

Microfinance in an Engineering Economics Course

Prof. Robert P. Leland, Oral Roberts University

Robert Leland was born in New York City in 1956. He received the S.B. degree in Computer Science from MIT in 1978, the M.S. degree in System Science from UCLA in 1982 and the Ph.D. degree in Electrical Engineering from UCLA in 1988. He served as a visiting assistant professor in Electrical Engineering at the University of Minnesota from 1989-1990. He served on the faculty at the University of Alabama in Electrical and Computer Engineering from 1990 - 2005, and has served on the faculty at Oral Roberts University in the School of Engineering since 2005. His research interests include control systems, MEMS, engineering education, stochastic processes, and additive manufacturing.

Microfinance in an Engineering Economics Course

Microfinance involves the making of small loans to borrowers who otherwise would not have access to credit, to help them build successful businesses. Many borrowers are women. In Fall 2022, students in EGR 461 Engineering Management and Economy at Oral Roberts University were introduced to microfinance through several background assignments, selecting and financing a loan through Kiva and writing a reflection paper.

Microfinance was demonstrated as a way to combat poverty and elevate the status of women by Muhammed Yunus and the Grameen Bank. Yunus was awarded the Nobel Prize for his efforts. Since then a large number of microfinance organizations have arisen. More recently, internet based microfinance has broadened the participation of both borrowers, who may live in remote areas, and lenders, who may now be private individuals, investing through organizations such as Kiva or Zidisha.

History of Microfinance

Microfinance was practiced as early as 1720 as a means to alleviate poverty in Ireland, including before and after the famine [1]. Microfinance proliferated after the success of the Grameen Bank in Bangladesh. Started as a project in 1976 by Yunus, the Grameen bank has grown to \$1.543B in outstanding loans in 2022, with a total loaned since inception of \$35.8B. The repayment rate as of 2022 was 97.23% [2]. Yunus describes the Grameen Bank as a ‘social business’:

As I built Grameen Bank, I frequently encountered social and economic problems that were making life difficult for the bank’s borrowers. In many cases I tried to solve the problem by creating a business around it [3].

Rather than simply making a profit, a social business seeks to change the world in a positive way, while being self-sustaining and using any profits to invest back in the mission of the business. An advantage the ‘social business’ model has over the charity model is that the funds are repaid and can be used to help more people in an economically sustainable way [3].

In 1973 Accion began making microloans for small businesses in Brazil and found these loans were a successful way to alleviate poverty and provide jobs in a community. Accion now partners with over 200 microfinance institutions in 63 countries [4]. SKS, operating in India since 1998 has become one of the largest microfinance institutions in the world [5]. The Consultative Group to Assist the Poor (CGAP) estimated that microfinance institutions (MFI’s) served about 120 million people in 2021 and considered this an undercount [6]. The role of technology, in particular the internet and digital funds transfer, is also growing, so access to technology is now linked to access to credit. [6].

Many loans are smaller, funding supplies for a retail business, or feed for livestock. In general larger, higher risk, loans are required for capital equipment to expand a business [7].

Internet Based Microfinance

Two internet based MFIs are Kiva and Zidisha. Kiva makes loans globally through in-country field partners. Kiva charges no interest, but the partners generally do. Kiva also makes loans in

the US directly, and these are interest free. On the Kiva website, individuals can identify borrowers and contribute to a loan. In reality, the loans on Kiva have already been made, so funding to the borrower is not delayed by the funding process. In this author's experience, many Kiva loans become completely funded very quickly through the website. Kiva loans are repaid to the lender and can be reused for another loan or withdrawn by the investor. Kiva finances its operations through contributions, rather than charging interest [8].

Zidisha works solely with borrowers with internet access, and tends to make smaller loans than Kiva. These are not repaid to the individual investors. The borrower, after repaying their loan, selects a loan to another individual to make with the funds repaid. This empowers the borrower to become an investor as well. Zidisha also facilitates contact between borrowers and investors, and reports to the original investor how the loan repayments have been used [9], [10].

