Title: ECO FAUCET (Development Log)

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Note:

Contents

I. Kickstarter Pitch

People who can least afford to waste water are actually wasting and throwing away the most. 100 years ago, there were 1.6 billion people on earth, now there are 7.4 billion which has created unprecedented pressure on the world's scarce water supply. 20.7 million people live in Mumbai and are limited to 2-3 hours of water daily. The city currently has a supply of 3200 million liters of water every day (MLD) against a demand of 3700 MLD which means there is a gap of 500 MLD and a loss of about 650 MLD due to mismanaged water (pipe leakages) This could fill the equivalent of 260 Olympic sized swimming pools or provide adequate water to 216 million people. There has got to be a better solution! What if we could regulate this process that would result in no water waste while ensuring water abundance for current population and future generations. The Eco Faucet targets people in urban developing cities with limited access to water, who are unable to manage the available water due to shortage and inadequate water storage capacity. Our product provides a convenient, no-waste solution unlike the current manual process, ensuring maximum water utilization efficiency.

The Eco Faucet provides features that allows the user to control the flow rate out of the device from a tiny stream to brush your teeth to a full stream to wash dishes. For an added premium, the device also comes with an additional feature that automatically turns the water on & off when a battery powered sensor senses your hands, toothbrush, dishes, etc. Target customers are apartment dwellers in urban developing water stressed cities. With a population of 20.7 million and an approximate median yearly income of $10,000, the product will initially serve the middle-class population of Mumbai. The Eco Faucet will cost $22 and should payback within 1 year of installation.

The first 10 working prototypes would be installed at no charge in few apartment buildings preferably in a locality that faces higher water shortage rates in Mumbai within the first 2 months following product development. Consumer feedback will be used to finetune the product in order to facilitate the next milestone i.e. to produce and sell the next 500 units. Initial Market surveys suggest that working class people in Mumbai are eager to utilize this technology. First product proliferation will target 500 customers in order to validate consumer adoption at the 6-month milestone. Key partnerships with municipalities and sponsorship from NGOs and investors will scale our product beyond our initial target customers to initiate the final stage of our products mass proliferation and consumer adoption. We are seeking an initial funding of $200,000 which will facilitate the product’s proof of concept. The product would be a one-time investment on the customer’s end. This initial revenue will also fund the production of the mass production of 5000 units with expected profit margin at 60%.

62% of Mumbai's population lives in slums and are adversely affected with the increasing shortage of water. By enabling efficient water management through the use of Smart Faucet in urban apartments, enough water will be saved to meet the needs of these people. Our success is defined by maximum water conservation, proper distribution, and addressing shortages, through reduction in wastage and creating awareness for efficient usage, which would be driven by widespread implementation of our product. With vast opportunities to grow within India and expanding geographies, the Eco Faucet will be the water management solution the world has been waiting for.

II. Eco Faucet New Development Process

A. Phase 0: Planning

1. Problem Statement

Water is a metered and an expensive commodity in developing countries such as India. Supply is sporadic, limited to only 2-3 hours per day and often requires storage in water tanks. It is difficult to monitor water storage and wastage while under constant pressure to manually fill water tanks. Due to the limited and random water supply in residential and commercial parts of the city, our project was inclined towards building a solution that automates water storage and also water conservation by controlling water wastage.

2. Market Research

For our market research, we dug into a number of municipal corporation websites, Indian national news and water management websites, to get into the nitty gritty of the water shortage and distribution situation. Through literature review, we pulled out the facts and figures, responsible for low water supply in the residential and commercial sectors of Mumbai. For a densely-populated city like Mumbai, the problem elevates in days of summer, when the temperatures rise to an average of 100°F, with low rainfall. This leads to water rationing and limited water supply for equal distribution of water into residential and commercial sectors of the city. The limited hours of water supply are unevenly timed, with taps running for less than 4 hours each day, leaving residents, manually store water, wherever available. The water demand and supply gap, reasons of inadequate supply and potential solutions opted by residents are listed as shown in the following table [1][2][3][4].

Table 1: Market Research

Water Demand & supply gap	Reasons behind inadequate water supply	Water management solutions by the residents
1. Mumbai's water supply demand increases by about 80million to 100 million every year - according to reports by BMC [1]	1. In March 2016, with a monsoon been 23% deficient and lake levels at their lowest in five years, the BMC declared a 20% water cut in force until the next monsoon. [2]	1. Due to inadequate water capacity, Mumbai corporations are compelled to water rationing, with residential water supply cut by 15% and commercial water supply cut by 30% [4]
2. As per September 2009, the city received 3280 million liters a day (MLD) as against to the demand of 4200 MLD of water [1]	2. A study by Observer Research Foundation (ORF) suggests that Mumbai loses 650 million liters of day everyday due to leaking pipes. [3]	2. Taps run between 1-3 hours/day and supply will be cut off entirely for one day per week in each neighborhood. [2]
3. As per 2010, the supply of water in Mumbai per day is about 3450 million liters, with a gap of at least 400 million liters.	3. Reasons of inadequate water supply - loss of water due to leakage of pipelines and illegal water pipe connections. [3][4]	3. Through most of the year, residents pay private tankers Rs 15 for every 35 liters. With rising demand for the tankers, the rate can go up to Rs 35 and even Rs 40. [2]
4. Because of water shortage, each family ends up with about 90 liters per head per day, 60 liters per head less than the minimum they are entitled to. [2]		

3. Mission Statement

The mission statement was summarized such that is can be referenced throughout the new product development process. The product will serve as some sort of water supply management system targeting urban developing cities. For this problem statement, we felt that we could focus on one city in particular - Mumbai, India. Mumbai was chosen as the initial target market because market research indicated that there is a prevalent need for a product that can provide a mechanism to manage water.

Mission Statement

Product Description:
- Water supply management

Key Business Goals:
- Serve as a flagship platform for business market penetration

Primary Market:
- Residential apartment dwellings, urban developing cities (i.e. Mumbai)

Secondary Markets:
- Commercial apartment, residential homes

Assumptions:
- New product platform
- Cost appropriate (low - medium income)

Stakeholders:
- Purchasers are users
- Third party plumbers
- Manufacturing & service operations
- Distribution (web) and resellers

Figure 1: Mission Statement

4. Opportunity Identification

To simplify the distressed and irregular water supply situation for residents of Mumbai, our team identified three potential product designs. Our jumping off point with opportunity identification was to provide a hassle free, easy to use plumbing control valve, that would automate the incoming water flow, at any given times, and storing the water in individual residential or commercial units.

1. Automated wireless plumbing control
2. Automated wired plumbing control
3. Automated mechanical plumbing control

5. Customer Segmentation

Despite of the complex Indian market structure and diversity among the people, the intensity of reduced water supply and mismanagement water distribution system still remains common. As per the different income levels, our target was to make the product available to the low, medium as well as high income groups of Mumbai city. It however was segmented, without understanding the primary issues with the current water management systems. Our segmentation was universal to all the income groups, however with very little understanding of each income group and their unmet needs and demands with water management systems

1. Low Income
2. Middle Income
3. High Income

B. Phase 1: Concept Development

1. Identifying Customer Needs

Through research it became clear that the residents of Mumbai city adopted different solutions for water storage and water conservation. Every individual had their own measures and solutions for water storage. However due to the irregular and unpredictable water supply routine, wanted to understand the primary problems the users faced. In our initial screening, we developed a set of basic questionnaire, to understanding the situations behind irregular water supply and water storage system. Our mission was to understand the common problems faced by the residents and their daily general water management system. For our product that offered automated water management and storage solution, we asked our survey takers, the following questions:

- Are you distressed with the current water storage system?
- What do you like and dislike about the current water management system?
- What is the biggest problem you face? Walk us through your daily water management routine.

2. Target Specifications

Initial target specifications were listed without actually understanding the customer needs. Customer needs were listed based off of what our team wanted the product to be, rather than gathering them from a target market survey.

No.	Customer Needs
1	Affordable
2	Allows ability to track & control water usage
3	Easy to use
4	Easy to install
5	Lasts a long time
6	Fits a wide variety of tanks
7	Doesn't make noise

Figure 2: Customer Needs

No.	Metric	Unit
1	Unit manufacturing cost	US$
2	Water monitoring	Liters
3	Ease of use	Subj.
4	Time to assemble	s
5	Industrial standard test	Binary
6	Size & compatability	List
7	Noise decibels	dB

Figure 3: Metrics

Customer Needs & Concept Ideas: Conclusions & Lessons Learned:

We, as a team, jumped too early on the product concept, that was committed to providing an automated solution to water storage and water management to the irregular water supply. However, as we went ahead with the high-level concept, our focus was far off from the real, end user needs for the water management system. Through the initial screening, we understood that people made use of buckets, storage tanks and even bottles for storing water, that would last for days. Assuming the manual solutions for water storage by customers, as unfavorable and ambiguous.

Also within the product development process, we recognized the potential technology features, that could elevate the product's capability and provide a better water management experience to the users. However not understanding the unmet needs of the potential end users with the current system and their personal solutions to the distressed supply, was a risky move.

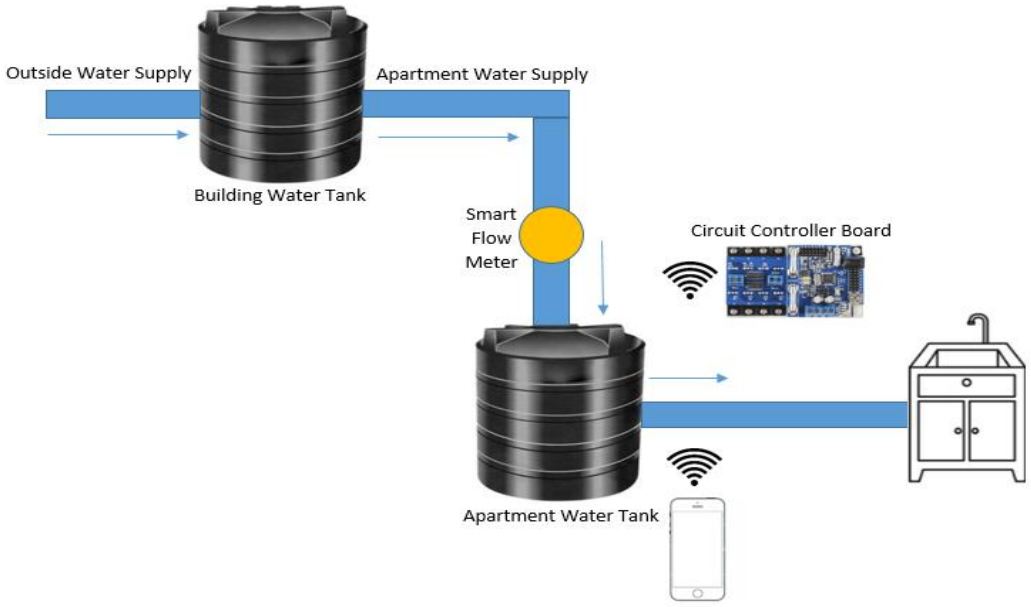

Figure 4: Initial Concept

3. Concept Generation

It was evident that we had to revisit our customer needs statements in order to better grasp product concepts. Jumping to a product idea before really understanding the customer needs had inhibited our team from unbiased concept generation. This mission for the project still remained the same - to develop solutions to improve the quality of life of individuals affected in a time where water demand exceeds water supply.

We developed an initial target market survey which proceeded to receive 35 responses from individuals living in Mumbai, India.

a) Target Market Survey

The survey questions were open ended and meant to engage surveyors to provide specific needs statements. The questions in the initial survey are summarized below:

1. Do you have 24-hour water supply?

2. Are you distressed with the current water system at your house/office/company?
3. What do you like or dislike about the current water system?
4. What is the biggest water problem you face?
5. How do you think this problem can be solved?
6. How much time does it take you to fill the water storage tanks?

