Integrating China into Teaching about the Food Industry and its Security

A Major Qualifying Project Report

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ABSTRACT

This teaching module project is designed to cultivate and strengthen global competencies of first year undergraduate students in WPI's Great Problem Seminar, "Food Sustainability," by integrating China material into course content. Through studying the food security landscape in China, students necessarily engage the Chinese cultural and socio-political context. This in turn, provides an alternate lens to the Western experience and highlights strengths and weaknesses in both.

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INTRODUCTION

Worcester Polytechnic Institute (WPI) has developed a Great Problem Seminar (GPS) course related to a fundamental global issue, food sustainability, aiming to help students understand the food control system and the industry from different aspects. One of the key questions to be answered in the course is that how the world can feed nine billion populations by 2015. To encourage students to tackle this problem and develop their ideas and interests towards similar worldwide issues, instructors will direct students to think, understand, and discuss various topics throughout the course, such as food availability, access, and uses in the biochemical, economic, environmental, or political fields, considering countries around the world. This teaching module will focus on the food industry and security in China, aiming to provide a platform for students to understand the main challenges and opportunities of the food industry and food insecurity issues in China through different readings, activities, and group analyzes. This course, GPS Food Sustainability, is specially designed for first-year students to consider important issues and topics in multiple dimensions under a global context. In order to strengthen the global competency of students and allow them to obtain an interdisciplinary and global experience on campus, we constructed a new teaching module to incorporate into this course.

This teaching module aims to benefit both instructors, who learn and utilize the module, and students, who take GPS Food Sustainability and other corresponding courses. For instructors, this teaching module emphasizes on two main tasks:

1. Develop a deep understanding of the topic and enrich the background knowledge in a short amount of time through introduction and selected readings for instructors;

2. Use and incorporate this teaching module entirely, or partially, to teach and guide students and to transfer their knowledge to students.

For students, this teaching module focuses on achieving the following learning outcomes, including but not limited to:

1. Develop a basic understanding of the food industry and food security in China through readings and lectures;
2. Think, research, and understand the food industry, Chinese industrialization, and security problems comprehensively;
3. Discuss and analyze the following questions from different perspectives:
    a. The definition of food industry and security in terms of China;
    b. The interconnections between Chinese food industrialization and recent food insecurity incidents;
    c. The top challenges and opportunities regarding to industrial development in China;
    d. The main reasons that cause food insecurity and unsafety in China;
4. Share and present research findings on questions through group projects and individual assignments:
    a. The main contributors to food insecurity from different aspects.
    b. Moves the government, or individuals could take to eliminate food insecurity
5. Strengthen and extend interests in this issue by drawing the link between Chinese food culture and national industrial development.

Overall, I was able to apply my background knowledge from both International Studies and Biochemistry into the completion of this Major Qualifying Project and deliver a feasible

teaching module. The whole project allowed me to deepen my understanding of sciences and humanities at the same time and to learn about Chinese food industry and security issues from a different perspective. Through this year-long research and study of the history and current conditions of the food industry in China, I have understood the opportunities and obstacles exiting in the future development of the food industry and learned how to integrate China as a subject to teach food sustainability. I was able to understand the significance of teaching module designation, apply my research skills, and optimize the teaching module function to help instructors deliver knowledge to students. At the end of this project, I was able to complete a completed teaching module, together with other teaching materials, including a vocabulary definition list for students and an online survey to evaluate the teaching outcome of the module as the deliverables of the project.

BACKGROUND

1. Food Industry

a. Global Food Industry

The food industry can be closely associated with different aspects of society. As most raw materials in food industry come from the production of farming, the food industry can be seen as an extension of agriculture: the prosperity of the food industry stimulates the development of agriculture in any country around the world. Financially, the development of the food industry promotes the economic growth of the rural areas and increases the standard of living worldwide.[1] The development of the food industry also leads to the prosperity of other industries, including mechanics, light, and chemical industry.[2] Socially, the food industry provides a nation with a stable living environment by providing a significant amount of job opportunities, economic benefits, and security and increases the overall national income.[3] Therefore, the food industry serves as a fundamental element of national growth.

The Gross Domestic Product (GDP) of the food industry in developed countries, including United States, United Kingdom, and Japan, often stands on the top of the national economic production ranking by occupying 10% to 18% of the total GDP.[4] Developed countries usually obtain an overall 70% rate of food processing, and some countries can even reach to a 92% rate of food processing.[5] According to the data from 2015, the overall ratio between the total output value of the food industry and the total output value of agriculture in developed countries can usually reach in between 1.6:1 and 2.4:1, meaning that these countries increase the value of agricultural production dramatically through the food industry processing.[6] During the

past decades, developed countries have also promoted the food industrialization to obtain a higher GDP every year.

In the United States, the GDP of the food industry between 1987 and 1992 generated a total GDP growth rate of 316%. In 1992, the total GDP produced in food industry reached $430 billion, and later in 1994, reached $405.8 billion.[7] It includes different products of meat ($93.6 billion), beverages ($58.2 billion), milk ($54.3 billion), cereal ($49.3 billion), canned and frozen food ($45 billion), bread ($28.7 billion), sugar and pastries ($22.7 billion), and other items($34.4 billion).[8] Moreover, the food industry in the United States provided a total of 1.67 million job opportunities. Indeed, the food industry added value to various agricultural products and improved both social and economic aspects of the country.

Nowadays, several categories of food are in high demand in the global food industry. For instance, "convenience food" is becoming an enormous developing aspect of the food industry.[9] Young generation with a fast pace of living wants food to be easy to prepare as well as nutritional. To produce and deliver safe, healthy, and tasty "convenience food", the food industry has developed a process of packaging, transportation, and storage. There are a total of 1.12 million kinds of convenience foods around the world.[10] Particularly in Europe and some other developed countries, "convenience food" accounts for two-thirds of the national food consumption.[11]

With an improvement of the living standards and a higher requirement of nutrition and health, functional food that is nutrient-rich and delicious attracts many people.[12] Functional food normally contains unique characteristics that can benefit human bodies and prevent diseases. For example, Fatty Fish like Halibut and Trout that contain Omega-3 fatty acids to reduce coronary heart disease Functional food in some developed countries has an annual growth rate of more

than 15%.[13] The United States regard functional food as “the food of the 21st century." However, there are some food companies blurring the line between functional food and drugs in order to hold out the promise of higher margin and faster growth.[14]

The third category is green food, which is the collective name of pollution-free, safe, and nutritious food of good quality, such as organic meat and vegetables. The development of international trades and food markets suggests that the production of green food is a major trend in the global food industry.[15] Some experts have predicted that, in the 21st century, agriculture will become ecological agriculture, which involves building the strengths of natural ecosystems into agroecosystems, and the dominant food type will become green food.[16]

Not only are these three big categories of food in high demand, there is also a push for the development of the diverse food production. There are currently more than one million kinds of food produced in different countries that vary according to raw materials, climates, eating habits, and cultures.[17] Due to the fast development of sciences and technologies, algae food, artificial food, and organic foods have also become available around the globe. For instance, recently, scientists have discovered a natural growth of algae, which is located in Pacific coastal water, that could potentially be developed and manufactured into food products that have the equivalency of 15 times of the energy produced by wheat foods.[18]

Due to the globalization and increasing international competition, some developed countries have gradually transferred from manufacturing-based food industry to a high-tech food industry. The current global food production and manufacturing has started to enter the high-tech era, growing towards a massive scale of international collaboration to use innovative technology for nutrition-directed food production. As early as 1995, 20% of the global food industry output value (US $115 trillion) has been generated from just around 100 multinational companies.[19]

Some of the world's leading industrialized countries, with their capital, technology, human resources, management, and other advantages, provide platforms and policies that allow a large number of multinational food companies to grow.

In addition to international cooperation, the global food industry must collaborate with other industries and governmental sectors. Therefore, the development of the food industry actually affects the development of agriculture, packaging and chemical industry, public transportation sectors, etc.[20] In order to increase the scale of operation and production and improve the standard and management for manufacturing, some of the world's leading multinational food companies have been trying to work with different central and local governments.[21]

Moreover, the development and penetration of advanced sciences and technology in the global food industry have increasingly influenced food production. Different applications of biotechnology, membrane separation, extraction, sterilization, and radiation have simplified manufacturing processes and greatly changed the traditional operating modes of the food industry to produce more foods that are natural, safe, nutritious, delicious, and convenient.[22]

b. Food Industry in China: Culture, History, and Industrialization

One of the oldest quotations about food is from the Han Dynasty in China: "Minyishiweitian, Shiyianweixian (民以食为天, 食以安为先)," meaning food is one of the fundamental elements for living and should also be safe.[23] The existence and variety of food and dishes in China has often been regarded as significant status and cultural symbols. From the greeting phrase "Have you eaten yet?" to the traditional food like dumplings and moon cakes at various Festivals and holidays, food is intimately ingrained in Chinese culture.[24] The purpose of

having food and producing food is more than just to allow people to eat well but to reflect their culture and history.