Information on both of these organizations is available on their websites at kiva.org and zidisha.org.

Microfinance and Engineering Education

Microfinance as an outreach activity for engineering students was proposed in [11]. A three course Global Solutions curriculum, that addresses a comprehensive range of issues is described in [12], and microfinance is included as an example of solutions for economic development. In the context of service learning, engineering students were engaged in developing a digital financial literacy system to aid women in understanding compound interest, even if they could not read. Similar systems and training were developed to facilitate accounting for microfinance self-help-groups to help them become sustainable without hiring an accountant, which might be cost prohibitive [13].

Microfinance in Engineering Economics

Including microfinance in an Engineering Economics course exposes a large percentage of engineering students to actual business activity, and does so in a way that engages them in making a positive impact, addressing ABET outcome 2: *an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors* [14]. Training in microfinance also prepares graduates to address NSPE Code of Ethics item III.2.a *Engineers are encouraged to participate in civic affairs; career guidance for youths; and work for the advancement of the safety, health, and well-being of their community* [15]. In a broader sense, the perception of engineers as making the world a better place is one component in attracting students to the profession, and has been identified as important in increasing the representation of women [16]. Engineering Economics provides an excellent venue for students to learn about the social and economic benefits of technology. Internet enabled microfinance is one example. The concept of a class making microenterprise loans was inspired by university finance classes the author heard about in which students invested \$1000 (many years ago) in the stock market and managed a portfolio.

The initial goal for this project was for the students to gain a good understanding of microfinance, especially as an example of a business activity that alleviates poverty. Ultimately I

want them to think about how they can use their knowledge and expertise to make a positive difference. As this project is a work in progress, other themes related to ABET outcome 2 emerged during the course. Students gained a better grasp of the economic realities of much of the world. Students gained a better grasp of the status of women globally, and the potential for improving their economic status through small businesses. Students gained a better understanding of how credit enables economic growth. They were introduced to the notion of a social business that produces a social benefit in an economically sustainable way. They participated in a real economic activity. They engaged in critical thinking about how a microfinance organization should operate.

In the future, having students analyze cash flows for the loans would connect microfinance with evaluation and comparison of cash flows. Currency risk, or inflation/devaluation, can be substantial, and could also be incorporated into a cash flow analysis. Additional data on interest rates and repayment schedules for specific loans would be helpful in applying concepts of interest, cash flows and present value. The way in which an MFI sets its interest rates could be addressed in terms of a minimum attractive rate of return, however this analysis would need to account for both the MFI's expenses and the impact of these rates on vulnerable borrowers in keeping with the mission of the MFI. A MARR of zero or even less might be very acceptable.

The approach was to first give the students a basic exposure to microfinance, then have them research the nuts and bolts of microfinance loans offered by Kiva, then actively participate by selecting and making a loan, then reflecting on their loan and microfinance. Since the loans were made through Kiva, Kiva was used as the case study for a microfinance institution.

First, students were assigned to watch a short video, Grameen Bank At a Glance [17], and write a one page paper on microfinance and the Grameen Bank. Yunus' perspective of credit as a human right, and lending without collateral as a successful business model represent innovative thinking that disrupted common practice, just as we would like our students to innovate and develop new technologies. Grameen makes 97% of its loans to women, which benefits their families and enables children to attend school. Grameen Bank also makes educational loans for these children to pursue professions requiring higher education, and Yunus specifically mentions engineers [17].

Next the students read about Kiva and its business model, as one example of a microfinance organization, and write a one page summary (How Does Kiva Work-Business Model and Revenue Streams)[8]. Students were also shown the video Microloans Make an Unexpected CEO about a woman in Rwanda who established a successful business making school uniforms, used microloans to purchase additional sewing machines and hired more women, making a community impact [18].

