs for the toilet pot.

The women were asked if they would prefer to be able to choose among for an example four colors of the product. They found this point of interest as long as the price wouldn't increase. The interviewed were positive about the functionality of being able to carry the pot by some kind of handle. They wouldn't have a problem with carrying the pot, though it's positive if it's not visible for people passing by, what they're carrying. The women who had been involved for the earlier Peepoo bag (small biodegradable bag used together with for an example a cut PET-bottle, see Fig. 34) test proposed that these bags should be bigger (currently around 10 cm wide and 40 cm long) to provide a bigger squatting area. One lady expressed a thought that the team also had considered: a bigger biological bag would allow a bigger amount of toilet visits per bag and then the price could be cut. Many of the women who tested commented that they had found it difficult to get used to using the Peepoo bag, but it was not impossible. Pee and Poo should be possible to do at the same time, using the toilet pot and it should be possible to wash at the very same place as well. Desired height of the pot – 20-30 cm.

Opinions about how many people that would use the same pot: maximum 3 persons. One woman was very skeptical about sharing with more people than that. The reason for this: referring to that it will be difficult to control who has paid for the service and not. Only persons, who are taking part in paying, should use the product and it's services. All the asked women meant that children would probably use it.

FIG 20. (4.4.3. DOCUMENTATION OF RESEARCH - FOCUS GROUP INTERVIEWS). *Slum interior. This is the environment where the toilet pot should be used in. Locally produced clay oven to the right in the left picture.*

FIG 21. (4.4.3. DOCUMENTATION OF RESEARCH - FOCUS GROUP INTERVIEWS). *Slum interior & exterior. To the right: woman is letting us into her home for research purpose, in a slum area close to Gulshan, in Dhaka, Bangladesh.*

FIG 22. (4. DOCUMENTATION OF RESEARCH). *The research were put together on paper board. A research board is very helpful in the sketching process - viewing the situations where the product will be used and combining it with the access of local material can lead to clever ideas...*

One elderly woman was using a terra-cotta pot as toilet pot in her hut. According to her it was a substitute for using the helicopter toilet in the river, she was very old and could hardly walk. Terra-cotta is often locally available as production material as well as has a low production cost. The team asked the women about how they would feel if the toilet pot was made of terra-cotta. They were not too positive about it and referred to that it could easily break and then the investment of the toilet pot would be worth nothing. A well used metal container (Fig. 27) for storage of water photographed in a slum area in central Dhaka, speaks it's clear language regarding this issue. The metal container on the photo is just a few years old, according to it's owner. Plastic was mentioned as a good alternative, since it's cheap and durable. The plastic used should not be of a too soft plastic.

4.5. DOCUMENTATION OF RESEARCH - TECHNOLOGY FINDINGS

The technology research has mainly focused on biodegradable bags as the team thinks this might have high potential regarding hygienic treatment around the toilet pot.

Biodegradable bags (Fig. 34) were invented as an alternative to the environmentally bad plastic bag widely used around the world as shopping bags. According to the English version of Wikipedia.org it's important to define in which kind of environment the biodegradable bag will have to be biodegradable in and in what time period it's going to degrade. We cannot claim a bag to be biodegradable unless we're speaking of specific conditions regarding climate and composting.

Biodegradable bags are bags made from materials that are able to compost under specified conditions of light, moisture, and oxygen. Compost conditions with exposure to sun, moisture, and oxygen are mostly needed: degradation is slow in landfills.
By doing web research the team found the following current usage areas for biodegradable bags (Fig. 34):

FIG 23. (4.4.3. DOCUMENTATION OF RESEARCH - FOCUS GROUP INTERVIEWS.) *Toilets current situation. Helicopter toilet in the river of Mymensingh, Bangladesh.*

FIG 24. (4.4.3. DOCUMENTATION OF RESEARCH - FOCUS GROUP INTERVIEWS.) *Slum bathroom/ kitchen. Water is running through this slum and the women are doing the dishes directly on the path outside their door.*

FIG 25. (4.4.3. DOCUMENTATION OF RESEARCH - FOCUS GROUP INTERVIEWS.) *Toilet current situation. Simple toilet shed made of spare fabric. To the right - stones to stand on inside the toilet and water bucket for anal cleansing in plastic.*

- Picking up dog waste
- Picking up garden waste
- Picking up toilet waste such as urine and faeces
- Shopping bags
- Snack bags

A biodegradable bag for the toilet pot could be designed in a way to support the daily usage of the toilet pot as well as carrying the biodegradable bag to the compost unit. It can also communicate how to use it with a graphic prints. Design of biodegradable bags regarding form and print, has therefore also been part of the biodegradable bags research. The visited factory All plastics Bangladesh can not at present manufacture biodegradable bags. However they're thinking about buying the necessary production equipment in the future.