In the Chinese history, imperial governments were obligated to have a stable food supply. Food shortages could lead to social instability and substitution of the new regime for the old. This link between food security, social stability, and legitimacy of the regime continues into the modern Chinese experience. In more recent times, China has had to overcome the man-made famine of the Great Leap Forward and chaos of the Cultural Revolution.[25] In fact, part of Deng Xiaoping's approach in the Reform Era to stabilize the society was to develop economy first. Not until President Deng Xiaoping's Economic Reformation in 1979 and his Open Door Policy, western food companies first got the chance to enter Chinese market.[26] After a thirty-year absence of western food products, Coca-Cola entered China in 1979 and the first American fast food KFC arrived in 1987, stimulating an establishment of the modern Chinese food industry with a large-scale industrial food production.[27] Western agricultural and industrial system soon influenced Chinese industries and markets significantly, which allow China to gradually develop and perfect its modern food industry.

Nowadays, China is a country with 1.3 billion people, and therefore, the food industry in China is often called "the industry of life."[28] It has already become an important representation of the national economy development and people's living standards. According to Chinese national classification, the food industry is divided mainly into food processing, food and beverage manufacturing, and tobacco processing.[29]

During the past thirty years of Economic Reformation, China has made considerable progress in the food industry. The overall food production capacity has increased, and the nutritional status of its people has also scaled up.[30] In 2008, the output value of the Chinese food

industry reached 4.2 trillion (RMB).[31] The food industry in China has become a vital national industrial pillar of the economy. While facing the world's economic depression and multiple financial crises, the development of the Chinese food industry still maintained a growth rate of 31.63%, as one of the leading manufacturing sectors even under pressure.[32] Thus, with a background of fast industrialization, urbanization, and globalization, the Chinese food industry has significantly contributed to increasing national and individual incomes. However, with such rapid growth, the food industry in China faces many different challenges and problems in terms of improving food quality and safety, international competitiveness, control and regulation for domestic food production.[33] Thus, being aware of the challenges as well as opportunities in the development of the Chinese food industry is important for the improvement of the food safety and security as well as the goal to achieve a harmonious and prosperous economic growth.

c. Opportunities and Trends of Development

During the past decade, the food industry in China has rapidly developed and expanded. There are many new opportunities and trends appearing in the development of the Chinese food industry.

The Chinese food industry remains stable in its rapid growth. From 2005 to 2015, the Chinese food industry has achieved much success. The number of food processing companies more than doubled, reaching a number of 41,135.[34] Industrial output production increased by 6.3 times in between 2000 and 2010 with an output value of 5.5431 trillion (RMB).[35] In 2008, the proportion of the output value by the food industry reached 7.93% of the total industrial output value, becoming the second largest industrial sector after railway manufacturing.[36]

The Chinese food industry is highly profitable. The total profits generated by the food industry increased 15 times in 2010 compared to the profits in 2001.[37] The proportion of the profits of food industry in that of the total industry reached from 5.62% in 2001 to 8.20% in 2010.[38]

Food processing rate will continuously increase. The Chinese food industry is favored by the market economy, which provides a huge platform for future development. During the past decades, the ratio of the output value in the food industry to the output value in agriculture has increased from 0.29:1 in 2001 to 0.8:1 in 2010, which demonstrates that the ability and necessity of food processing have increased.[39] In the Central government's *Chinese Food Industry Five-year Plan of 2010-2015*, the ratio of the food industry output value to agricultural production output value aims to reach 1.5:1 by 2015 and the total GDP of the food industry should increase to 12.3 trillion (RMB).[40]

China joined the WTO in 2001.[41] Many people might ask how the Chinese food industry can develop so rapidly and profitably. While the Economic Reform Era led to establishment of the initial Chinese food industry, the participation of China in the WTO infuses new life into its food industry. Moreover, the ability of food production, transportation, and storage has been largely improved by international collaboration, corporation restructure, and technology progression.[42]

An increasing demand for food products stimulates the development of the food industry. With the rapid growth of the domestic market and improving living standards, the consumers' demand for bread, milk, oil, meat, seafood, etc., is increasing due to the awareness of nutrition and health. Meanwhile, some large food companies and some well-known food brands are now gradually accepted by most consumers through promotion and advertisements.

d. Challenges that the Food Industry in China Face

The food industry in China has made significant progress. However, one cannot deny that many problems exist in the industry, which can be obstacles preventing continuous growth and development. Compared to some developed countries in the world and their standards for the food industry, there is still a long way to go for the Chinese food industry. The challenges faced by the food industry arise from different causes, such as weak international competitiveness, Research and Development, and the dependence on specific food productions.

The primary challenge existing in the industry is the weak awareness of competition. Most of the Chinese food enterprises cannot compete with food companies in the developed countries due to their scattered distribution and outdated technologies in China.[43] Currently, many Chinese food companies are not large enough to maintain low costs as well as high efficiency of food production. Much equipment in the industry is old and a huge amount of labor is required to operate it.[44] In 2008, for instance, while some developed countries have an average processing rate of milk between 400 and 600 tons per ton and rice between 200 to 400 tons per day, the Chinese enterprises can only process 100 tons of milk and 50 tons of rice per day.[45] This scale of production significantly limits the international competitiveness of the food industry in China.

Secondly, research and development departments of the various food industries in China need to be improved. Technological innovation and advanced equipment are extremely critical for the global food industry. However, lacking the ability to conduct independent research during the development phase has caused China to be more than 20 years behind developed countries.[46] Research and development usually provides companies and the industry with stable, consistent, and reliable development. Right now, the food industry in China still consumes high amounts of

capital while producing few advanced outcomes. In some key areas of the production, it still highly relies on foreign enterprises and technologies, which increases the import rate of technologies and products every year. For example, manufacturing processes, such as separation, modification, and non-thermal sterilization are still lacking during the process of production, transportation, and storage.[47] Thus, the value added to the agricultural products after processing in China is less than the value being added in the developed countries.

Finally, the high profits generated by tobacco and alcohol production often cover up the weakness and shortage of the overall food industry.[48] In 2008, the output value of tobacco was 448.8187 million (RMB), accounting for 14% of the total food industry profits.[49] The overall high profits and taxes provided by alcohol and tobacco production will affect the authentic food growth of China and the healthy development of the industry over the long term.

2. Food Security

a. Achievements in Food Security and Safety Control

With an increasing integration of the global economy and accelerating industrialization in China and food consumption have been turned into a quality, nutrition, convenience, and high-tech oriented sector. The public attention towards food security and safety has increased in the process of food manufacturing, transportation, and storage. Food security, which includes its accessibility, safety, and utilization, serves as a symbol of achieve a high standard of living. Control of food security and safety comes together, which is function of from the national regulatory system, laws and regulations, exposure to the incidents by media and social media, and the attention from the public.[50]

During the past decades, led by the Chinese National Food and Drug Administration, different governmental sectors have been implemented and developed in order to regulate and supervise food security and safety during the industrial food production. A control system has been formed by the central regulations, state supervision, and local regulatory agencies. This monitoring and control system aims to work together to regulate food security and safety during production and procession from different aspects, including agriculture, industry, commerce, health, environmental protection, and consumers' rights.