Kiva was selected for several reason. Kiva is large, well known and has a good reputation, which helped the author feel comfortable investing funds with Kiva. Also loans made with Kiva are repaid to the investor's account, so the funds can be reused in the next academic year, perhaps with small losses due to inflation and other factors. Thus we ourselves are actually operating in the 'social business' model making this microfinance project economically sustainable. At the

time of writing 89% of the loaned amount has been repaid. Internationally, Kiva funds loans through field partner organizations that actually make the loans and collect payments with interest. Kiva itself does not earn interest, and is funded by separate contributions. In the US, Kiva makes direct, interest-free loans, however the US loans tend to be larger. Another organization, Zidisha was also considered, and has the advantage of establishing communication between borrower and lender, however working through Zidisha would require new funding every year. Students were assigned to find a loan on Kiva, and report on the amount, borrower's story, payment schedule, provision for currency loss (inflation), mission of the field partner organization making the loan, and cost to borrower.

Funding (\$875) was obtained by approved repurposing of funds previously contributed by the alumni association for another project. Then students were organized by the instructor into groups of four. Each group was assigned to make a loan of up to \$125, under the condition that their amount must complete the loan, the loan must be for business, and must have a repayment period of 10 months or less. Kiva also funds loans for education, medical care and other worthy purposes, but we focused on business. The 10 month maximum repayment period makes the funds available for next year's class. For larger loans, up to two groups can collaborate. Then the students will report basic information on their loan, and write a reflection paper on their loan, and how they would operate a microfinance organization.

This fall seven loans were funded by the students, and one was funded by the instructor to open the account. Several loans funded supplies for retail businesses, and one loan completely funded the purchase of a pig. Two other loans funded supplies for pigs and piglets. Two groups chose to collaborate in order to make a larger loan. Of the \$825 loaned, \$737.47 has been repaid so far and \$.03 has been lost due to currency fluctuations. As loans are repaid on schedule, or fall behind schedule, students are exposed to the uncertainties of microfinance. COVID-19 has had a definite effect on worldwide commerce, and microfinance supported businesses are no exception. 87.5% of the loans were to women. Loans were made in 5 different countries, and half were made in the Philippines. This supported a university-wide emphasis on globalization. 62.5% were for retail businesses, and 37.5% were for agriculture.

Students wrote a reflection paper with two sections. The first section was written by the groups of 4 and described basic factual information, such as the amount of the loan, the borrower's story, the country and what the loan is for. Also reported are the loan details such as the duration of the loan, frequency of payments, date disbursed, and how is currency loss (effect of inflation where loans are repaid in currency that has been devalued since making the loan) covered. In addition, since loans are made through field partners, the name and mission statement of the field partner, the average cost to the borrower (interest rate or portfolio yield), and the field partner's return on assets (ROA) are required. A positive return on assets is a good indicator of economic sustainability. A very high ROA might be an indicator of exploitation. The second part of the paper was more subjective. Each individual student described why they selected this particular loan. They also described how their own microfinance institution would function, including mission statement, policy for selecting loans, interest rates and target return on assets.

The assignments are included at the end of the paper.

Impact on Students

Some of the comments made by students in their reflection papers (included with permission) were interesting, and showed a variety of perspectives that were both positive and at the same time different from student to student.

One student wrote: Over the course of the semester, I have learned plenty about how microfinancing works and the miracles it can produce for the lives of many people. I find it interesting that the reason microfinancing was created is to help people that bigger banks are not willing to trust because of a system set up by them. It shows that, even if the world says you cannot put your trust in someone, if you choose to look a bit deeper, you will find that you can, and you will feel better for doing so as you will also be benefiting their lives. . . . I have never considered myself to very knowledgeable in the field of finances, but through microfinancing, I believe I have learned more about how to optimize the use of loans through the microfinance process than in the typical way using an accredited bank. Microfinancing is indeed a God-given tool to support the people the world does not seem fit to be supported.

One female student wrote: I chose this loan because I was interested in supporting entrepreneur women in impoverished countries. . . . It was very important for me to find an entrepreneur that was not only looking for her own interest and gain, but to help others as well.

