Design Proposal Report

Dough Dispensing Device for Earth Elements Market and Bakery
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Mission Statement

At Perfect Mix Creations, we seek to fix our clients’ “mixed-up” business headaches. We create innovative solutions through emphasis in product development and communications to make your company more profitable. Our dedication to excellence and professionalism makes us the perfect solution for your next company conundrum.
Problem Statement

Earth Elements Market and Bakery needs a quick and efficient way to create uniform cookies through a device that consistently dispenses the same amount of dough. The company also needs new or revised promotional materials to market its products.
Statement of Work
Submitted by:
Perfect Mix Creations

Cookie Dough Dispenser for Earth Elements Market and Bakery

1. Objectives

1.1 Create a quick and efficient way for the client to produce uniform cookies through a device that consistently dispenses the same amount of dough.

1.2 Create new or revised promotional materials to market the client’s products.

2. Background

2.1 Earth Elements’ goal is to build a local food system through preserving locally grown ingredients and keeping them in the community. It utilizes crops grown on its own farm and those from other local farmers to produce “authentic” Oklahoma foods. A major component in the business is creating baked goods from hand-scooped doughs or mixes. Goods created in this manner include cookies, spinach balls, and meat balls. Cookies comprise the largest percentage of these goods, as employees hand scoop a maximum of 900 to 1,200 cookies per day. The client is limited to its current production by time. It needs a more efficient way to dispense the doughs and mixes to increase production. The client has tried several other “cookie dispensers” with limited success.

2.2 Earth Elements currently is at a standstill in annual growth after experiencing a 20 percent increase per month over the past two years. The present economy along with the client’s limited production and lack of marketing promotions contribute to the client’s present financial state. Perfect Mix Creations seeks to remedy Earth Elements’ problems through increasing production and customer awareness.

3. Scope of Work

3.1 Perfect Mix Creations shall submit a design proposal report to presiding professors that includes:

3.1.1 a problem statement, statement of work, work breakdown structure, and task list.
3.1.2 a competitive analysis report including market and patent research
3.1.3 a definition of customer requirements and development of engineering specifications.
3.1.4 a proposed media and communications plan.
3.1.5 a generation of design concepts including the feasibility and determination of suitable designs.
3.1.6 a Gannt chart project schedule.
3.1.7 a proposed budget for the prototype
3.2 Perfect Mix Creations shall provide a design proposal oral presentation including all materials presented in the design proposal report to presiding professors and the client.

3.3 Perfect Mix Creations shall submit self- and peer-evaluations to presiding professors.

3.4 Perfect Mix Creations shall submit a team Web site to presiding professors.

3.5 Perfect Mix Creations shall submit individual project notebooks to presiding professors.

3.6 Perfect Mix Creations shall conduct a one-on-one interview between the project’s team leader and presiding professors.

3.7 Perfect Mix Creations shall submit a working prototype followed by a final design to presiding professors and the client. Steps taken to deliver the final product will include:

3.7.1 checking all relevant patents to make sure there are no infringements.
3.7.2 inspecting all standards so the machine is built to code.
3.7.3 creating computer-aided design (CAD) drawings to show the client the best options.
3.7.4 building prototypes to test possible alternatives.
3.7.5 testing the machine to verify allotment of the correct dough amount in a proper manner.
3.7.6 finding the most economical means to build the machine to meet the client’s funding requirements.

3.8 Perfect Mix Creations shall submit campaign element drafts followed by the final products to presiding professors and the client. The campaign elements include:

3.8.1 a business card.
3.8.2 a brochure.
3.8.3 a both display sign.
3.8.4 a Web site.

4. Location of Work

4.1 Design development:

4.1.1 Multiple locations will be required for the development of the dough-dispensing device. Work involved in the device’s production includes computer drawing, fabricating, testing, and analysis.
4.1.2 CAD drawings will be completed in the Oklahoma State University engineering computer labs. All engineering labs have computers installed with CAD software. The labs are located in the Engineering South, Engineering North, Cordell, and Kerr-Drummond buildings. Cordell and Kerr-Drummond are open 24 hours per day, and Engineering South and Engineering North are open from 7 a.m. to 11 p.m.

4.1.3 Fabrication will be conducted either in the Design and Manufacturing Lab (DML) or the Biosystems and Agricultural Engineering (BAE) construction lab depending on needed tools and the lab availability. The fabrication includes prototype and final product creation. The DML is located off campus, and the BAE construction lab is on campus.

4.1.4 Testing will take place in OSU’s Food and Agricultural Products Center (FAPC). Dough will be mixed and dough-dispensing trials will be conducted in the lab’s bakery section. Data on the device’s performance will be gathered for analysis. Small adjustments to the hardware may be conducted at FAPC, but major alterations require the DML or BAE lab.

4.1.5 Analysis of the device will require Microsoft Excel. Any computer lab on OSU’s campus can be utilized for the analysis. The library also may be used to collaborate and understand the data.

4.2 Campaign elements development:

4.2.1 Campaign elements will be designed on computers containing the necessary software, such as InDesign, Photoshop, Dreamweaver, and Illustrator. The location of work may include any OSU computer lab or the home of the communications specialist depending on the programs’ availabilities.

4.2.2 The location of campaign element production and printing will be decided jointly by Perfect Mix Creations and the client.

5. Period of Performance

5.1 Project initiation date: August 17, 2009

5.2 Project completion date: May 7, 2010

5.3 Hours dedicated to project:

5.3.1 design development and production: 6 hours per week
5.3.2 marketing / promotional materials: 6 hours per week
6. Delivery Requirements

6.1 Deliverables schedule:

<table>
<thead>
<tr>
<th>Item</th>
<th>Delivery Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>competitive analysis report</td>
<td>Oct. 26, 2009</td>
</tr>
<tr>
<td>statement of work</td>
<td>Oct. 30, 2009</td>
</tr>
<tr>
<td>work breakdown structure</td>
<td>Nov. 6, 2009</td>
</tr>
<tr>
<td>task list</td>
<td>Nov. 16, 2009</td>
</tr>
<tr>
<td>design proposal report draft</td>
<td>Nov. 23, 2009</td>
</tr>
<tr>
<td>design proposal report</td>
<td>Dec. 4, 2009</td>
</tr>
<tr>
<td>design proposal oral presentation</td>
<td>Dec. 4, 2009</td>
</tr>
<tr>
<td>self- and peer-evaluations</td>
<td>Dec. 7 - Dec. 11, 2009</td>
</tr>
<tr>
<td>team Web site</td>
<td>Dec. 7 - Dec. 11, 2009</td>
</tr>
<tr>
<td>project notebooks</td>
<td>Dec. 7 - Dec. 11, 2009</td>
</tr>
<tr>
<td>project leader interview</td>
<td>Dec. 7 - Dec. 11, 2009</td>
</tr>
<tr>
<td>campaign elements drafts</td>
<td>Apr. 5, 2010</td>
</tr>
<tr>
<td>working prototype</td>
<td>Apr. 5, 2010</td>
</tr>
<tr>
<td>finalized campaign elements</td>
<td>May 7, 2010</td>
</tr>
<tr>
<td>final product</td>
<td>May 7, 2010</td>
</tr>
</tbody>
</table>

6.2 Perfect Mix Creations shall provide weekly updates to presiding professors on the progress of design, business, and communications elements.