China is now developing its regulatory legislation, for food security and safety. The *Food Sanitation Law (Trial)* was promulgated in 1982 as one of the earliest standards for the Chinese food industry control food security.[51] In 1995, the National People's Congress officially published and implemented *The Food Sanitation Law* to protect the health and safety of its people.[52] Under the rapid development of the Chinese food industry, the increasing promotion of different food products, and the large international import, it is important to improve laws and regulations. Additional subsequent legislation, including the *Food Quality Law*, *Agriculture Law*, *Standardization Law*, *Common Inspection Law*, and nearly 20 other laws and regulations, has improved the food industry in China.[53] The National People's Congress has affirmed the performance and historical role of these laws and regulations in controlling and regulating food security and safety in 2002.[54] In 2015, the latest *Food Safety Law* was published and put into practice to control further gray areas of the Chinese food industry.[55] There are also more than 150 regulations other than the officially published laws pertaining to Chinese food standards and trying to cover all different aspects to make food industries to maintain safe and secure.[56]

Moreover, there are many different ways to increase the awareness of food security and safety that at the same time also regulate the food industry. Both traditional media and social

media expose and pay attention to different food security incidents that happen in China. The media exposure of those incidents has often brought pressure to the industry and resulted in better controls. The second week of June each year has recently been named as National Food Safety Awareness Week by the government.[57] During this week, the National Food Safety Administrative identifies different themes and organizes a variety of activities to promote knowledge and establish food safety awareness among the people.[58] Research institutes, schools, and companies are also obligated to spread relevant food safety information by various methods to mainly rural and poor areas.[59] The universities and some research institutes are encouraged through public and private research funds to broaden and deepen food science- and technology based research.[60] In conclusion, different methods have been used to allow the concept of food security to become deeply rooted in the people's consciousness in order to obtain a fast resolution of food insecurity incidents.

b. Causes for Food Security and Safety Incidents in China

Although the government and local sectors and agencies have achieved much success in regulating the food industry in China, the industry still has many different problems regarding security and safety. For the past decade, many food security and safety incidents have occurred in China, causing a series of panic, concerns, and damage. Therefore, it is important to understand the weakness of the industry and the reasons for those incidents and problems. Social, moral, and regulatory factors can potentially lead to failures in the mechanism of controlling and supervising food safety and security in China.

The development of the environmental-friendly industry is slow. While obtaining a fast and massive rate of industrialization and urbanization, environmental pollution has become a

primary threat to human safety and health. The pollution problem in China is particularly prominent because of industrial and agricultural wastes, including gas, water, and other materials. Agricultural and industrial wastes are often directly discarded into the environment, which can contaminate plants and other raw materials for food production.[61] The widespread utilization of pesticides and fertilizers also pollute different products in the food industry. Fast urbanization leads to another environmental problem, which is air pollution and haze caused by the gas emission from cars.[62] In addition, major industrial accidents in some nearby foreign countries have had increasing impacts on the food industry. For example, after the nuclear power plant leak in Fukushima, Japan, radioactive substances were observed in some coastal areas of China, leading to a significant environmental concerns and impacting Chinese food security and safety.[63] Different pollutants can often contaminate the raw materials supplied for food production. As most of the industries are not environment-friendly including the food industry, it is hard to ensure food security and safety from its origin as a fundamental guarantee.

The control system and legislation are imperfect. Most of the developed countries have a systematic food safety and security control system, functioning as a unified body and having a perfect mechanism reacting to different crises.[64] However, the control system responding to food security and safety crisis in China is multi-sectorial and multi-agency. It lacks overall systematic control and management and as well as an efficient mechanism when encountering large-scale food incidents.[65] Although different government sectors, such as agriculture, health, commerce, and entry-exit inspection, take responsibility to regulate the food production, the particular responsibility for each department remains unclear.[66] When any food safety and security incidents cause damage to the public, those sectors and related factories, schools, and enterprises often shirk responsibility and easily escape the punishment.[67] Thus, this

imperfect control system significantly influences the quality of the food products and the efficiency to solve crises. Since most of the food companies in China are relatively small and randomly distributed, a robust regulatory system is required to ensure food security and safety during the food production and procession.

Existing technology cannot support the inspection of food production. Although there are many different types of inspection agencies, most of them are redundant, having only outdated equipment and testing technologies that cannot be used to support food quality control. For various types of food, such as green food, organic food, and functional food, the levels of food security and safety are poorly defined.[68] Many terminologies used in those definitions could potentially confuse consumers, who cannot easily recognize and distinguish the food products. In addition, while using outdated technologies to support food security and safety inspection, many imported food products cannot be effectively regulated and inspected.[69] Therefore, it leads to a larger gap between the national and the international food production standards and danger of eating those products.

The awareness of legislation is weak in China. To earn huge profits, some food companies and enterprises use people's lives and health in exchange for money. Those people lack the basic awareness of laws and moral standards. Therefore, many food security and safety lapses have happened in recent years. Consumers stop trusting not only some local companies, but also many big food brands and enterprises. However, some companies in the industry that meet the standard of high-quality food production often obtain low profits and occupy only a small portion of the market.[70] This phenomenon creates a vicious cycle. Thus, it is important to improve the food safety and security awareness for companies and enterprises in the industry.

METHODS

In order to achieve the overall goal of the project, designing a teaching module is chosen, functioning as a tool to deliver knowledge to students. A teaching module functions as self-contained "units" of content or technique. Teaching modules are produced so that any instructor can adapt and use them to meet the needs of a particular course. A good teaching module should include content, activities, and bibliographic resources for people who need to acquire more knowledge before they use the module.

A possible basic structure of a teaching module is outlined below, and further explanations for each section will also be provided.

- Themes and Goals
- Audiences
- Instructor Introduction
- Instructor Readings
- Student Readings and Activities
- Evaluation

An educational module often contains an "Abstract" or a section of "Themes and Goals" to allow instructors to identify the subject and potential value to their course and how to integrate into their own plans and teaching goals. Moreover, a teaching module is a short cur for a teacher to meaningfully include materials outside of their expertise but related to their teaching subject. It allows for greater inclusivity and comparative analysis. The instructor has a guide for how to incorporate and teach the new material. In addition, this short cut have an independent unit for learning and mastering the material in a way that allow student to connect the module to the larger subject matter, which in this case is food sustainability.

Introductory materials in a teaching module usually include a list of competencies, objectives, and methods of instruction, together with suggested resources in order. The content of the module should focus intensely on the subject, which allows instructors to obtain problem-solving techniques throughout teaching. Student reading and activities should be provided, which enable instructors to deliver their knowledge to students. Finally, an evaluation procedure should be provided for both students and instructors to assess the feasibility of the teaching module for the improvement and development of the module in the future.

While designing the teaching module, it is important to consider the principal of teaching in order to maximally deliver knowledge about the subject to instructors and students through different teaching and learning activities. In this particular project, the subjects are the food industry in China and food security and safety. In order to understand the prototype formation of these two subjects, we need to present students and instructors with prototypical examples, which can demonstrate a simultaneous generality and describe the subjects in the sequence. In the other words, the examples and articles chosen in the teaching module should be typical but simple. This principal of teaching has already defined the requirement of choosing learning materials for college entry level students.

Finally, a good teaching module should provide activities that enable students to research, learn, and think through lectures and assignments. It should include multiple learning nodes and graded difficulty in appear like a good teacher. Thus, the teaching module should have the ability guide instructors to deliver knowledge and teach students.

RESULTS

This teaching module contains five different parts to guide instructors to teach the topic of the Chinese food industry and its security and safety, including themes and goals, audiences, instructor introduction and readings, student readings and activities, and evaluation. Each component functions differently within the module to allow instructors to achieve their teaching goals and students to obtain individual learning outcomes regarding the topic.

The section “themes and goals” explains the motivation to construct this module, which could potentially contribute to the Great Problem Seminar course, Food Sustainability, strengthening the awareness of global competency among first-year students at WPI. It summarized the main topic and stated the significance for students and instructors to learn about the food industry and food security in China. It also mentioned how global impacts and national influences could affect the development of the Chinese food industry. By citing the current laws, regulations, and research articles, it brought out the challenges and opportunities that the Chinese food industry could achieve and face and how people should learn and discuss the topic. In general, the section “themes and goals” allow instructors to understand the significance of spreading the knowledge about the food industry and security in China.

The part of "audience" answers the question that can use this teaching module, or whom this teaching module could benefit? From the first section of "theme and goal", we have already understood that it was initially designed, studied, and delivered to the GPS food sustainability. However, since the module contains a complete teaching unit of the food industry and security in China, It could also be used in some other courses to teach different topics, including but not limited to sustainable agriculture and food safety, environmental issues in China, food industrialization, and food legislation. Moreover, this teaching module can be entirely or

partially used in any college level courses that are associated with China or the food industry in China.

"Instructor Introduction and Readings" contains the fundamental knowledge that instructors should understand regarding teaching about the food industry and food security in China. The section of food industry went from the current food industry development of the world into the particular food industrialization of China. Based on Chinese culture, social development, and economic mode, it also discusses several primary challenges and opportunities when developing and regulating the Chinese food industry. Instructors will be able to use the information to guide the discussion and the assignment for students. The introduction also gives a basic definition of food security from three pillars, which are food availability, food safety, and food uses. Instructors will be capable of giving students examples, and explanations that cause food security and safety incidents. However, it is important for instructors to understand that each student can form their individual definition of food security and safety in China as well as summarize and consider different problems and achievement within the food industry based on the learning materials. Therefore, from this part of the module, instructors should be able to develop a thorough understanding of the topic and be familiar with the subject in a shorter amount of time to encourage students to think and research in the class.