One student wrote that his microfinance organization would "provide single fathers the ability to provide for their families through small business loans."

One student's microfinance organization would "provide micro-financial resources to help bridge the gap between historically disadvantaged communities in the United States and encourage underprivileged entrepreneurs to become self-sustainable."

For our class, students also write a research paper selected from a set of topics addressing the intersection of economics and technology. Some of them choose to write about internet enabled microfinance, or a related, broader topic on the impact of wireless communication in developing countries.

Student Survey Results

The class consisted of 28 students, of which 9 were international students. Early in Spring 2023, students were surveyed about the microfinance project both in terms of what they learned, and their perception of the value of microfinance. The results were a bit mixed. 15 students completed the survey, which is included at the end of this paper. The scale is 1-5. The first two questions ask students about their knowledge about microfinance before and after the class. The objective of making them familiar with microfinance appears to have been achieved. Student opinion on the effectiveness of microfinance in combating poverty was positive, but weaker than expected. Students were exposed to this through the Grameen Bank and World Vision videos, but perhaps more background is needed. There are also some controversies on this topic. The likelihood of future participation was low, and this could be a result of the weaker than expected perception of effectiveness. On question 5, students should have been aware of the Grameen Bank and Kiva at least, but some indicated just one institution. Question 6 treats an important

topic beyond microfinance. Student understanding of small businesses in developing countries is important for them to develop and implement engineering solutions that consider *global, cultural, social, environmental, and economic factors* [15]. 86.7% indicated their understanding had increased at least moderately (3-5).

Question	Ave	% 4 or 5
1. How knowledgeable were you about microfinance before taking EGR 461 (1 not at all, 5 understand in detail)	1.93	13.3
2. How would you rate your familiarity with microfinance (1 not at all, 5 understand in detail)	4.2	86.7
3. Microfinance is an effective means of creating wealth and reducing poverty (1 strongly disagree, 5 strongly agree)	3.71	60
4. How likely are you to participate in microfinance as a lender/investor in the future. (1 not likely, 5 very likely)	2.67	26.7
5. How many microfinance organizations are you aware of.	1.6	0
6. How has your understanding of small business economics in the developing world changed as a result of your experience with microfinance. (1 not at all, 5 a lot)	3.4	40

Student comments indicated they would like exposure to more microfinance institutions, to better understand the industry. They also wanted to see more of the impact of their specific loans, and would like to start earlier to facilitate this. Working with Zidisha would facilitate direct contact with the borrower, but would also require renewed funding every year. They also indicated a desire to know more about the role of technology. Both the internet and wireless communication have been enabling technologies, especially in funds transfers. Students also requested fewer restrictions on the choice of loans. This might be accomplished by removing the requirement that they complete the loan amount. That would enable them to invest in larger loans.

Future Plans

In the future I plan to start this project earlier in the semester, so the students can get more feedback on the repayment of their loans. It would also be helpful for the students to conduct some research on the borrower's country, especially with regard to the economic conditions affecting potential borrowers. I also plan to include more connections to cash flow analysis.

Discussion

This project does veer away from the typical topics in Engineering Economy involving cost estimation, cash flow analysis, present value, taxes, etc. We still do cover these topics completely, so this project is somewhat of an add on. I have typically devoted one class to microfinance, and one to two classes on the quality movement, however with a pandemic-shortened semester was not able to include these classes. I hope to restore these classes next year.

Acknowledgement

The author wishes to thank the Alumni Association of Oral Roberts University for providing funding for the loans.