7. Applicable Standards

7.1 Hazard Analysis and Critical Control Points (HACCP) Plan

7.1.1 To ensure our machine complies with industry safety standards, a HACCP plan will be developed and followed. A description of the type of food being processed, the food’s intended use, and how the food’s distribution methods will be the first step. A flow chart will be constructed showing the steps involved in the entire cookie production process. Potential hazards with the machine will be identified and evaluated on the basis of the hazard’s severity and probability. Corrections will be made to design aspects deemed overly hazardous. Critical control points (CCPs) will be implemented by Earth Elements during the mixing of the dough and transferring the dough to the machine. Monitoring the quality of the dough and taking corrective actions to fix problems with the dough will be done by the client. Verifying that the product is within specifications will be done during testing and evaluation procedures, and should not require any further verification once specifications are reached. Procedures for
cleaning the device will be evaluated and adjusted as necessary, and documentation will be provided to Earth Elements.

7.2 Food and Drug Administration (FDA)

7.2.1 The device’s design needs to comply with FDA regulations. Therefore, the machine will be constructed of non-absorbent materials and parts with smooth surfaces to prevent food particles from becoming stuck and spoiling. All corners in parts that contact food will be rounded to make cleaning easier and act as another preventative for leftover food spoilage. Contaminate entry must be addressed to avoid metal shavings, hair, or anything else that may harm the consumer from mixing with the food. Harm to the user of the machine, whether by malfunction, improper use, or repetitive use, also needs to be evaluated.

7.3 Institutional Review Board (IRB)

7.3.1 The IRB either approves research, requires modifications in planned research prior to approval, or disapproves research conducted on human subjects. Should Perfect Mix Creations choose to use human participants in a survey or study to determine the success of its device, regulations outlined by the IRB will be followed. Perfect Mix Creations shall submit all required documents to the IRB before any research of this manner is conducted.

8. Acceptance Criteria

8.1 Our device’s acceptability will be based on whether or not it increases cookie production at Earth Elements’ bakery. The dispenser will be considered a success if it produces 900 or more cookies per day. Employees cannot consistently scoop such an amount every day due to the wrist strain it causes.

8.2 Aside from increased production, the client will evaluate our device based on its simplicity, size, cleaning ease, and cost.

8.2.1 The device must be simple to operate and use by any employee without additional training.
8.2.2 The device must be no larger than 18 by 36 inches in order to fit within Earth Elements’ sink for cleaning.
8.2.3 Parts must be easily removable and minimal in number as the device will be washed at least once a day.
8.2.4 Earth Elements will spend no more than $1,000 on the device, but $200 to $500 is the optimal range.
9. Special Requirements

9.1 Software required for the device’s creation includes either Pro-Engineer or Solid Works. Special software is needed only for the device’s design, not the performance analysis. No special requirements will be needed for hardware except that it must meet federal and state food-processing requirements. Materials are available through local sources, and machines are available in various machine shops.

9.2 Employee training for the device’s operation will include no more than a basic demonstration of its function. No specific certifications above food handling standard requirements will be necessary.

9.3 Travel requirements for this project will include trips to Earth Elements, grocery stores, and constructions and food processing labs. Additional travel outside these requirements is not expected.
Work Breakdown Structure

1. Dough Dispensing Device
   1.1 Prototype
     1.1.1 Acquisition of Dough
     1.1.2 Write-up of Testing Procedures
     1.1.3 Write-up of Testing Results

   1.2 Construction
     1.2.1 Gather Raw Material
     1.2.2 Fabrication of Components
     1.2.3 Assembly

   1.3 Concept
     1.3.1 Brain storm
     1.3.2 Check Patents
     1.3.3 Literature Search
     1.3.4 Review Relevant Standards
     1.3.5 Consider Current Products

   1.4 Design
     1.4.1 Determine Feasible Alternatives
     1.4.2 CAD Drawings
     1.4.3 Mechanical Analysis

   1.5 Testing
     1.5.1 Develop testing procedure
     1.5.2 Test Alternatives
     1.5.3 Testing Results
       1.5.3.1 Size of Product
       1.5.3.2 Size of Cookies
       1.5.3.3 Rate of Production
       1.5.3.4 Durability
       1.5.3.5 Cleanability
     1.5.4 Test Participants
       1.5.4.1 Ease of use
       1.5.4.2 Feedback
     1.5.5 Modify Alternatives
     1.5.6 Analysis of Results
     1.5.7 Final Design Determination

   1.6 Management
     1.6.1 Access
       1.6.1.1 DML
       1.6.1.2 BAE
       1.6.1.3 FAPC
1.6.2 Communication to Client
   1.6.2.1 Current Process Information
   1.6.2.2 Gather Opinion

1.7 Costs
   1.7.1 Fixed Costs
      1.7.1.1 Salary Costs
         1.7.1.1.1 Salary of BAE Lab Workers
      1.7.1.2
   1.7.2 Variable Costs
      1.7.2.1 Input Costs
         1.7.2.1.1 Dough
         1.7.2.1.2 Sausage Press
         1.7.2.1.3 Steel
         1.7.2.1.4 Plastic
         1.7.2.1.5 Silicone
      1.7.2.2 Supplies
         1.7.2.2.1 Machines
         1.7.2.2.2 Welding Materials
         1.7.2.2.3 Software
      1.7.2.3 Labor Costs
         1.7.2.3.1 Machining Costs
         1.7.2.3.2 Lab Technician
      1.7.2.4 Advertising Costs
         1.7.2.4.1 Business Cards
         1.7.2.4.2 Brochures
         1.7.2.4.3 Display Booth Sign
         1.7.2.4.4 Stationary
      1.7.2.5 Transportation Costs
         1.7.2.5.1 Fuel
      1.7.2.6 Utilities
         1.7.2.6.1 Electric Bill
         1.7.2.6.2 Water Bill
         1.7.2.6.3 Gas Bill
      1.7.2.7 Depreciation
         1.7.2.7.1 Depreciation on University Building
         1.7.2.7.2 Depreciation on University Equipment
         1.7.2.7.3 Depreciation on University Vehicles
      1.7.2.8 Opportunity Costs