By following reading materials and activities provided in this teaching module, students will be first introduced of the general definition regarding the food industry and food security from World Health Organization and other terminologies from the vocabulary builder. They will further strengthen their understanding of the food industry and safety problems in China from in-class lecture prepared by instructors using different materials. While students obtain some knowledge about the subjects from the readings and the lecture, they are encouraged to practice

their understanding through some other student activities, including in-class discussion, individual assignment, group project, and extra-curriculum activity. Divergent activities can allow students to strengthen their understanding and to enhance their memory from the lecture. Individual reflection paper and group project provide students with opportunities to think and research, to extend their knowledge from the classroom. These activities were built in an easy-to-difficult pathway allowing students to follow the module and achieve learning outcomes.

Finally, instructors could watch and observe the performance of students in each student activities to evaluate teaching outcome of the module. Each student activity was designed to achieve different teaching goals of the module so that students could be one of the biggest reflections of the module. Besides, instructors will be able to reflect whether the teaching module works or not by collecting students' feedback from course evaluation form, a typical way for students to rate the course and the instructor. Basic on these two results, instructors could then evaluate the success of the teaching module by filling out the online survey for the creator of the module to collect feedback. That feedback could be used to improve, edit, and change the module in the future. In conclusion, this teaching module utilizes different components to achieve different goals. Conducting evaluation for the teaching module could allow it to be further developed for both instructors and students to obtain success in learning these subjects from the module.

DISCUSSION

To complete this major qualifying project, I not only designed, researched, and delivered a teaching module together with other teaching materials, but also utilized my background knowledge in both International Studies and Biochemistry to analyze and learn about the food industry and security from different aspects. As a senior student, I was able to learn about the food industry and security issue in China through research, readings, and discussion of the topic with Professor Jennifer Rudolph and other professors and students who understand the food industry and care about food insecurity. I was also able to gather advice and support from different professors who have the experience teaching about food sustainability. By completing this individual research, I deepened my understanding of the topic and was able to summarize them into the final report and transfer my knowledge to the designation of this teaching module to benefit both instructors and students.

While designing the content and structure for instructors, I learned about the different composition of teaching modules. I tried to answer the question that how to use various part of the module could achieve instructors' teaching goals. Therefore, I determined what learning outcomes instructors want to see after using this teaching module. Based on the goals, I wrote different contents to allow instructors to achieve them easily and quickly. From wiring and designing the teaching module, I was able to learn more about the principal of teaching and different teaching modules, understand functions and significance of the module, and deliver my knowledge on the food industry and security to instructors through this teaching module.

Through designing and organizing different student activities, I learned about how other people teach in the college and how I would expect a lecture to be as a student. Moreover, I also want to obtain a feasible evaluation for the teaching module to access the teaching outcomes

quantitatively and qualitatively. When I evaluated the module of education, I want to gather feedback from different perspectives, including both students and professors. The primary purpose is to obtain the expected teaching goals and allow students to gain knowledge and satisfied with the learning outcomes from self-evaluation and instructors' grading for different tasks, assignments, and class performance. The other is to collect feedback for the teaching module from instructors (online survey delivered together with the teaching module) and course evaluation form from students.

However, more research and further practices can be done in the future study of the project. In order to test the feasibility of the module and improve its teaching outcomes, there are several suggestions for the future major qualifying projects and students who are interested in this topic:

1. Deliver and practice this teaching module in Great problem seminar course, Food Sustainability, within one or two lectures in order to observe the feasibility of the module.
2. Allow instructors, who use this module, to take online survey and to incorporate accessing questions for the module in the course evaluation form for student.
3. Promote the utilization of the teaching module at WPI and other universities to collect feedback and concerns
4. Edit the module based on the evaluation to improve the teaching outcomes.

APPENDIX 1: A Teaching Module

Integrate China into Teaching about Food Security at WPI

Themes and Goals

Worcester Polytechnic Institute developed a Great Problem Seminar (GPS) course called Food Sustainability to address the topic of food sustainability, aiming to provide students an understanding of food systems, industry, security, and safety from different angles. This course is designed to allow students to think and solve real-world problems in multiple dimensions and a global context. The key question to be answered in the course is how people can feed 9 billion populations by 2015. In order to be capable to answer this fundamental question, students will think, research, and discuss various topics through the course, such as food availability, uses, production from biochemical, economic, environmental, and political levels around the world. To strengthen the global competency of the course, we constructed a new teaching module to be incorporated into the course, focusing on the subject of the food industry, security and safety in China, aiming to let both instructors and students understand the contributors and the opportunities and challenges that are associated with food industrialization and food security and safety incidents happened recently in China through different readings and activities.

This teaching unit explores and focuses on China in terms of the food industry and security. While having a successful economic, technological, and political development, China has nowadays modernized rapidly in different industries. In particular, the traditional economy in China, which largely depends on agriculture, has been gradually transformed into a modern industry and market-dependent economy, like most of the developed Western countries. Its food industry has become one of its most significant economic sectors. According to the recent study, the individual output of the Chinese food industry was 7.8 trillion Yuan in 2011 with a continuously growth rate of 31.6%, which is much higher than the average national economic growth rate 3.6%. Indeed, the Chinese food industry with its rapid development promotes significant economic growth, provides job opportunities, opening new factories and markets. However, it also brings many problems, as a series of food safety and additives incidents that have happened demonstrate.

Many problems exist in the Chinese food industry. During the past ten years, several notorious food safety incidents in China drew public attention to the food industry; these include the melamine contamination in infant milk powder, the Sudan I red dye, the gutter oil scandal, and the overuse of clenbuterol (veterinary medicine) in meat production. In 2004, at least, 70 infants died because of malnourishment from drinking fake powdered milk. About 200 infants suffered from malnutrition, with an enduring impact on their mental and physical development. In 2014, the use of gutter oil by many well-known restaurants was exposed to the public, again

attracting attention to food safety and security. Gutter oil is a kind of illicit cooking oil that some people filtered, recycled, and sold from waste oil. A series of food crises generated panic among people in China. Therefore, it is important to learn about the Chinese food industry and current safety and security issues to further understand the problems, challenges, and opportunities in the industry.

In addition, this teaching module aims to strengthen the global competency in the Great Problem Seminar course at WPI by integrating China into teaching, as it provides students with a particular culture context that differs from the United States. Although China currently obtains a rapid economic growth, it is still a developing country in many different ways. Since the participation of China in World Trade Organization in 2001, the multinational collaboration in different industries and trades has significantly increased, meaning a greater impact of China on other countries. The import and export values of food products between China and the United States have also increased. Thus, the development of food industry and food security and safety in China is also important for the United States and its future generations. Moreover, students, who learn about this topic, can also acquire an ability to analyze other countries' context through exercise of Chinese case study.

By using this teaching module, students will be able to obtain a basic understanding of the food industry in China and food safety and security through the lesson and selected readings. Students should be able to think, analyze, and discuss questions comprehensively. They will be capable of listing and describing main contributors to food safety and security incidents. In addition, students could conduct extensive research to think about how to prevent food security and safety events from happening through the group project. More importantly, student activities also allow them to demonstrate and share their ideas through presentations. At the end of this teaching unit, instructors can also use films to develop students' interests in the topic outside the classroom. In conclusion, this teaching module aims to shed lights on why and how to incorporate China as a subject into teaching about food sustainability.

Audiences

The teaching modules span topics from different aspects of Chinese society, emphasizing the relationships between food industry, security, public health, and the environment. The material is focused on issues in the food industry and security but also touches on some of the global implications. Though this teaching unit is originally designed for Great Problem Seminar Food Sustainability course at WPI, it could also be used in a number of courses, including but not limited to:

Sustainable Agriculture and Food Security
Food Security and Environmental Issues
Food Industrialization in China
Food Law, Policy, and Regulation in China

Instructor Introduction

Food Industry

The food industry can be closely associated with different aspects of society. As most raw materials in food industry come from the production of farming, the food industry can be seen as an extension of agriculture: the prosperity of the food industry stimulates the development of agriculture in any country around the world. Financially, the development of the food industry promotes the economic growth of the rural areas and increases the standard of living worldwide. The development of the food industry also leads to the prosperity of other industries, including mechanics, light, and chemical industry. Socially, the food industry provides a nation with a stable living environment by providing a significant amount of job opportunities, economic benefits, and security and increases the overall national income. Therefore, the food industry serves as a fundamental element of national growth.

Nowadays, several categories of food are in high demand in the global food industry. For instance, "convenience food" is becoming an enormous developing aspect of the food industry. Young generation with a fast pace of living wants food to be easy to prepare as well as nutritional. To produce and deliver safe, healthy, and tasty "convenience food", the food industry has developed a process of packaging, transportation, and storage. There are a total of 1.12 million kinds of convenience foods around the world. Particularly in Europe and some other developed countries, "convenience food" accounts for two-thirds of the national food consumption.

