

# **Business Study of Alternatives Uses for Brewers' Spent Grain**

**I PRO 340**

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## Abstract

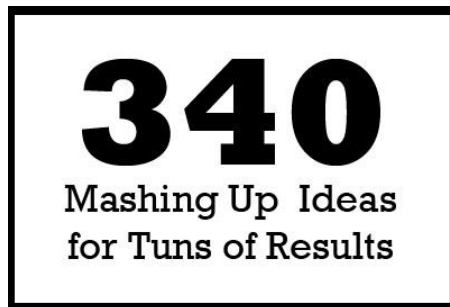
IPRO 340 (The Idea Fermentors) is working with Rock Bottom Brewery to determine alternative uses for the spent grain the brewery produces. Over 1,000 pounds of spent grain are produced at each of the three area locations weekly. Spent grain has many applications because of its high content of protein and fiber. Applications range from production of bio-plastics and bio-fuel, to agricultural uses as animal feed and compost material, to reuse as food for people. A major issue that Rock Bottom Brewery faces is that spent grain spoils very quickly, so alternative uses of spent grain must happen within a matter of days. IPRO 340 will determine what will be the best use of Rock Bottom Brewery's spent grain in terms of logistics, cost, practicality, and environmental impact. The Idea Fermentors will learn and understand the brewery process and various applications for spent grain, as it pertains to Rock Bottom Brewery. The team will work together to accomplish project requirements as set forth by the IPRO office at IIT on time as well as satisfy the sponsor company's needs.

## Team Information

The IPRO 340 team roster can be found in Appendix A, and each of the members' strengths, weaknesses, and expectations can be found in Appendix B.

### IPRO 340

#### The Idea Fermentors



### Team Purpose

The Idea Fermentors (IPRO 340) will work with the sponsor company, Rock Bottom Brewery, to identify uses for spent grain, a valuable by-product of the beer brewing process. The team will identify the barriers prohibiting microbreweries in the Chicagoland, specifically the sponsor brewery, from participating in the spent grain business market. The team will work to determine ways to overcome those barriers, as well as work to find additional uses for spent grain. One of the alternatives that will be evaluated is the practicality of implementing a Butanol solution similar to Scotland's recent discovery. Other alternative applications for spent grain that will be studied include making tofu, granola bars, and other food products. The team will also look into developing storage methods for spent grain that prolong its viability. During the IPRO project, members of The Idea Fermentors will evaluate the business practices, logistics, costs, storage, partnering, environmental impact, and practicality of each use option in order to find a solution that best suits the needs of our project sponsor.

## Team Objectives

- Learn and understand the various application for spent grain
- Determine which application will best serve the sponsor's (Rock Bottom, Lombard) needs
- Work together to deliver Rock Bottom in Lombard a solution and use of their spent grain
- Work together to complete deliverables on time, as put forth by the IPRO Office at IIT

## Background

Our sponsor, Rock Bottom Brewery, is a local microbrewery that has several brew pubs throughout the Chicagoland area. The types of beer available at each of the locations are different and are up to the discretion of the Brewmasters. The types of beers available can depend on the resources that are available to the Brewmasters at that location or that time of year. Each of the Brewmasters develops their own recipe for each batch of beer they make and each batch has their own signatures in them.

At each of the locations, the Brewmasters all use a similar brewing process to create their concoction. The brewing process takes the grain through seven different stages before it becomes beer and is ready to serve. They are: the Mill, the Grist Hopper, the Mash Tun, the Brew kettle, the Plate heat exchanger, the Fermentation vessel, and the Serving vessel. Throughout these seven stages, two major products are formed, spent grain and beer. Our IPRO is set with the task of working with the former.

Spent grain is the product that comes from the Mash Tun; it is primarily a mixture of grain and grain husks that has had the majority of its sugars extracted. In the past, the majority of spent grain produced was disposed of in a dumpster but recently there have been more alternatives for brewers to get rid of their spent grain. Currently, the majority of the spent grain from brewers are being trucked away and used as cattle feed. Much smaller portions of it are being used for composting, growing mushrooms, cooking, bio-ethanol production, and production of biodegradable plastics. The idea of using spent grain for cooking has become quite popular; there is a patent for a method of separating the husks from the bran in the spent grain through a continuous process so that large amounts of the grain can be processed. There is some research being done currently to find better alternatives, if any, to dispose of the tons of spent grain produced daily. But of the research being done, there are some promising results. There is an instance where the spent grain is being used to purify water contaminated with lead or cadmium. Results are showing removal of up to 90 percent of the heavy metals. All these alternatives may be areas of interest for our IPRO as the project progresses.