1.8 Campaign Elements
   1.8.1 Business Card
   1.8.2 Brochure
   1.8.3 Web Site
   1.8.4 Display Booth Sign

1.9 Class Assignments
   1.9.1 Design Proposal Report
1.9.1.1 Problem Statement  
1.9.1.2 Statement of Work  
1.9.1.3 Work Breakdown Structure  
1.9.1.4 Task List  
1.9.1.5 Competitive Analysis Report  
1.9.1.6 Definition of Customer Requirements  
1.9.1.7 Development of Engineering Specifications  
1.9.1.8 Proposed Media and Communications Plan  
1.9.1.9 Generation of Design Concepts  
1.9.1.10 Gantt Chart Project Schedule  
1.9.1.11 Proposed Budget for Prototype  

1.9.2 Design Proposal Oral Presentation  
1.9.3 Self- and Peer-Evaluations  
1.9.4 Team Web Site  
1.9.5 Individual Project Notebooks  
1.9.6 One-on-One Interview with Team Leader  
1.9.7 Final Presentation
Competitive Analysis, Research, and Investigations

1. Overview

1.1 Background

April Harrington founded her co-existing entities Earth Elements Farm and Earth Elements Market and Bakery (EEMB) in 1996. She initiated the businesses as a solution for eliminating as many chemicals as possible from her food products due to battling cancer for several years prior. Earth Elements’ goal since has been building a local food system through preserving locally grown ingredients and providing them to the community. It utilizes crops grown on its own farm as well as those grown by other local farmers to produce quality, wholesome, “Oklahoma authentic” foods. While the company is not considered organic, it uses many organically grown ingredients in its products.

Earth Elements produces more than 200 products at any given time based on the seasonality of its ingredients. One of Earth Elements’ major components is creating baked goods, such as spinach balls, meat balls, and cookies, from hand-scooped doughs or mixes. Cookies comprise the largest percentage of these goods, as employees hand scoop between 900 and 1,200 cookies each day.

1.2 Problem and Mission

Our client has opportunity for cookie-sale growth in existing and emerging markets, however, the company is limited to current production levels by time. Earth Elements employees cannot scoop any more cookies per day than they are currently. Several existing “cookie dispensers” have been tried with limited success. The dispensers either operated more slowly than hand scooping, required an excessive amount of cleaning, created too much waste, or produced inconsistent cookie sizes. The company needs a quick and efficient way to produce uniform cookies through a device that consistently dispenses the same amount of dough. It also needs new or revised promotional materials to help market its increased production.

At Perfect Mix Creations, we seek to provide solutions for our client through emphasis in product development and communications. Our objective is to create an innovative dough dispensing device collaborated with new marketing materials to make Earth Elements more profitable. Our dedication to excellence and professionalism makes us the “perfect” solution for this company’s conundrum.
2. Industry Analysis

2.1 Overview

The Oklahoma foods industry is comprised of businesses around the state interested in selling and preserving locally grown or raised products. The industry goal either is met by selling local products directly to the consumer or by processing perishable products into other items such as baked goods. Our client has involved itself in both methods through developing her cooperating entities. Earth Elements Farm raises produce and EEMB utilizes that produce to create baked goods, canned goods, and entire entrees.

The current economic climate has had a significant impact on the statewide industry and Earth Elements. The recession-like economy has caused increased credit card debts, lower incomes, mortgage risks, and savings losses. According to the Third Quarter Economic Review through the Federal Reserve Bank of Kansas City,

“Sweeping demographic shifts are challenging the growth of many rural communities in the Tenth District. The retirement of the baby boomers, coupled with the exodus of young adults, threatens to leave rural areas with a rapidly aging population and a shrinking local workforce. The strength of these demographic changes could hinder economic growth for many rural communities in the future” (Henderson and Akers 99).

As a result, industry growth has slowed. For example, Earth Elements experienced a 20 percent growth per month from 2006 to 2008 but now is experiencing a standstill. Although the company is not losing profit, its halt in growth is undesirable. Over the past five years, 60 to 70 percent of our sponsor’s profits have come from Oklahoma Food Cooperative (OFC) sales. This leads to the conclusion that the current economy has prevented customers from buying through the cooperative as frequently, and its related sales have dropped. Oklahoma-food entities around the state are feeling similar trends in today’s economy.

2.2 Regulations and Standards

The government regulates all materials that can come into contact with food. The different regulation agencies include the National Sanitation Foundation International (NSF), United States Department of Agriculture (USDA), American National Standards Institute (ANSI), Underwriters Laboratory (UL), and the Code of Federal Regulations (CFR). Standards affecting our group’s project with Earth Elements are 21 CFR 110 and NSF Standards 2, 8, 51, 73, and 763. The NSF provides a product and manufacturer search to help individuals determine
whether or not a material is food-safe and what companies make it (“NSF Product and Service Listing”). All materials planned for our use, including stainless steel and plastic, can be made food-safe.

2.3 Gatherings and Publications

A few key gatherings exist for this industry. The OFC’s annual meeting is held on January 31 for all member producers. Also, farmers’ markets around the state are important to producers marketing and selling their locally grown or raised products. The Oklahoma Farmers’ Market Alliance (OFMA) has weekly markets in Tulsa, Collinsville, Edmond, Jenks, Muskogee, Owasso, Bethany, and Stillwater.

Aside from gatherings, publications assist in communicating information between producers and consumers. *Farmers’ Market Today* is a significant trade publication in this industry. Since its introduction in 2007, the bimonthly magazine has sought to make small farmers and farmers’ markets more successful and profitable. It contains information and stories on what “growers, artisans, and farmers markets are doing to promote their businesses, reach new customers and develop value-added products” (*Farmers’ Market Today*). The *Oklahoma Buy Fresh Buy Local 2009 Green Country Farmers’ Market Guide* is another key industry publication. The *guide* lists markets, by county, throughout northeastern Oklahoma where shoppers can find locally-produced agricultural food and goods (“Buy Fresh Buy Local – Green Country”). “OK Grown” markets, where only produce grown in Oklahoma may be sold, also are noted in the publication. A similar publication in the Frontier Country region around Oklahoma City has yet to emerge, but the new Buy Fresh Buy Local chapter in that area is making plans for future promotions.

2.4 Resources

Key resources for businesses in the Oklahoma foods industry include local farmers and food-equipment dealers. Local produce and ingredients are available to industry businesses based on the season. Businesses within this industry must create their products around ingredients available at the current time. Materials used for processing (mixers, ovens, storage units, etc.) the local ingredients either are readily available and bought through specialized dealers or acquired second-hand through auctions or the Internet.

3. Customers and Buyers

3.1 Characteristics and Buying Practices
Earth Elements’ major target market shops through the OFC, Oklahoma farmers’ markets, and health food specialty stores. These customers are middle-aged and elderly individuals ranging from about thirty to seventy years in age. They are male and female and have at least high-school educations. The customers fall into middle or upper socioeconomic classes and are mostly Caucasian due to being geographically located in Oklahoma. They are concerned with purchasing healthy, “homegrown” products and supporting local, small farming operations. Customers value the fresh, non-preserved qualities local products ensure and appreciate the history behind each item. These customers take the added time of sifting through different local producers over the convenience of shopping at major retail grocers. Many are working or retired individuals with families.