FIG 26. (DOCUMENTATION OF RESEARCH - FOCUS GROUP INTERVIEWS). *Above: Mymensingh slum next to the railway track. Below: River toilet build in connection to a river slum in Mymensingh.*

FIG 27. (4.4.3. DOCUMENTATION OF RESEARCH - FOCUS GROUP INTERVIEWS). *A metal container for storage of water photographed in a slum area in central Dhaka, speaks it's clear language regarding the need for a very durable material choice of the toilet pot. The metal container on the photo is just a few years old. As one can see it has not been handled with care. Products to be used in the slum should probably rather be in a durable material.*

FIG 28. (4.4.3. DOCUMENTATION OF RESEARCH - FOCUS GROUP INTERVIEWS). *How does the look like living in a slum? Pictures from a slum area next to Gulshan, Dhaka, Bangladesh.*

4.6. DOCUMENTATION OF RESEARCH PROTOTYPING FACILITIES FINDINGS

The toilet project result, in the end being successful, includes at least one prototype. Therefore researching local prototyping facilities' and possibilities has been part of the research process.

Below available prototyping materials are listed and evaluated regarding which forms that could be made, time and approximately price. Please refer to Fig. 30-31.

Material	Form	Time	Price
Terra-cotta (500 thaka/day)	- Extruded forms - Moulded forms - Hollow forms - Can hold water	1 day 1 month 1 day	500 thaka/ day
Clay (extremely local stove - clay craftsmanship)	- Sculptural		50 thaka
Clay (craft creating God-figures)	- Sculpture, skel-leton based	1 month 1 day	3000 thaka/ day
White painted ceramics (Fig. 29)	- Sculptural, hollow	-	-
Ready-made plastic prod-ucts	- Hollow forms - Can hold water	-	-
Card-board	- Geometric forms - Volume forms	-	-

FIG 29. (4.6. DOCUMENTATION OF RESEARCH PROTOTYPING FACILITIES FINDINGS.) *Ceramic prototyping tools. Above: tools used for creating ceramics moulds. Below: White painted ceramic ecosan toilets, at Shital Ceramics, Ahmedabad, India.*

5.2. ANALYSIS OF EXISTING PRODUCTS

There are no found ecosan toilet pots so far on the market. The conventional ecosan toilets on the market are made in white painted ceramics or epoxy plastic. The toilet pots for the camping market are made in paper as well as plastic. All ecosan toilets come with a lid to cover the faeces. The Peepoo biodegradable bag is close to an ecosan toilet when being used with some kind of bucket. However it's not separating faeces and urine. The cost is also high per toilet visit for our target group (with current information). In terms of economy and viability there's no toilet pot for slums on the market yet.

5.3. ANALYSIS OF FIELD RESEARCH

The analysis of findings from the focus group discussions with women in Mymensingh, Bangladesh has been conducted into an industrial design functional analysis as the base for this project's design brief. Here follows the function analysis made from the same. The desirable functions has been given grades of priority from * to ***** with reference to the field research as well as the industrial designers thoughts and opinions.

Function analysis for the collecting service picking up faeces and urine should be further researched and analyzed.

Necessary functions:

Hold faeces		*****
Hold Urine		*****
Offer toilet visits without infrastructure		*****
Avoid smell		*****
Avoid flies		*****
Offer urine separation		*****

FIG 30. (4.6. DOCUMENTATION OF RESEARCH PROTOTYPING FACILITIES FINDINGS.) *Materials and constructions in the slum. Looking at existing constructions used in Dhaka slums gives an assumption of what is possible to construct cheap and of local materials. Photo: Annamaja Segtnan*

FIG 31. (4.6. DOCUMENTATION OF RESEARCH PROTOTYPING FACILITIES FINDINGS.) *Rapid prototyping is though not available in Dhaka. Photo: different internet sources and Annamaja Segtnan*

Desirable functions:

Hold washing water	****
Offer mobility	*****
Offer light-weight	****
Avoid two-handed carriage	****
Offer easy cleaning	****
Offer no cleaning	**
Avoid breaking when falling	****
Offer durability	****
Possibility for post-processing to destroy pathogens in faeces	****
Offer leaning support	****
Offer sitting support	***
Offer separated use of urine and faeces containers	***
Avoid a dirty look	***
Offer possibility of washing within the product	***
Offer collecting service (with product)	***
Avoid possibility of recognizing (toilet)	*
Offer possibility of recognizing (toilet)	*
Offer hanging possibility storage	***
Offer handle	****
Offer hygienic caring of faeces	****
Offer squat height inside dwelling/shack	****

Emotionally desirable functions:

Use a trustful material (in relation to previous associations) Avoid unwanted treatment of faeces and urine Communicate functions intuitively (semiotics)	** **** *****

FIG 32. (4.6. DOCUMENTATION OF RESEARCH PROTOTYPING FACILITIES FINDINGS.) *Materials and crafts available in the slum. This is a well seen oven in slums in Bangladesh that the team has visited. The clay oven is made of local clay by women living in the slum. On the right picture ovens for sale.*

FIG 33. (4.6. DOCUMENTATION OF RESEARCH PROTOTYPING FACILITIES FINDINGS.) *A Bangladeshi craft where amazing sculptural forms are made using straw, metal wire, rope, wood and clay.*

5.4. ANALYSIS OF FIELD RESEARCH PRICE

The interviewed women in Mymensingh generally suggested that they would pay around 50-100 thaka for the pot (0,5-1 €) . Monthly cost using the toilet pot: (total cost for 4-5 persons including everything): 30-150 thaka/Month (0,30-1,5€/Month). The price is depending on if the pot will replace all current toilet costs, including the men's cost for using pay & go toilets at the mosque.