References

- [1] A. Hollis, A. Sweetman, "The Evolution of a Microcredit Institution: The Irish Loan Funds, 1720 – 1920," U. Toronto, Working Paper UT-ECIPA-ECPAP-96-01, Jan. 2, 1996.
- [2] Grameen Bank, "About Grameen Bank," [Online]. Available: <https://grameenbank.org/about/introduction>, 2023.
- [3] M. Yunus, "Social Business and Microfinance: Building Partnerships with Corporations and Other Entities to Speed the End of Poverty," in *New Pathways Out of Poverty*, S. Daley-Harris, A. Awlimbo Eds. Sterling, VA: Kumarian Press, 2011, pp. 121-141.
- [4] Accion, "Accion Our History," [Online]. Available: <https://www.accion.org/about/history>, 2023.
- [5] J. Kagan, "Microfinance Definition: Benefits, History, and How It Works," *Investopedia*, Jan 4, 2022. [Online]. Available: <https://www.investopedia.com/terms/m/microfinance.asp> .
- [6] G. Bull, "Small but Mighty: CGAP and the future of Financial Inclusion," Consultative Group to Assist the Poor (CGAP), July 27, 2021. [Online]. Available: <https://www.cgap.org/blog/small-mighty-cgap-and-future-of-financial-inclusion>.
- [7] A. V. Banerjee, E. Duflo, *Poor Economics: A Radical Rethinking of the Way To Fight Global Poverty*. New York: Hachette Book Group, 2011.
- [8] Daffodil, "How Does Kiva Work? Business Model and Revenue Stream," Feb. 23, 2022. [Online]. Available: <https://insights.daffodilsw.com/blog/ho-does-kiva-work-business-model-and-revenue-streams>.
- [9] Zidisha, "How Zidisha Works," 2023. [Online]. Available: <https://zidisha.org>.
- [10] J. Kurnia, "Why I Founded Zidisha," May 2, 2014. [Online]. Available: https://www.huffpost.com/entry/why-i-founded-zidisha_b_4885629.
- [11] W. Jordan, "Using Appropriate Technology And Social Entrepreneurship To Help Transform Poor Communities", *2008 ASEE Annual Conference & Exposition, Pittsburgh, PA, June 22-25, 2008*.
- [12] M. E. Sharp, A. L. Stevenson, "Creating A Global Solutions Curriculum," *2013 ASEE International Forum, Atlanta, GA, June 22, 2013*.
- [13] A. Johri, A. Sharma, "Learning from Working on Others' Problems: Case Study of an Interdisciplinary Project-based Global Service-learning Program," *2012 ASEE Annual Conference & Exposition, San Antonio, TX, June 10-13, 2012*.

- [14] ABET, *Criteria for Accrediting Engineering Programs, 2022 – 2023*, 2021.
- [15] National Society of Professional Engineers, *Code of Ethics*, Alexandria, VA, 2019.
- [16] L. M. Kissane, L. Fang, R. J. Silver, “Female Millennial Perceptions of Engineering’s ‘Brand’,” *2015 ASEE Annual Conference & Exposition, Seattle, WA, June 14-17, 2015*.
- [17] M. Yunus, M. (2011, “Grameen Bank At a Glance,” Sept. 6, 2011. [Online]. Available: <https://www.youtube.com/watch?v=MgYes4bA7oM>.
- [18] World Vision, “Microloans Make an Unexpected CEO,” Nov. 8, 2011. [Online]. Available: <https://www.worldvision.org/economic-empowerment-news-stories/microloan-unexpected-ceo-jacqueline>.

Microfinance Survey

Please answer the following questions on a scale of 1-5.

1. How knowledgeable were you about microfinance before taking EGR 461?
1. Not at all. 2. Had only heard of it. 3. Knew a little 4. Basic understanding of how it works 5. Understand in detail how it works. _____
2. How would you rate your current familiarity with microfinance?
1. Not at all. 2. Had only heard of it. 3. Knew a little 4. Basic understanding of how it works 5. Understand in detail how it works. _____
3. Microfinance is an effective means of creating wealth and reducing poverty.
1. Strongly disagree. 2. Disagree, 3. Neutral, 4. Agree. 5. Strongly agree _____
4. How likely are you to participate in microfinance as a lender/investor in the future:
1. not likely, 2. Somewhat likely 3. 50-50, 4. Likely, 5 Very likely _____
5. How many microfinance organizations are you aware of: 0, 1, 2, 3, 4..... _____
6. How has your understanding of small business economics in the developing world changed as a result of your experience with microfinance:
1. not at all, 2. A little, 3. Moderately, 4 Significantly 5. A lot. _____

How could the microfinance exercise be improved for students next year?