Due to the globalization and increasing international competition, some developed countries have gradually transferred from manufacturing-based food industry to a high-tech food industry. The current global food production and manufacturing has started to enter the high-tech era, growing towards a massive scale of international collaboration to use innovative technology for nutrition-directed food production. As early as 1995, 20% of the global food industry output value (US $115 trillion) has been generated from just around 100 multinational companies. Some of the world's leading industrialized countries, with their capital, technology, human resources, management, and other advantages, provide platforms and policies that allow a large number of multinational food companies to grow.

In addition to international cooperation, the global food industry must collaborate with other industries and governmental sectors. Therefore, the development of the food industry actually affects the development of agriculture, packaging and chemical industry, public transportation sectors, etc. In order to increase the scale of operation and production and improve the standard and management for manufacturing, some of the world's leading multinational food companies have been trying to work with different central and local governments.

Moreover, the development and penetration of advanced sciences and technology in the global food industry have increasingly influenced food production. Different applications of biotechnology, membrane separation, extraction, sterilization, and radiation have simplified manufacturing processes and greatly changed the traditional operating modes of the food industry to produce more foods that are natural, safe, nutritious, delicious, and convenient.

Food Industry in China: Culture, History, and Industrialization

One of the oldest quotations about food is from the Han Dynasty in China: “Minyishiweitian, Shiyianweixian (民以食为天，食以安为先),” meaning food is one of the fundamental elements for living and should also be safe. The existence and variety of food and dishes in China has often been regarded as significant status and cultural symbols. From the greeting phrase "Have you eaten yet?" to the traditional food like dumplings and moon cakes at various Festivals and holidays, food is intimately ingrained in Chinese culture. The purpose of having food and producing food is more than just to allow people to eat well but to reflect their culture and history.

Nowadays, China is a country with 1.3 billion people, and therefore, the food industry in China is often called “the industry of life." It has already become an important representation of the national economy development and people's living standards. According to Chinese national classification, the food industry is divided mainly into food processing, food and beverage manufacturing, and tobacco processing.

During the past thirty years of Economic Reformation, China has made considerable progress in the food industry. The overall food production capacity has increased, and the nutritional status of its people has also scaled up. In 2008, the output value of the Chinese food industry reached 4.2 trillion (RMB). The food industry in China has become a vital national industrial pillar of the economy. While facing the world's economic depression and multiple financial crises, the development of the Chinese food industry still maintained a growth rate of 31.63%, as one of the leading manufacturing sectors even under pressure. Thus, with a background of fast industrialization, urbanization, and globalization, the Chinese food industry has significantly contributed to increasing national and individual incomes. However, with such rapid growth, the food industry in China faces many different challenges and problems in terms of improving food quality and safety, international competitiveness, control and regulation for domestic food production. Thus, being aware of the challenges as well as opportunities in the development of the Chinese food industry is important for the improvement of the food safety and security as well as the goal to achieve a harmonious and prosperous economic growth.

Opportunities and Trends of Development

During the past decade, the food industry in China has rapidly developed and expanded. There are many new opportunities and trends appearing in the development of the Chinese food industry.

The Chinese food industry remains stable in its rapid growth. From 2005 to 2015, the Chinese food industry has achieved much success. The number of food processing companies more than doubled, reaching a number of 41,135. Industrial output production increased by 6.3 times in between 2000 and 2010 with an output value of 5.5431 trillion (RMB). In 2008, the proportion of the output value by the food industry reached 7.93% of the total industrial output value, becoming the second largest industrial sector after railway manufacturing.

The Chinese food industry is highly profitable. The total profits generated by the food industry increased 15 times in 2010 compared to the profits in 2001. The proportion of the profits of food industry in that of the total industry reached from 5.62% in 2001 to 8.20% in 2010.

Food processing rate will continuously increase. The Chinese food industry is favored by the market economy, which provides a huge platform for future development. During the past decades, the ratio of the output value in the food industry to the output value in agriculture has increased from 0.29:1 in 2001 to 0.8:1 in 2010, which demonstrates that the ability and necessity of food processing have increased. In the Central government's *Chinese Food Industry Five-year Plan of 2010-2015*, the ratio of the food industry output value to agricultural production output value aims to reach 1.5:1 by 2015 and the total GDP of the food industry should increase to 12.3 trillion (RMB).

China joined the WTO in 2001. Many people might ask how the Chinese food industry can develop so rapidly and profitably. While the Economic Reform Era led to establishment of the initial Chinese food industry, the participation of China in the WTO infuses new life into its food industry. Moreover, the ability of food production, transportation, and storage has been largely improved by international collaboration, corporation restructure, and technology progression.

An increasing demand for food products stimulates the development of the food industry. With the rapid growth of the domestic market and improving living standards, the consumers' demand for bread, milk, oil, meat, seafood, etc., is increasing due to the awareness of nutrition and health. Meanwhile, some large food companies and some well-known food brands are now gradually accepted by most consumers through promotion and advertisements.

Challenges that the Food Industry in China Face

The primary challenge existing in the industry is the weak awareness of competition. Most of the Chinese food enterprises cannot compete with food companies in the developed countries due to their scattered distribution and outdated technologies in China. Currently, many Chinese food companies are not large enough to maintain low costs as well as high efficiency of food production. Much equipment in the industry is old and a huge amount of labor is required to operate it. In 2008, for instance, while some developed countries have an average processing rate of milk between 400 and 600 tons per ton and rice between 200 to 400 tons per day, the Chinese enterprises can only process 100 tons of milk and 50 tons of rice per day. This scale of production significantly limits the international competitiveness of the food industry in China.

Secondly, research and development departments of the various food industries in China need to be improved. Technological innovation and advanced equipment are extremely critical for the global food industry. However, lacking the ability to conduct independent research during the development phase has caused China to be more than 20 years behind developed countries. Research and development usually provides companies and the industry with stable, consistent, and reliable development. Right now, the food industry in China still consumes high amounts of capital while producing few advanced outcomes. In some key areas of the production, it still highly relies on foreign enterprises and technologies, which increases the import rate of technologies and products every year. For example, manufacturing processes, such as separation, modification, and non-thermal sterilization are still lacking during the process of production, transportation, and storage. Thus, the value added to the agricultural products after processing in China is less than the value being added in the developed countries.

Finally, the high profits generated by tobacco and alcohol production often cover up the weakness and shortage of the overall food industry. In 2008, the output value of tobacco was 448.8187 million (RMB), accounting for 14% of the total food industry profits. The overall high profits and taxes provided by alcohol and tobacco production will affect the authentic food growth of China and the healthy development of the industry over the long term.

Food Security and Safety

Although the government and local sectors and agencies have achieved much success in regulating the food industry in China, the industry still has many different problems regarding security and safety. For the past decade, many food security and safety incidents have occurred in China, causing a series of panic, concerns, and damage. Therefore, it is important to understand the weakness of the industry and the reasons for those incidents and problems. Social, moral, and regulatory factors can potentially lead to failures in the mechanism of controlling and supervising food safety and security in China.

The development of the environmental-friendly industry is slow. While obtaining a fast and massive rate of industrialization and urbanization, environmental pollution has become a primary threat to human safety and health. The pollution problem in China is particularly prominent because of industrial and agricultural wastes, including gas, water, and other materials. Agricultural and industrial wastes are often directly discarded into the environment, which can contaminate plants and other raw materials for food production. The widespread utilization of pesticides and fertilizers also pollute different products in the food industry. Fast urbanization leads to another environmental problem, which is air pollution and haze caused by the gas emission from cars. In addition, major industrial accidents in some nearby foreign countries have had increasing impacts on the food industry. For example, after the nuclear power plant leak in Fukushima, Japan, radioactive substances were observed in some coastal areas of China, leading to a significant environmental concerns and impacting Chinese food security and safety. Different pollutants can often contaminate the raw materials supplied for food production. As most of the industries are not environment-friendly including the food industry, it is hard to ensure food security and safety from its origin as a fundamental guarantee.

The control system and legislation are imperfect. Most of the developed countries have a systematic food safety and security control system, functioning as a unified body and having a perfect mechanism reacting to different crises. However, the control system responding to food security and safety crisis in China is multi-sectorial and multi-agency. It lacks overall systematic control and management and as well as an efficient mechanism when encountering large-scale food incidents. Although different government sectors, such as agriculture, health, commerce, and entry-exit inspection, take responsibility to regulate the food production, the particular responsibility for each department remains unclear. When any food safety and security incidents cause damage to the public, those sectors and related factories, schools, and enterprises often shirk responsibility and easily escape the punishment. Thus, this imperfect control system significantly influences the quality of the food products and the efficiency to solve crises. Since most of the food companies in China are relatively small and randomly distributed, a robust regulatory system is required to ensure food security and safety during the food production and procession.