Since the OFC comprises a majority of Earth Elements’ business, most of its customers have buying practices and decision-making processes in line with the cooperative’s purpose. The OFC only sells products made in Oklahoma and puts emphasis on customers being able to know exactly who grew their product, where their product was grown, and what practices the producer uses (Oklahoma Food Cooperative). So, Earth Elements’ customers are looking for a locally grown, quality food product. A large percentage of the business’s customers are repeat buyers who make orders every month. OFC orders open the first day of the month, and local farmers bring their products to Oklahoma City on the third Thursday. The cooperative's volunteer crew then sorts everything into customer orders, which are shipped to thirty-two pickup sites across the state (Oklahoma Food Cooperative). Each customer buys enough product to last until the next delivery date. The product amount depends on whether the customer is an individual or business, and product type depends on seasonal availability.

The prices of the OFC cookies are very reasonable for buyers as Earth Elements charges $4.00 per dozen for the small cookies. We are focusing on the smaller cookies since they are the main size sold through the coop and bring in the most sales. Since such a large amount of the company’s annual profit, around 70 percent, come from the OFC, it is important to understand and observe the products with which the company has the best success.

The remaining customer base buys Earth Elements’ products through farmers’ markets or specialty stores. These buyers are more likely to purchase on a whim than the OFC customers. They browse through the company’s products while shopping for several other items at the market or store. They may not be specifically looking for the Earth Elements logo. The
cooperative buyers put more thought into their purchases and who they want the items to come from due to the nature of the ordering process. So, Earth Elements has to cater to both mind sets.

A new target market for Earth Elements is emerging on Oklahoma State University (OSU) and University of Oklahoma (OU) campuses. These customers have slightly different demographic and psychographic characteristics than the business’s previous target market. They are males and females eighteen to twenty-five years old in the process of obtaining college educations. These customers fall into the middle to upper socioeconomic classes but have limited expendable incomes. The target market is Caucasian as a majority but also includes black, Asian, and other multicultural races attracted to a university setting. The customers are geographically located either in Stillwater or Norman, Oklahoma, and generally are not providing for families. College students value low cost as a majority, but a growing trend in organic and all-natural products is arising. The value of more expensive, healthy products is in a battle with the average college student’s expendable income.

The cookies targeted at this market are placed in high-traffic areas around OSU’s campus. For example, some are available in a small café on the first floor of the library and others can be found in a café in one of the Classroom buildings where many classes are held each day. The small cookies are placed in bags and the large products are individually wrapped, which makes them easy for students to grab on the run. Another positive in having cookies for sale on campus is the ability for students to utilize their Bursar accounts and charge the items on their student IDs. April charges $1.39 for a six pack of these cookies, but OSU obviously marks the price up in its end retail value.

3.2 Market Size

The Oklahoma Food Cooperative currently has over 2,600 members. All members are potential customers for Earth Elements and represent the company’s possible growth. Earth Elements currently averages between 300 and 500 orders per month. These numbers leave much of the cooperative population in untouched by the business.

Limited market research currently is available for small businesses like Earth Elements. A survey was conducted during the business’s product sampling at OSU’s campus on September 29, 2009. The survey questions were created through collaboration between our group and Ms. Harrington. The survey was conducted by Ms. Harrington, and the questions were asked verbally while the students sampled. Results are attached in Appendix A. Additional research
with larger numbers needs to be conducted on OSU and OU’s campuses to generate a more accurate representation of the target market. Similar primary research also is needed from the target market utilizing farmers’ markets and the OFC.

Consumers and other businesses learn of our sponsor’s new products through OFC producer notes. These notes are published on a monthly basis on the cooperative’s Web site in addition to a company description and full product line. The notes are sent in by member companies each time a new or renovated product is released. The business currently has no publications for new wholesale products. Consumers learn of these products by seeing them on the shelf. Creating awareness in this market could greatly increase Earth Elements’ sales. The OSU and OU campuses are two markets Earth Elements is exploring and has a small share in. The “college scene” is emerging as a great market possibility and product demand is on the rise. Cookies, crackers, and granola are among the products provided in this market. Our group’s machine will aid in the college market’s expansion by fulfilling demand at the least expense possible.

3.3 Perfect Mix Creations’ Market

In order to expand our sponsor’s own customer base, Perfect Mix Creations has received the challenge of creating a quick and efficient way to create uniform cookies through a device that consistently dispenses the same amount of dough. So, we are looking at a different market than Earth Elements. Currently, the market for a cookie dispenser either is for large-scaled production or at-home use. Companies for large scale production include Rhodes Kook E King, CMC America Corporation, and Unisource Food Equipment. These companies sell machines that dispense multiple cookies, but they are large, heavy, and contain multiple parts to clean. Companies providing at-home cookie products include Pampered Chef, Russell Hobbs, and BonJour Cookie Factory. These companies offer either a scoop or press that handles one or two batches of cookies. Entities falling between large- and small-scale production currently are underserved by existing products. Small bakeries, catering businesses, and gourmet companies with midsized production have limited space, limited staff, and a large product variety. A small, simple-to-use-and-clean device that still produces many cookies is not available through companies handling large- or small-scale production. Earth Elements Farm has been in contact with other companies similar in size and production that also are interested in a medium-scale dispensing system.
The intended use of our potential product is to dispense raw cookie dough on to a baking pan in portioned amounts. The device should be simple and able to dispense small portions of any non-solid food product. The basic concept starts with a bowl for holding the dough and a hole in the bottom of the bowl from which the dough will dispense. A press will be positioned above the bowl to push dough through the hole. A cutter underneath the bowl then will separate the dough into appropriate portions. The device will function through an electric motor that operates the press and cutter. The pan underneath the cutter will be manually moved to catch the portioned dough and create three rows of four cookies.

4. Client Company and its Resources

4.1 Management Team

Five main positions exist in Earth Elements’ management team. Lisa Weissenbuehler is the office manager, David Weissenbuehler is the packager, Sarah Shore is the sweets baker, Brian Thompson is the yeast baker, and Thelma Jones is the assembler. Three to four other “ floater” positions are hired as the need arises.

4.2 Products

Earth Element’s product line varies with the seasonal availability of ingredients since it utilizes only locally grown produce from its own farm and other surrounding farms. It produces baked goods, canned goods, jellies, jams, and all-natural body care products. Earth Elements provides over two-hundred different products on average, seventeen of which are cookies. The current product line is attached in Appendix B.