Rock bottom currently produces 3000 to 5000 pounds of this spent grain per week from its Chicagoland breweries. The spent grain is contained in 40 gallon garbage pails or deposited in a dumpster to be removed by a waste removal contractor. We estimate that the spent grain is 5 to 7 pounds per gallon depending on its saturation level and each facility produces about 2 yards of waste per week. The average disposal cost of a 2 yard dumpster is \$40 to \$50 per week. Loose agreements have been established with local farmers/agriculturists for feed or compost, however the farmer has the final say if he feels the product has "turned" and is not able to use for feed, which is more valuable than feed. If the pails are stored outside of the building, depending on the weather conditions, the spent

grain will become unfit for any purpose as soon as 24 hours. In colder environs the life of the product can be extended.

Currently our sponsor does not have any problems with its methods of disposing of the spent grain but they would like to find out if there is a better way of getting rid of it. There may or may not be a better alternative to dispose of the grain but the spent grain still has nutritional value remaining and this may be an area for exploration as the project moves forward. As of right now detailed analysis of the "problem" has not yet been established. But a framework for alternatives will be provided upon further examination. Upon determining one or more alternatives, our team will compare and contrast these with available technologies relative to the scale of the operation.

## Ethical Considerations

The brewing process is well documented and common knowledge with many facilities using standardized equipment. But the recipes are closely guarded by each Brewmaster, however the recipe does not reflect the waste product (spent grain) make up in any way--all brewing process produce spent grain.

Each of the team members has a responsibility to maintain the integrity of the information regarding specific process steps, and if the brewery reveals a recipe's ingredients, to maintain that secret.

## Team Values Statement

All group members of this IPRO acknowledge and agree to adhere to the following principles of professional and ethical conduct.

### Desired Behavior

- Complete their assigned tasks in a timely manner and trust in their fellow team members to do likewise
- Seek help and/or clarification when needed to understand what is required of them
- Remain informed of all topics and important issues addressed by the group
- Treat each of the group members with courtesy and respect as dictated by professional standards
- Communicate clearly and effectively when sharing information with the group
- Be present, on time, attentive, and open-minded during group meetings so as to achieve maximal participation and comprehension
- Resolve any grievances among group members quickly and peacefully, thereby maintaining focus on their primary objective
- Provide/accept constructive criticism to/from other group members politely

## Absence/Tardy Policy

All team members are expected to fully participate in this IPRO. Each member is allowed one personal unexcused absence without any academic penalty. All other absences must be petitioned one week prior to the expected absence. The petition must be presented in front of the group for group approval. If the absence of that team member is approved:

- A task will be assigned (pertaining to the individual's sub team)
- A written and oral presentation will be assigned
- The hour does not count toward out-of-class work
- The team member will present their findings to the class
- In the case where a team member has more than one personal unexcused absence, a penalty will be incurred.

As it relates to the decision-making process, relevant decisions are to be voted upon, with majority rule. There will be a provision for allowing decisions that were struck down to be reconsidered for discussion after a vote. The motion will be set forth by one individual from the majority party. Up to five minutes will be set aside for discussion before the final vote. This will be the decisive vote. There will be communication established in group meetings, as well as outside of meetings. There are many portals we will utilize for discussion: discussion boards on iGroups, Gmail, Google Documents, etc.

## Conflict Resolution

The Conflict Resolution Model-Australian is the conflict resolution method that was chosen by our current group to implement, should any conflict arise. This was proposed by a group of psychologists in Australia, and has four main stages: developing expectations for win-win solutions, defining each party's interests, brainstorming creative options, and combining options into win-win solutions. The first stage focuses on eliminating the "sides and arguments" and only focuses on the concerns of both parties, so that they are heard. If the positions are individually addressed in a common setting, more arguments will be caused because each party will try explaining why it is correct, which leads us to the creative brainstorming stage. A solution can be developed based on fulfilling those concerns, which is both creative and pleasing to both parties. The last stage involved filtering through the brainstormed ideas, combining as many of them as possible, while ensuring that a maximum of concerns of each party are addressed.