Existing technology cannot support the inspection of food production. Although there are many different types of inspection agencies, most of them are redundant, having only

outdated equipment and testing technologies that cannot be used to support food quality control. For various types of food, such as green food, organic food, and functional food, the levels of food security and safety are poorly defined. Many terminologies used in those definitions could potentially confuse consumers, who cannot easily recognize and distinguish the food products. In addition, while using outdated technologies to support food security and safety inspection, many imported food products cannot be effectively regulated and inspected. Therefore, it leads to a larger gap between the national and the international food production standards and danger of eating those products.

The awareness of legislation is weak in China. To earn huge profits, some food companies and enterprises use people's lives and health in exchange for money. Those people lack the basic awareness of laws and moral standards. Therefore, many food security and safety lapses have happened in recent years. Consumers stop trusting not only some local companies, but also many big food brands and enterprises. However, some companies in the industry that meet the standard of high-quality food production often obtain low profits and occupy only a small portion of the market. This phenomenon creates a vicious cycle. Thus, it is important to improve the food safety and security awareness for companies and enterprises in the industry.

Instructors Readings

See Articles

- Godfray, H. Charles J., John R. Beddington, Ian R. Crute, Lawrence Haddad, David Lawrence, James F. Muir, Jules Pretty, Sherman Robinson, Sandy M. Thomas, and Camilla Toulmin. "Food security: the challenge of feeding 9 billion people." *science* 327, no. 5967 (2010): 812-818.

This article addresses the topic of how to feed 9 billion people subjectively. It discusses different components of the multifaceted and linked global strategy to ensure sustainable and equitable food security while feeding the population. With a continuously increasing population and growing competition for land, water, and energy, in addition to the overexploitation of fisheries, the ability to produce food and the environment will also be significantly impacted. This article gives a scientific overview of the factors challenging food security and provides readers with a potential solution and thinking methods.

- Jia, Chenhao, and David Jukes. "The national food safety control system of China–a systematic review." *Food Control* 32, no. 1 (2013): 236-245.

This paper describes and discusses the components of the Chinese system using the five key elements of a national food control system identified by the World Health Organization (WHO) and the Food and Agriculture Organization (FAO) as essential for an effective safety control system. It carefully explains that how the latest implemented Chinese national food safety control system has made a significant improvement on its regulation framework while more work needs to be done on standards, law enforcement, and information exchange.

- Yongmin, Bian. "The Challenges for Food Safety in China. Current legislation is unable to protect consumers from the consequences of unscrupulous food production." *China perspectives*. 53 (2004).

This article gives a summary of potential problems in the food industry that are related to food security and safety since the year of 1995. This article allows instructors to have a basic idea of what potential challenges China faces making the transition from the agricultural economy to the industrial economy. By reading this article, instructors will enrich their understanding and knowledge regarding current risks relevant to food safety and security in China.

Student Readings

- Chen, Jie. "Rapid urbanization in China: A real challenge to soil protection and food security." *Catena* 69, no. 1 (2007): 1-15.

This article uses official statistics and data demonstrating the rapid urbanization in China could become a real challenge to soil protection and food security. It explicitly addresses the impacts of urbanization and industrialization. Based on analyses and examples, it gives different reasons that urbanization could be a significant threat to future agricultural production and a potential cause of the food security problem in China.

- Pei, Xiaofang, Annuradha Tandon, Anton Alldrick, Liana Giorgi, Wei Huang, and Ruijia Yang. "The China melamine milk scandal and its implications for food safety regulation." *Food Policy* 36, no. 3 (2011): 412-420.

This article examines the development of the Chinese dairy sector since 2000 and investigates how this has affected food safety. The ongoing problems caused by melamine contamination are linked to the rapid and unregulated development of this industry. According to the paper, a serious restructuring of the dairy sector as well as of the public food safety control agencies is required. Students can learn about this important industry as well as how to regulate and monitor the food security from this sector.

- Shen, Xiaobai. "Understanding the evolution of rice technology in China–from traditional agriculture to GM rice today." *The journal of development studies*46, no. 6 (2010): 1026-1046.

This paper provides a historical survey of the evolution of rice technology in China, from the traditional farming system to genetically modified rice today. It analyzes rice technology as a complex interaction of material and social elements and discusses the specificity of technology development and its socio-technical outcomes. Students can learn about the history of development in one of the sectors in the Chinese food industry and get to analyze the subject from different perspectives.

- Schneider, Mindi. "Feeding China's pigs: implications for the environment, China's smallholder farmers and food security." (2011). *Schneider*, Mindi.

By discussing the development of pork and meat sector in the food industry, this article reflects the development of the Chinese food industry, from the small households to large enterprises and companies. Students will be able to learn about different factors that influence the development of the industry as well as the regulation and control system for safety and security within the sector.

Student Activities

Activity 1- Lecture-Presentation

- To achieve the purpose of developing a basic understanding
- Instructors prepare a class lecture
- Student will be divided into four groups; each group can pick one article to read
- Student will be able to describe the food industrialization and industry in China and define food security and safety

Activity 2- Lecture-discussion

- To achieve the purpose of thinking and researching comprehensively
- Instructors conduct and guide Lecture discussion, covering several important topics:
    - Students can share their definition of food security and safety in China and their perspectives on current food industrialization.
    - Students will be able to analyze the contributors to food insecurity and unsafety incidents in China.
    - Following discussion questions should be answered:
        - How can we measure the food security in China?
        - Why does food insecurity exist in China?
        - What factors in the Chinese food industry contribute to food insecurity and unsafety?
        - How should food insecurity and unsafety in China be addressed?

Activity 3 – Individual Assignment

- To achieve the purpose of further analyzing and summarizing
- Students will write and share a two-page reflection paper on one of the articles they read to demonstrate their ideas of what is the primary challenge and opportunity within the development of the Chinese food industry.

Activity 4 – Group Project

- To achieve the purpose of sharing and presenting
- Students will brainstorm different ways to prevent food safety and security incidents in China at both the industrial or individual levels. Then, students will create a poster to promote the awareness of food safety and security.
- In this project assignment, students will be encouraged draw a comparative study between the United States and China in terms of the control mechanism of food security and safety in the food industry.
- Poster presentation

Activity 5 – Film Watching: Chinese Food and Culture: The Family and the Industry (Extra-curriculum student activity)

- Documentary Movie: A Bite of China:
    - Episode 1: Gifts from Nature
    - Episode 2: The Story of Staple Food
    - Episode 3: Inspiration for Chance
    - Episode 4: The Taste of Time
    - Episode 5: Secrets of the Kitchen
    - Episode 6: A perfect Blend of Five flavors
    - Episode 7: Our Farm

Discussion Questions:

- What are the influences on traditional culture and agriculture due to the rapid food industrialization?
- How different cultures change the eating habits in China?
- How do the culture and eating habits influence the food security and safety in China both positively and negatively?

Evaluation:

Instructors who use this teaching module should be able and welcome to provide their feedback and assess module through following link:

https://docs.google.com/forms/d/18aw-WT-34STVBagtiHwOenp9vMPAqLtesAilknJd1SI/viewform

APPENDIX 2: Vocabulary Definition

In this curriculum, **food** refers to both food and beverages.

Agriculture
The production of food and goods through farming.

Food Industry
The **food industry** comprises a complex network of activities pertaining to the supply, consumption, and catering of food products and services across the world. Finished food products and partially prepared 'instant' food packets are also a part of the food industry.

Food Processing
The practices used by food industries to transform raw plant and animal materials, such as grains, produce, meat and dairy, into products for consumers.2-4 Examples include freezing vegetables, milling wheat into flour and frying potato chips. Slaughtering animals is sometimes considered a form of food processing.