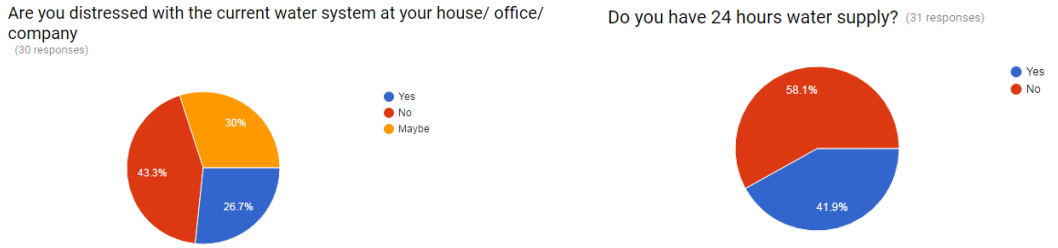

Figure 5: Target Market Survey

It became evident that a majority of the survey responses indicated that there was not 24-hour water supply. This did not correlate with the second question indicating whether the surveyed individuals were actually distressed with their current water system. Surprisingly, 43.2% said they were not distressed with the water management system even though 58.1% did not have continuous water supply. We had made the assumption that everyone with limited water supply would be distressed to some degree, which was not the case. Market surveys tend to give interesting insight on what may otherwise be overlooked.

b) Customer Needs Statements

The customer needs statements were gathered directly from the target market survey. After each statement was subsequently scribed, it was clear that each statement belonged to certain categories. Only 17 statements were gathered from the 35 survey responses because some responses had single words such as “like,” “dislike,” or “none.” These were excluded because they could not be translated into specific needs statements.

The customer needs were organized into 4 categories:

1. Inconsistent water supply
2. Insufficient water storage
3. Inconvenient water schedule
4. Water quality

We had made assumptions that inconsistent water supply and inconvenient water schedule would be prevalent customer needs. Water quality was not something we had not previously deduced to integrate in a concept idea. It was also assumed that any product concept would not be able to improve water storage because its size is dependent on the relative size of the apartment. This allowed us to begin brainstorming concepts that might be able to mitigate the water storage customer need as well.

After customer needs were organized into categories, need statements were inferred with respective metrics.

Table 2: Customer Needs

No	Customer Statement	Need Statement	Metric
	1. Inconsistent Water supply		
1	I like that the supply is regular except in summer when the supply is limited and we do not get water on some days	Product needs to provide continuous water supply.	% Time Disrupted (no water supply) = Supply Disruption Time / Total Time
6	There's no 24 hours' water supply anymore		
9	Biggest problem we face in May vacation. As water levels are less supply of water is less. In such dry weather, every living thing required maximum water.		
10	Timing problem, insufficient water to use by after 3 or 4 days' gap		
5	Water scarcity especially in the summer, water supply restricted to only once in two days. It would be good if there would be 24/7 direct water supply		
13	Insufficient water, irregularity		
16	No regular supply		
2. Insufficient Water Storage			
7	There is no proper water storage and always there is a shortage of water as compared to the demand	Product needs to manage available water.	Liters water available.
8	Water shortage during summer season		
11	Insufficient storage of water due to small space		
3. Inconvenient Water Schedule			
3	I dislike the fact that the supply is really late and I have to depend on others and it's a manual process. There are apps for everything. I need an app	Product needs to provide mechanism to manage water when it is available.	Liters water available.
4	Coordinating with others in the house to remind them to fill the tanks in the house as I work from 9-5 and the water is normally available from 10 am. I leave my house at 7 in the morning so I have to ask someone in the house to open the valve to fill the tank and close it after 20 minutes so that the water does not overflow.		
15	In my locality, some systems are good but, the time of water is not good.		
4. Water Quality			
12	Sometimes the water is impure n stinks too	Product needs to provide mechanism to supply clean water supply.	pH, turbidity, Water Contamination (PPM)
14	I am satisfied with the fact that the municipal corporation plans in advance for likely water shortage in the summer months. But I dislike the decades old pipeline system prone to leakages. Besides there is no modernization of the processes or the mechanisms used to carry out the water management system		
17	In monsoon water is contaminated		

c) *Benchmark on Customer Needs*

Benchmarking on customer needs helps in gauging relative competition. Water in Mumbai is currently managed using five platforms. These platforms were inferred through targeted phone screenings. This entailed calling someone who lives in Mumbai and asking them what they currently use to manage water in their household. The current water system managed utilizing a manual control gate valve, water storage tank, buckets, faucets, and water filters.

The customer needs were then graded using a negative, zero, and positive criteria. A negative tag entailed that the customer need was not met and rather deducted from the overall customer need. A zero-tag meant that the customer need was not met and was neutral meaning it neither added nor removed from meeting the customer need. The positive tag entailed that the customer need criteria was met.

No.	Needs	Manual Control Gate Valve	Basic Storage Tank	Buckets	Faucets	Detachable Water Filter
1	Product needs to provide continuous water supply.	Zero	Positive		Zero	
2	Product needs to manage availiable water (storage).		Positive	Negative	Zero	
3	Product needs to provide mechanism to manage water when it is available (schedule).	Positive			Positive	
4	Product needs to provide mechanism to supply clean water supply.				Negative	Positive

Figure 6: Benchmark Customer Needs

4. Concepts

Following the benchmark, three separate concepts were generated in order to meet the needs criteria.

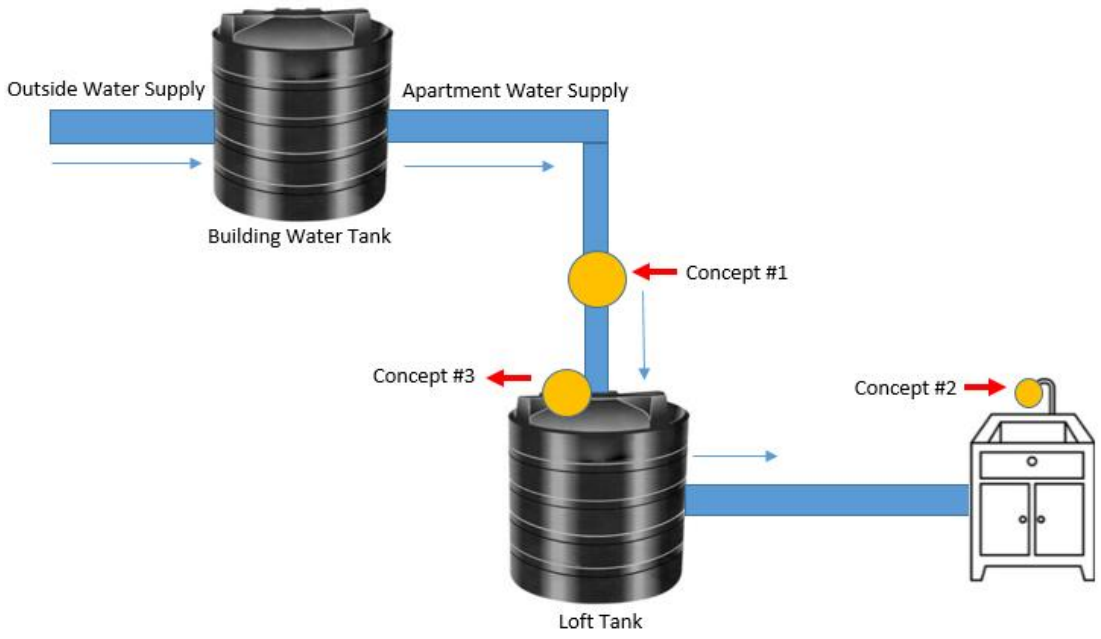

Figure 7: Concepts

a) *Concept 1*

A device that is installed in between your water supply line and your loft tanks. The device allows opens and closes a valve to fill the tanks without requiring anyone to be home to do so. A device that is installed in

between your water supply line and your loft tanks. The device allows opens and closes a valve to fill the tanks without requiring anyone to be home to do so.

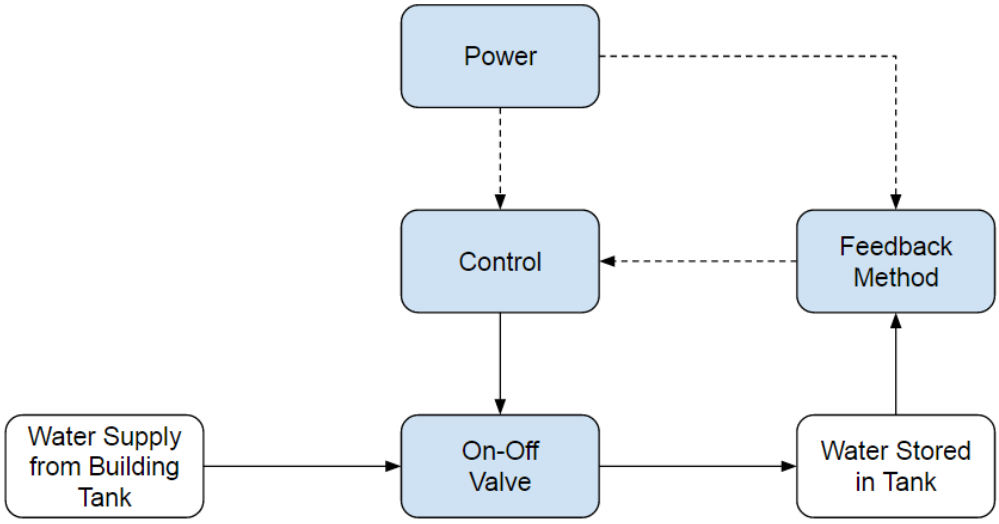

Figure 8: Concept 1 & 3 Function Diagram

b) Concept 2

A Device that is installed on your existing water faucets. The device allows the user to control the flow rate out of the device from a tiny stream to brush your teeth to a full stream to wash dishes.

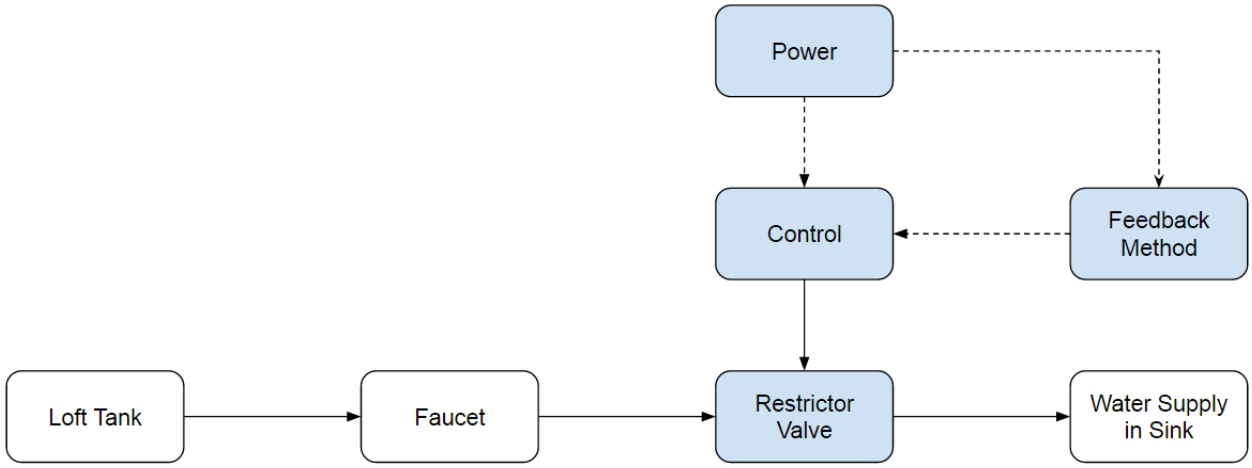

Figure 9: Concept 2 Function Diagram

c) Concept 3

A device that installs in the tank that allows the supply valve to always be open but prevents the tank from overflowing. The device will always allow the loft tanks to be filled as long as there is water in the main building tanks.