## Project Methodology

### Work Breakdown Structure

The problem we are addressing is the fact that spent grain that breweries inevitably produced, is being discarded by small breweries, while there lies within it a potential of being a source of income and benefit to the brewery and the customer respectively. The process to attaining our end goal: Embark on extensive research: we have made a list of breweries, with their contact details and we have divided these companies amongst ourselves. We intend to call them and have a short interview, talking about how they use their spent grain, and a list of other in-depth questions. We have collected information on the cost of discarding spent grain. We are also researching for the most cost effective way of turning spent grain into a beneficiary product.

### Goals

- Determine the plausible uses of spent grain for our sponsor
- Determine the best use of the spent grain for our sponsor
- Evaluate business practices, logistics, costs, storage, composition, packaging, partnering, etc. in order to find the best solution.
- Stay in touch with our sponsor, so to find out if there has been any new developments

To test and analyze the potential solution we have to the problems we are facing, we will draw up market data for what our affiliate brewery is making out of the spent grain at present, and we will compare with what they will be making after our solution is proffered. The solutions that we have not come up with yet, will be broken down into different parts and the fiscal implications will be analyzed. For instance if the spent grain is going to be turned into dog biscuits, we would consider the amount of money it will take to take a certain amount of spent grain to a factory, then to turn the spent grain into dog biscuits, and the marketing implications for dog biscuits. We will then scale up or down, and extrapolate if need be, to see if in the end the solution proffered will be realistic and monetarily wise. To accomplish the optimum result of providing the most effective uses of spent grain, might be tedious, but we should be able to achieve our major tasks. Spent grain has many uses and probably lot more that have not been discovered. So the task of finding the most efficient use of spent grain might not be achieved. We will try our best to achieve in finding the most efficient uses of spent grain, but the most efficient way may not be the best solution for our sponsor.

Major Tasks and Subtasks	Expected Output
<ul style="list-style-type: none"> <li>• Research what other brewers do with their spent grains (due January 31, 2011)                             <ul style="list-style-type: none"> <li>○ Call other local micro breweries</li> <li>○ Discuss what is the optimal use for spent grain</li> <li>○ Discuss what is best for Rock Bottom brewery</li> </ul> </li> </ul>	<p>Define the quantity, value, existing methods of disposal/consumption and logistics of working with spent grain in Chicagoland area</p>
<ul style="list-style-type: none"> <li>• Experiment with the spent grain                             <ul style="list-style-type: none"> <li>○ Try spent grain recipes</li> <li>○ Trial and error</li> <li>○ Attempt to create a final product</li> </ul> </li> </ul>	<p>Determine product characteristics, nutritional value, shelf life, consumable value</p>
<ul style="list-style-type: none"> <li>• Make a final decision of what to do with Rock Bottoms spent grain                             <ul style="list-style-type: none"> <li>○ Discuss how to execute the final decision</li> <li>○ Collaborate with Rock Bottom</li> </ul> </li> </ul>	<p>Reprocess, throw away, do nothing</p>
<ul style="list-style-type: none"> <li>• Project report and presentation (by March 1, 2011)                             <ul style="list-style-type: none"> <li>○ Make brochure</li> <li>○ Make poster</li> <li>○ Make presentation</li> </ul> </li> </ul>	<p>Report that quantifiably defines alternative uses of spent grain</p>

## Team Structure

### Team Leader: Sakshi Sahni

Oversees all tasks, makes sure everything is done in timely manner, and effectively communicate with the advisors and all the team members.

### Archivists: Edward Chiem and Soha Zahir

Takes meeting minutes, responsible for iGroups, and keeps everyone on their tasks.

### Deliverables: Aram Apyan, Amanda Smith, and Stephen Tomlin

Responsible for composing and submitting the final drafts of all the required deliverables, give presentations, and compile the accumulated references.

### Research and Development: Kevin Acacio, James Kapaldo, , Paul Kim, Rodolfo Mares Araiza, Moyosoreoluwa Orekoya, and Mateusz Prusak.

Actively participate in research, lab work, and explore the ethical, economical, societal and all other relevant topics that may be needed.