We are focusing on cookie production since it comprises the largest amount of Earth Elements’ baked goods and requires the most hand work. Total cookie numbers produced each day depends on employee work hours. Many constraints accompany production both before and after cookies are put in the oven. Before baking, each cookie individually must be hand scooped, leveled, and placed on the cookie sheet. The second constraint is the actual baking. The company’s small oven can handle either eight-dozen small or four-dozen large cookies, while the large oven can bake either twenty-dozen small or ten-dozen large cookies at a time. Once the baking is complete, packaging then becomes the final constraint. Different packaging types require different product amounts and sizes, so cookies must be sorted. Since it would be difficult to improve the second or third constraint without applying large amounts of additional
capital, we will focus on simplifying and speeding-up the first step of this process. Our efforts should allow Earth Elements to increase production while keeping labor and input costs constant.

4.3 Inputs and Distributors

Ingredient inputs (wheat, flour, produce, etc.) are acquired both internally from the company’s farm as well as from local farmers across the state. Whatever the company does not grow itself, it seeks from other local producers. Inputs not found locally are bought from Braum’s or Sam’s Club. Earth Elements purchases used equipment from small estate auctions and other local auctions for its baking and cooking inputs. The different kitchen utilities include mixers, bowls, knives, ice cream scoops, cookie sheets, and ovens.

Earth Elements utilizes a number of different small distributors. The main distributor is Urban Agarian, which delivers to farmers’ markets as well as the OSU and OU campuses. Matt Burch is specifically used to deliver products to small restaurants around the state. Other distributors perform specific deliveries depending on the region they are located in and the current product line. The going rate charged for delivery is between 2 and 5 percent, but the rate decreases as the shipment volume increases.

Local farmers and distributors are key people in Earth Elements’ success. The business’s key current customers include people at Oklahoma farmers’ markets; several restaurants and grocers Mr. Burch delivers to in Guthrie, Oklahoma; Native Roots Market in Norman, Oklahoma; Crescent Market in Nichols Hills, Oklahoma; The Health Food Center in Oklahoma City, Oklahoma; Oklahoma State University; and the University of Oklahoma.

4.4 Financing

Earth Elements uses a costing program for its products costs and profits. Costs are plugged into the computer, and it generates a cost analysis. Ingredient costs run at twelve cents per ounce and packaging costs include twenty-five cents per box, seventeen cents per pouch, and three cents per label. Due to the company’s profit margin, it wants to spend between $200 and $500 on our group’s cookie dough machine.

Earth Elements’ lack of growth and small-business status are affecting its current business decisions. To improve its financial condition and cash flow, the business is developing an at-home delivery system for its products. The company’s distributors will have a list of households to which products will be taken. Such distribution straight to the consumer is intended to reduce unnecessary expense. The service will be launched November 1.
4.5 Marketing and Promotions

Product marketing is done in-house by Ms. Harrington. She served as a graphic designer for ten years prior to opening Earth Elements. The company currently has existing business cards, brochures, display signs, and product labels. Earth Elements’ Web site was lost at one point due to a server complication. The current site simply consists of the recovered files posted onto the OFC Web site. It contains no real design, just a long list of product pictures and prices. The company is open to all suggestions and revisions for a new promotional campaign.

Earth Elements’ current logo was designed by Ms. Harrington. She does not want it altered in any way due to the recognition it provides for her products. Ms. Harrington commonly tells potential customers to look for the “green bullet” to find her products. The logo is supposed to bring to mind her company’s reputation of producing wholesome, Oklahoma-grown products. Ms. Harrington wants her products to be associated with preserving locally grown ingredients and her ultimate goal of building a local food system. The two entities have slightly different logos. The logo utilized by our client for promotional purposes is attached in Appendix C.

5. Competitors and their Resources

Several local businesses compete for customers in Earth Elements’ target market. These businesses include Persimmon Hill Farm, 1 Smart Cookie, Dara Marie’s Boutique & Bakery, Prairie Thunder Baking Company, Upper Red Fork, Mother's Catering, Granny, The Prairie Gypsies, and Renrick's Family Recipes. Limited market research is available on small businesses. However, the OFC Web site and Renee Albers-Nelson, OSU Food and Agricultural Products milling and baking specialist, helped provide information on each competitor. A summarization of the compiled facts is located in Appendix D.

After unsuccessful attempts to locate any further data on Earth Elements’ competitors, we have decided to conduct a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis on the current and potential process of baking cookies. The current process can be considered competition to Earth Elements as it is how the company’s competitors also currently make their cookies. The current way consists of an employee scooping the dough by hand with a scoop and then scraping off the excess dough to keep the size uniform. Whenever this process is used, a worker can make between 900 and 1,200 cookies maximum per day. One problem with this process is the fact that the dough is handled more than is ideal. With our potential new dough dispenser, more cookies can be made in a cleaner and more health-conscious manner. The
ability to make more cookies becomes a financial benefit to Earth Elements as it has a growing market for that product.

When conducting a SWOT analysis on the potential and competing processes, Weaknesses and Opportunities should receive emphasis in analyzing competition. The reason for this is because they are internal weaknesses currently and potential opportunities in the future. The current process’s biggest weakness is time consumption. Whenever employees are spending an entire day making cookies at a rate that could be more efficient, it is causing high opportunity costs. The opportunity cost is the best alternative solution that is available. If another way exists to make cookies faster with fewer labor costs, then it can be considered the opportunity cost.

There also can be opportunities to look at in the new system. A major opportunity is the potential for consistent sales to the OSU campus. Once again, Earth Elements can send larger amounts of cookies to campus and meet OSU’s demands if the company can increase production. Another opportunity available for our client arises from labor opportunities. If it takes less time for the new system to make the same amount of cookies, employees can spend that saved time working in other areas around the bakery. The potential system could provide a more efficient way for Earth Elements to spend its labor costs.

In a complete SWOT analysis, the Threats of the new system must be looked at as well as the current Strengths. One threat of having this new system could arise on the technical side. If the new system fails to make all the cookies the same size, employee may fail to notice as quickly due to the enhanced production rate. Since there are several possibilities in how the new system may operate, the system may require more skill than just scooping dough out of a mixing bowl. This is where a current Strength of the process arises. Our client knows all of its currently produced cookies are going to be uniform because employees scoop each cookie individually. The same person scoops the dough, scrapes it off, and bakes it in the same manner for each batch.

6. Technical Analysis

6.1 Scientific Literature Review

Current products existing in the market, such as Kook-E-King, are unable to meet Earth Element Farm’s needs for several reasons. Cost is the largest issue with the products since the company is a small business and cannot afford the high cost of large and complex machines.
Although the larger machines can produce a high number of cookies, they are not an option due to cost. Other affordable machines, such as those offered by Pampered Chef, are not practical because of the cookie number produced by Earth Elements and the extended amount of time and work required to clean the device. Another issue with smaller dough machines is inconsistency in cookie size. For example, the bench model Kook-E-King produces very large cookies when the hopper is full due to the weight of the dough. However, cookie sizes become smaller and smaller as the hopper empties.

Durability, reliability, maintenance costs, and programs vary widely with the type of machine and company. For example, large companies provide classes to show owners how to operate large, computer-based machines, where as the personal, hand-held gun comes with a simple instruction booklet.