5. Concept Selection

a) Benchmark Concepts

The concepts were then put through the same benchmarking process as the relative competition. The fourth customer need was not met in any of the concepts because it was viewed more as an add on feature. For

example, an additional filtration mechanism could be added onto the second concept, but it was not viewed as pertinent relative to the project's original objective. Additionally, water filtration is difficult to manage within an apartments individual storage tank and should rather be managed at the water inflow of the buildings storage tank.

No.	Needs	Concept #1	Concept #2	Concept #3
1	Product needs to provide continuous water supply.	Positive	Positive	Positive
2	Product needs to manage availiable water (storage).	Zero	Positive	Positive
3	Product needs to provide mechanism to manage water when it is available (schedule).	Positive	Zero	Positive
4	Product needs to provide mechanism to supply clean water supply.	Negative	Negative	Negative

Figure 10: Benchmark Concepts to Customer Needs

b) Target Market Survey for Concept Screening

An additional survey was utilized in order to understand which concept our target market would most likely purchase.

The survey included the following:

1. Part One: Qualification
2. Part Two: Concept Screening (Concept 1, 2, and 3)
    a. Concept description and purchase intent.
    b. Price point.
    c. Additional features and associated price point.

The survey results indicated that customers were highly in favor of concept 2 in comparison with the other concepts. This data was used as a contributing factor to choose which concept should be pursued.

	Yes	No
Concept 1	69.20%	30.80%
Concept 2	92.30%	7.70%
Concept 3	61.50%	38.50%

Figure 11: Benchmark Concepts to Survey

c) Final Concept Selection Process

The final concept was chosen using a combination of weighted criteria and the target market survey. The weights were generated using the total customer statements corresponding with the need statements derived from them as well as from the market research. By calculating the average weight, it was clear that the target customers major concern was to have a continuous supply of water.

Criteria 1: Customer Needs Statements		
No.	Need Statements	Weight
1	Product needs to provide continuous water supply.	43%
2	Product needs to manage availiable water (storage).	19%
3	Product needs to provide mechanism to manage water when it is available (schedule).	19%
4	Product needs to provide mechanism to supply clean water supply.	19%

Figure 12: Criteria 1 - Customer Needs

Criteria 2: Market Research		
No.	Need Statements	Weight
1	Product needs to provide continuous water supply.	46%
2	Product needs to manage availiable water (storage).	27%
3	Product needs to provide mechanism to manage water when it is available (schedule).	18%
4	Product needs to provide mechanism to supply clean water supply.	9%

Figure 13: Criteria 2 - Market Research

Average Weight		
No.	Need Statements	Weight
1	Product needs to provide continuous water supply.	45%
2	Product needs to manage availiable water (storage).	23%
3	Product needs to provide mechanism to manage water when it is available (schedule).	19%
4	Product needs to provide mechanism to supply clean water supply.	14%

Figure 14: Average Weighted Values

We further rated the concepts on a scale of 0 to 5 by matching them need statements. If the concept met the need we rated it 4 and 5 based on the accuracy. 1 and 2 were given if the needs were not met and 0 was assigned if the concept made no difference in satisfying the need statement. The weighted scores were generated by multiplying the ratings with the weights and added for each concept. Concept 2 received the highest rating and weighted score which led us to choose concept 2 as our final product.

Rate 1-5			Concept Variants					
1(negative) 2(negative) 3(zero) 4 (positive) 5 (positive)			1		2		3	
No.	Selection Criteria (needs)	Weight	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
1	Product needs to provide continuous water supply.	45%	4	1.8	5	2.25	4	1.8
2	Product needs to manage availiable water (storage).	23%	3	0.69	5	1.15	5	1.15
3	Product needs to provide mechanism to manage water when it is available (schedule).	19%	5	0.95	3	0.57	5	0.95
4	Product needs to provide mechanism to supply clean water supply.	14%	1	0.14	2	0.28	1	0.14
Weighted Score			13	3.58	15	4.25	15	4.04

Figure 15:Decision Matrix

In our second market survey consisting of a brief description of each of the product concepts, 92.3% chose Concept 2. Further enquiry with the respondent of the survey brought to light that most customers chose product concept 2 because of its technically advanced features. This gave us an interesting insight as to how customers perceive new products. The survey also consisted an option for respondents to leave comments and questions about the products. It was interesting to learn that concept 2 received the most number of questions/ negative concerns. It showed that people were interested in this product and thus raised concern about the product.

Customer Feedback	Concerns
1	How much water will that save actually?
2	How does this solve the overall problem we have in our city of continuous water suuply?
3	Are there any instalation charges?
4	Are there any additional instalation charges?
5	Will it prevent water overflow?
6	Is it easy to install?
7	How different is this from a normal tap?

Figure 16: Customer Feedback from Concept 2

For a standard product with no additional features 69.2% of the surveyors were willing to buy the product for a price of 1000-2000 INR (approximately 25 USD) For the additional motion sensor feature, 30.8% of the surveyors were ready to pay a premium price of 2000-3000 INR (approximately 44 USD) and 15.4% were ready to pay a price of 3000-4000 INR (approximately 60 USD). The data received helped us understand the customer segment better and also be key factor when we plan for manufacturing and supply chain.

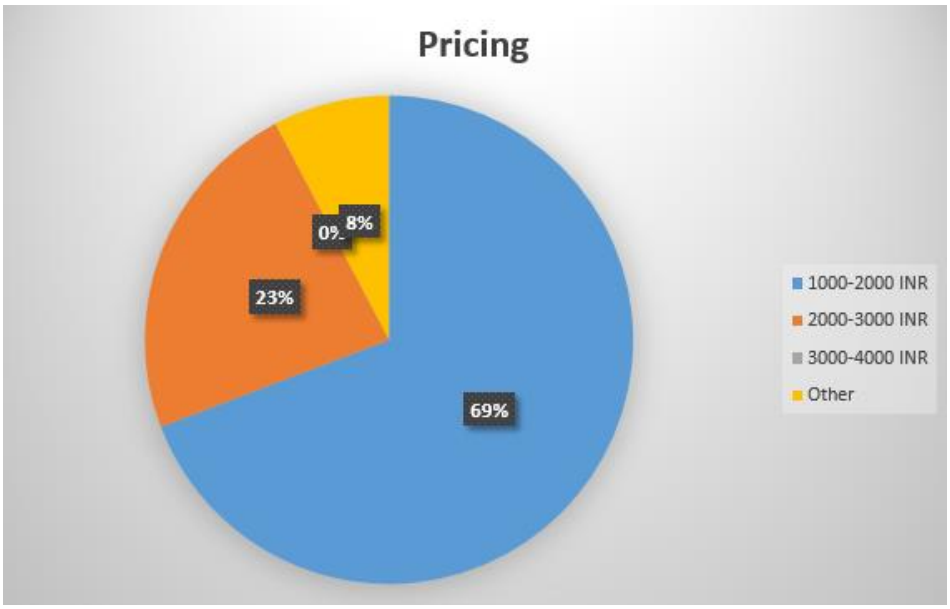

Figure 17: Customer Feedback Cost of Concept 2

Additional questions in the target market survey were geared towards understanding whether additional features, such as an additional motion sensor, would be incorporated into the design of the concept and what they would be willing to pay. Although this was not included in the initial design, this would prove useful information for design iterations at different price points.

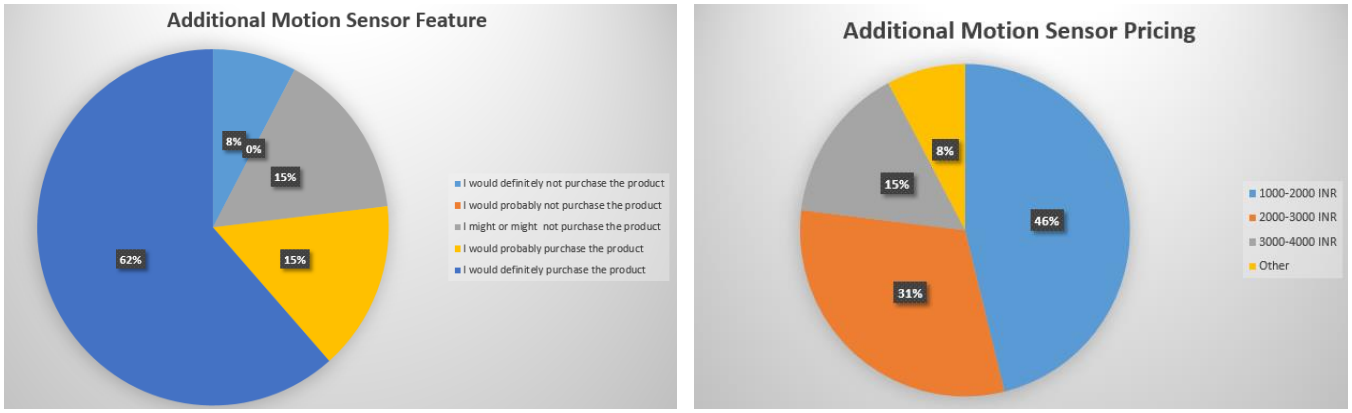

Figure 18: Customer Feedback for Additional Product Features and Cost

Product Concepts: Conclusion & Lessons Learned:

As indicated previously, it was important for our team to revisit the customer needs in order to generate concepts without bias. We began the new product development process with a specific product in mind. This initial concept, however, was nothing close to the concepts we generated after revisiting and understanding the target customer needs. Understanding the target customer specifications allowed us to come to generate concept ideas that better met the understood customer needs.

In order to help us understand which concept to pursue, an additional target market survey was formulated. At this point, a written description of each concept was included with additional potential add-on features indicated. It would have been ideal to have a sketch or rendering of the concept instead of relying on a description. Concept 2 was more favorable because it was the easiest to understand. The target market survey did not have intelligence built into the survey process which led us to survey concepts on individuals that most likely had no requirement for them. For example, our survey's qualification (part one) had a question that indicated whether the individual was water stressed. If the individual was not water stressed, they would immediately be exited from the survey rather than including feedback on the concepts they may have no use for.

The importance of understanding customer needs was prevalent from the concept generation process of our new product development journey. We also learned the importance of utilizing surveys to understand purchase intent as well as product price point.

III. Phases 2 & 3: Design

A. Product Description

The Eco Faucet is a small device intended to install on the faucet thread intended for a faucet aerator. The device has 5 detented settings, manually controlled by the user to enable fine-tuned flow control. By allowing the user more control over their flow output, the user has better command over their case by case water usage. From a slight trickle to brush one's teeth, to a full flow to wash dishes, the device enables flow selection instead of flow guessing. With a device installed on each faucet, the user turns the front face dial to the desired flow selection. The dial transmits the torque into a bevel gear system that adjusts an orifice in the line of the flow. The faucet then can be turned on at full flow with the confidence that only the desired flow comes out of the device. This improved water usage control allows the user to be able to better efficiently use their existing water reserves.