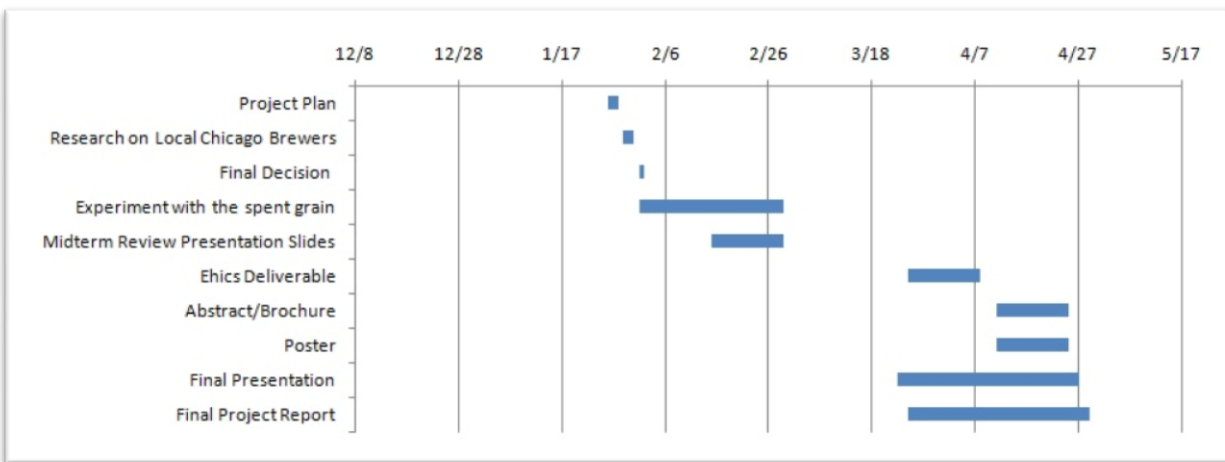
Research and Development is the core subgroup and every single member of the IPRO team is responsible for actively contributing to research and development constantly. Team Leader, Archivists, and Deliverable Group positions are expected to be rotated every four weeks. Every team member is expected to hold a position in at least one of these subgroups during the course of the semester.

Subgroup leaders were not utilized. Each subgroup member is responsible for bringing new ideas and understanding the responsibilities of the group as a whole. The subgroup members are expected to work very closely with each other and build an effective communication system. As a result, it was agreed that creating a subgroup leadership was not necessary for this stage. However, they may be utilized as the need arises.



Deliverables	Due Date
Project Plan	January 28, 2011 (11:59 p.m.)
Research on Local Chicago Brewers	January 31, 2011 (3:15 p.m.)
Midterm Review Presentation Slides	March 1-10, 2011
Ethics Deliverable	April 8, 2011 (11:59 p.m.)
Abstract/Brochure	April 25, 2011 (12:00 p.m.)
Poster	April 25, 2011 (12:00 p.m.)
Final Presentation	April 27, 2011 (12:00 p.m.)
Final Project Report	April 29, 2011 (11:59 p.m.)

### Gantt Chart



### Expected Time Contribution

- Research what other brewers do with their spent grains (due January 31, 2011)
  - Every team member
  - 3-4 hours each
- Make a final decision of what to do with Rock Bottoms spent grain
  - Every team member
  - 2 hours max
- Experiment with the spent grain
  - 3 to 5 members
  - 8-12 hours each
- Project report and presentation
  - Every team member
  - 5 hours each

### Milestones

- Visited Rock Bottom brewery
- Learned how beer is made first hand
- Learned how spent grain is produced
- Procured sample of spent grain

### Expected Result

Our team will be conducting research on different alternatives to dispose of spent grain. We will be contacting and visiting multiple breweries to investigate different methods of spent grain disposal and then comparing them based on efficiency, cost, reliability, time, etc. From the research, we hope to find the most efficient alternative for the disposal of spent grain and then present this information to our collaborating sponsor, Rock Bottom. Potential means of usage of the spent grain are animal feeds, dog biscuits, bread, growth medium for laboratories, removal of heavy metals from waste water, and production of bioethanol and lactic acid. We are also looking into finding several other methods of usage.

### Project Budget

Type of Expenditure	Description	Cost
Printing	Poster and presentation printing	\$200.00
	Printing and binding for presentation for our sponsor	\$50.00
Research and Development	Materials: lab materials and food for testing spent grain recipes	\$125.00
	Lab time to run tests and experiments on the spent grain	\$125.00
Transportation	\$0.51 per mile compensation for 33.4 miles roundtrip with a total of 4 tolls at \$0.80 each (4 trips throughout the semester with 4 cars each trip)	\$334.00
Incidentals	Just in case (may be used for additional lab materials)	\$100.00
<b>Total amount proposed:</b>		<b>\$934.00</b>

## Designation of Roles

**Minute Takers:** Edward Chiem and Soha Zahir

Records decisions made during meetings, including task assignments, or changes under considerations