Characteristics of a cookie cutting device are limited only by a person’s imagination, but the usefulness of the device is not based solely on the fact that it works. Most patented and workable cookie-cutting machines are not being used because they are overly complex or difficult to clean. Such machines include components like robotic arms used to scoop portions of dough from the mixing bowl or high pressured streams of water could to cut portions off a log of cookie dough. While creative, these options are unnecessarily complex.

When dealing with food processing equipment, issues of keeping the food contaminate free are a big concern. All parts that come in contact with the food must be smooth, nonporous, and nonabsorbent. Parts like bowls and tubing must not have any square corners. Instead, they must have a radius corner to prevent food from collecting in sharp corners and spoiling. Construction materials must not react with the food and must be corrosion resistant. Acceptable materials include stainless steel, titanium, glass, plastic, and ceramics (Schmidt). Inspection of new food processing equipment designs is done by the Food and Drug Administration (FDA), which follow the Current Good Manufacturing Practices (cGMPs) outlined in the Food, Drug and Cosmetic Act. This act covers bakery personnel, plant and grounds, sanitary facilities and processing. cGMPs are the standard for designing properly cleanable food processing equipment. Food processors can be prosecuted for not following such provisions (Prejean).
6.2 Patent Searches

We discovered five patents relevant to our proposed cookie machine. Our assessment of each patent is included in Appendix E. Each patent’s abstract, claims, and drawing sheets can be found in Appendix F. Our research revealed no relevant patent infringements for our prototype design.

6.3 Current Process

Currently at Earth Elements, ingredients are gathered and blended in a mixing bowl, hand scooped onto cookie sheet, and baked. The only time the dough is frozen is when a batch has not been completed at the day’s end or when it is marketed as frozen dough for home cooking. The current process is diagramed in Figure 1.

![Figure 1: Current Process](image)

6.4 Proposed process

We propose a device that will dispense dough instead of portioning the dough through manual scooping. The bowl with the mixed ingredients will be secured onto the proposed device. After mixing, the dough then will be dispensed through a hole in the machine by a crank shaft or electric motor. Dough will be separated by a wire cutter into the correct portions. The uncooked cookies then will be placed on the baking sheet. The proposed process flow is shown in Figure 2.
6.5 Lab Experiments

Experiments soon will be conducted to begin designing Earth Elements’ new machine. We will start by testing the viscosity of the cookie dough and the amount of force needed to extrude the dough through various sized holes. Physical testing and data collection will include changes in production speed, varying cookie sizes, speed comparison between production with and without the device, easiest input method determination, durability testing, and cleanability.

Three-dimensional CAD drawings will model the proposed system. Animated simulation of the device will be produced using the CAD software. From a bill of materials, the parts will be drafted to scale and sent to the DML or BAE shops for fabrication. To demonstrate the setup, a small prototype of the device will be made. We will ask a group of people unfamiliar with the device to operate it and provide feedback on the ease of use in order to simulate how the system will work at Earth Elements. Modifications then will be made based on the feedback.
Environmental, Societal, or Global Impacts

The production of our design is unlikely to affect any global market. The probability of our device taking off and being distributed worldwide is minimal. It is a device for medium-sized businesses like Earth Elements, which does, however, lead to environmental and societal impacts.

Several medium-sized Oklahoma bakeries have expressed an interest in a product like we intend to create. Should our device prove a success, it will make those businesses more profitable. Added profit would allow the companies to expand productivity and maximize their growth. The medium-sized companies then either could become a larger-scale entity or could maintain their current size and produce the highest quality products possible. In either case, the expansion of medium-sized bakeries around Oklahoma would lead to a definite impact on the area’s environment and society. The increased bakery production would cause a higher demand for raw ingredients used by the companies. Area farms and other suppliers of the ingredients would have to produce more crops to meet the growing demand, and a resulting impact on the farmland and surrounding environment could be felt. Also, the families of the growing bakeries would feel a societal impact of increased income. Individuals who may have fallen into the lower or middle income range could possibly find themselves at a higher economic and societal status through the use of our product.

Overall, the success of our design could have a measurable influence around Oklahoma. Rural Oklahoma’s environment and the society of individuals operating middle-sized bakeries are likely to be affected by our proposed device.
Engineering Specifications

1. Definition of Customer Requirements

We need to create a product that portions dough efficiently in constant amounts and in a constant formation. The product should be easily cleanable in the company’s sink, so the largest size it can be is 18” x 36”. The cost can be negotiated, but it must be under $1000 with $200 to $500 being ideal. The dough needs to be dispensed faster than the current production rate to accommodate the recent increase in sales. The dough dispensed needs to be spaced appropriately to drop the dough on a sheet in four rows of three cookies each.

2. Engineering Specifications

Beyond the customer requirements, the device must meet codes and regulations for food processing. Regulations and codes this device must meet were put forth by National Sanitation Foundation International (NSF), United States Department of Agriculture (USDA), American National Standards Institute (ANSI), Underwriters Laboratory (UL), and the Code of Federal Regulations (CFR). Standards affecting our group’s project with Earth Elements are 21 CFR 110 and NSF Standards 2, 8, 51, 73, and 763.

The FDA’s Food, Drug, and Cosmetic Act has a section of Current Good Manufacturing Practices is the standard for designing properly cleanable food processing equipment. To prevent the contamination of the dough, all contact points must be smooth. Bowls and tubes must have not any corners or creases for food to become stuck.

The materials used are steel and plastics of food-safe quality to prevent reaction or corrosion in the materials under normal use. The materials also must be nonporous and nonabsorbent, which food-safe plastics also are.
Proposed Media/Communications Plan

1. Core Campaign Problem

   Earth Elements Market & Bakery (EEMB) needs a more modern, simple, and cohesive design in its collective campaign. The graphic appeal of its existing promotional materials is detracted from due to the overwhelming and cluttered presentation of information on each element. In addition, many of the elements are outdated.

2. Existing Campaign Elements

   EEMB currently has a logo, product labels, a business card, a promotional brochure, a Web site, and display signs. The company has an existing logo and does not want it to be altered. Earth Elements feels it has built brand recognition around its “green bullet,” and has spent several years modifying the logo to its present state. Its current design and color scheme can be seen in Figure 3. Aside from the logo, Earth Elements is open to all other promotional suggestions and revisions.

3. Proposal of New Campaign Elements

   We propose creating a new, cohesive design in all of EEMB’s existing campaign elements. The only thing currently tying them together is the company logo. We plan to build off the green and white colors used in the emblem. Additional accent colors and type fonts will be explored to represent the organic, wholesome, and local feel the company seeks to portray. Once a finalized color scheme and design concept is decided, they will be applied to all elements of the marketing campaign.