Figure 19: Eco Faucet

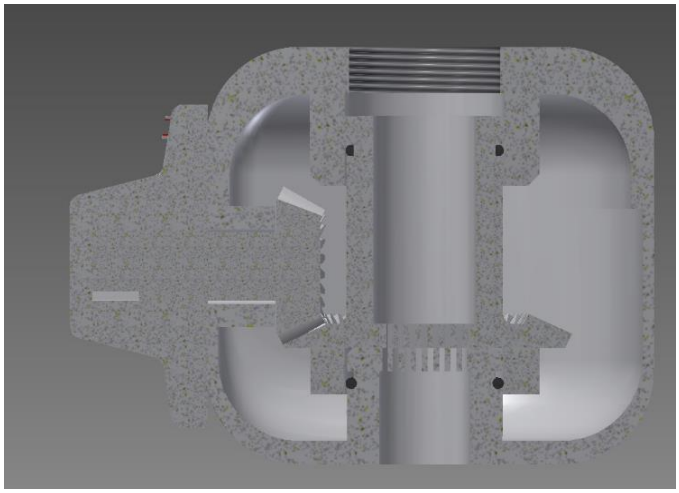

Figure 20: Eco Faucet Cut-Away View

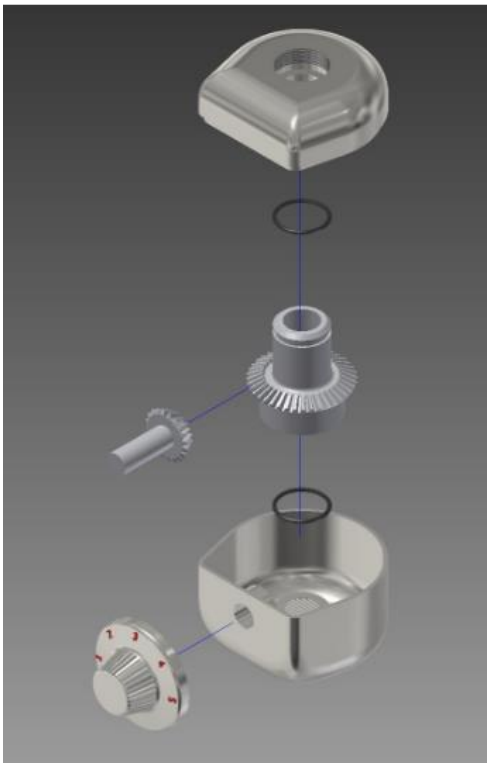

Figure 21: Eco Faucet Exploded View

B. Design for Manufacturing

Materials		
	Plastic	Recycled platic (water bottles)
Components		
	Restrictor	Plastic
	Dial	Plastic
Manufacturing Process		
	Injection Molding	Vendor
Manufacturing		
	Vendor	Vendor in India
Assembly & Packaging		
	In-House	Domestic labor
Shipping		
	Domestic	Utilize distribution centers

Figure 22: Design for Manufacturing

C. Industrial Design

1. Functionality: Water flow 1-10 level, Universal compatibility
2. Ease of Use: Legible settings
3. Safety: BPA free plastic
4. Durability: High density plastic
5. Physical Design: Faux nickel finish

D. Supply Chain Cost

From the example shown below, it is not possible to break even with merely 500 units of the product produced.

Manufacturing		Cost
500 Units		
Vendor Injection Mold (1 set - 5 parts)	$1000 per mold	$5,000
Tooling	$5000 per mold	$25,000
Material	$0.137 per part (500 units)	$69
Production	$0.570 per part (500 units)	$285
O-ring (2 per faucet)	$0.04 per O-Ring (1000 units)	$40
Assembly		Cost
In-House Labor	1 person assembles 2000 in 1 week (80% utilization) $3.50/day, 2 days to assemble 500	$7
Packaging		Cost
Plastic	$0.120 per part (500 units)	$60
Box	$0.30 per part (500 units)	$150
Instruction Manual	$0.120 per part (500 units)	$60
Shipping		Cost
Domestic Shipping	$1.00 per unit (500 units)	$500
	Sum:	$31,171

The break-even point with 60% profit margins would be at 5000 units. The initial high cost of injection mold sets and tooling account for a majority of the initial costs.

		Quantity	5000
Manufacturing		Unit Cost	Total Cost
5000 Units			
Vendor Injection Mold (2 sets - 10 parts)	$1000 per mold		$10,000
Tooling	$5000 per mold		$50,000
Material	$0.137 per part	$0.137	$685
Production	$0.140 per part	$0.140	$700
O-ring (2 per faucet)	$0.04 per O-Ring	$0.040	$200
Assembly			Cost
In-House Labor	1 person assembles 2000 in 1 week (80% utilization) $3.50/day, 5 days to assemble 2000	$0.009	$43.75
Packaging			Cost
Plastic	$0.120 per part	$0.120	$600
Box	$0.30 per part	$0.300	$1,500
Instruction Manual	$0.120 per part	$0.120	$600
Shipping			Cost
Domestic Shipping	$1.00 per unit	$1	$5,000
	Sum:		$69,329
		$14	per unit
		$22	sale price

E. Sales

The sales strategy will involve direct business to customer sales through online mechanisms summarized below.

Direct Sales:	Online (Website, Amazon, Alibaba)
Customer Cost:	1 Unit: $22

	3 Units: $50
Profit:	60% Margin

F. Marketing

The common method of advertising in our products target market is through television commercials, online social media advertising and print media including billboards and newspapers. The Indian advertising industry advertising industry is projected to be the second fastest growing advertising market in Asia after China [5]. By making use of marketing strategies like Television commercials, online media advertisements, we aim to offer value for money products which are affordable for the masses and forming long term relationships with intermediaries in the market.

1. Pilot product
    a. Beta Apartment Project
    b. Word-of-mouth (WOM) Advertising
2. Advertising
    a. Television Commercials
    b. Billboards
    c. Online Social Media
3. Partnership
    a. Local businesses/Retail Stores

Design: Conclusion & Lessons Learned:

- One of the critical lessons that we learned was the understand the customer needs before generating concepts based on our conclusions of what the customer needs.
- The spiral product development process provided us a framework to develop the eco faucet by incorporating many iterations of design, build and test. This process will help us scale our project beyond the initial target customers.
- The team was biased towards the original idea as we did not really go out and get real customer feedback. We interpreted existing data about the problems faced by potential customers, without actually getting feedback from customers and identifying the actual pain points of the user and thus came up with a biased solution.
- Different countries have different rules and regulations. Government policies make it difficult for companies to enter international markets. As we are currently based in the United States we will first have to familiarize ourselves with the international policies.
- Product testing and refining will be a complex task as the customer base will be in India.

IV. List of Figures

V. List of Tables

VI. References

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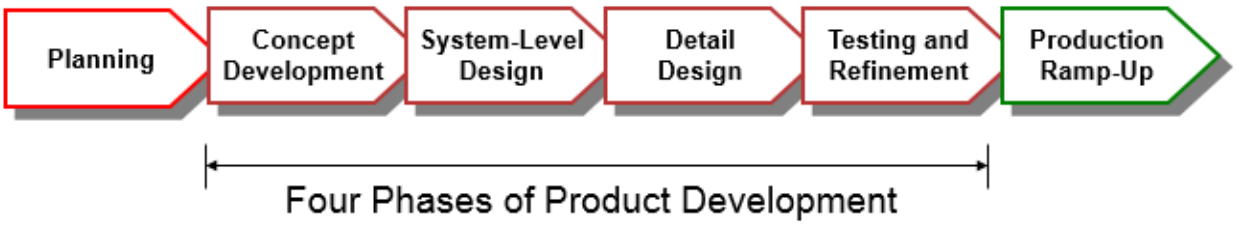
[5] A. India, "Advertising & Marketing Industry in India: Television, Digital, Mobile, Print...IBEF", Ibef.org, 2017. [Online]. Available: http://www.ibef.org/industry/advertising-marketing-india.aspx. [Accessed: 07- Mar- 2017].

VII. Appendix: Development Log



Planning:

1. Planning
   1.1. Activities
      1.1.1.Ch. 3: Opportunity Identification
         1.1.1.1. Establish a Charter

- Charter Statement: Create a physical product in the water utility control and monitoring category that we can launch into the market by the end of the fourth quarter.
  - Opportunity generation for solving the problem of water shortages in developing countries.
  - Boundary conditions: method to save water, method to manage water, cost effective

1.1.1.2. Generate and Sense Many Opportunities

Problem:
Water is a metered and an expensive commodity in developing countries such as India. Supply is sporadic, limited to only 2-3 hours per day and often requires storage in water tanks. It is difficult to monitor water storage and wastage while under constant pressure to manually fill water tanks.

Opportunities:

1. Automated wireless plumbing control
2. Automated wired plumbing control
3. Automated mechanical plumbing control

- Opportunity product concepts:
  - Automated wireless plumbing control
    - i.e. Something like wireless Sensor meter device (Smart Meter) connected with Smart Phone
  - Automated wired plumbing control
    - i.e. Something like wireless Sensor meter device connected directly to home “master panel”
  - Automated Mechanical plumbing control
    - i.e. Something like flush tank mechanism to refill tanks (mechanical plumbing control)

Opportunities: (Broad)
Water Supply Management:

1. Municipal
2. Residential
3. Commercial

High Level:

- Supply Management
- Storage Management
- Use Management

- Water shortage in developing countries.
- Specific use case is Mumbai where water availability is limited.

- Mismanaged water due to the current manual system results in a loss of 650 million liters of water every day.
- The city now receives 3,280 million liters a day (MLD) against the demand of 4,200 MLD of water.

1.1.1.3. Screen Opportunities

- Automated wireless plumbing control
  - Question of cell phone availability. How much of the target market has cell phones?
  - Has to potential to permit remote control.
  - Could require electrical work
  - Could be battery or solar powered
- Automated wired plumbing control
  - "Hands off," "one and done"
  - Similar to the existing capabilities of manual operation
  - Will require electrical work
- Automated Mechanical plumbing control
  - Foreseeable issue to make this universal for all tanks.
  - May be difficult to make this a single universal product.
- Technology Feasibility:
  - How many people have smart connected devices in developing countries? Particularly, Mumbai middle class?
    - From research, Smart Phones are considered a necessity by most to all
    - Mumbai has the highest number of internet users in India according to Internet & Mobile Association of India
  - Can a "smart meter" be retrofitted on existing water storage tanks?
    - Yes, should be simple retrofit.
- Market Opportunity / Need:
  - Smart water management.
  - Hassle free usage.
  - Simple enough for urban households to be able to operate.
  - Market Opportunity
    - Residential versus commercial market opportunity
    - Apartment dwellers versus house
- Market Strategy:
  - One of a kind device that enables users to manage and maintain water storage tanks
  - Device that allows people to manage water flow as per their convenience- customer attributes, being the primary concept of this product (back up with customer stories of problems faced by irregular water supply, leading to water wastage).

1.1.1.4. Develop Promising Opportunities

- Automated wireless plumbing control
  - Continue: Still feasible
- Automated wired plumbing control
  - Continue: Still feasible
- Automated Mechanical plumbing control
  - Remove: too difficult to make this universal
- Enabling people to be more flexible with their methods of storing water.
- Initial Screening (interviews):
  - Water management solutions adopted by the customers.
  - Societal and individual needs.

1.1.1.5. Select Exceptional Opportunities

- Is the opportunity real?
  - Poor water resource management is a worldwide issue
  - Hassle free water management and storage options

- Can you win with this opportunity?
  - Yes
- Is opportunity worth it financially?
  - Yes

1.1.1.6. Reflect on the Results and the Process

- Opportunity is feasible. Additional market survey to screen with concept to bring forward.