EGR 461 Engineering Management and Economy

Kiva Microfinance

Kiva is one of the world's largest online microfinance institutions. A good description of its operations can be found at:

<https://insights.daffodilsw.com/blog/ho-does-kiva-work-business-model-and-revenue-streams>

Kiva is very much enabled by internet technology. It operates through partner organizations internationally and directly in the United States. In Kiva's model, loans are repaid by the borrowers and the funds can be withdrawn by the lender, or used to fund other loans. So one time funding can have consequences beyond the original loan. Borrowers do not wait for funding, but are approved and funded by partner organizations (not Kiva), then funds used by Kiva are paid out to the partner organizations. Partner organizations charge interest.

Your assignment is to read the article linked above and write a one page summary. We will be making microfinance loans this semester through two organizations, Kiva and Zidisha.

Bob Leland

EGR 461 Microloan research

Due 9/19/2022

Pick a loan (international) posted on kiva.org .

1. Identify the loan amount, and total left to go.
2. Summarize the borrower's story in one line.
3. Identify the country, and what the loan is for.
4. Click on Loan Details
 - a. Identify the loan length.
 - b. Identify the frequency of payments (usually monthly)
 - c. Identify the disbursed date.
 - d. What is currency loss, and how is it covered by the partner.
5. Click on Field Partner (the agency on site, making the loan, collecting interest)
 - a. Search for them on the web and add their mission statement.
 - b. Identify the Average cost to borrower (for this Field Partner) Explain what PY (portfolio yield) and APR (Annual percentage rate) mean, depending on which one is listed for this loan.
 - c. Explain what is meant by return on assets, and identify ROA for this organization.

You can just edit this file and turn it in.

EGR 461 Microloan research

Part 1 Due 10/26/2022

As a group of four, you will select a loan to fund. Each group has up to \$125 to loan. This is from donated funds from the <university> Alumni association, so you don't need to personally finance the loan. The loans must satisfy the following conditions.

- A. Your investment must complete the loan amount.
- B. The loan must be for business, and not other worthwhile expenses such as education, health or home improvement.
- C. The term of the loan must be 10 months or less.
- D. If you want to do a loan for more than \$125, you can team up with another group to make a loan up to \$250. Up to two groups can collaborate this way.

When your group has selected a loan, fill in the information below, and email this form to me.

This is due by October 26, but sooner is better.

1. Identify the loan amount, and total left to go.
2. What is the borrower's story in your own words (about a paragraph).
3. Identify the country, and what the loan is for.
4. Click on Loan Details
 - a. Identify the loan length.
 - b. Identify the frequency of payments (usually monthly)
 - c. Identify the disbursed date.
 - d. How is currency loss covered by the partner.
5. Click on Field Partner (the agency on site, making the loan, collecting interest)
 - a. What is the name of the Field Partner
 - b. What is the mission statement of the Field Partner.
 - C. Identify the Average cost to borrower (for this Field Partner), either APR or PY or whatever terms are used.
 - c. What is the return on assets, (ROA) for this organization.

Part 2: Due 11/7/2022 One paper per person.

Why did you choose this loan. (1-2 paragraphs)

1. If you ran a microfinance organization
 - a. Write a mission statement for your organization that states what you would like to accomplish. (1 sentence)
 - b. How would you select which loans to finance. Assume that in any given year, you have funds to support 50% of the loan application. (1-2 paragraphs)
2. What do you consider a reasonable interest rate (APR or PY) and why? (1-2 paragraphs)
What do you consider a reasonable return on assets (ROA) and why? (1--2 paragraphs)