5.5. ANALYSIS OF FIELD RESEARCH - USER SCENARIOS

Through analyzing the interviews these user scenarios were identified:

	Users	Faeces per day	Urine per day	Where	Price
1. Private single	Elderly person living alone	300 ml*	800-1500 ml*	Inside house/ outside house	50 / thaka month
2. Private family	Woman and children, 4-5 persons	900 ml*	Adults: (800-1500x3) = 2400-4500 ml*	Inside house/ outside house	50-100 / thaka month
3. Outside (sharing shed without toilet)	Two families and two elderly sharing.	2400 ml*	Elderly (800-1500)x2 = 1600-3000 ml* Family (2400-4500x2) ml = 4800-9000 ml*	Existing open defecating toilet sheds outside/ Inside house	200 / thaka month

* = These figures are from a study performed in Nepal. Bangladesh conditions may be different.

FIG 34. (5.8. TECHNOLOGY ANALYSIS OF FINDINGS). *Examples of different biodegradable bags designs - form and graphical print. Photo: different internet sources and Annamaja Segtnan.*

5.6. ANALYSIS OF FIELD RESEARCH - SELLING POINTS

Even though the users are extremely price sensitive the team believes that an extremely well functioning and likable product could gain both respect and popularity (willingness to pay more). However the lower the price the more possible increased number of users/buyers.

The team wants to look into the possibility of adding selling points to the product such as quality, design and extra functions in relation to a higher price. The reason to do this would be the ability to reach different target groups within the slum. A price strategy could be to differentiate the product by adding value and giving it different names: Toilet Pot Normal and Toilet Pot Delux. It's also possible degrading the product in this way, could make the product more desirable for the target group, as it may sound like a "real mass produced marketed product". This kind of products rarely reaches the target group. Coca cola, Pepsi and mobile phone operator companies are examples of brands that are highly valued among the target group. However this was not part of the interview subjects during the field research. The author of this report has got these opinions expressed from the target group – women living in slums, from a previous field research made in Gujarat (please refer to Ecoloove in References on last page).

Too many user moments when using the toilet could also affect the motivation of using the toilet and the benefit of having a toilet. An example: urinating at home, having to carry the pot to a collection point 100 meters away. This would perhaps be a less preferred way of going to toilet compared to open defecation. Or defecating at home - but not having the possibility of washing at home - having to step out and wash under a primitive shed or in the open. A local production in local craft would probably give us a price for the product affordable for the target group but

FIG 35. THE ANAL CLEANSING "BODNA" *is something as uncommon as a product for poor. It's seen in restaurant toilets as well as slum toilets all over Bangladesh.*

FIG 36. THE ANAL CLEANSER "BODNA" *Fill up water and use it for anal cleansing. It's designed with inspiration from a traditional Bangladeshi design in metal.*

could on the other hand mean a risk as the production speed and availability could be unreliable and would as well perhaps mean a more increased involvement for GIZ's staff.

5.7. PROTOTYPING FACILITIES ANALYSIS OF FINDINGS

Making the prototype of the toilet pot cannot, with current knowledge and information, be done using conventional industrial design prototyping facilities in Bangladesh. Conventional industrial design prototyping is done in foam at a workshop (this is not available according to our research, not even at the architecture university in Dhaka). Prototyping will be adapted to the specific prototyping needs and the documentation of findings could be used as a guide to choose the right prototyping material. Using a mix of soft (for an example textile) prototyping material and hard materials could be considered. By sketching/prototyping in a locally available material the team might come up with a product that is extremely cheap to produce. Priority should however be given to solve the design brief rather than producing in a local craft.

5.8. TECHNOLOGY ANALYSIS OF FINDINGS

The technical research has been within biodegradable bags. There's a rancorous discussion in social media about how biodegradable, biodegradable bags actually are. More research should be done in this area. According to the research the cost per biodegradable bag increases the more compostable the biodegradable bag is. This might mean that we might have to cut out the fertilizer aspect and just be satisfied with not adding on plastic to the soil when the bag breaks down.

The team suspects that a product that requires biodegradable bags could result in an unwanted usage or treatment (example: not using given biodegradable bags, instead plastic bags) as well as dependence on a production company (factory) for viable biodegradable bag prices. A second risk with the biodegradable bags is that plastic bags are banned in Bangladesh and we're uncertain about the allowance of using biodegradable bags.