1.1.2.Ch. 4: Product Planning

1.1.2.1. Identify Opportunities

Opportunities Identification

Opportunities:

Water Supply Management:

1. Municipal
2. Residential
3. Commercial

Opportunity Categories:

- Supply Management
- Storage Management
- Use Management

- Opportunities:
  - Automated wireless plumbing control
  - Automated wired plumbing control
  - Automated mechanical plumbing control
- Market:
  - Residential home
  - Residential apartment
  - Commercial apartment

1.1.2.2. Evaluate and Prioritize Projects

- Competitive strategy: Technology leadership
- Market segmentation: Competitors
  - Residential apartment, residential home, commercial apartment
  - How is water managed? i.e. motorized pump
  - Competition:
    - Electrical Toggle Switch Operated Motorized Mechanical Pump (norm)
    - Manual Controlled Gate Valve
    - Local municipal plumbers

1.1.2.3. Allocate Resources and Plan Timing

- Project timing:
  - Timing of product introductions: generally, the sooner the better
    - Sooner
  - Technology readiness: robustness of underlying technologies
    - Underlying technology is not readily available
  - Competition: anticipated release of competing products
    - Existing products od valve control, leak detection, general usage monitoring

1.1.2.4. Complete Pre-Project Planning

- Market research

	Fact / Figures	Source
1	Mumbai has the largest number of internet users. 16.4 million users in the year 2014, with a growth rate of 36.6 % in comparison to the year 2013, which has 12 million users	http://tech.firstpost.com/news-analysis/mumbai-records-highest-number-of-internet-users-in-india-240291.html
1a	One the key factors contributing to rise in internet usage - rise in smartphone use by the people in the city of Mumbai	
2	Mumbai's water supply demand incresases by about 80million to 100 million every year - according to reports by BMC(	http://www.thehindu.com/news/national/other-states/Mumbairsquos-annual-water-demand-goes-up-by-80m-100m-million-litres/article16883454.ece
2a.	As per September 2009, the city recived 3280 million liters a day (mld) as against to the demand of 4200 mld of water	
2b	As per 2010, the supply of water in Mumbai per day is about 3450 million liters, with a gap of atleast 400 million liters.	http://mobile.reuters.com/mobile/m/FullArticle/CECO/nenvironmentNews_uUSTRE5B22IQ20091203?src=RSS-ECO]
2c	Per capita supply is dropping to an alarming 90l per person and day – scientists seem to agree that 100l is the absolute minimum one person requires	
2d	It is the city's poor, mainly the 62% of Mumbaiites living in slums, who are worst-hit every time a water cut is enforced, says Sitaram Shelar, convenor of the Paani Haq Samiti.	http://www.hindustantimes.com/more-lifestyle/the-trickle-down-effect-of-mumbai-s-20-water-cut/story-G3ghW06Ek8i5jmagTuStGK.html
2e	In Malad's 24-year-old Ambujwadi slum in Mumbai, there is no municipal water supply. Through most of the year, residents pay private tankers Rs 15 for every 35 litres. Now, as demand for the tankers has risen, the rate has gone up to Rs 35 and even Rs 40.	
3	In March 2016, with a monsoon been 23% deficient and lake levels at their lowest in five years, the BMC declared a 20% water cut on August 27, 2015 and, on March 17, 2016 announced that it would most likely keep the cut in force until the next monsoon.	http://www.hindustantimes.com/more-lifestyle/the-trickle-down-effect-of-mumbai-s-20-water-cut/story-G3ghW06Ek8i5jmagTuStGK.html
4	A study by Observer Research Foundation (ORF) suggests that Mumbai looses 650 million liters of day everyday due to leaking pipes.	https://www.commonfloor.com/news/mumbai-witnesses-650-million-litres-water-loss-per-day-31213
4a	Reasons of inadequate water supply - loss of wate due to leakage of pipelines and iillegal water pipe connections.	http://urbz.net/water-management-some-hard-facts-about-water-supply-in-mumbai/
4b	There is heavy loss of about 720 mld water during the summer season, and it calls for water managemet and storage solutions to manage the water supply according to the stock available at the end of the monsoon, to meet the 3,750 mld requirement.	http://www.hindustantimes.com/mumbai/as-lake-levels-go-down-mumbaiites-summer-water-troubles-may-just-begin/story-G0GKAfEnrUaMmbDzu9sXIP.html
5	In 2016, The Economist suugests - after 2 successive day years, 330 million people in india are facing acute water shortages	http://www.economist.com/blogs/economist-explains/2016/05/economist-explains-11
5a	In may 2016, trains carried millions of liters of water to Latur, a district, 400 kms east of Mumbai	
6	Due to indequate water capacity, Mumbai corporations are compelled to water rationing, with residential water supply cut by 15% and commercial water supply cut by 30% in the summer season of 2010	http://urbz.net/water-management-some-hard-facts-about-water-supply-in-mumbai/
6a	This means that taps are only running between one and three hours per day, and supply will be cut off entirely for one day per week in each neighborhood in order to improve water pressure in the other parts of the city.	
6b	Households share taps, each tap shared by 4-10 households and every tap runs dry in usually one hour. Men and women line up in queues to fills their water pots and head home.	http://www.hindustantimes.com/more-lifestyle/the-trickle-down-effect-of-mumbai-s-20-water-cut/story-G3ghW06Ek8i5jmagTuStGK.html
6c	Because of water shortage, each family ends up with about 90 litres per head per day, 60 litres per head less than the minimum they are entitled to.	
6d	User inference- 'I have only one 225-litre drum, On most days, it is one-fourth full. But with the 20% water cut, I can no longer fill it up even that much."	
6e	Geeta Nagar, an area in Mumbai receives water in two time slots — 11 am and 3 pm. These are official timings, accoridng to a resident. Sometimes 11 is 11.45, and the 3 pm slot can instead start at 5. On days of pipe bursts or maintenance, water is released at 2 am.	

7	Water Crisis in a nutshell: Where we stand (Mumbai specific information) * This year's monsoon has been 23% deficient. * On October 2, officially the end of the monsoon, Mumbai's water stocks stood at a five-year low of 11.43 million litres, down from 14.05 million litres at the same time last year. * Since August 27, based on low lake levels, the BMC has been enforcing a 20% water cut across the city, and a 50% cut for industrial and commercial users. * Currently, Mumbai has enough water for 243 days. The BMC usually takes stock of water supply on October 1, accounting for 304 days (till July 31, in case of a delayed monsoon)."	http://www.hindustantimes.com/more-lifestyle/the-trickle-down-effect-of-mumbai-s-20-water-cut/story-G3ghW06Ek8i5jmagTuStGK.html
7a	Who gets how much * According to BMC records, of the 3.81 lakh official water connections in the city, 2.35 lakh are routed to slums and 88,000 to buildings. Another 4,900 connections are for industrial users and 53,100 for commercial users. * Slums, both notified (pre-95) and non-notified (post-95), account for 62% of Mumbai's population of 12.4 million, according to the 2011 Census, and just under 62% of total water connections. It's in the distribution and payment models that differences emerge. * Currently, whether the water is being used for drinking, washing cars or filling up a swimming pool, building residents pay the BMC Rs 4.67 per 1,000 litres; slum dwellers pay Rs 3.87. * In terms of quantity, buildings get 240 litres per capita per day (LPCD); and slums, 150 LPCD. *But in most buildings and slums alike, BMC supply is not found to be sufficient and is supplemented by privately owned water tankers. The tanker companies get their water from wells and borewells, paying nominal sums to the owners and selling the water at a profit. * Most buildings buy this water by the truckload, paying a 'discounted' rate of about Rs 2,000 per 8,000 litres—a rate of about 25 paise per litre. Most slumdwellers buy this water in much smaller quantities, usually in batches of 35 litres, paying upto Rs 1 per litre suring summer or in times of scarcity."	
7b	Water stocks as of Oct 2 2015 — 11.43 million litres 2014 — 14.05 million litres 2013 — 13.72 million litres 2012 — 12.41 million litres 2011— 12.24 million litres	

1.1.2.5. Reflect on the Results and the Process

- Market research indicates a product is required to manage water constraints. Product will be developed to meet this customer need.
- Next steps: Concept generation

1.2. Gates

1.2.1. Project Mission Statement

Mission Statement:

- To develop solutions to improve the quality of life of individuals affected by a time where water demand exceeds water supply.

Mission Statement

Product Description:
- Water supply management

Key Business Goals:
- Serve as a flagship platform for business market penetration

Primary Market:
- Residential apartment dwellings, urban developing cities (i.e. Mumbai)

Secondary Markets:
- Commercial apartment, residential homes

Assumptions:
- New product platform
- Cost appropriate (low - medium income)

Stakeholders:
- Purchasers are users
- Third party plumbers
- Manufacturing & service operations
- Distribution (web) and resellers

Product Description:

- Automatic water supply management

Key Business Goals:

- Serve as a flagship platform for business market penetration

Primary Market:

- Residential apartment dwellings, urban developing cities (i.e. Mumbai)

Secondary Markets:

- Commercial apartment, residential homes

Assumptions:

- New product platform
- Cost appropriate (low - medium income)

Stakeholders:

- Purchasers are users
- Third party plumbers
- Manufacturing & service operations
- Distribution (web) and resellers

1.2.1.1. Target Market for the Product

- Target customers are apartment dwellers in urban developing water stressed cities. With a population of 8.2 million and an approximate median yearly income of $10,000, the product will initially serve the middle-class population of Mumbai.

Market:

1. Residential apartment
2. Commercial apartment
3. Residential home

Customer Segmentation:

1. Low Income
2. Middle Income
3. High Income

1.2.1.2. Business Goals

- Mission Statement: To develop solutions to improve the quality of life of individuals affected by a time where water demand exceeds water supply.

1.2.1.3. Key Assumptions

- Universal compatibility (need to verify)
- Current loft tank configuration (need pictures to verify)

1.2.1.4. Constraints

Potential Risks:

- International market entry
- Limited startup and sustained capital
- Universal component compatibility

Concept Development:

2. Concept Development

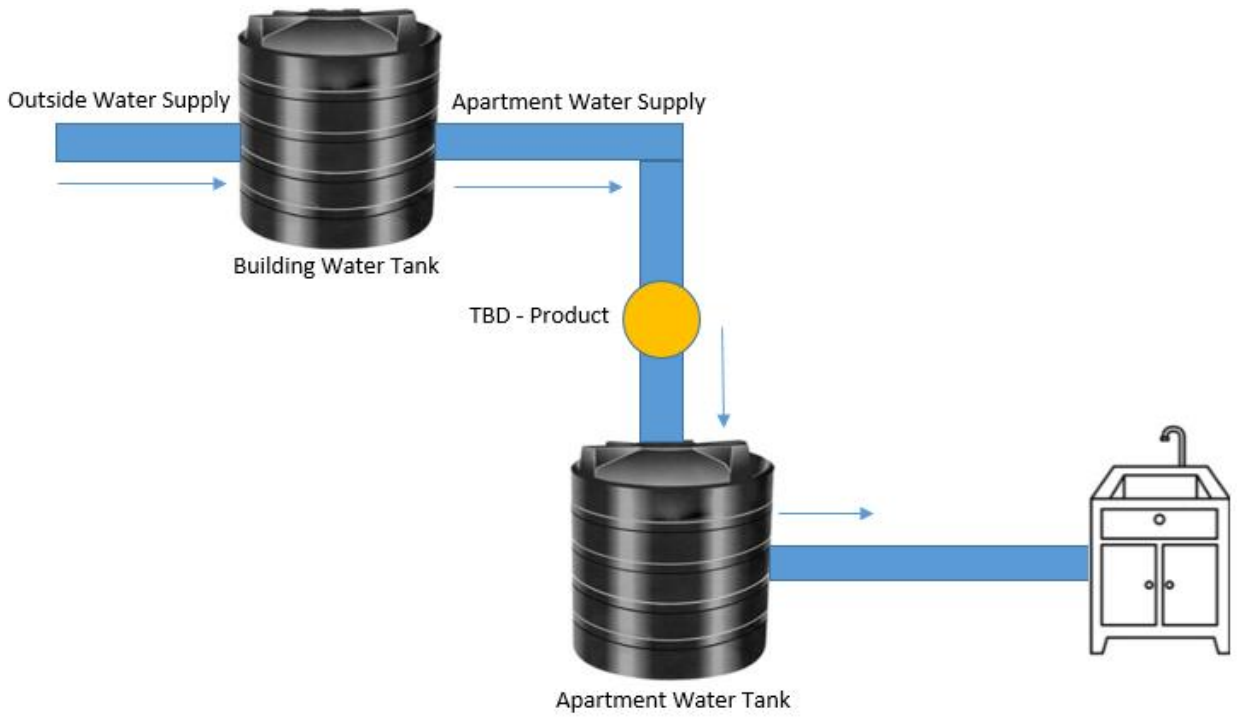
2.1. Activities

2.1.1.Ch. 5: Identify Customer Needs

- Are you distressed with the current water storage system?
- What do you like and dislike about the current water management system?
- What is the biggest problem you face? Walk us through your daily water management routine