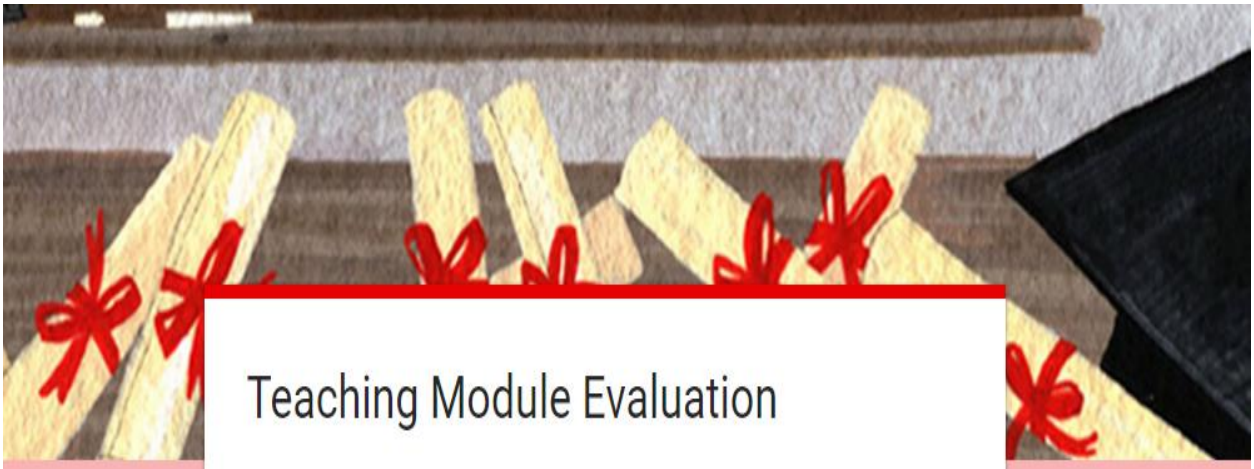
Food security
Consistent and dependable access to adequate, safe and nutritious food for an active and healthy life. For a region to be food secure, it must have an adequate, stable supply of food even during drought and other difficult conditions; and its people must be able to locate and afford food, even in the presence of an abundant supply.

Food safety
The science and practice of protecting the food supply from contamination by disease-causing organisms, harmful chemicals and other threats to health.

Fertilize
Apply **fertilizer** to soil.

Fertilizer
Materials spread on soil to increase its capacity to promote plant growth. Common fertilizers include animal **manure**, **compost**, synthetic (human-made) chemicals and certain minerals.

APPENDIX 3: Online Survey



Teaching Module Evaluation

Thank you for using and evaluating Teaching the Food Industry and Security in China. Your feedback on this brief survey helps us to improve the curriculum.
Your personal information will not be shared outside of Worcester Polytechnic Institute, though if you provide particularly quotable foodback, we might ask your permission to share it on the report and project. If you have any question, please contact: ysun5@wpi.edu.
Note: The pilot evaluation of teaching the food system at Johns Hopkins University is used for reference

* Required

1. Contact information

Name *

Your answer

Profession *

Your answer

Email Address *

Your answer

Module evaluation

Please be candid. You won't hurt our feelings.

Questions marked with an asterisk (*) are required.

2. Which part(s) of this module were the MOST effective? Why?

Your answer

3. Which part(s) of this module were the LEAST effective? How could they be improved?

Your answer

4. Please note any changes you made to this module, and your reasons for doing so:

Your answer

* 5. Please rate the overall effectiveness of each part of this module:

1 (Poor) 2 (Fair) 3 (Good) 4 (Very good) 5 (Excellent) 6 (Did not use)

Student Activities *

1	2	3	4	5	6
○	○	○	○	○	○

Vocabulary Definitions *

1	2	3	4	5	6
○	○	○	○	○	○

Background Reading *

1	2	3	4	5	6
○	○	○	○	○	○

Presentation Slides *

1	2	3	4	5	6
○	○	○	○	○	○

Film *

1	2	3	4	5	6
○	○	○	○	○	○

Comments *

Your answer

6. What criteria informed your decision to teach this module? (Select all that apply).

- [ ] The subject area seems the most interesting
- [ ] The objectives match the standards for my school system
- [ ] The activities seem the most engaging
- [ ] I am familiar with the subject matter

7. How would you rate YOUR prior knowledge of the subjects covered in this module?

- ○ Poor
- ○ Fair
- ○ Good
- ○ Very Good
- ○ Excellent

8. How would you rate your STUDENTS' prior knowledge of the subjects covered in this module?

- ○ Poor
- ○ Fair
- ○ Good
- ○ Very Good
- ○ Excellent

9. Please rate the difficulty level of this module:

- ○ Too easy for my students
- ○ Appropriate for my students
- ○ Too difficult for my students

Comments

Your answer

12. Did you experience or do you foresee any obstacles to use this module at your institution?

Your answer

SUBMIT

Never submit passwords through Google Forms.

BIBILOGRAPHY

1. Fanzhen Kong. “Trends of the Global Food Industry and the Current Standing of the Food Industry in China. *Food and Drugs.* 7, no. 02A (2005): 11-14.
2. Yu Zhang, Guiying Huang, and Zijie Liu “Difference between the Production Condition of the Global Food Industry and the Chinese Food Industry.” *Food and Nutrition in China.* 2003, (3), pp.11-14
3. Warde, Alan. "Convenience food: space and timing." *British Food Journal*.101, no. 7 (1999): 518-527.
4. De Boer, Martine, Mary McCarthy, Cathal Cowan, and Isabel Ryan. "The influence of lifestyle characteristics and beliefs about convenience food on the demand for convenience foods in the Irish market." *Food quality and preference.* 15, no. 2 (2004): 155-165.
5. Bigliardi, Barbara, and Francesco Galati. "Innovation trends in the food industry: the case of functional foods." *Trends in Food Science & Technology* 31, no. 2 (2013): 118-129.
6. Menrad, Klaus. "Market and marketing of functional food in Europe." *Journal of food engineering.* 56, no. 2 (2003): 181-188.
7. Yakovleva, Natalia, Joseph Sarkis, and Thomas Sloan. "Sustainable benchmarking of supply chains: the case of the food industry." *International Journal of Production Research.* 50, no. 5 (2012): 1297-1317.
8. Yu Zhang, Guiying Huang, and Zijie Liu “Difference between the Production Condition of the Global Food Industry and the Chinese Food Industry.” *Food and Nutrition in China.* 2003, (3), pp.11-14
9. Fieldhouse, Paul. *Food and nutrition: customs and culture*. Springer, 2013.
10. Cheung, Sidney, and David YH Wu, eds. *Globalization of Chinese Food*. Routledge, 2012.
11. Zhang Tianzuo “China’s food industry trends and areas of focus." *Food Science.* 24 (2012): 3-6.
12. Liu, X. 2014. *International perspectives on food safety and regulations – a need for harmonized regulations: Perspectives in china. Journal of the Science of Food and Agriculture.* 94 (10): 1928-31.
13. Wang Xiuqing. “China Food Industry: growth, structure and performance," *Chinese Rural Economy.* 3 (2000) : 11-19
14. *China Food Industry Yearbook from 1991 to 2007:* http://www.chinabookshop.net/china-food-industry-yearbook.html
15. *China Food Industry Yearbook from 2001 to 2010:* http://www.chinabookshop.net/china-food-industry-yearbook.html
16. *China Industrial Economy Yearbook 2008:* http://www.chinabookshop.net/china-food-industry-yearbook.html
17. *China Industrial Economy Yearbook 2010:* http://www.chinabookshop.net/china-food-industry-yearbook.html
18. *China Industrial Economy Yearbook 2015:* http://www.chinabookshop.net/china-food-industry-yearbook.html

19. Snyder, Francis. "Multilateral Monitoring of Food Safety Law in China: The WTO Trade Policy Review Mechanism (TPRM), 2006-2014." *Forthcoming in Peking University Transnational Law Review*. 2, no. 2 (2014): 1-90.
20. Xin Xu. "China Food Security: Problems, causes and countermeasures " Problem of Agricultural Economy 10 (2002): 45-48.
21. Zhao Lin and Baoshan Fen "Chinese food safety issues in the 21st Century". *Food and Nutrition in China*. 2 (2001): 5-7.
22. Xie Min. "Analysis of the Chinese food safety issues." *Shanghai Economic Studies*. 1, no 1 (2002): 2.
23. Jia, Chenhao, and David Jukes. "The national food safety control system of China–a systematic review." *Food Control*. 32, no. 1 (2013): 236-245.
24. Liu, Shan, Zhimei Xie, Weiwei Zhang, Xia Cao, and Xiaofang Pei. "Risk assessment in Chinese food safety." *Food control*. 30, no. 1 (2013): 162-167.
25. Zeng, K.S., Luo X.H., and Liu. Y.L. 2014. Food safety incidents' influence on the food industry. *China Agricultural Economic Review*. 6 (2): 264-77
26. Pitt, J. I., Marta H. Taniwaki, and M. B. Cole. "Mycotoxin production in major crops as influenced by growing, harvesting, storage and processing, with emphasis on the achievement of Food Safety Objectives." *Food Control*. 32, no. 1 (2013): 205-215.
27. Xue, J.H, and Zhang W.J. 2013. Understanding china's food safety problem: An analysis of 2387 incidents of acute foodborne illness. *Food Control*. 30 (1): 311-7.
28. Lin, B.Q., and Lei X.J. 2015. Carbon emissions reduction in china's food industry. *Energy Policy*. 86: 483-92.
29. Zeng, K.S., Luo X.H., and Liu. Y.L. 2014. Food safety incidents' influence on the food industry. *China Agricultural Economic Review*. 6 (2): 264-77
30. Liu, Y., Liu F.Y., Zhang J.F., and GAO J.B. 2015. Insights into the nature of food safety issues in Beijing through content analysis of an internet database of food safety incidents in china. *Food Control*. 51: 206-11.