These are necessary features that the biodegradable bag should fulfill:

- Affordable
- No toxic residues
- Sufficient disintegration (into particles that don't have to be screened out of fertilizer later on)

In addition some desirable features are:

- Rapid degradation (to allow air and micro organism to reach feces)
- Will break down in anaerobic conditions if it somehow ends up in a landfill
- Able to be processed into fertilizer (through composting with kitchen waste and other plant materials)

6. EXPLAINED SKETCH EXAMPLES

All of the explained sketch examples are based on a urine separating toilet system. Urine and faeces are not mixed. The sketch examples are not ready designed products, but ideas that could be developed into products. Colours used in the sketches is to guide the viewer for a better understanding of the sketches.

Tools for evaluating design sketches

The following graphs: 1. Number of toilet visits vs volume of toilet, 2. Price vs mass produced look and 3. Price vs ideal functions, will be a useful tool for evaluating design concepts. It helps to clearly distinguish the advantages between different product ideas and to guide the evaluation process of the future design concepts. Among the four explained sketch examples "Toilet pot bucket style" and "Low sitting toilet pot" seems to be among the best ones. Please refer to the graph: "Price vs mass produced look", to the right on this page.

7. CONCLUSIONS/RECOMMENDATIONS

All conclusions and recommendation below referred to as "I" means that it's the author of this report, industrial designer Annamaja Segtnan's, conclusions and recommendations.

Material

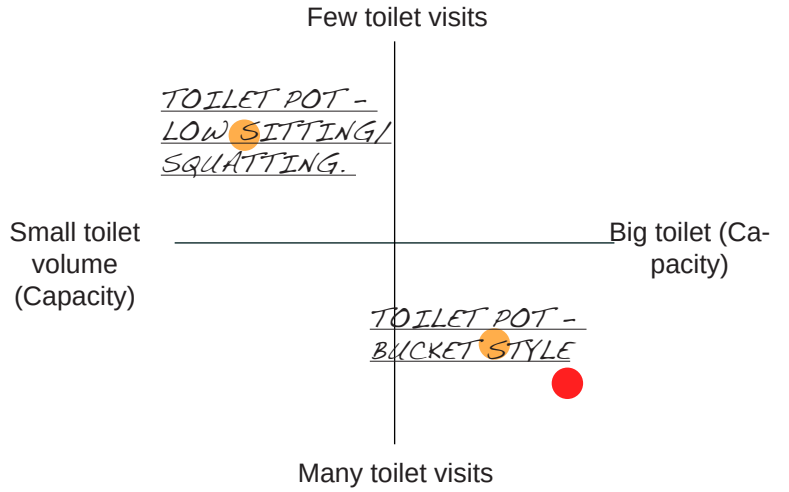
Materials vice I had a vision at the beginning of the project that it should be possible to produce the toilet pot in a natural, local and cheap material such as pottery or ceramics. I have given up this idea, since the target group clearly expressed (and we could also see it with our own eyes that the kind of products they chose for their households were made of tolerant materials); the need for a product in a resistant and durable material. If the toilet pot breaks, buying it was totally useless. Since the target group is extremely price sensitive, a toilet pot in steel would probably be too expensive. Probably plastic is the material to go for, even if it's a non-eco-friendly material. Using enamel as a material has not been clearly researched during this project, but has been a material choice for toilet pots looking at the history. According to interviews that I made with poor women in India, for an other mobile sanitation project (please refer to references, Ecoloove, at last page), they wanted a real modern product design look. Handmade look on a product was not price worthy for them. This again speaks for a material that allows a mass production look.

Prototyping technique

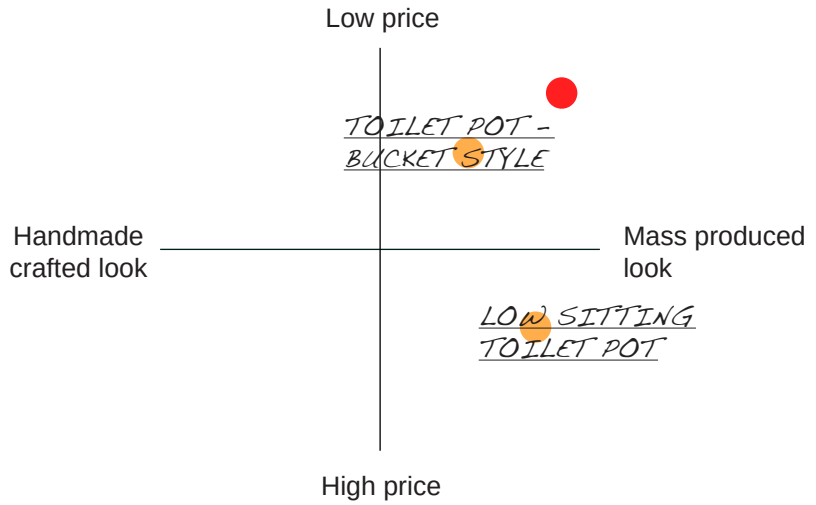
The choice of prototyping technique depends on the choice of design to prototype. If plastic is chosen, I definitely recommend prototyping in foam. Finding industrial design prototyping facilities in Dhaka has been quit a challenge. For further work I would set the prototyping process to a country where the industrial designer has access to industrial design prototyping facilities. The responsibility to find the correct facilities should be on the industrial designer.