2.1.1.1. Gather Raw Data from Customers

High level current situation:



2.1.1.2. Interpret Raw Data in terms of Customer Needs

2.1.1.3. Organize the needs into a hierarchy of primary, secondary, and tertiary needs

No.	Customer Statement	Need Statement	Metric
1. Inconsistent Water Supply			
1	I like that the supply is regular except in summer when the supply is limited and we do not get water on some days		
6	There's no 24 hours water supply anymore		
9	Biggest problem we face in May vacation . As water levels are less supply of water is less . In such dry weather every living thing required maximum water.		
10	Timing problem, insufficient water to use by after 3 or 4 days gap		
5	Water scarcity especially in the summer, water supply restricted to only once in two days.It would be good if there would be 24/7 direct water supply		% Time Disrupted (no water supply) = Supply Disruption Time / Total Time
13	Insufficient water,irregularity		
16	No regular supply	Product needs to provide continuous water supply.	
2. Insufficient Water Storage			
7	There is no proper water storage and always there is a shortage of water as compared to the demand		
8	Water shortage during summer season		
11	Insufficient storage of water due to small space	Product needs to manage availiable water.	Liters water available.
3. Inconvenient Water Schedule			
3	I dislike the fact that the supply is really late and i have to depend on others and its a manual process. There are apps for everything. I need an app		
4	Coordinating with others in the house to remind them to fill the tanks in the house as i work from 9-5 and the water is normally available from 10 am. I leave my house at 7 in the morning so i have to ask someone in the house to open the valve to fill the tank and close it after 20 minutes so that the water does not overflow.		
15	In my locality some systems are good but, the time of water is not good.	Product needs to provide mechanism to manage water when it is available.	Liters water available.
4. Water Quality			
12	Sometimes the water is impure n stinks too	Product needs to provide mechanism to supply clean water supply.	pH, turbidity, Water Contanimation (PPM)
14	I am satisfied with the fact that the municipal corporation plans in advance for likely water shortage in the summer months. But I dislike the decades old pipeline system prone to leakages. Besides there is no modernisation of the processes or the mechanisms used to carry out the water management system.		
17	In monsoon water is contaminated		

2.1.1.4. Establish the relative importance of the needs.

1. Inconsistent water supply
2. Insufficient water storage
3. In consistent water schedule
4. Water quality

2.1.1.5. Reflect on the results and the process

- Needs statements put into four categories
- Concept will be generated based on needs

2.1.2.Ch. 6: Product Specifications

2.1.2.1. Prepare the list of metrics

No.	Needs	% Time Disrupted (no water supply) = Supply Disruption Time / Total Time	Liters water available	pH, turbidity, Water Contanimation (PPM)
1	Product needs to provide continuous water supply.	X		
2	Product needs to manage availiable water (storage).		X	
3	Product needs to provide mechanism to manage water when it is available (schedule).		X	
4	Product needs to provide mechanism to supply clean water supply.			X

2.1.2.2. Collect competitive benchmarking information

No.	Needs	Manual Control Gate Valve	Basic Storage Tank	Buckets	Faucets	Detachable Water Filter
1	Product needs to provide continuous water supply.	Zero	Positive		Zero	
2	Product needs to manage availiable water (storage).		Positive	Negative	Zero	
3	Product needs to provide mechanism to manage water when it is available (schedule).	Positive			Positive	
4	Product needs to provide mechanism to supply clean water supply.				Negative	Positive

Competition and Potential Risks:

Latent Innovation:

- No strong competitors

Competition:

- Manual Controlled Gate Valve
- Local municipal plumbers

Potential Risks:

- International market entry
- Limited startup and sustained capital
- Universal component compatibility

2.1.2.3. Set ideal and marginally acceptable target values

- % Time disrupted
- Liter water available
- pH contamination

2.1.2.4. Reflect on the results and the process

- Concept generation will be based off of customer needs.

2.1.3.Ch. 7: Concept Generation

2.1.3.1. Clarify the problem

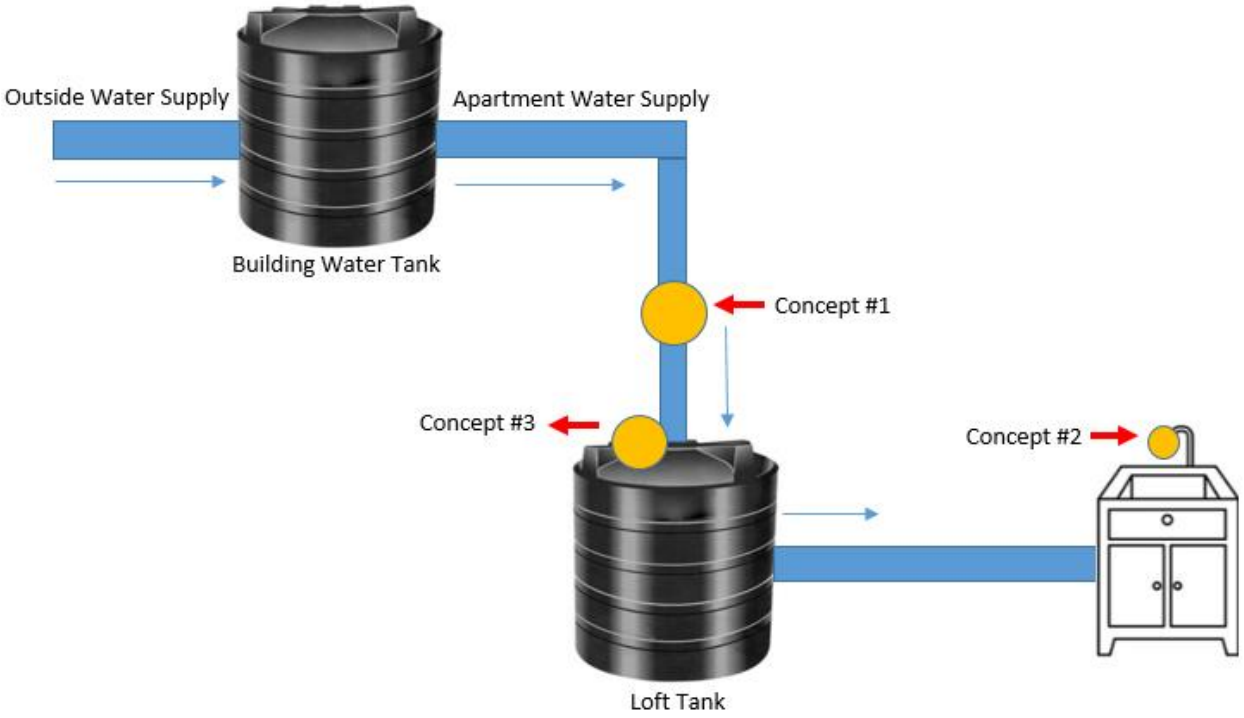
2.1.3.1.1. Decompose a Complex Problem into Simpler Sub problems

2.1.3.1.2. Focus Initial Efforts on the Critical Sub problems

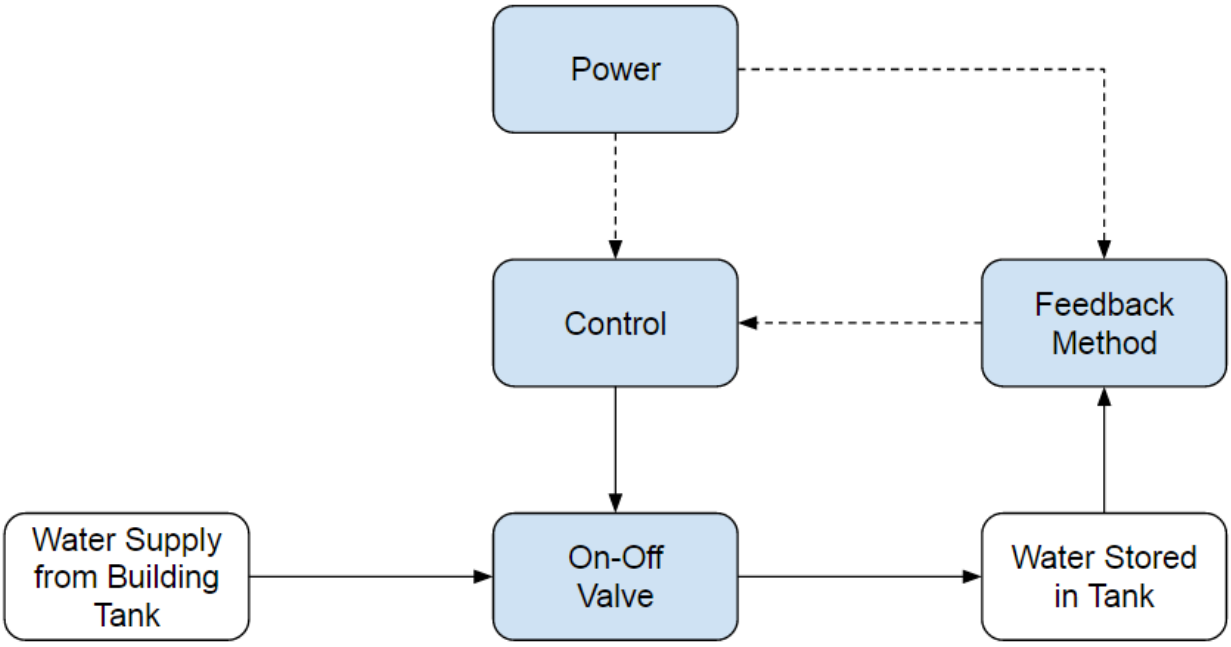
3 Concepts:

Concept	Detail
1	A device that is installed in between your water supply line and your loft tanks and is powered by your wall outlet. The device allows opens and closes a valve to fill the tanks without requiring anyone to be home to do so. The device will sense when the loft tank is fully and shut off supply to prevent water overflow.
	The device is set by the user to automatically open at the same time every day and is set at the device.
	The device is set by the user via a smartphone app and allows remote control through the app (requires in home WiFi, added premium)
2	A Device that is installed on your existing water faucets. The device allows the user to control the flow rate out of the device from a tiny stream to brush your teeth to a full stream to wash dishes.
	Water On-Off is controlled by faucet itself.
	Water automatically turns on & off when a battery powered sensor senses your hands, tooth brush, dishes, etc... (added premium)
3	A device that installs in the tank that allows the supply valve to always be open but prevents the tank from overflowing. The device will always allow the loft tanks to be filled as long as there is water in the main building tanks.