   We will use EEMB’s product labels as the “beginning glue” in unifying the elements as they are currently receiving the most public exposure. The current label can be seen in Figure 4. Brand and product recognition is extremely important to a business’s success, so we want to Earth Elements’ promotional materials to match its products.

   Next, we will address the company’s business card and brochure. Both materials contain numerous different text fonts, color schemes, and information groupings. The business card is printed on a different paper color and weight than the brochure and also contains too much information. The point of a business card is to relay a company’s name, brand, slogan, and contact information as succinctly and uniformly as possible. The brochure was created in 2006 and contains currently irrelevant information. It also contains an overwhelming amount of
information presented in a disorganized manner, like the business card. Additionally, the pictures could be updated to convey a more professional vibe to the observer. Overall, we intend to unify, modernize, and organize the existing business card and brochure.

EEMB’s Web site was lost at one point due to a server complication. The current site simply consists of the recovered files posted onto the Oklahoma Food Cooperatives Web site. It contains no real design – just a long list of product pictures and prices. Positive Internet exposure would greatly benefit our client and expand its customer base. We intend to create a completely new site that matches the other existing campaign elements in its graphic appeal and consumer message.

Our final revisions will be conducted on Earth Elements display signs. The company currently has larger signs for its booths at local farmers’ markets, however, no smaller signs exist for product displays at convenience stores or other distribution points. As seen in Figure 5, the company’s products have plenty of space in most of their display shelves across Oklahoma State University’s campus for a small sign. We intend to create such an element to differentiate EEMB’s products from others in the stores and to attract a potential customer’s attention as he or she passes by.

4. Campaign Element Costs

Price is an important consideration for EEMB’s campaign elements. It is a small business with limited resources for promotional materials. All materials have been produced in-house up to this point due to the owner, April Harrington, having a graphic design background. In-house production has allowed the company’s marketing costs to remain minimal. Therefore, price restrictions will dictate much of our design including printing colors, paper choices, and production numbers.
Proposed Business Plan/ Financial Analysis

1. Financial Statement

One of Perfect Mix Creations’ largest goals for this project is to make a financially stable decision for our client. Should our proposal fail to make Earth Elements more profitable, it must be re-evaluated.

2. Calculating Profits

Since our design proposal mostly affects cookie amounts sold, our focus will be on cookie profits. Earth Elements currently sells its small cookies at $1.39 per six-pack to Oklahoma State University. Although the amount sold per week currently is inconsistent, room for growth is apparent in this market. Other small cookie sales take place through the Oklahoma Food Cooperative for $4 per dozen. Currently, Earth Elements can produce a maximum of 900 to 1,200 cookies per day. These high numbers only are obtained on an extremely productive day when an employee focuses solely on cookie production. Such production does not occur daily due to the amount of strain it causes on an employee’s wrists and the need to bake or create other products. Therefore, Earth Elements would consider our device a success if it could produce more than 900 cookies per day. This would create a profit of at least $208.50 per day depending on the exact amount produced and the intended buyer. Such a production increase coupled with a growing market would make our device economically beneficial to Earth Elements.

Another aspect of calculating profit is the potential for cutting cost, with two major areas including distribution and labor costs. Earth Elements’ distributors charge from 2 to 5 percent of the company’s sales for product delivery. The percentage varies depending on shipment size—the larger the shipment, the lower the charge. If the company consistently sends larger shipments around the state, it will be charged consistently less for delivery. The decrease in labor costs can be calculated by how many “man hours” it takes to mix and create a given amount of cookies. As stated earlier, one employee can produce a maximum of 900 to 1,200 cookies a day. An increase in production will cause the amount of cookies per man hour to rise and, therefore, decrease the labor dollars spent per cookie.

3. Cost Versus Benefit

The new system’s benefits can be measured by the rate at which cookies are scooped. In a test done by our engineers, hand scooping was conducted at a rate of 12 cookies per minute.
The sausage press, which is a major component of our proposed prototype, made approximately 16 cookies per minute. The benefit of increased production must be weighed against the cost of the system. The prototype’s total cost is estimated to be $645. Labor hours play a major factor when evaluating this cost versus the benefit of increased production. Earth Elements’ employees make between $8 and $9 per hour. At these rates, the proposed prototype must save approximately 76 labor hours to justify its cost. Our machine possibly could produce up to 1,920 cookies in an eight hour day since it is projected to make 4 cookies per minute more than the previous process. Depending on the amount of cookies needed each day, our device enables more time to be spent in other areas of the bakery. For example, if a limit of 1,000 cookies per day were to be set, the new process could make those cookies approximately 2.5 hours faster throughout the work day. The resulting extra time around the bakery would allow employees to be more diligent with other tasks. Additional factors such as employee satisfaction and productivity may also be improved by producing cookies at a faster rate.
Design Concept Evaluation

Each method examined reduces employee exposure to the dough by eliminating as much handling as possible. The alternatives also are versatile in the sense that other mix types, such as meat and spinach balls, can be produced with the devices. All of the concepts have the option of either hand or motor operation.

1. Sausage Press

This design concept is based on a sausage press. The theory is to press the cookie dough through an opening like a sausage press presses ground meat through an opening in the side of its container and into tubes for linked sausage. The press operates by the user hand cranking a plate down a cylindrical bowl until dough is funneled through a hole in the bottom. The idea for this design is to modify the press to push cookie dough rather than ground meat. The modification allows the dough to go through the bottom of the container as opposed to the side. Once the dough is pushed through the cavity, a thin wire moves back and forth under the bowl to cut the dough into portions. The entire process for this machine includes:

1. moving the dough from the mixing bowl to the straight-sided bowl,
2. placing the straight-sided bowl under the press,
3. pressing the dough through the opening,
4. separating the dough with a wire once a specific amount is pressed out, and
5. allowing individual cookies to fall onto a baking sheet.

A motor can be added to make this device automatic, which means the operator only has to move the baking sheet. This is a very simple machine to use but requires the dough to be moved from its original mixing bowl into the press’s straight-sided bowl. Items to clean include the mixing bowl, straight-sided bowl, stopper, and wire. The machine would be simple to manufacture and contains very few parts. This design is proposed for further review because of its ease in manufacturing and use.

2. Using Mixer

The original concept was to modify the current mixer. The modification would involve creating an attachment that will press the dough down through a mixing bowl with a hole in the bottom. The process of the dough through this machine included:
1. mixing the dough the bowl,
2. removing a plate from the bowl,
3. replacing the mixing paddle with a press,
4. pressing the dough through the hole in the bottom,
5. cutting the dough with a wire, and
6. allowing individual cookies to fall onto a baking sheet.

The bowl in this design must be modified with holes in the bottom along with a plate to hold the ingredients while mixing. The cutting apparatus is similar to that of the sausage press concept. This device would be automatic, and the operator would move the cookie sheet to catch the dough. Additional items for cleaning would include the attachment press, the plate, and the wire. The attachment would be very difficult to manufacture because it would consist of a circular disk moving within another disk. The mixer paddle not only rotates but moves circular around the bowl, so developing a press to fit the current machine would involve too many modifications. This method is not feasible because of the difficulty in manufacturing the attachment.