1. NUMBER OF TOILET VISITS VS VOLUME OF TOILET:

● = Product optimal placement in graph ● = Sketch example placement



PRICE VS MASS PRODUCED LOOK



I definitely recommend making prototypes. The prototypes don't have to perfect. Testing it practically with real potential users, will guide to the right design. Don't spend too much time at the drawing desk!

Technology

Designing the toilet pot coming with biodegradable bags should not be overlooked. But it requires specific research on a potential manufacturer, making sure the biodegradable bags actually can be defined as biodegradable bags. The toilet pot system shouldn't be claimed or marketed as an eco friendly toilet solution, unless the biodegradable bags used are qualified under an international standard for biodegradable bags. US, Australia and Europe has this kind of standards. The biodegradable bags should of course be produced locally, to keep the price down. There is production of biodegradable bags in India at present, though the factory of subject for field research, All Plastics Bangladesh, are not currently producing biodegradable bags.

Using other bags to collect faeces

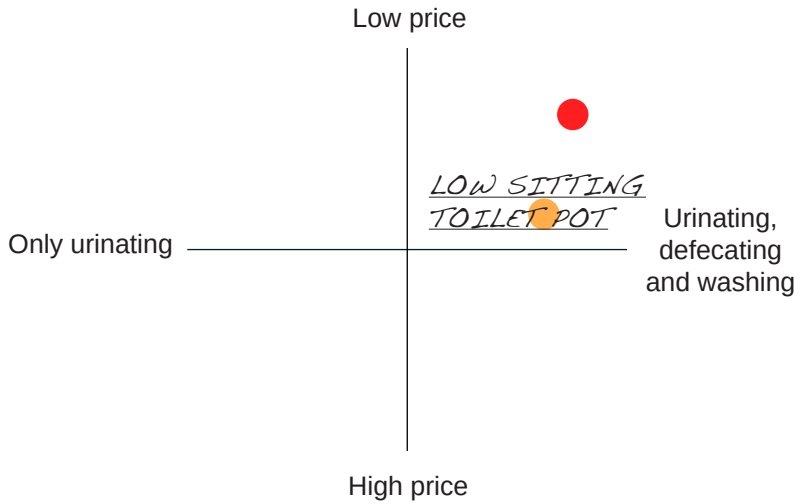
Could other bags be used than biodegradable bags? Paper bags, cotton bags? Yes, plastic bags has been used for storing the faeces for a while, until the product is nicer to handle. The faeces has been moved over to an other long time storage after a few months. In my opinion designing a toilet pot coming with biodegradable bags, makes sense, even if the production aspect of the bags as well as technology and material has not been fully evaluated.

Culturally acceptable

The knowledge within what is culturally acceptable in relation to the product design sketches is yet to be tested and evaluated at the time when the prototypes are ready. However offering squatting position definitely is important regarding the product being culturally acceptable.