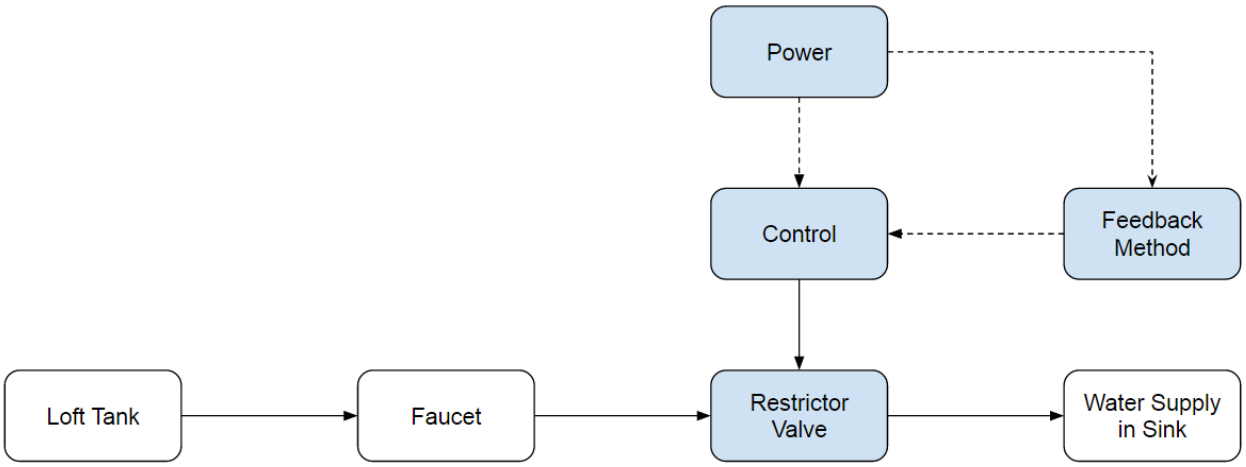
No.	Needs	Concept #1	Concept #2	Concept #2
1	Product needs to provide continuous water supply.	**Positive**	**Positive**	**Positive**
2	Product needs to manage availiable water (storage).	**Zero**	**Positive**	**Positive**
3	Product needs to provide mechanism to manage water when it is available (schedule).	**Positive**	**Zero**	**Positive**
4	Product needs to provide mechanism to supply clean water supply.	**Negative**	**Negative**	**Negative**



Function Diagram Concept 1 & 3:



Function Diagram Concept 2:



2.1.3.2. Search externally
2.1.3.2.1. Interview Lead Users
2.1.3.2.2. Consult Experts
2.1.3.2.3. Search Patents
2.1.3.2.4. Search Published Literature
2.1.3.2.5. Benchmark Related Products
2.1.3.3. Search internally
2.1.3.4. Explore Systematically
2.1.3.4.1. Concept Classification Tree
2.1.3.4.2. Concept Combination Table
2.1.3.5. Reflect on the Solution and the Process

- Target market survey will be used to help with concept selection

2.1.4.Ch. 8: Concept Selection
2.1.4.1. Prepare the selection matrix

No.	Needs	Concept #1	Concept #2	Concept #3
1	Product needs to provide continuous water supply.	**Positive**	**Positive**	**Positive**
2	Product needs to manage availiable water (storage).	**Zero**	**Positive**	**Positive**
3	Product needs to provide mechanism to manage water when it is available (schedule).	**Positive**	**Zero**	**Positive**
4	Product needs to provide mechanism to supply clean water supply.	**Negative**	**Negative**	**Negative**

Criteria 1: Customer Needs Statements		
No.	Need Statements	Weight
1	Product needs to provide continuous water supply.	43%
2	Product needs to manage availiable water (storage).	19%
3	Product needs to provide mechanism to manage water when it is available (schedule).	19%
4	Product needs to provide mechanism to supply clean water supply.	19%

Criteria 2: Market Research		
No.	Need Statements	Weight
1	Product needs to provide continuous water supply.	46%
2	Product needs to manage availiable water (storage).	27%
3	Product needs to provide mechanism to manage water when it is available (schedule).	18%
4	Product needs to provide mechanism to supply clean water supply.	9%

Average Weight		
No.	Need Statements	Weight
1	Product needs to provide continuous water supply.	45%
2	Product needs to manage availiable water (storage).	23%
3	Product needs to provide mechanism to manage water when it is available (schedule).	19%
4	Product needs to provide mechanism to supply clean water supply.	14%

2.1.4.2. Rate the concepts

2.1.4.3. Rank the concepts

Rate 1-5			Concept Variants					
1(negative) 2(negative) 3(zero) 4 (positive) 5 (positive)			1		2		3	
No.	Selection Criteria (needs)	Weight	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
1	Product needs to provide continuous water supply.	45%	4	1.8	5	2.25	4	1.8
2	Product needs to manage availiable water (storage).	23%	3	0.69	5	1.15	5	1.15
3	Product needs to provide mechanism to manage water when it is available (schedule).	19%	5	0.95	3	0.57	5	0.95
4	Product needs to provide mechanism to supply clean water supply.	14%	1	0.14	2	0.28	1	0.14
Weighted Score			13	**3.58**	15	**4.25**	15	**4.04**

2.1.4.4. Combine and improve the concepts

2.1.4.5. Select one or more concepts

2.1.4.6. Reflect on the results and the process

2.1.5.Ch. 9: Concept Testing

2.1.5.1. Define the purpose of the concept test

2.1.5.2. Choose a survey population

2.1.5.3. Choose a survey format

Target population: Apartment dwellers, working professionals, annual salary range (Low: > $8K, Median: $8K-$10K, High Income: $11K-$15K)

Part 1: qualification

- Are you satisfied with the current water management system at your house?
  Yes
  No
- Do you currently own any of the following?
  Smartphone
  Wi-Fi
  Both
- Do you currently live in an apartment?
  Yes
  No
- What age group do you belong to?
  16-25
  26-40
  41-60
  Over 60 years
- Are you a working professional?
  Yes
  No
- What is your daily water supply schedule or do you have constant supply?
  From 5 AM to 8 AM
  From 9AM -12 PM
  Post 12 PM
  Constant water supply
- How do you store your water supply?
- How many water tanks do you currently own?
- What is the capacity of the loft tank?
- Including yourself how many adults live in your house currently?
- How many children live in your house currently?

- **Part 2: Product description 1**
  - Would you be interested in a product that is connected to your loft tank and automatically fills and manages the water levels in the storage tanks? You will be able to control the product using your smartphone.
- **Part 3: Purchase Intent 1**
  - If the product was priced to your expectations, how willing would you be to purchase it?
    - I would **definitely not purchase** the Product
    - I would **probably not purchase** the Product
    - I **might or might not purchase** the Product
    - I would **probably purchase** the Product
    - I would **definitely purchase** the Product
- **Part 4: Comments 1**
  - What would be the ideal price (Rupees) for the Product?
    - 1000-2000 INR
    - 2000-3000 INR
    - 3000-4000 INR
  - What concerns do you have about the product concept?
  - Can you make any suggestions for improving the product concept?
- **Part 5: Additional Features 1**
  - If the product had the following additional features how likely would you be willing to buy it
    1.Application connectivity using smartphones

        - I would **definitely not purchase** the Product
        - I would **probably not purchase** the Product
        - I **might or might not purchase** the Product
        - I would **probably purchase** the Product
        - I would **definitely purchase** the Product
    - If interested how much would you be willing to pay for it?
        - 1000-2000 INR
        - 2000-3000 INR
        - 3000-4000 INR
        - Specify if other ---------

- **Part 2: Product Description 2**
    - Would you be interested in a product that intelligently manages how much water is flowing out the faucets to more efficiently make use of the available water. The product consists of motion sensors and smart flow management technology.

- **Part 3: Purchase Intent 2**
    - If the product was priced to your expectations, how willing would you be to purchase it?
        - I would **definitely not purchase** the Product
        - I would **probably not purchase** the Product
        - I **might or might not purchase** the Product
        - I would **probably purchase** the Product
        - I would **definitely purchase** the Product
- **Part 4: Comments 2**
    - What would be the ideal price (Rupees) for the Product?
        - 1000-2000 INR
        - 2000-3000 INR
        - 3000-4000 INR
    - What concerns do you have about the product concept?
    - Can you make any suggestions for improving the product concept?

- **Part 5: Additional Features 2**
    - If the product had the following additional features how likely would you be willing to buy it
      1.Motion activated
      2.Automatic shutdown when water isn't in use
      3.Water filtration
        - I would **definitely not purchase** the Product
        - I would **probably not purchase** the Product
        - I **might or might not purchase** the Product
        - I would **probably purchase** the Product
        - I would **definitely purchase** the Product
    - If interested how much would you be willing to pay for it?
        - 1000-2000 INR
        - 2000-3000 INR
        - 3000-4000 INR
        - Specify if other ---------

- **Part 2: Product Description 3**

- A device that installs in the tank that allows the supply valve to always be open but prevents the tank from overflowing. The device will always allow the loft tanks to be filled as long as there is water in the main building tanks.

- **Part 3: Purchase Intent 3**
  - If the product was priced to your expectations, how willing would you be to purchase it?
    - I would **definitely not purchase** the Product
    - I would **probably not purchase** the Product
    - I **might or might not purchase** the Product
    - I would **probably purchase** the Product
    - I would **definitely purchase** the Product
- **Part 4: Comments 3**
  - What would be the ideal price (Rupees) for the Product?
    - 1000-2000 INR
    - 2000-3000 INR
    - 3000-4000 INR
  - What concerns do you have about the product concept?
  - Can you make any suggestions for improving the product concept?

2.1.5.4. Communicate the concept
2.1.5.5. Measure customer response

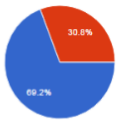
- Survey Results:

2.1.5.6. Interpret the results

—

Concept 1: Survey Results

Would you be interested in purchasing a device that is installed in between your water supply line and your loft tanks and is powered by your wall outlet. The device opens and closes a valve to fill the tanks without requiring anyone to be home to do so. The device will sense when the loft tank is full and shut off supply to prevent water overflow.



Yes	9	69.2%
No	4	30.8%

Yes: 69.2%
No: 30.8%

Concept 2: Survey Results

Would you be interested in purchasing a device that is installed on your existing water faucets. The device allows the user to control the flow rate out of the device from a tiny stream to brush your teeth to a full stream to wash dishes.Water On-Off is controlled by faucet itself.

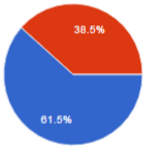
Yes	12	92.3%
No	1	7.7%

Yes: 92.3%
No: 7.7%

Concept 3: Survey Results

Would you be interested in buying a device that installs in the tank that allows the supply valve to always be open but prevents the tank from overflowing. The device will always allow the loft tanks to be filled as long as there is water in the main building tanks.

Yes	8	61.5%
No	5	38.5%



Yes: 61.5%
No: 38.5%

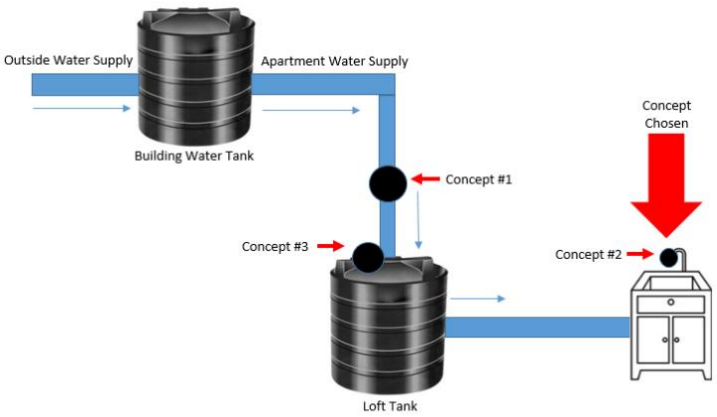
2.1.5.7. Reflect on the results and the process

	Yes	No
Concept 1	69.20%	30.80%
Concept 2	92.30%	7.70%
Concept 3	61.50%	38.50%

2.2. Gates

2.2.1.Concept Selected

Chosen Concept



2.2.2.Set of Specifications

Product Summary

Description: A Device that is installed on your existing water faucets. The device allows the user to control the flow rate out of the device from a tiny stream to brush your teeth to a full stream to wash dishes.