3. **Flip Method**

   This method consists of having a separate machine to push the dough out of the mixing bowl explained in the previous method. The process of the dough through the machine includes:
   1. attaching a plate to the top of the bowl,
   2. flipping the bowl over and placing it on a press,
   3. securing the bowl on the machine,
   4. pushing the dough out with the press,
   5. separating the dough with a wire that goes back and forth, and
   6. allowing individual cookies to fall onto a baking sheet.

   This technique has the possibility to leave a large amount of dough in the bottom of the rounded-bottom bowl the bowl. However, three to four cookies could be produced at a time. The items to clean for the method include the bowl, the plate, and the wire. The problems created by this method are the size of the machine and the manual effort of flipping over a bowl filled with dough.
4. **Side Pusher**

This method uses the mixing bowl and a separate machine. The machine would press the dough out of the bowl, and no bowl modification would be required. The operation would include:

1. placing the bowl sideways on the machine,
2. securing the bowl onto the machine,
3. utilizing a half-moon press to push the dough from the top to the bottom,
4. the dough being fed downward to an opening,
5. separating the dough into equal portions with a wire, and
6. allowing the unbaked cookie to fall onto the baking sheet.

The device would take up a large amount of space and be complex to operate. Also, large dents in the bowl would lead the machine to jam. Items to clean for the method include the bowl, wire, press, and hopper. This method only produces one cookie at a time and would be reasonably difficult to machine.

5. **Scooper**

This machine would automatically scoop the dough out of the bowl and place it on the cookie sheet. It would be similar to a robotic arm. The operation would include:

1. hooking the machine to the bowl,
2. the machine scooping individual cookies, and
3. the cookie ball being placed on a baking sheet.

The method is hard to machine, requires someone to push the dough towards the scoop, and leaves an excess amount of dough. The items to clean would be about the same as the current process, but the machine would need to be disassembled and re-assembled for every batch. This method would not be feasible because of the high manufacturing costs and difficulty.

6. **Rolling Cutter**

Another method is to place the dough on a conveyer and have the cookies are cut out. A rolling-cutter design utilizes a “squirrel cage,” and its operation would include:

1. placing the dough on a conveyer,
2. allowing the dough to be fed to the roller,
3. the roller cutting out each cookie,
4. the cookies moving to the baking sheet, and
5. Excess dough falling off the conveyer belt.

Large volumes of cookies can be produced with this device, and the cookie sizes and shapes will be consistent. However, the entire machine, including the large conveyor belt, would need to be completely disassembled and cleaned after each use. This design was not considered feasible mainly due to the machine’s large size and creation of additional clean-up.

7. **Continuous Dough Log Cutter**

For the continuous dough log cutter, dough is extruded onto a conveyor belt in a continuous stream. The dough then passes under a cutting blade. The device’s entire process would include:

1. placing the dough in a hopper,
2. allowing the dough to feed downward,
3. the dough being extruded onto a conveyor,
4. a blade cutting the dough into the individual cookies, and
5. the cookie slices being manually taken off the conveyer and placed on a baking sheet.

This method provides a high volume of cookie output and a mostly automated process. However, the machine would be large, cumbersome, and contain many parts to clean. Cleaning would require the machine’s disassembly. Due to these problems, the method was not considered for further evaluation.

8. **Hand-held Extruder**

One possibility is similar to what is currently available to the “home cooking” market. The idea is to have a hand-held extruder loaded with dough push out individual cookies. The process of the operation would include:

1. placing the dough in the tube,
2. pressing the dough through the opening, and
3. closing the opening by releasing the hand trigger.

The positive aspects of this method are the allocation for accurate placement of individual cookies onto the cookie sheet and the device’s small size. However, the device would need to be completely disassembled to be cleaned. This method was not considered further due
to the repeated use of the device causing its user to tire. Adding a motor or other power source would eliminate this problem but likely would entail a large amount of machining. Also, the amount of cookie dough the machine could handle would be small, resulting in excess downtime for refilling.
Proposed Schedule and Gantt Chart
Prototype Budget Proposal

1. Costs Overview

The budget for the prototype includes input costs incurred through constructing and testing the device. Costs will be paid for by the budget given to our group through the Innovations class in addition to money allotted by Dr. Holcomb. All costs will be recorded to keep track of the money spent on the prototype. Earth Elements ideally seeks to spend between $200 and $500 for our finalized product, however, we realize the synthesis and testing of a prototype will cost much more.

2. Cost of Materials

The finalized construction material for the prototype has yet to be determined, but our group recently visited Lowe’s to examine different materials and prices. After speaking with Dr. Weckler during the visit, we have decided to search for some of the materials through McMaster-Carr’s Web site. The company has more than 480,000 products, including hand tools and raw materials. The site gives the prices with the quantity per package and also allows partial packages to be purchased.

In addition to purchased materials, our group also has access to supplies in Oklahoma State University’s Biosystems and Agricultural Engineering (BAE) construction lab. The lab has bins of scrap metal that can be used for fabrication. Such materials will not add to expenses as long as the scraps already have been disposed of in the bins.

3. Testing Costs

The price for testing our new prototype can be minimized in several aspects. A sausage press has been purchased to use for testing purposes, to be modified as a part of the prototype, or possibly to fulfill both purposes. Another major testing input is the dough produced by Earth Elements. Our client has provided us with this input free of charge. We also have access to several locations including the BAE lab, the Design and Manufacturing Lab (DML), and the Food and Agricultural Products Center (FAPC) at which testing can be conducted. The sites are provided at no cost and have several tools available for various testing procedures.

4. Final Budget

All prices have been compiled to propose the final budget. Items taken into consideration for prototyping include:
• “scoopers” comparable in size to Earth Elements’ for output comparison,
• a sausage press for examination and modification,
• wire for cutting the dough,
• motors, gears, and wire for automation, and
• Plexiglas and stainless steel for testing other alternatives.

While it is necessary for all purchases to take place and be recorded for a final calculation, we have estimated a total prototype cost of $645. The price break-down can be seen in Table 1.

Table 1: Proposed Budget

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References


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Current Good Manufacturing Practice In Manufacturing, Packing, or Holding Human Food 21 CFR 110.


Food Equipment Materials NSF Standards 51.

Food Equipment NSF Standards 2.

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Motor-Operated Commercial Food Preparing Machines NSF Standards 763.


     <http://www.oklahomafood.coop>.


     <http://edis.ifas.ufl.edu/FS119>.

Appendix A: Earth Elements Survey

Appendix B: Earth Elements Product List

Appendix C: Earth Elements Logo

Appendix D: Competitors and Their Resources

Appendix E: Patent Evaluation

Appendix F: Relevant Patents