PRICE VS IDEAL FUNCTIONS

● = Product optimal placement in graph



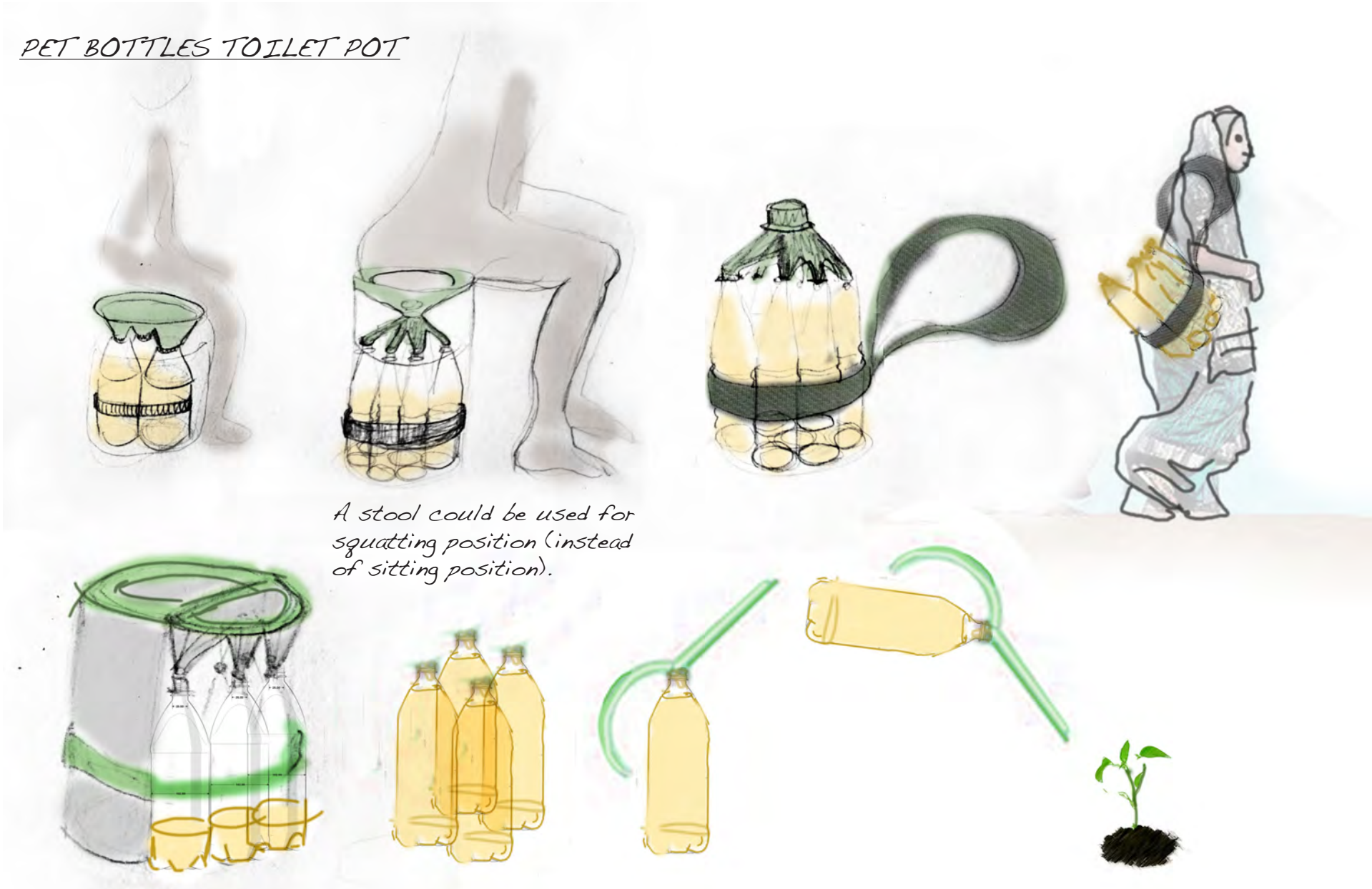


FIG 37. (6. EXPLAINED SKETCH EXAMPLES). *A sitting toilet from PET-bottles. PET-bottles are assembled together with a strap. This creates a foot stool. Assembled to the foot stool area - a special designed funnel directs the pee to the bottles. The PET-bottles could easily become watering cans with a special designed stopper that comes with a handle and a spout. Urine is a very good fertilizer. Sitting toilet position is however not in general preferable among the target group.*

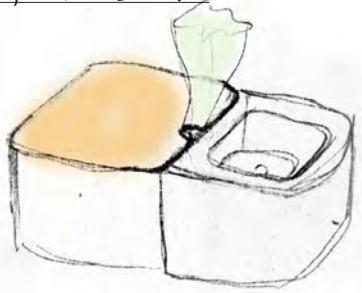
TOILET POT - BUCKET STYLE

Closing the biodegradable bag with a rubber string, take the rubber into the eyelet.

Urea as "pepper" could be added to the faeces compost material.

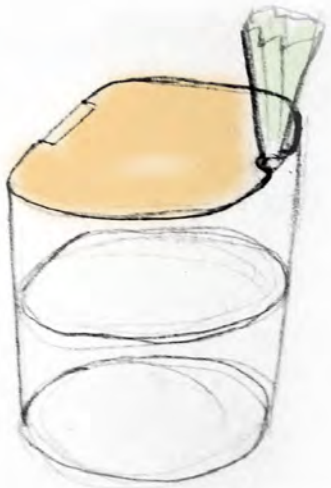
Urea makes the material compost faster/the micro-organisms to faster die.

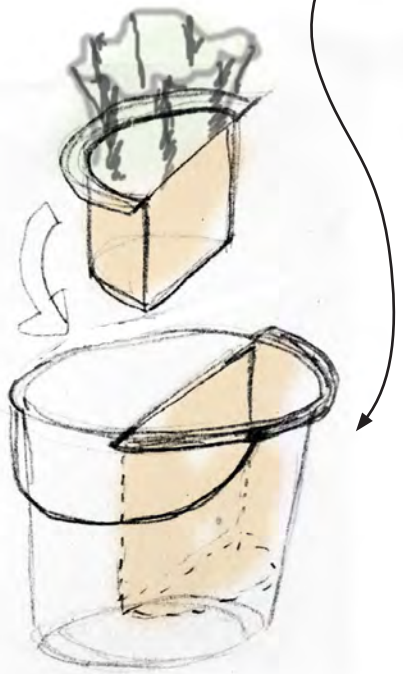
TOILET POT - LOW SITTING/ SQUATTING.