**Agenda Maker:** Aram Apyan and Stephen Tomlin

Creates an agenda for each team meeting, which provides structure to the meetings and offers a productive environment

**Time Keeper:** James Kapaldo

Responsible for making sure meetings go according to the agenda

**iGroups Moderators:** Sakshi Sahni and Amanda Smith

Responsible for organizing the team's iGroups account and ensuring that it is updated regularly

## Appendix A

Team Member	Major	Contact Information
Acacio, Kevin	Aerospace Engineering	kacaio@iit.edu
Apyan, Aram	Physics, Applied Mathematics	██████████ aramapyan@gmail.com
Chiem, Edward	Chemical Engineering	██████████ edward.chiem@gmail.com
Kapaldo, James	Physics	██████████ swimjk89@gmail.com
Kim, Paul	Architectural Engineering	██████████ phkim88@gmail.com
Mares Araiza, Rodolfo	Business and Administration	██████████ rodolfomares86@gmail.com
Orekoya, Moyosoreoluwa	Chemical Engineering	██████████ sublimediatribe@gmail.com
Prusak, Mateusz	Civil Engineering	██████████ mprusak1@gmail.com
Sahni, Sakshi	Biomedical Engineering	██████████ sahnisakshi@gmail.com
Smith, Amanda	Humanities	██████████ amandarockslife@gmail.com
Tomlin, Stephen	Industrial Technology and Management	██████████ biggergreenegg@gmail.com
Zahir, Soha	Biologoy	██████████ sohazahir27@gmail.com

## Appendix B

	<b>Strengths</b>	<b>Weaknesses</b>	<b>Knowledge and/or Skills to Develop</b>	<b>Expectations</b>
<b>Kevin Acacio</b>	Problem solving, and reliable	Easily distracted, presentation skills	Work more effectively in a group and learn more about the brewing process	Find a better utilization for spent grain
<b>Aram Apyan</b>	Analytical thinking, and problem solving	Quiet at times	Working and achieving results in a group environment	Find a feasible usage of spent grain
<b>Edward Chiem</b>	Good at time management, very organized, and reliable	Quiet, presentation skills, and easily frustrated	Learn more about the brewing process and develop better presentation skills	Work together as a team to create a basis for our sponsor to utilize their spent grain
<b>James Kapaldo</b>	Problem solving	Quiet	Effectively working in the group dynamic and learn about the beer brewing process	Be productive, Everyone contributes equally, and concise communication
<b>Paul Kim</b>	Making presentations and problem solving	Gets distracted at times when there multiple options in a project	Working with a local business to develop problem solving skills	Coming up with an idea that satisfies the sponsor.
<b>Rodolfo Mares Araiza</b>	Team player, patience, goal oriented, quick adaptation, good listener and good communication skills	Easily distracted, a bit quiet and shy at times	Better discipline and ability to work towards a common benefit, also improve and broaden my overall performance working with a multicultural team	Develop an excellent project that can fulfill all of our expectations, with the inclusion of everyone ideas and proposals
<b>Moyosoreoluwa Orekoya</b>	Passionate about discovering new things, good writing skills.	Can be a bit talkative	Learning about the new and innovative ways to utilizing spent grain	To work with a beautiful team, and to respect everyone's method of approaching research and information

Business Study of Alternative Uses for Brewers' Spent Grain

<b>Mateusz Prusak</b>	Diligent worker	Quiet and shy at times	Learning about beer brewing while also helping our sponsor to achieve a goal	Everyone works off each other's strengths to produce an acceptable final product
<b>Amanda Smith</b>	Communication and writing skills, assertive, reliable, team player	I can get frustrated easily when things are not going as planned	To help our sponsor utilize spent grain and learn more about its possible applications	To effectively work together to develop a use for the sponsor's spent grain
<b>Sakshi Sahni</b>	Leadership, timely, writing and presentation skills, insightful	Can be shy at times	Learn more about other people's disciplines and backgrounds	Combine everyone's skills to create an efficient solution
<b>Stephen Tomlin</b>	20 years of experience developing manufacturing processes across many industries	Easily distracted by the variety of things to discuss and challenges to seek	Integrating a completely different discipline into a skill that comes naturally to me (through experience and/or study)	To provide our sponsor with an informed report of what the alternatives are for spent grain
<b>Soha Zahir</b>	Timely, responsible, good at research, and reliable	Presentation skills, shy at times	Learn more about the whole process of beer brewing and different ways to utilize spent grain	Learn to work together with other members to achieve a common goal.

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