ENDNOTES

[1] Fanzhen Kong. "Trends of the Global Food Industry and the Current Standing of the Food Industry in China. *Food and Drugs.* 7, no. 02A (2005): 11-14.
[2] Ibid
[3] Yu Zhang, Guiying Huang, and Zijie Liu "Difference between the Production Condition of the Global Food Industry and the Chinese Food Industry." *Food and Nutrition in China.* 2003, (3), pp.11-14
[4] Fanzhen Kong. "Trends of the Global Food Industry and the Current Standing of the Food Industry in China. *Food and Drugs.* 7, no. 02A (2005): 11-14.
[5] Ibid
[6] Jianrong, Li. "The present situation and development strategy of food industry." *Food and fermentation industries* 27, no. 8; ISSU 164 (2001): 47-51.
[7] Ibid
[8] Shengmin Huang. "Trendy analysis of China food industry development in new century" *Science and Technology of Food Industry.* 1 (2000): 5-8.
[9] Fanzhen Kong. "Trends of the Global Food Industry and the Current Standing of the Food Industry in China. *Food and Drugs.* 7, no. 02A (2005): 11-14.
[10] Warde, Alan. "Convenience food: space and timing." *British Food Journal*101, no. 7 (1999): 518-527.
[11] De Boer, Martine, Mary McCarthy, Cathal Cowan, and Isabel Ryan. "The influence of lifestyle characteristics and beliefs about convenience food on the demand for convenience foods in the Irish market." *Food quality and preference* 15, no. 2 (2004): 155-165.
[12] Bigliardi, Barbara, and Francesco Galati. "Innovation trends in the food industry: the case of functional foods." *Trends in Food Science & Technology* 31, no. 2 (2013): 118-129.
[13] Ibid
[14] Menrad, Klaus. "Market and marketing of functional food in Europe." *Journal of food engineering* 56, no. 2 (2003): 181-188.
[15] Fanzhen Kong. "Trends of the Global Food Industry and the Current Standing of the Food Industry in China. *Food and Drugs.* 7, no. 02A (2005): 11-14.
[16] Yakovleva, Natalia, Joseph Sarkis, and Thomas Sloan. "Sustainable benchmarking of supply chains: the case of the food industry." *International Journal of Production Research* 50, no. 5 (2012): 1297-1317.
[17] Fanzhen Kong. "Trends of the Global Food Industry and the Current Standing of the Food Industry in China. *Food and Drugs.* 7, no. 02A (2005): 11-14.
[18] Ibid
[19] Yu Zhang, Guiying Huang, and Zijie Liu "Difference between the Production Condition of the Global Food Industry and the Chinese Food Industry." *Food and Nutrition in China.* 2003, (3), pp.11-14
[20] Jianrong, Li. "The present situation and development strategy of food industry." *Food and fermentation industries* 27, no. 8; ISSU 164 (2001): 47-51.
[21] Ibid
[22] Yu Zhang, Guiying Huang, and Zijie Liu "Difference between the Production Condition of the Global Food Industry and the Chinese Food Industry." *Food and Nutrition in China.* 2003, (3), pp.11-14
[23] Fieldhouse, Paul. *Food and nutrition: customs and culture*. Springer, 2013.
[24] Cheung, Sidney, and David YH Wu, eds. *Globalization of Chinese Food*. Routledge, 2012.
[25] Jianrong, Li. "The present situation and development strategy of food industry." *Food and fermentation industries* 27, no. 8; ISSU 164 (2001): 47-51.
[26] Ibid
[27] Ibid
[28] Zhang Tianzuo "China's food industry trends and areas of focus." Food Science 24 (2012): 3-6.
[29] Liu, X. 2014. *International perspectives on food safety and regulations – a need for harmonized regulations: Perspectives in china.* Journal of the Science of Food and Agriculture 94 (10): 1928-31.
[30] Ibid
[31] Ibid
[32] Wang Xiuqing. "China Food Industry : growth, structure and performance ," Chinese Rural Economy 3 (2000) : 11-19

[33] *China Food Industry Yearbook from 1991 to 2007:* http://www.chinabookshop.net/china-food-industry-yearbook.html
[34] *China Food Industry Yearbook from 2001 to 2010:* http://www.chinabookshop.net/china-food-industry-yearbook.html
[35] *China Industrial Economy Yearbook 2008:* http://www.chinabookshop.net/china-food-industry-yearbook.html
[36] Ibid
[37] Ibid
[38] *China Industrial Economy Yearbook 2010:* http://www.chinabookshop.net/china-food-industry-yearbook.html
[39] Ibid
[40] *China Industrial Economy Yearbook 2015:* http://www.chinabookshop.net/china-food-industry-yearbook.html
[41] Snyder, Francis. "Multilateral Monitoring of Food Safety Law in China: The WTO Trade Policy Review Mechanism (TPRM), 2006-2014." *Forthcoming in Peking University Transnational Law Review* 2, no. 2 (2014): 1-90.
[42] Ibid
[43] Jianrong, Li. "The present situation and development strategy of food industry." *Food and fermentation industries* 27, no. 8; ISSU 164 (2001): 47-51.
[44] Yu Zhang, Guiying Huang, and Zijie Liu "Difference between the Production Condition of the Global Food Industry and the Chinese Food Industry." *Food and Nutrition in China.* 2003, (3), pp.11-14
[45] Ibid
[46] Xin Xu. "China Food Security: Problems, causes and countermeasures " Problem of Agricultural Economy 10 (2002): 45-48.
[47] Zhao Lin, and Baoshan Fen "Chinese food safety issues in the 21st Century." Food and Nutrition in China 2 (2001): 5-7.
[48] Ibid
[49] Jianrong, Li. "The present situation and development strategy of food industry." *Food and fermentation industries* 27, no. 8; ISSU 164 (2001): 47-51.
[50] Xie Min. "Analysis of the Chinese food safety issues." Shanghai Economic Studies 1, no 1 (2002): 2.
[51] Ibid
[52] Ibid
[53] Jia, Chenhao, and David Jukes. "The national food safety control system of China–a systematic review." *Food Control* 32, no. 1 (2013): 236-245.
[54] Ibid
[55] Liu, Shan, Zhimei Xie, Weiwei Zhang, Xia Cao, and Xiaofang Pei. "Risk assessment in Chinese food safety." *Food control* 30, no. 1 (2013): 162-167.
[56] Ibid
[57] Zeng, K.S., Luo X.H., and Liu. Y.L. 2014. *Food safety incidents' influence on the food industry.* China Agricultural Economic Review 6 (2): 264-77
[58] Pitt, J. I., Marta H. Taniwaki, and M. B. Cole. "Mycotoxin production in major crops as influenced by growing, harvesting, storage and processing, with emphasis on the achievement of Food Safety Objectives." *Food Control* 32, no. 1 (2013): 205-215.
[59] Ibid
[60] Ibid
[61] Xue, J.H, and Zhang W.J. 2013. *Understanding china's food safety problem: An analysis of 2387 incidents of acute foodborne illness.* Food Control 30 (1): 311-7.
[62] Lin, B.Q., and Lei X.J. 2015. *Carbon emissions reduction in china's food industry*. Energy Policy 86: 483-92.
[63] Xie Min. "Analysis of the Chinese food safety issues." Shanghai Economic Studies 1, no 1 (2002): 2.
[64] Ibid
[65] Ibid
[66] Zhao Lin, and Baoshan Fen "Chinese food safety issues in the 21st Century." Food and Nutrition in China 2 (2001) : 5-7
[67] Ibid
[68] Ibid
[69] Zeng, K.S., Luo X.H., and Liu. Y.L. 2014. *Food safety incidents' influence on the food industry*. China Agricultural Economic Review 6 (2): 264-77

[70] Liu, Y., Liu F.Y., Zhang J.F., and GAO J.B. 2015. *Insights into the nature of food safety issues in Beijing through content analysis of an internet database of food safety incidents in china.* Food Control 51: 206-11.