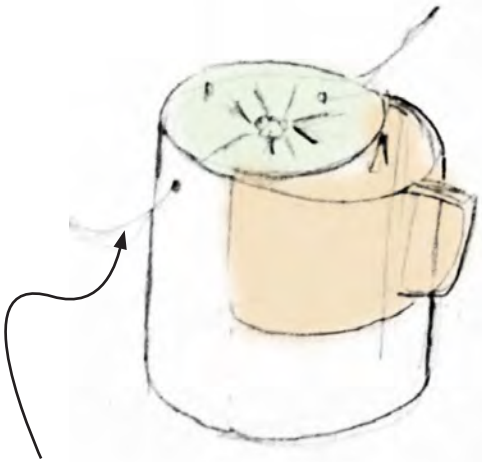


Designing components fitting to a locally produced no-name bucket, could be a way to keep the price down.

Keeping the biodegradable bag closed with the lid.







Opening and closing the biodegradable bag using less hand contact with strings and holes.

FIG 38. (6. EXPLAINED SKETCH EXAMPLES). *Removable urine container in different forms, all fit into a round container. Sitting position. Different solutions to keep the the biodegradable bag closed when not in use, to avoid smell and flies.*

LOW SITTING TOILET POT/SQUATTING

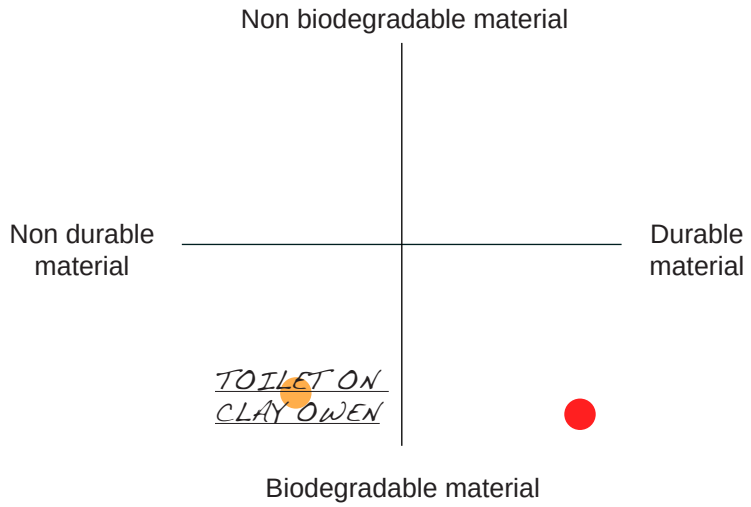
FIG 39. (6 EXPLAINED SKETCH EXAMPLES.) *Sitting toilet pot using separate lid for urine and faeces. Urine container can be locked and taken away to a urine storage place. The basis for this idea is a classic toilet pot with improved sitting ergonomics. The chubby cylindric shape is supposed to give a reliable stable sitting feeling - the toilet pot will not fall over.*

TOILET ON CLAY OWEN

FIG 40. (6. EXPLAINED SKETCH EXAMPLES.) *Traditionally slum locally produced owen in clay is used as a base for the biodegradable bag as well as sitting area. The owen should be build with the removable urine container.*

1. DURABLE MATERIALS VS NON BIODEGRADABLE MATERIALS

● = Product optimal placement in graph ● = Sketch example placement



Further project planning

This project has reached the first sketching phase for the toilet pot. There's still a long way to go before the product will be ready for production and first pilot. This is a recommended project plan after first sketching phase keeping in mind the team has chosen plastic as the main material of the toilet pot:

- 1. Research 15/8-1/9
  Interviews (field trip to Mymensingh interviewing women living in slums)
  Prototyping/production material (field trip to Mymensingh, research in Dhaka, web research)
  - Products on the market (web research)
  Participants: Industrial Design student Mona Mijthab, Researcher Ashley Wheaton and Industrial Designer Annamaja Segtnan
- 2. Inception report 15/8-1/9
  Participator: Annamaja Segtnan
- 3. Presentation (Inception report/research) 1/9
  Participants: Mona Mijthab, Ashley Wheaton, Annamaja Segtnan, Alexander Jachnow.
- 4. Defining the design brief 25/8
  Participants: Mona Mijthab, Ashley Wheaton, Annamaja Segtnan
- 5. Sketching 1-9/9
  Participants: Annamaja Segtnan