Added Features:

- Motion activated
- Automatic shutdown when water isn't in use
- Water filtration

2.2.3.Competitive Product Analysis

Customer Feedback	Concerns
1	How much water will that save actually?
2	How does this solve the overall problem we have in our city of continuous water suuply?
3	Are there any instalation charges?
4	Are there any additional instalation charges?
5	Will it prevent water overflow?
6	Is it easy to install?
7	How different is this from a normal tap?

System Level Design:

3. System Level Design
   - 3.1. Activities
     - 3.1.1.Ch. 10: Product Architecture
       - 3.1.1.1. Create a schematic of the product
       - 3.1.1.2. Identify the fundamental and incremental interactions
     - 3.1.2.Ch. 11: Industrial Design
       - 3.1.2.1. Investigate of customer needs
       - 3.1.2.2. Conceptualization
       - 3.1.2.3. Preliminary refinement
       - 3.1.2.4. Further refinement and final concept selection
       - 3.1.2.5. Control drawings or models
       - 3.1.2.6. Coordination with engineering, manufacturing, and external vendors

Industrial Design

Functionality:
- Water flow 1-5 level
- Universal compatibility

Ease of Use:
- Legible settings

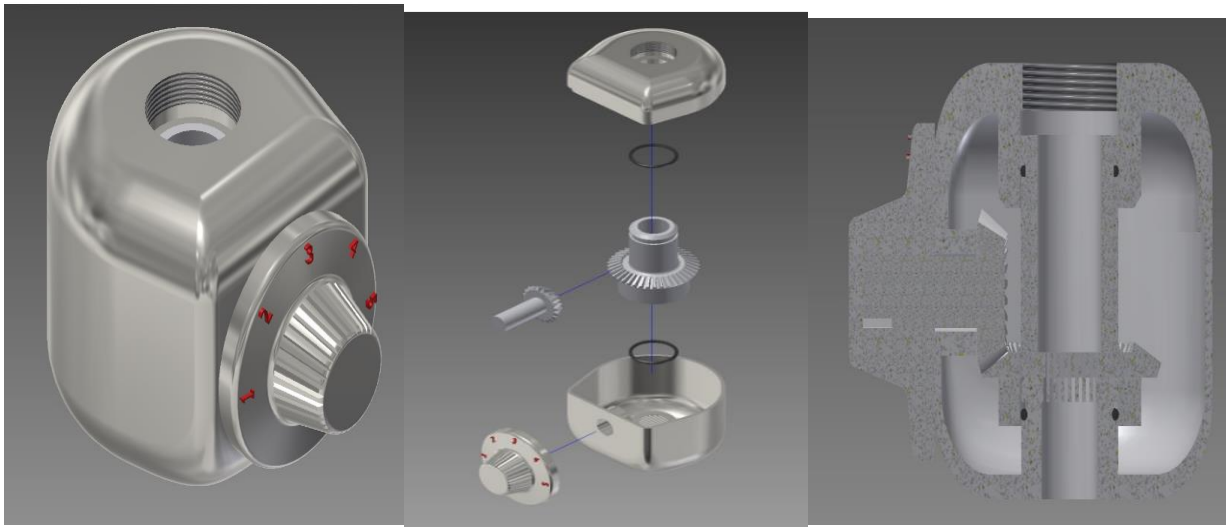
Safety:
- BPA free plastic

Durability:
- High density plastic

Physical Design:
- Faux nickel finish

3.2. Gates

3.2.1.Geometric Layout of Product



3.2.2.Functional Specification for Each Subsystem

3.2.3.Preliminary Process Flow Diagram for the Final Assembly Process

Design Detail:

4. Detail Design

4.1. Activities

4.1.1.Ch. 12: Design for Environment

For our eco Faucet, we decided to manufacture the injection mold, by using recycled plastic bottles, that are BPA free, to maintain the eco-friendly and sustainable development of the product.

4.1.2.Ch. 13: Design for Manufacturing

Design for Manufacturing

Materials		
	Plastic	Recycled platic (water bottles)
Components		
	Restrictor	Plastic
	Dial	Plastic
Manufacturing Process		
	Injection Molding	Vendor
Manufacturing		
	Vendor	Vendor in India
Assembly & Packaging		
	In-House	Domestic labor
Shipping		
	Domestic	Utilize distribution centers

4.1.2.1. Estimate the Manufacturing Costs

Adding up our production, manufacturing, packaging and shipping costs, with a goal of 60% gross profit margin, our manufacturing of 500 units, wasn't achieving the break-even point.

Manufacturing		Cost
Initial Cost (500 Units)		
Vendor Injection Mold (5 parts)	$1000 per mold	$5,000
Tooling	$5000 per mold	$25,000
Material	$0.137 per part (500 units)	$69
Production	$0.570 per part (500 units)	$285
O-ring (2 per faucet)	$0.04 per O-Ring (1000 units)	$40
Assembly		Cost
In-House Labor	1 person assembles 2000 in 1 week (80% utilization) $3.50/day, 2 days to assemble 500	$7
Packaging		Cost
Plastic	$0.120 per part (500 units)	$60
Box	$0.30 per part (500 units)	$150
Instruction Manual	$0.120 per part (500 units)	$60
Shipping		Cost
Domestic Shipping	$1.00 per unit (500 units)	$500
	Sum:	$31,171

4.1.2.2. Reduce the costs of components

To achieve a break-even point, we decided to compute the manufacturing costs for 5000 units, that would reduce the manufacturing costs, as a result of the mass production.

Supply Chain Cost 3 (5000 Units)

		Quantity	5000		
Manufacturing		Unit Cost	Total Cost		
Ramp Up Cost					
Vendor Injection Mold (10 parts	$1000 per mold		$10,000		
Tooling	$5000 per mold		$50,000		
Material	$0.137 per part	$0.137	$685		
Production	$0.140 per part	$0.140	$700		
O-ring (2 per faucet)	$0.04 per O-Ring	$0.040	$200		
Assembly			Cost		
In-House Labor	1 person assembles 2000 in 1 week (80% utilization) $3.50/day, 5 days to assemble 2000	$0.009	$43.75		
Packaging			Cost		
Plastic	$0.120 per part	$0.120	$600		
Box	$0.30 per part	$0.300	$1,500		
Instruction Manual	$0.120 per part	$0.120	$600		
Shipping			Cost		
Domestic Shipping	$1.00 per unit	$1	$5,000		
	Sum:		$69,329	$14	per unit
				$22	sale price

By producing 5000 units, our investment summed up to be $69,329, costing us $14, per unit. This allowed us to achieve a profit of 60% with the sale price of $22 per faucet.

4.1.2.3. Reduce the costs of assembly

4.1.2.4. Reduce the costs of supporting documentation

4.1.2.5. Consider the impact of DFM decisions on other factors

4.2. Gates

4.2.1. Control Documentation

4.2.1.1. Part & Assembly Drawings

4.2.1.2. Purchased Part Specification Drawings
4.2.1.3. Fabrication Process Plans
4.2.1.4. Assembly Process Plans

Testing & Refinement:

5. Testing & Refinement
   5.1. Activities
      5.1.1.Ch. 14: Prototyping

We chose 3D printing physical, customer ready prototyping as our go to method for generating concept prototypes.

5.1.1.1. Define the purpose of the prototype

As a team, with our initial investment we are manufacturing 10 prototypes, to monitor the initial performance of the product. Our plan is to distribute the initial batch of prototypes, at the cost of $5 per prototype to our lead users, and test it, to gather the user feedback. Our mission is to distribute the product prototype to the lead users, most of those involved in our initial survey and interview process, to gather an insight of the product performance and efficiency.

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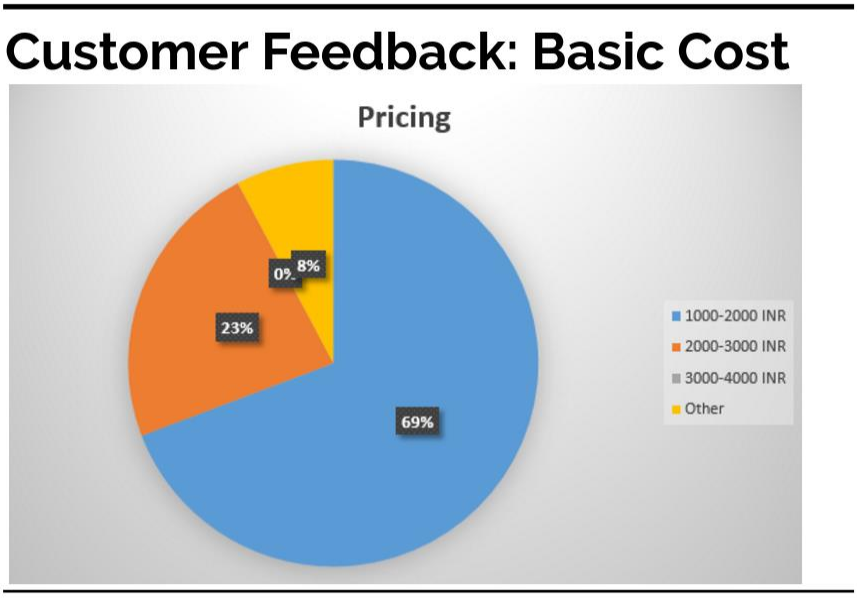
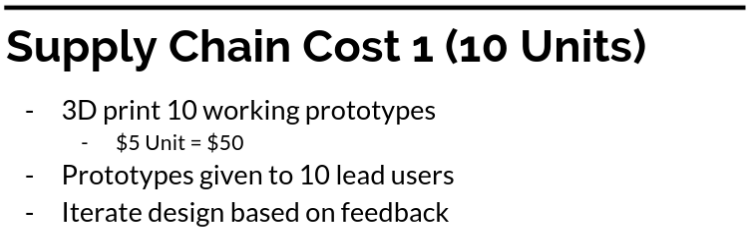
2000 INR = $22



5.1.1.2. Establish the Level of approximation of the prototype



5.1.1.3. Outline an experimental plan

Our next steps with product experimentation and implementation comprised of sale and marketing costs elevation.

Sales

Direct Sales:
- Online (Website, Amazon, Alibaba)

Customer Cost:
- 1 unit: $22

Profit:
- Margin: 60%

Marketing

Pilot Product
- Beta Apartment Project
- Word-of-Mouth (WOM) Advertising

Advertising
- Television Commercials
- Billboards
- Social Media Online

Partnerships
- Local businesses

5.1.1.4. Create a schedule for procurement, construction, and testing

5.2. Gates

5.2.1. Alpha Prototyping

5.2.2. Beta Prototyping

Production Ramp-Up:

6. Production Ramp-Up

Intellectual Property:

- Our next step is to file for a provisional patent application of the eco faucet industrial design in United States and India (primary market)
- Since the team has a limited budget, a provisional patent application would be the best way to initiate the patent process and in the meantime work toward perfecting the Eco Faucet for additional features and applications.
- Licensing technology in the future in specific targeted geographies to grow Eco Faucets market reach.