------This report concerns project work up to this point -------

- 6. 1st Evaluation.
  Proposed participants: Industrial Designer with Service Design competence & Project leader.
- 7. 1st Prototyping phase.
  Proposed participants: Industrial Designer.
- 8. Small field test of prototypes.
  Proposed participants: Industrial Designer with Service Design competence & Project leader.
- 9. 2nd Evolution
  Proposed participants: Industrial Designer with Service Design competence & Project leader.
- 10. 2nd Prototyping phase.
  Proposed participants: Industrial Designer.
- 11. 3rd Evaluation
  Proposed participants: Industrial Designer with Service Design competence & Project leader.
- 12. 1st Pilot
  Proposed participants: Industrial Designer with Service Design competence & Translator.
- 13. 4th Evolution
  Proposed participants: Industrial Designer with Service Design competence & Project leader, representative of possible buyer (NGO) of the product as well as 1-2 users (women and children).
- 14. 2nd Pilot.
  Proposed participants: Industrial Designer with Service Design competence & Translator.
- 15. Pre-construction phase.
  Proposed participants: Industrial Designer and Industrial Design engineer.
- 16. Preparation for production: engineering & CAD.
  Industrial Design engineer and/or CAD engineer.

If ceramics or enamel would be chosen instead of plastic for the material, involving a CAD engineer would probably not be necessary. A ceramics factory has according to my knowledge the proper facility to prepare for production based on a foam model.

Service design

A successful toilet pot design is not just about the functionalities and visual experience of the product. The service system around emptying and collecting the pot should be analyzed and effect the final product design, since the success of the final product depends on a well designed service activity around it. Here one example regarding service design: A possibility to motivate the users to leave the urine at a collection point (at some distance) could be a collaboration with a farmer who buys the urine and uses it as fertilizer. The urinators' would get paid to motivate carrying to the collection point.)

Industrial design

Below referring to "3. DESIGN BRIEF" and "6. EXPLAINED SKETCH EXAMPLES": Some women explained when we interviewed them, that they thought it was embarrassing to have a toilet and therefore wanted the purpose to be hidden, while others meant that they would be proud of having a toilet. I find it natural to hide what is actually being transported when for an example transporting urine or faeces to a collection point. There are examples of carrying the urine to a urine storage point among the sketches. The urine should of course not be visible while transporting. A simple textile bag could hide the content if the bottle is transparent.

The target group is extremely price sensitive. Therefore I've sketched designs with a base in locally available cheap or hand crafted product/material. However one must strive after balance regarding this - if the product feels too much hand-made and garbage-design, the target group could possibly find it unattractive. This is my own personal guessing, though based on designing innovative ecosan toilets for slums in dialogue with the same target group in India: women without toilets living in slums (Ecoloove.com). While I, industrial designer from west, enjoyed a crafted look, the Indian women I interviewed, in general preferred a mass produced product design look. This was luxury for them. I would keep this in mind when evaluating design concepts based on locally crafted materials/garbage with the target group.

In my sketch examples I am using PET bottles and a locally produced clay oven that people in the slum are producing themselves from locally available free clay material. These products are available at an affordable cost and by designing on these products as a base, the price could be kept down, as less products will have to designed and produced. Designing with a locally produced no-name bucket as a base is an other idea on the same theme.

The amount of liters and feces in relation to the faeces and urine containers volume has not been taken care of enough in this project so far. Of course the quantity will vary from area to area, user to user and even by different seasons (drinking more water for an example in the summer), but when designing the toilet pot, one should have an idea of how many toilet visits a specific volume could last for. Getting the clear Fig. about how big the products have to be to fulfill the target groups requirements; a good idea is to make volume models in paper board.

Communicating functions intuitively/semiotics thus not having to educate people on how to use the product. Threads and holes intuitively communicate how-to close the biodegradable bag. A handle is also directing the user on where the lid for faeces is as well as that it's possible to open/close it. Making sure the functions presented in the product are communicated with the form and materials itself, is probably the way to go. Designing with a no-name locally pro-

duced bucket as a base could again be great from communicative aspects: the users already knows how to use it. These experiences could be used for the design!

8. REFERENCES

Page 5: UNICEF (2010) 11 % of the Bangladesh population still defecate in the open. www.unicef.com

Page 12: Plastics Factory Bangladesh Ltd, All plastic Bangladesh Ltd. (APBL) RFL-HO, PRAN-RFL Group, PRAN-RFL Centre, 105/1 - Ga Middle Badda, Dhaka-1212. Cell: +8801924357698, +8801924357657

Page 9: Peepoo, www.peepoople.com

Page: 23 en.wikipedia.org/wiki/Biodegradable_bags

Page: 21 Urine & feces in liter per week: mail conversation with Katharina Conradin, Seecon international gmbh.

Page: 24 ecoloove.com - product innovation, business concept and service design within humanitarian industrial design. A Swedish-Indian company and a Non-profit Organization by the author of this report, industrial designer Annamaja Segtnan.

Page 31: "This is Service Design Thinking" by Marc Stickdorn.

Photographs and illustrations unless otherwise mentioned: by Annamaja Segtnan

Fig 41. *Field visit in Mymensingh slum, Bangladesh.*